

1929

ANNUAL REPORT
FIFTH IRRIGATION
DISTRICT

W. H. ROBINSON SUPERVISING ENGINEER

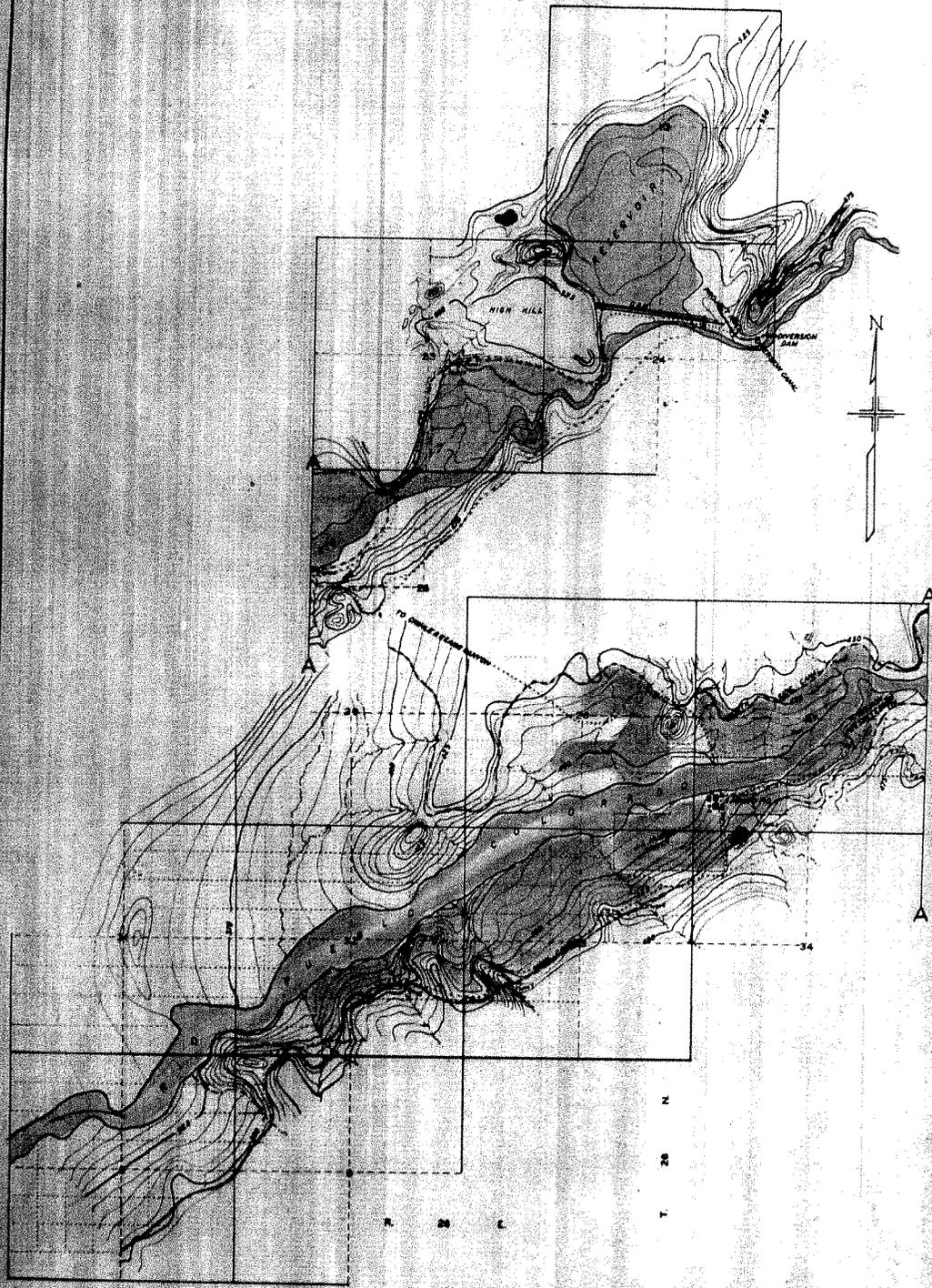
GANADO PROJECT.

This project is located on the Navajo Reservation in Arizona about 60 miles northwest of Gallup, New Mexico. The water is diverted from the Rio Pueblo Colorado to a reservoir in a flat on the north side of the stream, the capacity of which is 4300 acre feet.

The project lands lie on both sides of the stream and the total area is 1700 acres, of which 707 acres are irrigated.

There are two non Indian water users on the project; J. L. Hubbell, who owns a homestead on the reservation, and the Ganado Mission. Mr. J. L. Hubbell receives water from the storage reservoir under a contract executed between the United States of America and himself, dated May 31, 1913. The following excerpt taken from the contract defines his right under the project:

"The party of the second part agrees to perform a proportionate share of the labor and to pay a proportionate share of the cost of material and supplies incident to, or necessary for, the proper operation and maintenance of the Ganado Irrigation System of the party of the first part, or in lieu thereof at the option of the party of the first part to pay such proportionate charges as may be fixed for the annual operation and maintenance of said system.



INFORMATION OF INTEREST.

SOURCE OF WATER SUPPLY: RIO PUEBLO COLORADO.
 AREA OF COUNTRYSIDE: 200 SQUARE MILES.
 ANNUAL RUNOFF IN ACRES FEET: 411,000,000.
 LENGTH OF IRRIGATION SEASON: 180 DAYS.
 AVERAGE ELEVATION OF IRRIGABLE LANDS: 5,200.
 AVERAGE RAINFALL: 12 INCHES.
 RANGE OF TEMPERATURE: -10° TO +110°.
 CHARACTER OF SOIL: ON IRRIGABLE AREA: SANDY LOAM WITH SOME GRAVEL AND PATCHES OF ADOBE.
 PRINCIPAL PRODUCTS: ALFALFA, SALT WAX, WHEAT AND GARDEN TRUCK.
 PRINCIPAL MARKETS: LOCAL. TRADERS BUT THE INDIANS WILL GET LITTLE.
 IRRIGATION PLANS: THE PROJECT CONSISTS OF A DIVERSION FROM THE RIO PUEBLO COLORADO, AN EPHEMERAL STREAM, STORING THE WATER IN A RESERVOIR OUT OF THE STREAM CHANNEL WITH A CAPACITY OF 3,848 ACRES FEET. FOR THE FIRST ONE AND ONE-HALF MILES THERE IS ONE MAIN CANAL, WHICH THEN DIVIDES INTO THE SOUTH SIDE AND NORTHERN CANALS. ALL THE GOOD LAND UNDER THE SOUTHERN CANAL IS BEING CULTIVATED. THE NORTHERN CANAL STILL LACKS TWO FLOODS FOR THE BULK OF THE LAND TO BE AVAILABLE. TOTAL AREA UNDER CANAL IS 1,140 ACRES.

U. S. DEPARTMENT OF THE INTERIOR
 INDIAN IRRIGATION SERVICE
GANADO PROJECT
 SOUTHERN NAVAJO
 ARIZONA
 1926
 SCALE

In consideration of faithful performance of the preceding stipulations of the party of the second part and of the conveyance of the property hereinbefore mentioned, the party of the first part agrees that the party of the second part shall have the right to sufficient water from said system for the proper irrigation of his above described lands, not to exceed two and one-half acre feet of water for each acre of land, and not to exceed four hundred acre feet of water in each year, or so much thereof as shall constitute the proportionate share per acre from the water supply actually available for the lands under the project.

It is mutually understood and agreed that, in the performance of labor, or the use of material and supplies, or the fixing of the annual charge for maintenance and operation of the system, the users of water therefrom shall contribute as the area of the land of each irrigated is to the total area served thereby."

As to the Ganado Mission rights the following is an excerpt from a letter from the Commissioner of Indian Affairs, dated September 27, 1919:

"A formal agreement, signed by the proper officers of the Home Mission Board, binding the organization to bear its proportionate part of the expense covered in the construction of the irrigation project and its operation and maintenance, should be submitted. It should be stipulated in such agreement that water may be refused upon failure to pay proper charges when due. To date the aggregate cost, per acre, of the project, as now estimated, slightly exceeds \$71.00. The irrigable



ALFALFA FIELD
GANADO PROJECT

portion of the Ganado School lands, since the relinquishment of the ten acres, is only about 39 acres, as above list indicates."

From letter from Commissioner dated April 4, 1929:

"Our recommendation for the issuance of a patent contained no requirement that an agreement be signed before issuance of the patent, but set forth that the liability for payment of the proportionate construction charges would attach whether any reference thereto was made in the patent or not; the liability of the Mission Board being a matter of law. However, no requirement of payment has been made to date for the reason that the Navajo lands have not been allotted and, therefore, the proportions have not been established."

During the present fiscal year the annual spring cleaning was divided on an acreage basis. The Navajo Indians farming under the project cleaned their proportionate share of the canal; the Ganado Mission and Mr. J. L. Hubbell paid the Indians in cash for doing their proportionate share of the annual cleaning.

The amount paid by the Ganado Mission was \$164.98; by Mr. Hubbell \$503.39, and the amount done by the Indians \$271.31, making a total of \$939.74 in work done without cost to the Government.

The Indians on the Ganado Project have shown an unusual interest in the project affairs.



WHEATFIELD - GANADO PROJECT



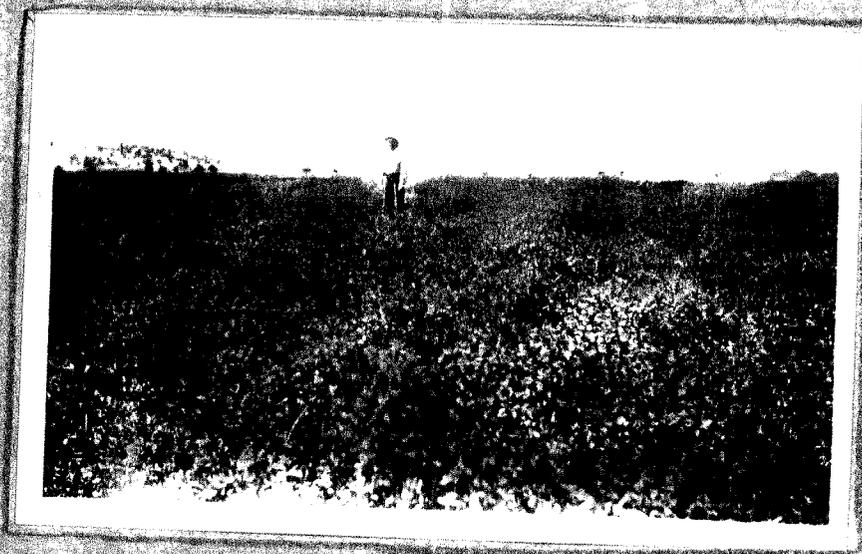
CORN AND PUMPKINS - GANADO PROJECT

An association has been formed for the general advancement and instruction of the Indians on the project. Meetings are held on the 30th day of each month at which time a representative of the Irrigation Service meets with them and discusses items of interest and project affairs with the Indians. Most of the Indians have constructed permanent homes and have engaged in general farming rather than raising alfalfa which has been the rule heretofore. Some of the Indians have raised exceptionally fine gardens and a few are raising chickens and turkeys. It is the intention at the present time to build up a market whereby the Indians can raise poultry on a more profitable basis.

Sufficient water was stored on the project to meet the irrigation demands for the present season. The Indians have asked that the North ditch be extended to make more irrigable lands available. In this connection it will be necessary to have an additional allotment of some \$5,500. The Indians have volunteered to do a part of this work without cost to the Government.

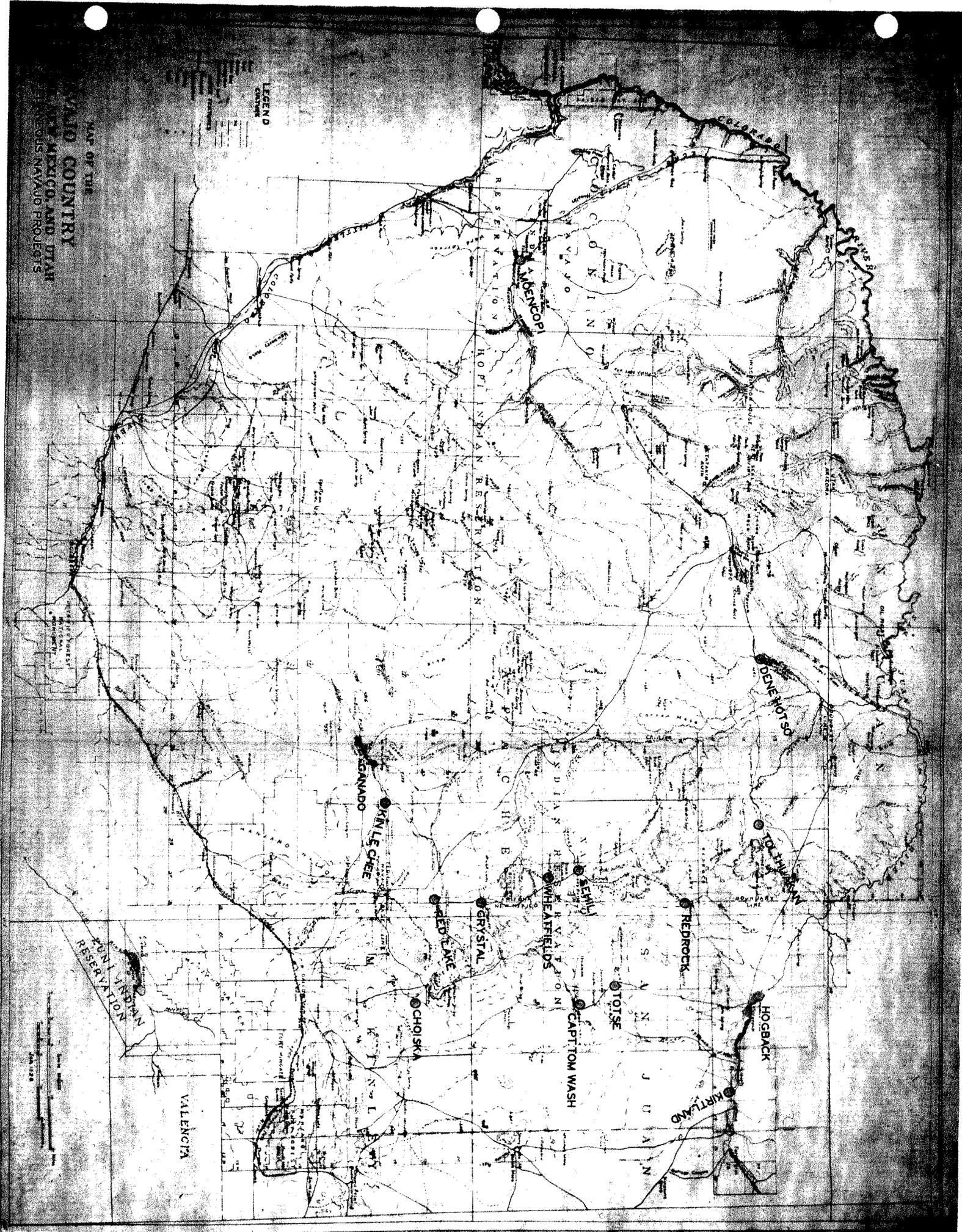


DAVID HUBBARD, NAVAJO, IN HIS GARDEN
GANADO PROJECT



ALFALFA ON J. L. HUBBELL FARM
GANADO PROJECT

MAP OF THE
INDIAN COUNTRY
AND DTAH
RESERVATIONS PROJECTS



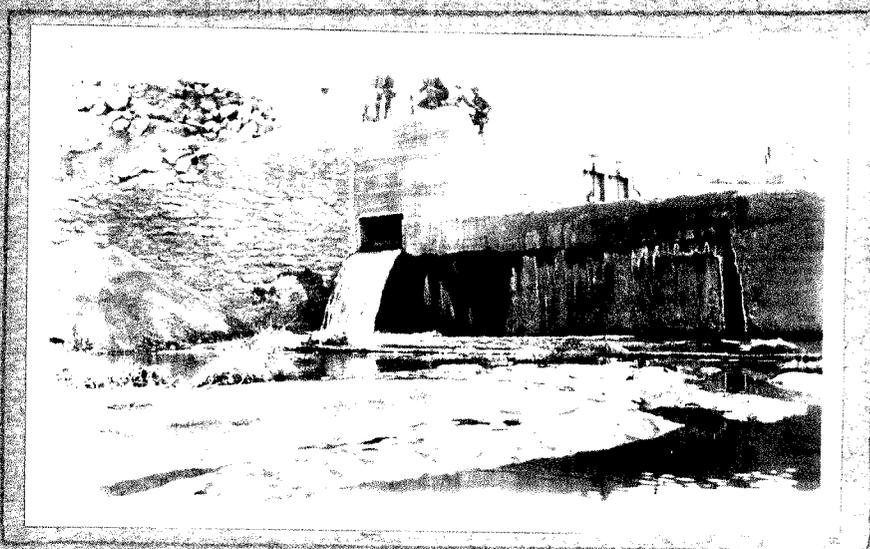
MOENCOPI WASH - TUBA CITY

This project was constructed some fifteen years ago for the benefit of the Navajo Indians living below the school farm and for the irrigation of agricultural lands held by the Tuba City Indian School.

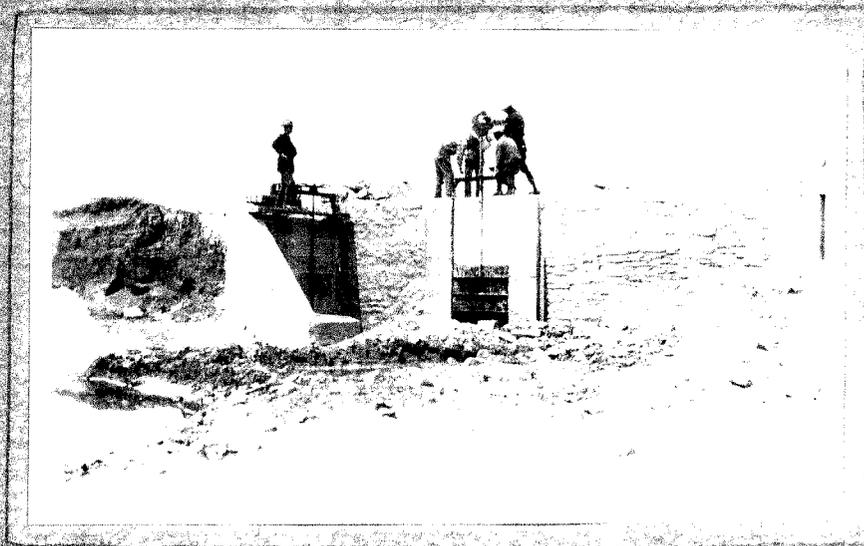
During the past season the headgates were replaced and a sluice gate installed in the diversion dam. A water bridge was constructed across the main canal to carry flood waters from the adjacent hill across the canal into the Moencopi Wash.

A detailed survey was made of the Indian School farm lands and a complete irrigation system laid out to facilitate their irrigation.

The total cost of the construction work was \$920.00; the estimate for the work, \$900.00.



DAM AND SLUICE GATE - MOENCOPI

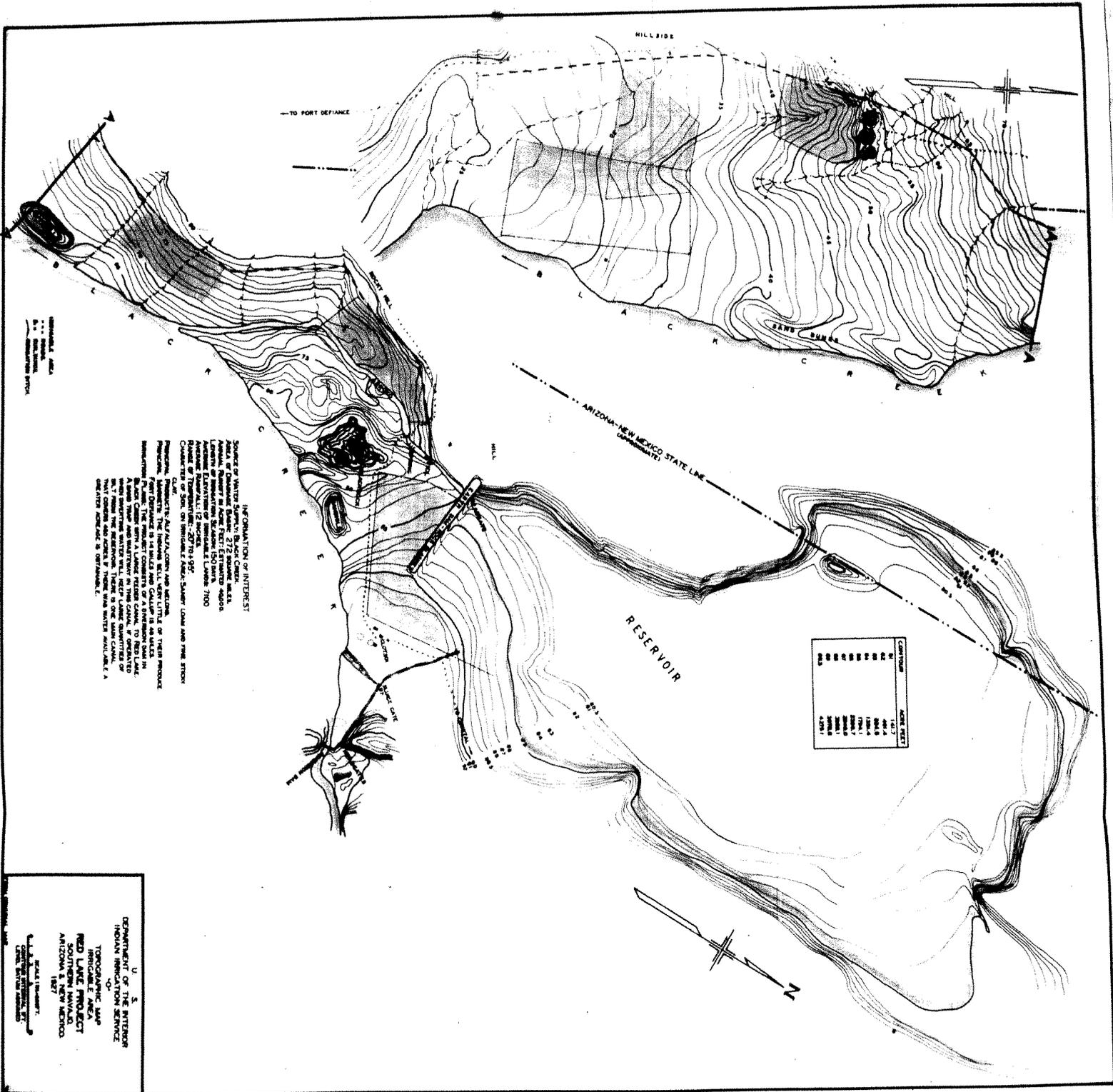


HEAD AND SLUICE GATE
MOENCOPI WASH, TUBA CITY

RED LAKE PROJECT.

This is an old project, originally built prior to 1904. However, no use was made of it and it almost went to pieces. Between that date and 1927 this Service rebuilt it twice, but still no use was made of it.

The construction of a sanitarium and the proposed construction of a large hospital at Fort Defiance made it necessary to provide for a large dairy herd to furnish milk to the patients. The limit of irrigation for raising forage at the Fort had been reached, so thoughts were again turned to the Red Lake Project, about 15 miles distant. Forty acres were set aside for the above use, and the superintendent agreed that he would see that the Indians made proper use of the project, so money was made available to rehabilitate the project. This was done during the fiscal years 1927 and 1928. As finished, it can irrigate about 700 acres of land with the extension of a few small ditches. The Indians seem to be taking hold of a considerable area and the forty acres for the agency is being put under cultivation.



CONTOUR	FOOT FEET
10	3000
11	3100
12	3200
13	3300
14	3400
15	3500
16	3600
17	3700
18	3800
19	3900
20	4000
21	4100
22	4200
23	4300
24	4400
25	4500
26	4600
27	4700
28	4800
29	4900
30	5000
31	5100
32	5200
33	5300
34	5400
35	5500
36	5600
37	5700
38	5800
39	5900
40	6000
41	6100
42	6200
43	6300
44	6400
45	6500
46	6600
47	6700
48	6800
49	6900
50	7000

INFORMATION OF INTEREST
 SOURCE OF WATER: Santa Rita Indian Reservation, 272 square miles, 10 miles from Phoenix, Arizona. The water is pumped to the reservoir by a pipeline 12 miles long. The reservoir is 12 miles long and 1/2 mile wide. The water is used for irrigation of 10,000 acres of land. The water is also used for domestic purposes. The reservoir is 12 miles long and 1/2 mile wide. The water is used for irrigation of 10,000 acres of land. The water is also used for domestic purposes.

SCALE
 1" = 1 MILE

U. S. DEPARTMENT OF THE INTERIOR
 BUREAU OF RECLAMATION
 PHOENIX, ARIZONA
 RED LAKE PROJECT
 SOUTHERN NAVALA
 ARIZONA & NEW MEXICO
 1957

The project consists of a diversion dam, a feeder canal to the reservoir, which has a storage capacity of 4275 acre feet, and about five miles of distributing canal. At the end of this fiscal year there is about 2500 acre feet in the reservoir.

The Project has been visited several times during the present season and it seems to be properly functioning. It is under the management of the Superintendent of the Southern Navajo jurisdiction and not this Service.

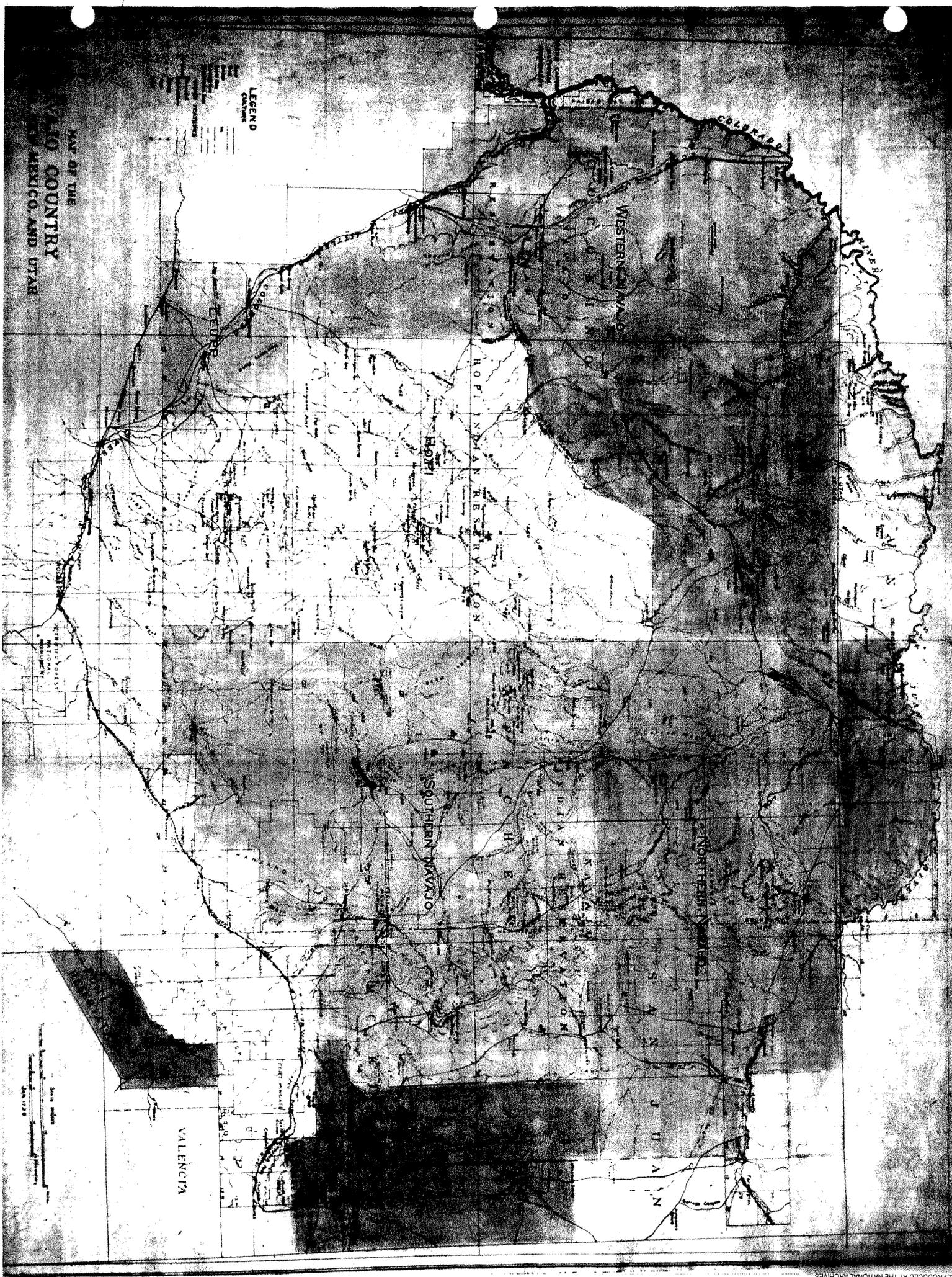
NAVAJO AND HOPI WATER DEVELOPMENT.

As a separate branch of the work in this District, is the development of domestic and stock water on the Navajo and Hopi reservations. This is the development of existing springs and seeps; the drilling of wells, both shallow and deep, and by the latter is meant over 300 feet; the digging of shallow wells, which is really a development of a spring that lies so the water will not flow from it by gravity, and the building of storm water reservoirs or ponds.

Organization.

All of this work is under the direct supervision of General Foreman A. H. Womack. Under him as his immediate assistant is J. J. Schwarz. The working force is divided into various crews - as two crews, one with headquarters at Polacca and the other one at Chin Lee, who look after the operation and maintenance of the finished wells which are equipped with windmills, storage tanks, troughs for stock, etc.

There are two crews who have tractors and rotary scrapers who are building the tanks



MAP OF THE
NAVAJO COUNTRY
NEW MEXICO AND UTAH

LEGEND

VALENCIA

or ponds, and from eight to ten other crews - varying with the season - who are developing springs.

At the beginning of the fiscal year we had bought seven light trucks for the use of various crews, and put on a new force of men. In order to get these trucks to the field, and to give certain instructions to the new men, they were called into the headquarters office and a little school of instruction, under Mr. Womack and Chief Clerk Albers, was held for a couple of days.

Cooperation.

The work of this water development was done under the closest cooperation with the Agency forces. Prior to the beginning of this year and at intervals, Mr. Womack, accompanied by the various superintendents, made trips over the reservation planning the work, mapping out a general plan for the year, which was to be followed as closely as possible. Contingencies which might arise from time to time would modify this, but so far as possible the original plan was adhered to, or if changed it was with the full approval of the superintendent. In this way the best distribution of the work,



EXCAVATING FOR SPRING



SPRING AFTER COMPLETION

and the development of water where it was most needed, was secured.

Mr. Womack submitted a report at the end of the year from which the following is taken, to show the viewpoint of the man in the field.

"You are aware of the long continued drouth in this Southwest country, also that on account of this continuous drouth all the stock is forced to concentrate at the permanent water which is the drilled wells and improved springs, which causes a congested condition and makes unusual demand on these permanent watering places. This, in turn, causes us to abandon our original plan in order to develop additional water near this overgrazed country. In some cases we have been forced to install gasoline pumping plant as an auxillary water supply to keep stock from perishing, these or other conditions causing us to have to deviate from the original program, such as this: Reservation superintendents will suddenly find out that they have an appropriation to construct sheep dips, then we are called on to develop water as near the proposed sheep dip location as possible. In a case of this kind we call together the necessary equipment and men to do this.

The requirements for water supply for one of these plabts is not only to supply water for dipping sheep, but as the sheep have to be dipped, and ten days later have to be dipped the second time, it is easy to understand that thousands of animals have to be held in this locality during this dipping period, therefore, using a great quantity of water which is considerably more than the usual spring will supply.

The superintendents fully realize the serious conditions of the grazing country, also the difficulty in providing water at all desired places, and they are reasonable in their requests for more water, also are constructive and cooperative.



GASOLINE ENGINE PUT IN BY AN
INDIAN AT HIS OWN EXPENSE.

However, the fact remains that the country is failing as a stock country at an alarming degree and every effort should be made to conserve the range in every way possible, not only by reducing the number of animals on it, but by scientific supervision of grazing, together with a sufficient amount of money to develop all the water possible and at the places where it will relieve the extremely overgrazed portions and allow some, at least, of the grass to mature and reseed the land. Not only is much of the grazing area kept grazed down to where it is prevented from developing seed, but is grazed down to the level of the ground the year round.

You will remember in our letter to General Scott on this subject (I think in 1915), I called his attention to the rapid destruction of the grazing land and expressed my belief that within a few years it would be reduced to a bad land and that there would commence the Real Indian Problem, and it is common knowledge in this country that since 1913 the increased stock has depleted much of the grazing land and there seems to be no relief in sight; however, the grazing seems to be the one resource of the Indian's existence.

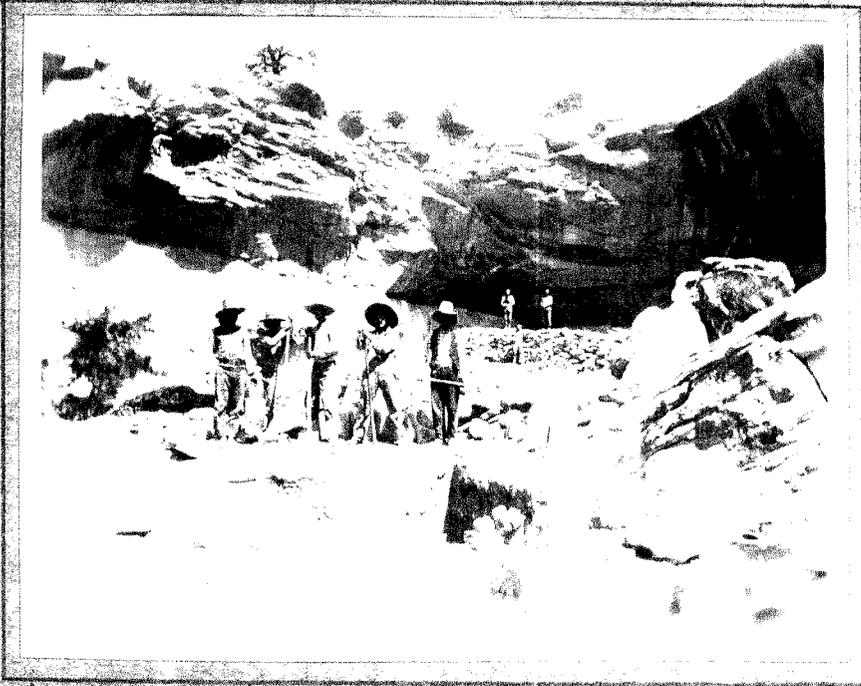
I believe that this Government could do well in using some such scheme of reseedling as did the British Government in Australia as this is about the same elevation (semi-desert) and something near the same rainfall per annum."

As showing the detail of work by jurisdictions, the following summary is submitted:

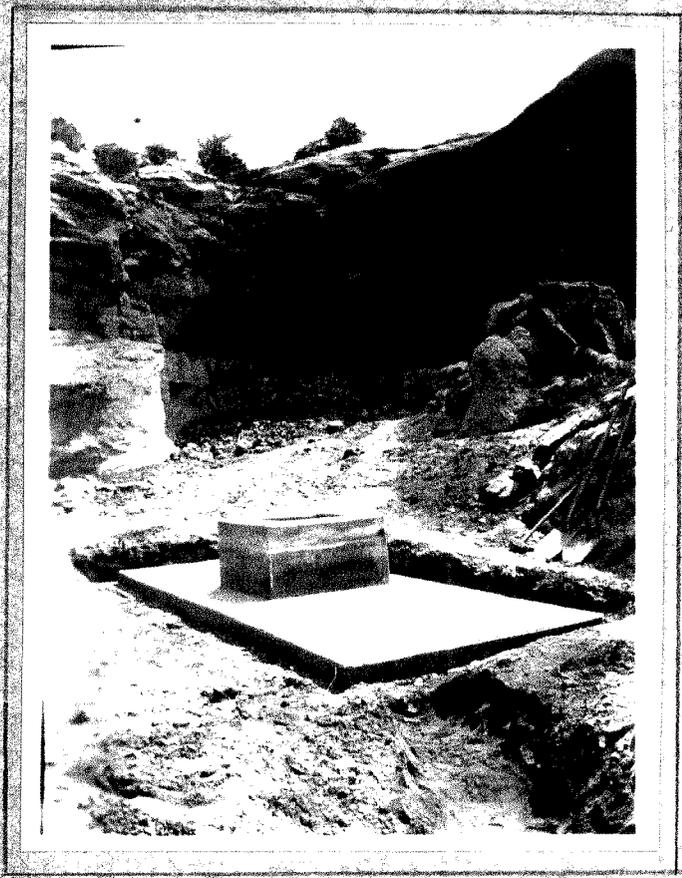
Northern Jurisdiction.

On the Northern Navajo we operated two spring crews with equipment including truck, tents, small tools, scrapers, picks, and shovels, etc. We also have material shipped here and have storage for material and implements.

This jurisdiction has many more springs than any of the other jurisdictions as much of the Northern is located in what is called the San Juan Basin, which is a natural artesian country. On



SPRING 3 MILES NORTH STEAM BOAT STORE



FINISHED SPRING

this account anything that makes a break in the overlying shale causes a spring to rise through the fault and this happens many times, especially along the major faults.

We have developed 36 springs and constructed concrete troughs at each, with the domestic storage away from the stock water; have dug 7 shallow wells which are walled up with a concrete slab top and in which is a heavy hinged lid.

Hopi Jurisdiction.

On this jurisdiction we have our headquarters camp including shop where we repair truck, automobiles, make forms for concrete, and issue all material for this jurisdiction.

We have one crew equipped with truck and tools which maintains 50 wells and windmills on this jurisdiction. We operated one spring crew the full year and had two other crews working part of the year who developed 10 springs and dug 12 shallow wells and at both the springs and wells reinforced concrete troughs were constructed.

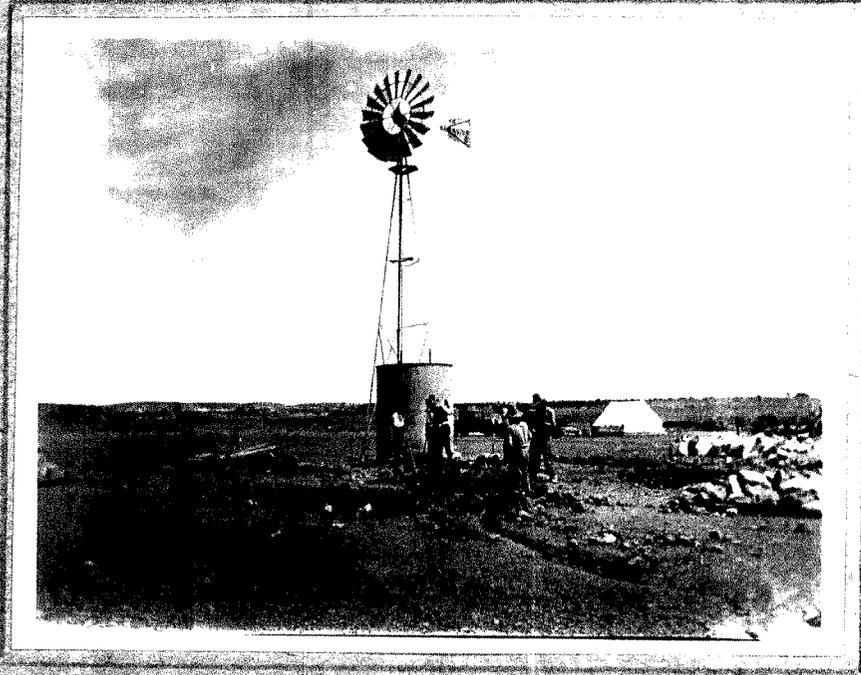
Southern Jurisdiction.

In addition to maintaining 35 wells and windmills, we have operated two spring crews developing 18 springs with reinforced concrete troughs, and have dug 13 shallow wells which were walled up and covered with concrete slab with hinged door; also placed concrete troughs at each of them.

Water conditions on the Southern Navajo are greatly improved by the permanent water development although there is but a small percent of the work necessary completed along these lines.

Leupp Jurisdiction.

On this jurisdiction there was little money to operate on, therefore, only 4 reservoirs were made. These reservoirs were located in what is called the Diablo country, where there are no springs and money was not sufficient to drill wells.



COMMENCING WORK OF MAKING REINFORCED CONCRETE TROUGH
WELL 728 - MOUTH OF STEAMBOAT

However, there were 2 wells dug in other parts of the reservation and reinforced concrete troughs constructed.

The allotment for Leupp jurisdiction is always small as the allotment of funds is based on the population.

Western Jurisdiction.

During the last year we operated one reservoir construction crew on the Western jurisdiction. This camp consists of the following men and equipment: one foreman, one tractor operator, one laborer (Indian). The equipment consists of one tractor, one rotary scraper, truck, tents, camping equipment, and cook shack.

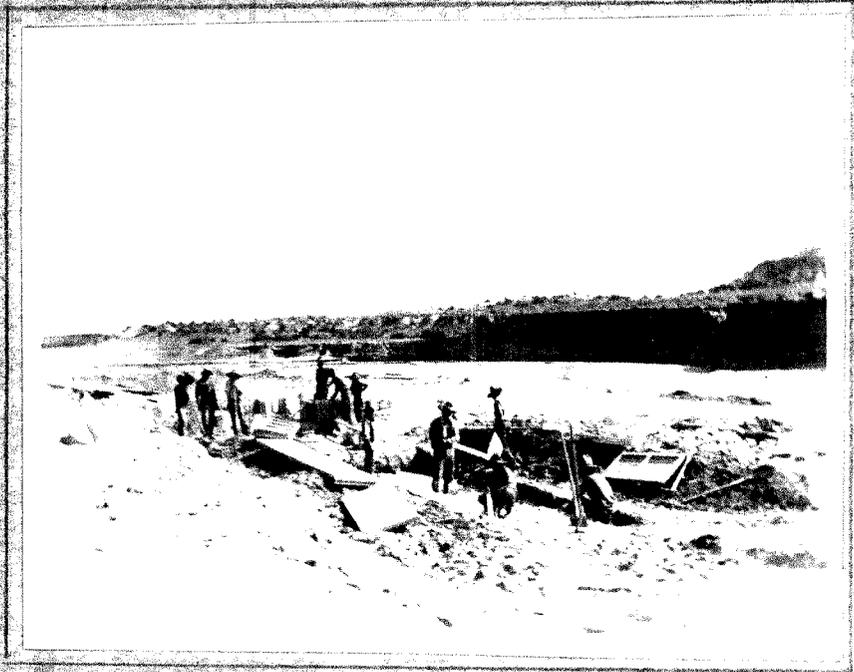
These reservoirs were constructed in order to supply stock water in a large area of the reservation where there are no springs and well drilling is impossible. There are 9 reservoirs constructed and the total earth moved on this reservoir work was approximately 28,847 cubic yards. In addition to this earth work there is the item of riprapping all the faces of these dams with slab stones. In some cases both sides of the dam were riprapped. This necessitated considerable work in getting the stone out.

There were two spring crews operating a part of the year who developed 10 springs and dug 12 shallow wells. At all springs and wells there is constructed a reinforced concrete trough.

The spring crew consists of one foreman, one assistant foreman, and the necessary Navajo laborers to carry on the work. The equipment consists of one truck, tents, scrapers, picks, shovels, and other small tools.

Eastern Jurisdiction.

On the Eastern Navajo we have had a duplicate of the construction outfit on the Western Navajo.



CONSTRUCTING PEACH SPRING - HOPI
3 MILES NORTHWEST BLACK MOUNTAIN STORE



PEACH SPRING

Owing to breakdowns in machinery, it has been necessary at times to quit work on the reservoirs, and the tractor crew was switched to the spring development work on the same jurisdiction. However, there were constructed 8 reservoirs with a total yardage of 20,000 cubic yards; this same party also dug 1 well, placing reinforced trough, etc.

This Eastern Navajo has but few springs and it will be necessary to continue the reservoir work, also to drill some wells as a permanent supply of water in order that in extremely dry times the stock can be moved to a permanent supply to prevent loss of herds.

S U M M A R Y

<u>Springs Developed</u>						
No.Navajo	So.Navajo	West.Navajo	East.Navajo	Hopi	Leupp	
36	18	10	3	10	0	
					TOTAL	77
<u>Reservoirs</u>						
Leupp	Western Navajo		Eastern Navajo			
4	9		8			
					TOTAL	21
<u>Wells Developed</u>						
No.Navajo	So.Navajo	West.Navajo	East.Navajo	Hopi	Leupp	
7	13	12	1	12	2	
					TOTAL	47

I N D E X

Springs and Dug Wells
Navajo and Hopi Reservations

1a	Jedito	Hopi
2a	Marty's	"
3a	Chief Spring	"
4a	Keams Canyon	"
5a	Walpi	"
6a	Tews Spring	"
7a	Shongopovi	"
8a	Wepo Spring	"
9a	Wacatova	"
10a	Solomy	"
11a	Tohadistoa	"
12a	Bradley's	"
13a	Todetai	"
14a	Denebito	"
15a	Denebito	"
16a	Bacoba	"
17a	Secota	"
18a	Ches-Keza	"
19a	Bacoba Spring No.2	"
20a	Tommy's spring	"
21a	Toreva spring	"
22a	Taylor's spring	"
23a	Burro spring	"
24a	Honana	"
25a	Ta-ho-not-a	"
26a	Pevait	"
27a	Cheskeza spring	"
28a	Chendeeto	"
29a	Seven Mile spring	"
30a	East Side spring	"
31a	Wacatova	"
32a	Cornfields spring	"
33a	Corner spring	"
34a	Chimopovi	"
35a	Clay spring	"
36a	Lucay Kad Top	No. Navajo
37a	Bekis Two Wells	"
38a	See Se Toa Well	"
39a	Wha Chee Yaza Well	"
40a	Etsidy Cli Bega well	"
41a	Sheep spring	"
42a	Silent Man's spring	"
43a	ToToTum spring	"
44a	Wha Chee spring	"
45a	Cross Roads well	"
46a	E-Ghany spring	"
47a	Salt Water Well	"
48a	Barber spring	"

49a	Stinking spring	No. Navajo
50a	One Eye spring	"
51a	Sulphur springs	"
52a	Kla Chee Toh Wells	"
53a	Doby Begay	"
54a	Be-Jes-To spring	"
55a	Billy Be-Kinny	"
56a	Sun Water	Hopi
57a	Nes Nahe Beto	"
58a	Sand spring	"
59a	Drilled Well No.702	"
60a	Koney Nez spring	Leupp
61a	Castle Butte spring	"
62a	Government spring pipeline	"
63a	Dalki spring	"
64a	Adakai Bega spring	"
65a	Many Mules spring	West. Navajo
66a	Sagne Et So	"
67a	Tokes Jae Well	"
68a	Chee Reservoir	"
70a	Morman spring	"
71a	Gap Well	"
72a	Cottonwood	Leupp
73a	Shone-to	"
74a	Fring spring	"
75a	Say To spring	"
76a	Sunny spring	"
77a	Bush spring	"
78a	Mason spring	"
79a	Low Ki spring	Hopi
80a	Garia Nez spring	North.Navajo
81a	Red Sand Stone spring	West. "
82a	End of Wall spring	North."
85a	Crow spring	Hopi
86a	Johns Well	North."
87a	Buck-a-lin Bega Well	West. "
88a	To-Enchoni spring	"
89a	Well No. 213	Hopi
90a	Manson Well	West. Navajo
91a	Belena Bega Well	Leupp
92a	Poison Fern spring	North.Navajo
94a	Nah-Tahn-Delet spring	Hopi
95a	Spotted Hand spring	"
11SJ	Te-La spring	No. Navajo
8 SJ	Frank W. Smith spring	"
3 SJ	Kimme-Do-De-Tsie spring(2)	"
2 SJ	Georges spring	"
5 SJ	Sahaezly spring	"
12SJ	White Water	"
44SJ	Gleason Sega Well	"

45SJ	Sheep spring No.2	No. Navajo
46SJ	Hogan Say-any spring	"
47SJ	Tsa-Skiesie Beyad To spring	"
48	Lone Cottonwood Well	"
1	Bitter Seep spring	West. Navajo
2	Burro or Honani spring	Hopi
3	Cemetary spring	West. "
4	Chil Chin Beto spring	No. "
5	Cow Camp spring	Hopi
6	Devil spring	"
7	De-be-Chady spring	No. "
8	Hole in the Rock spring	West. "
9	Ish-No-Gallie spring	Leupp
10	Kaibeto spring 1 & 2	West. "
11	Kaibeto Seeps 3 & 4	"
12	Koney Nez spring	Leupp
13	Rat spring	West. "
14	Red Lake Water Holes	"
15	Red Mesa spring	No. "
16	Sae-Es-Skeesie spring	Hopi
17	Saga-Nitso spring	West. "
18	Sand Stone spring	"
19	Say-Et-Sisie Seeps	"
20	Shan-to spring	No. "
21	Sheep spring	West. "
22	Taa-Pany spring	Hopi
23	Tan-E-Kis spring	No. "
24	Tanner Wash spring	West. "
25	Toh-La-Con spring	"
26	Tsa-Clizhin Beto spring	No. "
27	Tsa-Yo-To spring	"
28	Tsay-Ya-to spring	"
29	Walkers Seep	West. "
39	Chissey Yessie well	"
40	Drolet Well	So. "
41	Too Attley Well	No. "
42	Sheep Dip spring	"
44	To-No-Te spring	So. "
45	Sischene Badoni spring	West. "
46	Side-to spring	"
47	Tachine Badoni	"
48	Inscription spring	"
49	Say Atho spring	"
52	To-Inchony spring	No. "
53	West Sheep Dip spring	"
54	Black Rock spring	"
55	Charley Curley spring	"
57	Mud spring	"
58	Sheep Dip well	"
59	Tank well	West. "
60	Murphy spring	So. "

61	Adakai spring	Leupp
62	Big Butte spring	West.Navajo
63	Roy Nez spring	"
64	Air Singer spring	"
65	Bert Tso spring	"
66	Many Horses spring	"
67	Cla Chee spring	"
68	Gishi Beta spring	"
69	To-tocosh spring	So. "
70	Kit Seale springs (3)	"
71	Saebeto spring	"
72	Say-Beto Yeshie spring	"
73	Cow spring	"
74	Clizza Beto spring	"
75	Beck-ashe well	West."
76	Dabies well	No. "
77	Willie Pinto well	"
78	Sweet water spring	"
79	Sacisy-to spring	"
80	Tsa-to spring	"
81	Depa Bechan Beto spring	"
82	Alakli Seeps	"
83	Tocito spring	"
84	High Water spring	"
85	Stinking spring	"
86	Yellow Water spring	"
87	Snake spring	"
89	To-Do-Mui spring	"
91	Rock Ear Ring spring	"
92	Big Willow spring	"
93	Clizza Slone spring	So. "
94	Tsida Tsai Beto spring	"
95	Moencopi Sacret No.1 spring	West."
96	Cla Chee spring No. 2	"
97	Do Nagada spring	"
98	Hawthorn spring	So. "
99	Todo Cozie spring	No. "
100	Be Daa spring	"
101	Black mans well	"
102	Olivers well	"
103	Many Horses Badoni well	"
104	Brimhall Wash spring	"
107	Moencopi Spring No. 2	West."
108	N-Desh-a Beto spring	So. "
109	Nocki-Ba-to spring	Leupp
112	White Water well	"
113	Rock spring	West."
114	Hopi spring No. 3	Hopi
115	Burnt Corn spring	"
117	Moencopi spring No. 3	West."
118	To-Ha-Chee well	"
119	To-Ya-Nastladi spring	Hopi

120	Hostodi Ko spring	Hopi
121	Cleen Nakadi spring	"
122	Estla spring	"
123	Cla Chai spring	"
124	To Hoakle spring	"
125	Clair Gee spring	"
126	Tonalea well	"
129	To La Chee spring	Leupp
131	Nava wells	No. Navajo
132	Bechan Kelly Well	Leupp
133	Wall spring	Hopi
134	Shosh Beto	So. Navajo
135	Many Whiskers well	West. "
136	To Ha Leen well	"
137	Say Lachee spring	"
138	Tohaney Nez spring	"
139	Hogay To spring	So. "
140	Honagathme well	"
141	Tode Coz well	West. "
142	Toe Etsissie well	"
143	Joe Isaac Well	Hopi
144	Many Goats spring	"
145	Many Mules well	"
146	Salina springs No. 1	So. "
150	High Mt. spring	No. "
151	Saw Yazzie spring	"
152	Nocki To (2)	"
153	Tsa-Anea Wooly spring	"
154	Red Sheep spring	"
155	To-Denesjae spring	"
157	Cotton Wood spring	Hopi
158	Say Kole spring	"
159	Den Beto well	"
160	Trough spring	West. "
161	Gray Hat Charley well	"
162	Peach Tree spring	"
163	Sai spring	So. "
164	Salina spring No. 2	"
165	To Dis Caz spring	No. "
166	Sand Wash spring	"
167	Teece Beyad To spring	"
168	Lizzies spring	"
170	Sand spring	Hopi
171	Boiling spring	"
172	Clai Benalle well	"
173	Shanto canyon spring	West. "
174	John Smith well	"
176	White Rock spring	No. "
177	Iron spring	"
178	Little Shiprock spring	"
179	Juth Lachee spring	"

180	Dele Benalle spring	No. Navajo
181	Black Goats spring	"
182	Tohito springs (2)	So. "
183	Behito spring	"
184	To Jeel Kadi No.1 well	"
185	To Jeel Kadi No.2 well	"
188	Coyote well	West."
189	To Chine Bega well	"
190	Butler spring	"
192	Farm springs (3)	"
193	Say Sun well	"
195	Dynamite spring	No. "
196	Tohatchi spring	"
197	Toholee springs (2)	"
198	Cotton Wood spring	"
199	Crooked Tree spring	"
200	Flat Rock spring	"
201	Tode Coz spring	So. "
202	Tsa Lon spring	"
204	Tokes Jay spring	West."
206	Sunny Side spring	No. "
207	Willow spring	"
208	Poleman spring	"
209	Community spring	"
210	Chilibeto well	So. "
211	Chesenbeto well	"
212	Four wells	"
213	To Ladai spring	"
214	Black Mtn. spring (2)	"
215	Red Rock well	"
216	Nakai spring	No. "
217	Sand spring	"
218	Old Policeman spring No.2	"
219	Greasewood spring	"
220	Tillman well No. 1	Hopi
221	Box Canyon well	"
222	Water in Wash well	"
223	Badger spring	"
229	Sayana Chee well No. 1	So. "
230	Sayana Chee well No.2	"
231	Lone well	No. "
232	Black Rock spring No.2	"
233	Red Rock wash spring	"
234	Black Rock spring No. 1	"
235	Blind Man well	Leupp
236	To-Hat-Chi spring	Hopi
237	Rough Mesa well	"
238	White Rock spring	"
239	Squaw Track well	"
240	Smiling spring	"
243	Tuckeliny well	"
244	Mountain well	"

245	To Hannia Well	Hopi
246	Blue Water spring	No.Navajo
247	Black Stump Well	"
248	White Water well	"
249	Box well	"
253	Tsa Cleshie spring	So. "
254	Cove spring	"
255	Asona spring	"
256	Tso spring	"
257	Tode Cozie well	"
259	Rogers well	Hopi
260	Yellow spring	No. Navajo
261	Coal Mine spring	"
262	Black Peak well	"
263	Table Mesa well	"
264	Hoigegan spring	So. "
265	Straight Rock well	"
266	Burnt Corn No. 2	"
267	Bekay spring	"
270	Peach spring	Hopi
271	White Hat spring	"
272	Rim Rock spring	So.Navajo
273	Navajo spring	West."
275	Atsety well	So. "
276	Taos Pi spring	East."
277	Carson Cave spring	"
278	Judge Becentie spring	"

The springs and wells have been renumbered to correspond with the Cost numbers. This is a complete index of all springs and wells developed to date.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Bechan Kelly Well
 Other Names Big Stomach
 Reservation Leupp
 Location 10 miles N.E. of Bill Williams Store (in Sand hills)
 Date Developed September 19 28
 Flow in gals per minute:
 Before development None After 5

Development (or remarks):

This well was excavated down thru quicksand to shale, filter bed placed in bottom, masonry wall laid up and backfilled with gravel, a concrete slab with man hole molded over well and a diaphragm pump installed. Depth of well 16 ft. diameter of well at bottom 6 ft., diameter at top 3½ ft.

Name Wall Spring
 Other Names Santa Spring
 Reservation Hopi
 Location 6 miles S.E. Polacca at foot of Mesa
 Date Developed July 19 28
 Flow in gals per minute:
 Before Development 1 After 2

Development (or remarks):

There had been some development work done on this spring in the past, further development being to build a storage reservoir size 6'x12'x4' deep, stone masonry wall laid up and backfilled with gravel filter, a reinforced concrete slab with man hole molded over top, and water piped to a reinforced concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Shosh Beto
 Other Names Bear Spring
 Reservation So. Navajo
 Location 6 miles S.E. Steamboat Store and east of well
No. 734 up in narrow canyon.
 Date Developed July 1928
 Flow in gals per minute:
 Before development 1 After 2

Development (or remarks):

The Indians had done some development work on this spring in the past; excavation was continued on down and into shale and a trench opened up the canyon and heading water off from seeping into wash. This trench was filled with gravel filter, perforated pipe laid at lower end of seepage area, backfilled with gravel and piped to a reinforced concrete stock watering trough and a small storage reservoir size 4'x4'x3' deep for domestic water supply.

Name Many Whiskers Well
 Other Names _____
 Reservation W. Navajo
 Location 12 S. E. Kaibeto at foot of White Mesa.
 Date Developed July 1928
 Flow in gals per minute:
 Before Development Seep After 2½ gal.

Development (or remarks):

This well was excavated down and into sandstone to a depth of 8 ft., stone masonry wall laid up and back-filled with gravel. A trench 8 ft. deep and 30 ft. long was excavated from well to foot of mesa to drain water into well and prevent it from seeping in wash; A concrete slab with man hole molded over top.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name To Ha leen Well
Other Names John Daw Well
Reservation W. Navajo
Location 8 miles S.E. Cow Springs

Date Developed July 19 28
Flow in gals per minute:
Before development Seep After 1½

Development (or remarks):

This well was excavated down and in shale, depth 8 ft.; stone masonry wall laid up and backfilled with gravel; a concrete slab with man hole molded over well.

Name Say Lachee Spring
Other Names Red Sand stone spring
Reservation W. Navajo
Location 15 miles S.W. of Red Lake on bank of
Blue Canyon

Date Developed August 19 28
Flow in gals per minute:
Before Development 1 After 2½

Development (or remarks):

This spring was excavated down in sand stone 3 ft. deep and 180 ft. long, backfilled with gravel, perforated pipe laid at lower end and piped to a reinforced concrete stock watering trough 120 ft. from spring.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

138

Name Tobaney Nez Spring
 Other Names Black Mt. Well
 Reservation W. Navajo
 Location 8 miles S.E. Red Lake, 3 miles above
Blue Canyon Road
 Date Developed August 1928
 Flow in gals per minute:
 Before development Seep After 3½

Development (or remarks):

The Indians had tried to develop this water but were not successful. Excavated down 7½ ft. in old excavation into shale, laid up stone masonry wall, dug a trench up the bank of wash 7½ ft. deep into shale, filled with gravel, water raised sufficient to pipe to a reinforced concrete stock watering trough, a reinforced concrete slab with man hole molded over top and so arranged if water level should lower, water can be drawn and poured in sump box and on to trough.

139

Name Hogey To Spring
 Other Names Paul Williams
 Reservation S. Navajo
 Location 1 mile N. of Steam Boat or Paul Williams
Store.
 Date Developed August 1928
 Flow in gals per minute:
 Before Development 1 After 1 gal.

Development (or remarks):

This spring was in a seam of sandstone, seam opened and all water collected piped to a storage tank, laid up of stone masonry walls with concrete slab in bottom and reinforced concrete slab with man hole molded over top. Size of reservoir 4'x14'x4' deep. This spring is for domestic water supply for several families living in the canyon. Stock water at well 728.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Honagathne Well
 Other Names Liquid Sand Well
 Reservation S. Navajo
 Location 8 miles S. of Steamboat Canon Store in
main wash
 Date Developed August 19 28
 Flow in gals per minute:
 Before development None After 8 gal.
 Development (or remarks):

This spring was excavated down thru clay sand and into shale, masonry wall laid up and back-filled with gravel filter. Depth of well 12 ft. diameter 5 ft. A concrete slab with man hole molded over top of well. The reinforced concrete trough for this well will be constructed during the first week of September.

Name Wode Cos Well
 Other Names _____
 Reservation W. Navajo
 Location 8 miles W. of Red Lake
 Date Developed September 28
 Flow in gals per minute:
 Before Development None After 2 1/2
 Development (or remarks):

This well was excavated down into shale (red), a masonry wall laid up and backfilled with gravel. This well is near bank of wash therefore the wash was undercut, trench being 32 ft. long and 3 1/2 to 6 ft. deep. Placed gravel filter, perforated pipe, backfilled with gravel and covered with cement to protect from flood waters. A reinforced concrete slab was molded over well. Depth of well 14 ft. diam. 5 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Joe Etsiasie Well
 Other Names _____
 Reservation W. Navajo
 Location 8 miles W. of Red Lake and 1 mile from
Code Cox Well
 Date Developed Sept. 19 28
 Flow in gals per minute:
 Before development 2 After 2

Development (or remarks):

This well was developed for domestic use, and excavated down into sandstone to depth of 8 ft. by 4 ft. in diameter; a masonry wall laid up, concrete slab with man hole molded over top.

Name Joe Isaac Well
 Other Names Blue Lake Well
 Reservation Hopi
 Location 6 miles W. of Cow Springs and near head
of Blue Lake
 Date Developed September 19 28
 Flow in gals per minute:
 Before Development None After 1

Development (or remarks):

This well was excavated down thru quicksand and into clay; masonry wall laid up and backfilled with gravel. Depth of well 15 ft. diameter of well 5 ft. Cement slab with man hole molded over top.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Many Goats Spring
Other Names _____
Reservation Hopi
Location 7 miles S. W. of Red Lake

Date Developed September 19 28
Flow in gals. per minute:
Before development 2 After 4

Development (or remarks):

This spring was excavated down thru quicksand and into sandstone, perforated pipe laid and backfilled with gravel. A reinforced concrete trough constructed. Distance from spring to trough 180 ft.

Name Many Mules Well
Other Names _____
Reservation Hopi
Location 6 miles S. of Red Lake

Date Developed September 19 28
Flow in gals. per minute:
Before Development 1½ After 3½

Development (or remarks):

This well was excavated down thru quicksand and into sandstone; masonry wall laid up and backfilled with gravel, a concrete slab with man hole molded over top. Depth of well 10 ft. diam. of well 5 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Salina Springs No. 1
 Other Names _____
 Reservation So. Navajo
 Location 1/2 mile W. of Salina Trading Post at foot of
White Mesa
 Date Developed September 19 28
 Flow in gals per minute:
 Before development seep After 1

Development (or remarks):

This spring was excavated down and into sandstone, perforated pipe laid and backfilled with gravel. A storage reservoir was dug partly in sandstone, masonry wall laid up and covered with a concrete slab with man hole. Size of reservoir 12'x6'x5' deep and overflow was installed and connected with pipe line running to trough. Distance from reservoir to trough 120 ft.

Name High Mt. Spring
 Other Names Zilth Aney
 Reservation N. Navajo
 Location 3 miles West of Rock Point Store
 Date Developed September 28
 Flow in gals per minute:
 Before Development 1 1/2 After 2 1/2 gal.

Development (or remarks):

This spring was up on side of cliff above wash. Excavated in sandstone for distance of 30 ft. by 3 ft. deep, filled with gravel to depth of 1 ft., perforated pipe and backfilled with gravel. Covered with cement slab to protect from flood water pouring over face of cliff. A reinforced concrete stock watering trough constructed. Distance from spring to trough 120 ft. Also put in brush and rock fill to protect trough from flood water coming down canyon.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

153

Name Taa-Anaa Wooly Spring
Other Names _____
Reservation N. Navajo
Location 6 miles S. of Rock Point Store
Date Developed September 1928
Flow in gals per minute:
Before development Seep After 1/2 gal.
Development (or remarks):

This spring was excavated down and into sandstone depth 4 ft., perforated pipe laid and backfilled with gravel, a reinforced concrete stock watering trough constructed. Distance from spring to trough 240 ft. Rock and brush fill made near trough to protect same from flood waters.

154

Name Red Sheep Spring
Other Names Dubee-Clechhege Spring
Reservation N. Navajo
Location 2 1/2 miles N.W. of Rock Point
Date Developed _____ 19_____
Flow in gals per minute:
Before Development Seep After 1/2 gal.
Development (or remarks):

This seep is located on side of canyon wall. Excavated down and into sandstone, perforated pipe laid and backfilled with gravel. Piped 200 ft. to a reinforced concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name To-Denesjae Spring
 Other Names Scattered Water
 Reservation N. Navajo
 Location 5 miles S.W. of Rock Point Store on road to
Dene-Hotso
 Date Developed September 19 28
 Flow in gals per minute:
 Before development $\frac{1}{2}$ After $1\frac{1}{4}$ gal.

Development (or remarks):

This spring was excavated down and into original formation (shale), perforated pipe laid and back-filled with gravel, piped 320 ft. to a reinforced concrete stock watering trough.

Name Cotton Wood Spring
 Other Names _____
 Reservation Hopi
 Location 10 miles S.E. Cow Springs
 Date Developed October 19 28
 Flow in gals per minute:
 Before Development Seep After $\frac{3}{4}$

Development (or remarks):

This spring was excavated down and into shale, perforated pipe laid and backfilled with gravel filter, two reinforced concrete troughs constructed. Distance from spring to trough 220 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

158

Name Say Kole Spring
Other Names Cole Spring
Reservation Hopi
Location 13 miles S.E. Cow Spring

Date Developed October 19 28
Flow in gals per minute:
Before development Seep After 2

Development (or remarks):

This spring was excavated back into side of mesa a distance of 40 ft., perforated pipe laid and backfilled with gravel. A storage tank was excavated, size 15 ft. deep by 6 ft. in diameter. Rock wall laid up and cover with a concrete slab with a man hole molded in same. Two reinforced concrete troughs constructed.

159

Name Den Bato Well
Other Names Navajo Well
Reservation Hopi
Location 15 miles S.E. Cow Springs

Date Developed October 19 28
Flow in gals per minute:
Before Development Seep After $\frac{1}{2}$

Development (or remarks):

This well was excavated down and into shale, rock masonry wall laid up and backfilled with gravel. Slab with man hole molded over top. (No trough constructed.) This well was developed for domestic use only.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

160

Name Trough Spring
 Other Names Trench Spring
 Reservation W. Navajo
 Location 8 miles N. of Shanto Trading Post.

Date Developed October 19 28
 Flow in gals per minute:
 Before development 1 After 1

Development (or remarks):

This spring was excavated back into hill of solid rock following crevice, perforated pipe laid and backfilled with gravel. Pipe to storage reservoir size 6'x6'x6' deep with a concrete slab with man hole molded over top. A reinforced concrete trough constructed. Distance from spring to trough 90 ft.

161

Name Gray Hat Charley Well
 Other Names _____
 Reservation Western Navajo
 Location 2 miles S. of Hat Spring.

Date Developed October 19 28
 Flow in gals per minute:
 Before Development None After 2

Development (or remarks):

This well was excavated down in sandstone to a depth of 12 ft., masonry wall laid up, backfilled with gravel, a concrete slab with man hole molded over top. Also a reinforced concrete trough constructed.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Peach Tree Spring
Other Names _____
Reservation W. Navajo
Location 8 miles W. of Shanto

Date Developed October 19 28
Flow in gals per minute:
Before development 1 After 1 1/2

Development (or remarks):

This spring was excavated in sandstone, perforated pipe laid and backfilled with gravel. A reservoir was shot in sandstone and no concrete trough constructed.

Name Sai Spring
Other Names _____
Reservation S. Navajo
Location N.E. corner of Salabai Mesa and 2 miles
from Salina Trading Post
Date Developed October 19 28
Flow in gals per minute:
Before Development 1 After 3/4

Development (or remarks):

This spring was excavated down thru quicksand and into sandstone, perforated pipe laid and backfilled with gravel, a reinforced concrete trough constructed. Distance from spring to trough 285 feet.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Salina Spring No. 2
 Other Names _____
 Reservation So. Navajo
 Location 300 yds. N.W. of Salina Store
 Date Developed October 19 28
 Flow in gals per minute:
 Before development Seep After $\frac{1}{3}$
 Development (or remarks):

This spring was excavated down into sandstone, perforated pipe laid and backfilled with gravel, a storage reservoir size 6'x10'x5' deep with a concrete slab with man hole molded over top, a reinforced concrete trough constructed. Distance from reservoir to trough 85 ft.

Name La Dia Caz Spring
 Other Names Gold Water
 Reservation N. Navajo
 Location 6 miles S.W. Rock Point on road from
Rock Point to Looka Chuckai
 Date Developed October 19 28
 Flow in gals per minute:
 Before Development Seep After $\frac{1}{3}$ gal.
 Development (or remarks):

This spring was excavated down into sandstone, perforated pipe laid and backfilled with gravel filter, a reinforced concrete trough constructed.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Sand Wash Spring
Other Names Senapass Soca Spring
Reservation N. Navajo
Location 2 miles north of Sweet Water

Date Developed October 19 28
Flow in gals per minute:
Before development Seep After 1 1/2

Development (or remarks):

This seep is along bank of wash, excavated down four feet in gravel, boulders and into shale, perforated pipe laid and backfilled with gravel, reinforced concrete troughs constructed. Distance from spring to trough 465 feet.

Name Teece Boyad To Spring
Other Names Jug Nose Spring
Reservation N. Navajo
Location _____

Date Developed October 19 28
Flow in gals per minute:
Before Development Seep After 1/2

Development (or remarks):

This seep came from crevice in sandstone. Seam was opened up, perforated pipe laid and backfilled with gravel, reinforced concrete trough constructed. Distance from spring to trough 340 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

168

Name Lizzies Spring
Other Names _____
Reservation N. Navajo
Location 1 mile S.E. of Sweet Water

Date Developed October 19 28
Flow in gals per minute:
Before development Seep After 1/2

Development (or remarks):

This seep was excavated down thru quicksand and into shale, perforated pipe laid and backfilled with gravel, a reinforced concrete trough constructed. It was necessary to build some dirt, brush and rock fills to protect spring and trough from flood water. Distance from spring to trough 280 ft.

170

Name Sand Spring
Other Names One Eye
Reservation Hopi
Location Black Mt. 9 miles E. of Shanto

Date Developed November 19 28
Flow in gals per minute:
Before Development 3 After 3

Development (or remarks):

This spring was excavated down and into shale perforated pipe laid and backfilled with gravel and piped to reinforced concrete watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Boiling Spring
Other Names Bubbling Spring
Reservation Hopi
Location 6 miles S. of Sand or One Eye Spring

Date Developed November 1928
Flow in gals per minute:
Before development 2 After 2

Development (or remarks):
this spring was excavated down and into shale, perforated pipe laid and backfilled with gravel. Also piped 200 ft. where it is proposed to construct a reinforced concrete trough at a later date.

Name Claf Benalle Well
Other Names _____
Reservation Hopi
Location 6 miles N. of Red Lake

Date Developed November 1928
Flow in gals per minute:
Before Development 1 After 1

Development (or remarks):
This well was excavated down thru sand and into sandstone. Depth of well 12', diameter of well 5', rock wall laid up and backfilled with gravel, a concrete slab with man hole molded over top. It is proposed to construct a concrete water trough at a later date.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Shanto Canyon Spring
Other Names _____
Reservation W. Navajo
Location Shanto Canyon near store

Date Developed November 19 28
Flow in gals per minute:
Before development Seep After 2

Development (or remarks):

This spring or seep was excavated back into mesa, tunneled back a distance of 16 ft., shot out a storage reservoir 10'x12'x5' deep, all in sandstone. It is proposed to construct concrete trough later.

Name John Smith Well
Other Names Sayetsosie Well
Reservation W. Navajo
Location 2 miles W. of divide and Tuba City and Kayenta Road. 20 miles from Kayenta.
Date Developed November 19 28
Flow in gals per minute:
Before Development 1 After 1

Development (or remarks):

This well was partly developed by Indians years ago, all old timber, rock, etc. was removed and continued excavation down and into sandstone, laid up masonry wall, backfilling with gravel, concrete slab with man hole molded over top. A concrete trough will be constructed later.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name White Rock Spring
 Other Names Etsah Toah
 Reservation N. Navajo
 Location 8 miles E. of Sweet Water on Sweet Water and Shiprock Road
 Date Developed November 19 28
 Flow in gals per minute:
 Before development Seep After $\frac{1}{2}$

Development (or remarks):

This spring was excavated down and into sandstone depth 8 ft., perforated pipe laid and backfilled with gravel, piped 160 ft. to reinforced concrete stock watering trough.

Name Iron Spring
 Other Names _____
 Reservation N. Navajo
 Location 8 miles S. of Sweetwater
 Date Developed November 19 28
 Flow in gals per minute:
 Before Development Seep After $\frac{1}{2}$

Development (or remarks):

This spring was excavated down thru sand and gravel into sandstone, perforated pipe laid and backfilled with gravel and thence piped to a reinforced concrete stock watering trough. Distance from spring to trough 160 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Little Shiprock Spring
 Other Names _____
 Reservation N. Navajo
 Location 6 miles E. of Red Rock on Shiprock and
 Red Rock road.
 Date Developed November 19 28
 Flow in gals per minute:
 Before development 1½ After 4

Development (or remarks):

This spring was excavated down thru sand and into shale, perforated pipe laid and backfilled with gravel, a reinforced concrete stock watering trough constructed. Distance from spring to trough 485 ft.

Name Juth Lachee Spring
 Other Names _____
 Reservation N. Navajo
 Location 5 miles S. of Sweet Water Store
 Date Developed November 19 28
 Flow in gals per minute:
 Before Development 1 After 1½

Development (or remarks):

This spring was excavated down and into sandstone, perforated pipe laid and backfilled with gravel, a reinforced concrete stock watering trough constructed. Distance from spring to trough 160 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Dale Benalle Spring
Other Names _____
Reservation N. Navajo
Location 6 miles S. of Sweet Water

Date Developed November 19 28
Flow in gals per minute:
Before development Seep After 1/2

Development (or remarks):

This spring was excavated down thru liquid and into sandstone, perforated pipe laid and backfilled with gravel and piped to reinforced concrete stock watering trough.

Name Black Goats Springs (3 in number)
Other Names _____
Reservation N. Navajo
Location 3 miles E. of Sweet Water Store

Date Developed November 19 28
Flow in gals per minute:
Before Development 1/2 After 3/4

Development (or remarks):

These three seeps were developed by excavating down into sandstone, perforated pipe laid in each and piped to a reinforced concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Tohito Springs (2 in number)
Other Names _____
Reservation S. Navajo
Location 4 1/2 miles S. of Salina Spring

Date Developed November 19 28
Flow in gals per minute:
Before development None After 1/2

Development (or remarks):

These seeps were developed by excavating down thru sand and into shale, perforated pipe laid and backfilled with gravel; also a small storage reservoir 4'x4'x4' deep constructed near reinforced-concrete trough.

Name Bahito Spring
Other Names Rin Rock Spring
Reservation S. Navajo
Location 4 1/2 miles S.W. Salina Spring

Date Developed November 19 28
Flow in gals per minute:
Before Development Seep After 1/2

Development (or remarks):

Excavated down thru sand and into shale, perforated pipe laid and backfilled with gravel, a storage reservoir for domestic use constructed, size of reservoir 5'x6'x4' deep. Overflow from this reservoir is piped to reinforced concrete stock water trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name To Jeel Kadi No. 1 Well
 Other Names _____
 Reservation S. Navajo
 Location 1 mile N.W. of Sayah Rock in Sayah Canyon.
 Date Developed November 19 28
 Flow in gals per minute:
 Before development Seep After 1/2

Development (or remarks):

This well was excavated down thru sand and into sand stone. Depth of well 12 ft., diameter of well 5 ft. Stone wall laid up and backfilled with gravel, concrete slab with man hole and pouring box constructed over top with a drain pipe from pouring box to trough which is of reinforced concrete.

Name To Jeel Kadi No. 2 Well
 Other Names _____
 Reservation S. Navajo
 Location 2 miles N.W. of Sayah Rock and 1 mile N.W. To Jeel Kadi No. 1
 Date Developed November 19 28
 Flow in gals per minute:
 Before Development Seep After 3/4

Development (or remarks):

This well was excavated down thru soil and into shale, stone wall laid up and backfilled with gravel, a concrete slab with man hole and pouring box constructed over top of well and piped to a reinforced concrete trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Coyote Well
Other Names _____
Reservation W. Navajo
Location 8 miles S.E. of Old Copper Mine

Date Developed December 19 28
Flow in gals. per minute:
Before development 1/4 After 3/4

Development (or remarks):

This well was partly developed in the past. All timber and rock was removed and continued excavation down to shale a depth of 10 ft., stone wall laid up and backfilled with gravel, a top of lumber was placed. A concrete trough and concrete slab will be molded over top as soon as weather condition will permit.

Name To China Bega Well
Other Names _____
Reservation W. Navajo
Location 15 miles W. of Rat Springs

Date Developed December 19 28
Flow in gals. per minute:
Before Development 1 pt. After 1/2

Development (or remarks):

This well was excavated down and into sandstone to a depth of 12 ft., diameter 6 ft. at bottom and 3 ft. at top. Stone wall laid up and back-filled with gravel. A top of lumber placed over well; concrete trough and slab of concrete will be molded over well later.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT.

Name Butler Spring
 Other Names _____
 Reservation W. Navajo
 Location 12 miles W. of Rat Spring
 Date Developed December 19 28
 Flow in gals per minute:
 Before development 1/4 After 1/2
 Development (or remarks): _____

This spring was excavated down and into shale, perforated pipe laid and backfilled with gravel and piped to trough location, which will be constructed as soon as weather condition will permit.

Name Farm Springs (3 in number)
 Other Names _____
 Reservation W. Navajo
 Location 2 1/2 miles S.W. of Tuba City due N. of Farmers Cottage on side of Mesa.
 Date Developed December 19 28
 Flow in gals per minute:
 Before Development Seeps After 1 1/2
 Development (or remarks): _____

These seeps are on face of Mesa. A trench was excavated about 10 ft. back from face of Mesa, 6 ft. deep and 200 ft. This excavation is down and into shale, perforated pipe laid and back-filled with gravel and piped to a concrete storage reservoir which had been constructed by the agency several years ago.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

193

Name Say Sun Well
Other Names _____
Reservation W. Navajo
Location 7 miles N.W. of Rat Spring
Date Developed December 19 28
Flow in gals per minute:
Before development Seep After 1

Development (or remarks):

This well was excavated down and into shale a depth of 13 ft. Stone masonry wall laid up and backfilled with gravel. A top of lumber was put over the well but this is only temporary as it is proposed to construct concrete trough and mold a concrete slab over top.

195

Name Dynamite Spring
Other Names _____
Reservation N. Navajo
Location 4 miles S.E. of Red Rock Store
Date Developed December 19 28
Flow in gals per minute:
Before Development 1/4 After 3/4

Development (or remarks):

These seeps were developed by excavating back from face of seepage and down into shale. This trench is 100 ft. long and water was all concentrated in a basin, perforated pipe laid and backfilled with gravel, a reinforced concrete trough constructed. Distance from spring to trough 220 ft.

197

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Tobolee Springs (2 in number)
Other Names Dene Yazzie Badoni Spring
Reservation N. Navajo
Location 3 1/2 miles S.W. of Red Rock Store on Road

Date Developed December 19 28
Flow in gals per minute:
Before development 1 After 3

Development (or remarks):

These springs are near bottom of wash and in crevices of Blue Lime stone. These seems were opened and the two springs connected with same pipe line, concrete trough constructed. Distance from springs to trough 150 ft.

196

Name Tobatchi Spring
Other Names _____
Reservation N. Navajo
Location 3 miles E. of Red Rock

Date Developed December 19 28
Flow in gals per minute:
Before Development Seep After 3/4

Development (or remarks):

This seep is in bottom of wash excavated down and into shale in bed of wash, perforated pipe laid and backfilled with gravel, a reinforced concrete trough constructed. The trough is located 120 ft. from spring.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Cotton Wood Spring
Other Names Dene Beto Spring
Reservation N. Navajo
Location 4 miles N.E. of Red Rock Store

Date Developed December 19 28
Flow in gals per minute:
Before development Seep After 1/2

Development (or remarks):

This seep was developed by excavating down and into sandstone, perforated pipe laid and back-filled with gravel, and piped to a reinforced concrete stock watering trough.

Name Crooked Tree Spring
Other Names _____
Reservation N. Navajo
Location 5 miles N.E. of Little Shiprock

Date Developed December 19 28
Flow in gals per minute:
Before Development Seep After 1/2

Development (or remarks):

This seep was excavated down and into sandstone, perforated pipe laid and backfilled with gravel, concrete water trough constructed. Distance from spring to trough 250 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Flat Rock Spring
 Other Names _____
 Reservation N. Navajo
 Location 6 miles N.E. of Little Shiprock
 Date Developed December 19 28
 Flow in gals per minute:
 Before development Seep After 1/2

Development (or remarks):

This spring was excavated down and into sandstone, perforated pipe laid and backfilled with gravel; water piped 40 ft. to reinforced concrete watering trough.

Name Red Box Spring
 Other Names _____
 Reservation S. Navajo
 Location 4 miles E. Salina Spring Store
 Date Developed December 19 28
 Flow in gals per minute:
 Before Development 1 After 1-3/4

Development (or remarks):

This spring was excavated down and into shale. There is layer of coarse gravel between soil and shale, perforated pipe laid and backfilling with gravel filter, two reinforced concrete stock watering troughs constructed. Distance from spring to trough 100 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

202

Name Tsa Lon Spring
Other Names _____
Reservation S. Navajo
Location 4 miles N.W. Salina Store

Date Developed December 19 28
Flow in-gals per minute:
Before development Seep After 1/2

Development (or remarks):

This seep was excavated down and into dense sandstone, perforated pipe laid and backfilled with gravel and piped 400 ft. to a reinforced concrete stock watering trough.

204

Name Tokes Jay Spring
Other Names _____
Reservation W. Navajo
Location 8 miles south Red Lake

Date Developed January 19 29
Flow in gals per minute:
Before Development 1 After 2

Development (or remarks):

This spring was excavated down and into gravel and rock, perforated pipe laid and backfilled with gravel, storage reservoir shot in rock and piped to reinforced concrete trough. Distance from spring to trough 260 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Sunny Side Spring
 Other Names Slona To
 Reservation N. Navajo
 Location 5 miles S.E. of Little Shiprock
 Date Developed January 19 29
 Flow in gals per minute:
 Before development Seep After 1/2
 Development (or remarks):

This spring was excavated down and into rock, perforated pipe laid and backfilled with gravel, thence piped to a reinforced concrete trough.

Name Willow Spring
 Other Names
 Reservation N. Navajo
 Location 4 miles S. of Little Shiprock
 Date Developed January 19 29
 Flow in gals per minute:
 Before Development 1 After 1 1/2
 Development (or remarks):

This spring was excavated down and into shale, perforated pipe laid and backfilled with gravel, a reinforced concrete trough constructed. Distance from spring to trough 220 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

208

Name Poleman Spring
Other Names _____
Reservation N. Navajo
Location 3 miles S.E. community spring

Date Developed January 19 29
Flow in gals per minute:
Before development 1/2 After 3/4

Development (or remarks):

This spring was excavated down and into original formation (shale), perforated pipe laid and backfilled with gravel and piped to a reinforced concrete trough.

209

Name Community Spring
Other Names _____
Reservation N. Navajo
Location 7 miles S. Red Rock

Date Developed January 1929
Flow in gals per minute:
Before Development Seep After 1/2

Development (or remarks):

This spring was excavated down and into shale, sand overlying the shale, perforated pipe laid and backfilled with gravel. Storage tank for domestic use constructed overflow of which runs into reinforced concrete trough. Distance from spring to trough 400 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Chilibeto Well
 Other Names James well
 Reservation S. Navajo
 Location 4 1/2 miles East of Salina Spring
 Date Developed January 19 29
 Flow in gals per minute:
 Before development 2 After 3

Development (or remarks):

This well was excavated to a depth of 12 ft. into gravel, stone wall laid up and backfilled with gravel. Concrete slab with man hole and pouring box molded over top with pipe leading from pouring box to reinforced concrete trough.

Name Cheserbeto Well
 Other Names Left Hand Well
 Reservation S. Navajo
 Location 5 miles E. Salina Spring Store
 Date Developed January 19 29
 Flow in gals per minute:
 Before Development 2 After 3

Development (or remarks):

This well was dug down and thru gravel to original formation sandstone, masonry wall laid up and backfilled with gravel to water level, concrete slab with man hole molded over top, also a pouring box of concrete over well from which water flows to a reinforced concrete trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Four Wells
 Other Names _____
 Reservation S. Navajo
 Location 7 miles N.W. Salina Springs Trading Post
 Date Developed January 19 29
 Flow in gals per minute:
 Before development Seeps After $\frac{1}{2}$ each
 Development (or remarks):

These wells located in canyon were partly developed by Indians. Well No. 1 was cleaned out, trench dug and connected with well No. 2 which was further developed, reinforced concrete trough constructed. Well No. 3 cleaned out, trench dug, perforated pipe laid, backfilled with gravel and connected with well which was developed and a reinforced concrete trough constructed.

Name No Lada Spring & trough
 Other Names _____
 Reservation Southern Navajo
 Location 3 mi. So. Well No. 346 on Polacca and
Chinlee Road
 Date Developed February 19 29
 Flow in gals per minute:
 Before Development Seep After $\frac{1}{2}$
 Development (or remarks):

This seep was located at base of white sandstone mesa, excavated along the side of the mesa, the trench being 30' long and 6' deep, trench filled, gravel filter placed around perforated pipe and piped to a reinforced concrete trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

214

Name Black Mt. Spring (2 in No.) & trough
Other Names _____
Reservation Southern Navajo
Location 18 mi. West of Chinlee

Date Developed February 19 29
Flow in gals per minute:
Before development None After $\frac{1}{2}$

Development (or remarks):

These two seeps were both developed and water concentrated to a basin, perforated pipe placed in filtration bed and piped to a reinforced concrete stock watering trough.

215

Name Red Rock Well & trough
Other Names Setheleto
Reservation Southern Navajo
Location 10 mi. SW of Chinlee, 12 mi. NE of Salina Store

Date Developed February 19 29
Flow in gals per minute:
Before Development One After Two

Development (or remarks):

This well was excavated down thru liquid sand and into sandstone, depth 12-ft. diameter 8 ft., walled up with stone, filtration bed placed back of stone wall, a reinforced concrete slab with man hole and pouring box molded over top, and piped to a reinforced concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

216

Name Nakai Spring
 Other Names Mexican Spring
 Reservation Northern Navajo
 Location 2 1/2 mi. NW of Red Rock Trading Post on road
leading from store to west of Shiprock
 Date Developed February 19 29
 Flow in gals per minute:
 Before development None After 1/2

Development (or remarks):

This spring was excavated down through sand and into sandstone, perforated pipe placed in filtration bed, and piped to a reinforced concrete stock watering trough.

217

Name Sand Spring & trough
 Other Names Clase Beto
 Reservation Northern Navajo
 Location 1 1/2 miles N.E. of Red Rock on old road
leading from store to spring
 Date Developed February 19 29
 Flow in gals per minute:
 Before Development Seep After 1/2

Development (or remarks):

This spring was excavated down and into sandstone, perforated pipe laid in filtration bed and back-filled with gravel, and piped to a reinforced concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

218

Name Old Policeman Spring No. 2
 Other Names _____
 Reservation Northern Navajo
 Location Northwest of Red Rock Trading Post, spring
located in wash
 Date Developed February 19 29
 Flow in gals per minute:
 Before development $\frac{1}{4}$ After $\frac{3}{4}$

Development (or remarks):

This spring was excavated down and into sandstone, gravel filtration bed placed around perforated pipe and backfilled; also piped to a reinforced concrete stock watering trough.

219

Name Gressewood Spring and trough
 Other Names _____
 Reservation Northern Navajo
 Location 10 miles West of Red Rock Trading Post
 Date Developed February 19 29
 Flow in gals per minute:
 Before Development Seep After $\frac{1}{2}$

Development (or remarks):

This spring was excavated down through sand and into sandstone, perforated pipe laid and backfilled with gravel and piped to a reinforced concrete watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

220

Name Tillman Well No. 1 and trough
Other Names _____
Reservation Hopi
Location 20 mi. SE of Coal Mine and 6 mi. SE of Box
Canyon Well
Date Developed February 19 29
Flow in gals per minute:
Before development None After 1

Development (or remarks):

This well was excavated down to a depth of 17 ft. by 6 ft. in diameter, walled up with stone, concrete slab with man hole and pouring box molded over top of well, and piped to a reinforced concrete trough. This well was excavated down and into gravel.

221

Name Box Canyon Well & trough
Other Names _____
Reservation Hopi
Location 14 miles SE of Coal Canyon
Date Developed February 19 29
Flow in gals per minute:
Before Development None After 1

Development (or remarks):

This well was excavated to a depth of 12 ft. by 6 ft. in diameter, walled up with stone, reinforced concrete slab with man hole and pouring box molded over top, and piped to a reinforced concrete water trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

222

Name Water in Wash Well
 Other Names _____
 Reservation Hopi
 Location 11 mi. SE of Coal Mine, 100 yds. from Tuba City
and Keams Canyon road
 Date Developed February 19 29
 Flow in gals per minute:
 Before development None After $\frac{1}{8}$

Development (or remarks):

This well was developed for domestic use, excavated down to a depth of 10 ft. by 6 ft. in diameter, walled up with rock, a concrete slab with man hole molded over top.

223

Name Badger Spring
 Other Names _____
 Reservation Hopi
 Location 10 mi. SE Blue Canyon, 3 mi. SW Blue Canyon
and Keams Canyon road
 Date Developed February 19 29
 Flow in gals per minute:
 Before Development 1 After 2

Development (or remarks):

This spring flows from gravel bed in side of wash; excavated back into gravel bed, a submerged concrete weir to check the underflow constructed, placed gravel in filtration bed back of same around pipe which leads to reinforced concrete water troughs (two in number).

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

229

Name Sayana Chee Well No.1
Other Names _____
Reservation Southern Navajo
Location 2 1/2 mi. SW of Black Mt. Trading Post

Date Developed March 19 29
Flow in gals per minute:
Before development Seep After 1/2

Development (or remarks):

This well was partly developed by Indians in the past, old log cribbing taken out and continued excavation to bed rock, walled up with stone, filtration bed placed in back of stone wall to water level, a concrete slab with man hole and pouring box molded over top of well, and a reinforced concrete trough constructed.

230

Name Sayana Chee Well No. 2 and trough
Other Names _____
Reservation Southern Navajo
Location 2 1/2 miles SW of Black Mt. Trading Post

Date Developed March 19 29
Flow in gals per minute:
Before Development None After 1/2

Development (or remarks):

This well was excavated down through sand and into sandstone, walled up with rock, gravel filter placed back of wall, a concrete slab with manhole and pouring box molded over top of well and piped to a reinforced concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

231

Name Lone Well & Trough
 Other Names _____
 Reservation Northern Navajo
 Location 1 1/2 mi. East of Red Rock Store
 Date Developed March 19 29
 Flow in gals per minute:
 Before development : Seep After 1 1/2

Development (or remarks):

This seep is located in a small wash, a trench was dug across wash 30 ft. long, backfilled with gravel, a sump or storage reservoir excavated on side of wash 10 ft. deep and 10 ft. in diameter, walled up with rock and a concrete slab with man hole and pouring box molded over top, and piped to a reinforced concrete stock watering trough.

232

Name Black Rock Spring and Trough No. 2
 Other Names _____
 Reservation Northern Navajo
 Location 8 mi. West of Red Rock Trading Post
 Date Developed March 19 29
 Flow in gals per minute:
 Before Development : Seep After 3

Development (or remarks):

This spring was excavated down through sand and into gravel, perforated pipe laid and backfilled with gravel and cement over top to protect from flood water, then piped to a reinforced concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

233

Name Red Rock Wash Spring and trough
 Other Names _____
 Reservation Northern Navajo
 Location 200 yards East of Red Trading Post, on bank
of wash
 Date Developed March 19 29
 Flow in gals per minute:
 Before development Seep After 2½

Development (or remarks):

This spring flows from gravel bed on side of wash, a submerged concrete weir constructed, filtration bed placed in back of weir, perforated pipe laid and piped to a concrete stock watering trough.

234

Name Black Rock Spring & Trough No. 1
 Other Names _____
 Reservation Northern Navajo
 Location 1 mile south of Red Rock Store
 Date Developed March 19 29
 Flow in gals per minute:
 Before Development Seep After 1½

Development (or remarks):

This spring was excavated down through sand and into sandstone, perforated pipe placed in filtration bed, and piped to a reinforced concrete watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

235

Name Blind Man Well & trough
 Other Names _____
 Reservation Leupp
 Location 5 mi. North of Red Lake Trading Post

Date Developed March 19 29
 Flow in gals. per minute:
 Before development None After 1

Development (or remarks):

This well was excavated down through sand and into shale for storage capacity, depth 18 ft. diameter 6 ft., walled up with stone, a concrete slab with man hole molded over top, and a pouring box. (A reinforced concrete watering trough will be constructed in April).

236

Name To-Hat-Chi Spring & Trough
 Other Names _____
 Reservation Hopi
 Location 10 mi. NE of Rough Mesa Well

Date Developed March 19 29
 Flow in gals. per minute:
 Before Development 1½ After 1½

Development (or remarks):

This spring flows from crevice in sandstone, excavated down into sandstone, perforated pipe laid surrounded by gravel filtration, and covered with cement to protect from flood water, and piped to a reinforced concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

237

Name Rough Mesa Well & trough
 Other Names _____
 Reservation Hopi
 Location 3 mi. NE of Hootavilla and Blue Canyon road,
and 6 mi. from rim of Blue Canyon
 Date Developed March 19 29
 Flow in gals per minute:
 Before development Seep After 1

Development (or remarks):

A trench was dug across well, length 75 ft. by 8 ft. deep, backfilled with gravel and piped to storage basin at side of wash, a concrete slab with pouring box and man hole molded over top, and thence piped to a reinforced concrete stock watering trough.

238

Name White Rock Spring & trough
 Other Names _____
 Reservation Hopi
 Location 4 mi. NE of road going from Hootavilla to
Blue Canyon
 Date Developed March 19 29
 Flow in gals per minute:
 Before Development: Seep After 1 1/2

Development (or remarks):

This seep was located in canyon, a trench was dug across wash down to clay and shale, back-filled with gravel and piped to accumulating basin or storage basin at side of wash, and piped to a concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

239

Name Squaw Track Well & trough
 Other Names _____
 Reservation Hopi
 Location 20 mi. SE of Coal Mine
 Date Developed March 19 29
 Flow in gals per minute:
 Before development $\frac{1}{2}$ After $\frac{1}{8}$

Development (or remarks):

This well was excavated down and into sandstone to a depth of 12 ft. by 7 ft. in diameter. Gravel filter placed in back of wall which was laid up, and a concrete slab with man hole and a pouring box molded over top, thence piped to a reinforced concrete stock watering trough.

240

Name Smiling Spring
 Other Names _____
 Reservation Hopi
 Location 14 mi. N. of Hoatavilla, and 2 miles North
of Denebete Wash
 Date Developed March 19 29
 Flow in gals per minute:
 Before Development None After 1

Development (or remarks):

This spring was excavated down through sand and into shale, depth 10 ft., perforated pipe laid in filtration bed, a storage reservoir 6 ft. by 8 ft. by 4 ft. deep constructed with a concrete slab over top, and thence piped to a reinforced concrete trough. (Trough to be constructed in April).

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

243

Name Tuckeliny Well & trough
Other Names _____
Reservation Hopi
Location 1/2 mile East Smiling Spring, 14 mi. N. Hotavilla

Date Developed April 19 29
Flow in gals per minute:
Before development 1/2 After 3/4

Development (or remarks):

This well was partly developed by Indians, excavation was continued down and into shale, rock wall laid up and backfilled with gravel, concrete slab with man hole and pouring box molded over top of well, and a reinforced concrete trough constructed.

244

Name Mountain Well & trough
Other Names _____
Reservation Hopi
Location 17 mi. N.E. Hotavilla

Date Developed April 19 29
Flow in gals per minute:
Before Development Seep After 1

Development (or remarks):

This well was excavated down and into shale, rock wall laid up and backfilled with gravel, diameter of well at bottom 7 ft., at top 3 ft., depth 12 ft. A reinforced concrete trough to be constructed in May.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

245

Name To Hannia Well & trough
Other Names _____
Reservation Hopi
Location 19 mi. N. Hotavilla

Date Developed April 19 29
Flow in gals. per minute:
Before development Seep After 1 1/2

Development (or remarks):

This well is located in bottom of wash, excavated down and into gravel, rock wall laid up and back-filled with gravel, depth of well 7 ft., diameter at bottom 6 ft., at top 3 ft. Concrete slab with man hole molded over top, a reinforced concrete trough constructed.

246

Name Blue Water Spring
Other Names _____
Reservation N. Navajo
Location 10 mi. E. Red Rock Store

Date Developed April 19 29
Flow in gals. per minute:
Before Development Seep After 4

Development (or remarks):

This spring is located in wash, excavated down through sand and gravel into blue shale, perforated pipe placed in filter bed and backfilled with more gravel, a reinforced concrete trough constructed. Distance from spring to trough 550 ft. Also protection from flood water constructed of brush and rock rip rap.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Black Stump Well & trough
 Other Names _____
 Reservation N. Navajo
 Location 8 mi. E. Red Rock Store
 Date Developed April 19 29
 Flow in gals per minute:
 Before development Seep After 3/4

Development (or remarks):

This well was excavated down through sand and gravel, depth 6 ft., diameter 6 ft., rock wall laid up and backfilled with gravel, a concrete slab with man hole molded over top of well and connected with a reinforced concrete trough.

Name White Water Well & trough
 Other Names _____
 Reservation N. Navajo
 Location 4 1/2 mi. NE Red Rock Store
 Date Developed April 19 29
 Flow in gals per minute:
 Before Development Seep After 1

Development (or remarks):

A trench was dug across wash $3\frac{1}{2}$ ft. deep and backfilled with gravel. A storage reservoir constructed at side of wash 9 ft. deep and 5 ft. in diameter, rock wall laid up and backfilled with gravel, a concrete slab with man hole and pouring box constructed over well and piped to a reinforced concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

249

Name Box Well & trough
 Other Names _____
 Reservation Northern Navajo
 Location 6 $\frac{1}{2}$ mi. NE of Red Rock Store
 Date Developed April 1929
 Flow in gals per minute:
 Before development Seep After 2

Development (or remarks):

A trench was dug across wash to a depth of 3 ft., backfilled with gravel, a storage tank was constructed at side of wash which was excavated down through sand and gravel to shale and excavation continued 5 ft. more into shale, a rock wall laid up and backfilled with gravel, a concrete slab with man hole molded over top and piped to a reinforced concrete trough.

253

Name Tsa Cleshie Spring
 Other Names Match
 Reservation La.
 Location $\frac{1}{2}$ mi. E. Black Mt. Store
 Date Developed April 1929
 Flow in gals per minute:
 Before Development Seep After 15 gal. per hour

Development (or remarks):

Excavated down through seepage area, backfilled trench with gravel and at lowest level placed perforated pipe covered with gravel and piped to a small storage reservoir, size 4x4x3 ft. deep, capacity 360 gal.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

254

Name Cove Spring, a storage reservoir (domestic use)
Other Names _____
Reservation S. Navajo
Location 3 mi. N. Black Mt. Store

Date Developed April 19 29
Flow in gals per minute:
Before development Seep After 15 gal. per hour.

Development (or remarks):

This seep was located in crevice of sandstone, excavated back into crevice, gravel filter placed around perforated pipe and piped to a small storage reservoir 4x4x3 ft. deep, covered with concrete slab in which a man hole was molded. Capacity of reservoir 360 gal.

255

Name Asone Spring & storage reservoir (domestic use)
Other Names _____
Reservation S. Navajo
Location 1 mile N. Black Mt. Store

Date Developed April 19 29
Flow in gals per minute:
Before Development Seep After 1/8

Development (or remarks):

This seep was developed for domestic use, excavated along base of Mesa, trench filled with gravel and perforated pipe surrounded by gravel filter placed in lowest level of trench and piped to a small storage reservoir size 4x4x3' deep, capacity 360 gal.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Tso Spring & storage reservoir (domestic use)
 Other Names _____
 Reservation S. Navajo
 Location 1/2 mi. N. Black Mt. Store
 Date Developed April 1929
 Flow in gals. per minute:
 Before development Seep After 20 gal. per hour
 Development (or remarks):

This seep was excavated down 4 ft. and trench 60 ft. long dug and backfilled with gravel and piped to a small concrete storage reservoir size 4x4x3 ft. deep, capacity 360 gal.

Name Tode Cozie Well & troughs
 Other Names _____
 Reservation S. Navajo
 Location 7 miles N. of Black Mt. Store
 Date Developed April 1929
 Flow in gals per minute:
 Before Development 24 After 10

Development (or remarks):

A trench was dug across this wash 4 ft. deep and backfilled with gravel. A storage reservoir was dug 21 ft. deep by 6 ft. in diameter, a rock wall laid up and backfilled with gravel to natural water level in well, upper backfill of dirt, a concrete slab with man hole and pouring box molded over top and pipe connects troughs with well. There are two reinforced concrete troughs at this well, also a pump was installed for Indians using this water.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Rogers Well
Other Names _____
Reservation Hopi
Location 14 miles S. Oraibi

Date Developed April 19 29
Flow in gals per minute:
Before development Seep After 2

Development (or remarks):

This well is located at side of wash bank,
excavated down and into shale, rock wall laid
up and backfilled with gravel filter, concrete
slab with man hole molded over top; a reinforced
concrete trough will be constructed at a later date.

Name _____
Other Names _____
Reservation _____
Location _____

Date Developed _____ 19 _____
Flow in gals per minute:
Before Development _____ After _____

Development (or remarks):

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

Name Yellow Spring, storage tank and trough
Other Names _____
Reservation Northern Navajo
Location 4 miles west of Big Shiprock

Date Developed May 19 29
Flow in gals per minute:
Before development seep After 1 1/2

Development (or remarks):

This spring was excavated down and into sandstone, perforated pipe laid and backfilled with gravel, concrete slab poured over top of filter bed to protect from flood water, piped to a reinforced concrete storage tank and trough; distance from spring to trough 280 ft.

Name Coal Mine spring and trough
Other Names _____
Reservation Northern Navajo
Location 4 miles east Table Mesa Oil Field, near coal mine.

Date Developed May 19 29
Flow in gals per minute:
Before Development seep After One

Development (or remarks):

This spring is located on bank of small wash, excavated down through sand and gravel to shale; perforated pipe laid and backfilled with gravel, piped to a reinforced concrete stock watering trough; distance from spring to trough 180 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

262

Name Blaek Peak Well and trough
 Other Names _____
 Reservation Northern Navajo
 Location 11 miles south of Shiprock P.O. and $\frac{1}{2}$ mile east highway

Date Developed May 19 29
 Flow in gals per minute:
 Before development $\frac{1}{2}$ After $1\frac{1}{2}$

Development (or remarks):

This well was excavated down through clay and sand and into shale a depth of 7 feet, rock wall laid up and back filled with gravel, a concrete slab with pouring box molded over top and piped to a reinforced concrete trough. Depth of well 7 ft. diameter 5 ft.

263

Name Two Concrete troughs - Table Mesa Well (Art)
 Other Names _____
 Reservation Northern Navajo
 Location 18 mi. SE Shiprock P.O. 4 miles east highway

Date Developed May 19 29
 Flow in gals per minute:
 Before Development _____ After _____

Development (or remarks):

Two reinforced concrete troughs constructed at this well for stock use, distance from well to trough 225 ft.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

264

Name Naigagan spring and trough
Other Names _____
Reservation Southern Navajo
Location 13 miles N. Black Mt. Store, 38 miles SW Chin Lee
Date Developed May 1929
Flow in gals. per minute:
Before development scap After 3/4

Development (or remarks):
This spring was excavated down through clay, sand, and gravel, depth 7 ft., perforated pipe laid and backfilled with gravel and piped to a reinforced concrete watering trough. Distance from spring to trough 400 ft.

265

Name Straight Rock Well and trough
Other Names _____
Reservation Southern Navajo
Location 11 miles N. Black Mt. Store
Date Developed May 1929
Flow in gals. per minute:
Before Development 2 After 5

Development (or remarks):
Excavated down eleven ft. near wash through clay, sand and gravel. Rock wall laid up and backfilled with gravel to water level in well, balance of backfill of clay. A concrete slab with man hole and pouring box molded over top of well and piped to a reinforced concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

266

Name Burnt Corn Spring No. 2 and two troughs
 Other Names _____
 Reservation Hopi
 Location 2 miles NE Pinon Stone, near Burnt Corn spring No. 1
 Date Developed May 1929
 Flow in gals per minute:
 Before development seep After 1 1/2
 Development (or remarks):
 This spring was excavated down through sand and into shale,
 perforated pipe laid and backfilled with gravel, and piped to
 two reinforced concrete stock watering troughs.

267

Name Bekays spring and trough
 Other Names _____
 Reservation Hopi
 Location 3 miles south of Burnt Corn Springs No. 1 and 2
 Date Developed May 1929
 Flow in gals per minute:
 Before Development seep After 1
 Development (or remarks):
 This spring was excavated down through sand and into gravel
 perforated pipe laid and backfilled with gravel and piped
 to a storage reservoir (small) and reinforced concrete stock
 watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

270

Name Peach Spring and trough
Other Names _____
Reservation Hopi
Location 17 miles NE Hotavilla near Blue Canon, down in
a side canyon
Date Developed May 19 29
Flow in gals per minute:
Before development Seep After 1

Development (or remarks):

This spring was excavated down through sand and into shale, perforated pipe laid and backfilled with gravel and piped 100 ft. to a reinforced concrete stock watering trough.

271

Name White Hat spring and trough
Other Names _____
Reservation Hopi
Location 17 miles NE Oraibi, near Rock crossing on Oraibi Wash.
Date Developed May 19 29
Flow in gals per minute:
Before Development Seep After 1

Development (or remarks):

This spring is located on side of mesa, excavated back into mesa 8 ft. laid up rock wall at front, backfilled with gravel and piped to a small storage tank for domestic use and to a reinforced concrete stock watering trough.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

272

Name Rin Rook Spring and trough
Other Names _____
Reservation Southern Navajo
Location 12 miles N. Black Mt. Store

Date Developed Sept 19 3/4
Flow in gals per minute:
Before development _____ After _____

Development (or remarks):

This spring was excavated down through sand and into shale.
perforated pipe laid and backfilled with gravel, and piped to
a reinforced concrete stock watering trough.

273

Name Navajo Spring
Other Names _____
Reservation _____
Location _____

Date Developed _____ 19 _____
Flow in gals per minute:
Before Development _____ After _____

Development (or remarks):

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

275

Name Abney Well and trough
Other Names _____
Reservation Southern Navajo
Location 12 miles N. Black Mt. Store

Date Developed June 19 29
Flow in gals per minute:
Before development One After Two

Development (or remarks):

This well was excavated down through sand, gravel, and into shale, rock wall laid up and backfilled with gravel, a concrete slab with man hole and pouring box molded over top and piped to a reinforced concrete stock watering trough.

276

Name Tasa Pi Spring
Other Names _____
Reservation S. Navajo
Location 7 miles NW Elizabeth Mission

Date Developed June 19 29
Flow in gals per minute:
Before Development Seep After 4 bbl. per day.

Development (or remarks):

This was a seep in the sandstone. We shot the shale out from under, making a reservoir and built an eight inch wall, 14 feet long across the front, the wall 36" high, of concrete. The Water piped 200 ft. down the mountain side to the level into a 14' reinforced concrete trough for drinking water.

NAVAJO AND HOPI SPRING DEVELOPMENT
FIFTH IRRIGATION DISTRICT

277

Name Carson Cave
Other Names _____
Reservation E. Navajo
Location 7 miles NW Hingate R. R. Station

Date Developed: June 20 1929
Flow in gals. per minute:
Before development Seep After 3 bbls. per da.

Development (or remarks):

This spring was a seep in the back of the cave. We shot it back under and built a six inch wall twenty inches high, twenty six ft. across the front; perforated pipe laid in and the water piped 160 ft. to mouth of cave into two concrete troughs 14" each, one for drinking water and surplus for stock.

278

Name Judea Hecathi Spring
Other Names _____
Reservation E. Navajo
Location 7 miles NW Hingate R. R. Station

Date Developed: June 10 1929
Flow in gals. per minute:
Before Development Seep After 6 bbls. per day

Development (or remarks):

This spring was a seep partly developed. We shot it out and built an eight inch wall, twenty inches high across the front, piping the water 300 ft. down the canyon to two reinforced concrete troughs 14 ft. each. One trough to be used for drinking water and the surplus running into second trough for stock water.