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Geological Survey

Memorandum on status of water-supply investigation of Sawmill area Navajo Indian Reservation, Apache County, Arizona

By

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As a part of a comprehensive study of the ground-water resources of the Navajo Indian Reservation, the Geological Survey has been investigating the possibility of increasing the water supply for the community and industrial establishment at the Navajo Tribal Sawmill, Apache County, Arizona. The sawmill is near the crest of the Defiance uplift, about 13 miles northwest of Fort Defiance. The altitude is about 7,600 feet. Unusually heavy snows during January and February 1949, and resulting exceptionally heavy surface runoff during the early part of March, have delayed completion of field work in the sawmill area. At the time this memorandum was prepared, the geology of the sawmill area had been mapped, and water samples had been collected from most of the wells and springs. Field work yet to be done includes making pumping tests on the wells and making periodic measurements of the discharge of each of the springs in the area.

It is planned to enlarge the community and to construct a planing mill. After the proposed expansion, a perennial water supply of about 125 gallons per minute, or a total of 180,000 gallons per day, will be needed. The plans for expansion cannot proceed until an adequate water supply is assured. However, if a review of the field work to date indicates that sufficient water is available, initial construction will be started before the water-supply investigation is completed.

An investigation of the water supply in the area was made during the spring and summer of 1946 by R. H. Rupkey, hydraulic engineer in the Irrigation Division, Office of Indian Affairs. In his report, Mr. Rupkey stated that further development of the sources then in use would yield additional water. He also stated that a supplemental supply could be obtained by developing and utilizing the water from springs about 3 miles southeast of the sawmill. He concluded that if both these suggestions were followed, an assured supply of more than the required 125 gallons per minute would be available. At the time of Rupkey's investigation, R. O. Hornberger, electrical engineer in the Office of Indian Affairs, submitted a report which indicated that if conservation of water were

practiced at the sawmill, the total water requirement after expansion might be as low as 109,000 gallons per day, or about 76 gallons per minute.

The improvements suggested by Mr. Rupkey had not been put into effect at the time of the present investigation. At the time this memorandum was prepared, the water being used for domestic purposes was obtained from a well about half a mile west of the community, constructed in the alluvial fill of a wash which drains eastward from the Defiance uplift. Springs farther upstream furnish a continuous supply of water to the alluvium. At the sawmill, about half a mile downstream from the well, underflow and surface runoff were being collected from the wash to supply water for the log pond. Water for the steam boilers used in operation of the sawmill and for generation of electric power was being pumped from a sump which collects underflow downstream from the log pond, about 3,000 feet east of the sawmill. There are two abandoned wells at the sawmill which penetrate the alluvial fill of the wash. According to the Rupkey report, the domestic well will yield a perennial supply of 10,000 gallons per day, and the supplies now being used for mill operations will yield a perennial supply up to 40,000 gallons per day without further development.

About 3 miles southeast of the sawmill a perennial stream flows southeastward into Bonito Creek. The stream derives its supply by seepage from the underlying Permian age formation. At the time this stream was first visited by the writers, on October 25, 1948, the discharge was about 100 gallons per minute. A water sample was collected, and the analysis showed that the water is low in dissolved solids and is suitable for domestic and industrial use (see table 1, analysis 3). Mr. Rupkey measured the discharge twice in 1946, once in the spring, when melting snows had greatly increased the discharge from ground-water runoff, and once in the summer, when little precipitation had occurred, and ground-water runoff was at a minimum. The measurements were: April 8, 175 gallons per minute; and June 11, 80 gallons per minute. Mr. Rupkey estimated that a minimum of 100 gallons per minute could be developed at the point where the measurements were made. An analysis of this estimated minimum yield shows that about 80 gallons

per minute would be collected from surface discharge of the stream and about 20 gallons per minute would be made available by reducing the amount of water that is now lost by underflow and transpiration along the stream. If Mr. Rupkey's estimate of the amount that could be developed is correct, the stream would supply a minimum of 144,000 gallons per day.

Mr. Rupkey's estimates of the total supply available to the area are summed up as follows:

Source	Gallons per day
Domestic well	10,000
Sawmill supply	40,000
Springs	144,000
TOTAL	194,000

The initial field work done by the writers indicates that these estimates are conservative. As the amount of water needed is 180,000 gallons per day, or less, it is concluded that expansion of the sawmill can proceed as planned.

In the event that more than 180,000 gallons per day is needed for the sawmill area, an additional source of water is available from three springs in Buell Park, about 3 miles to the east. The minimum discharge of these springs is 200 gallons per minute, or 288,000 gallons per day. The water is of good quality, analysis of and is suitable for domestic and industrial use (see table 1).

Table 1. Analyses of water samples from Sawmill area, Apache County, Arizona.
Analyses by Geological Survey
(Parts per million, except specific conductance)

Sample No. a/	1	2	3	4
Date of collection, 1948	Oct. 25	Oct. 25	Oct. 25	Sept. 29
Specific conductance (micromhos @ 25°C.)	514	552	459	342
Calcium (Ca)	-	67	58	28
Magnesium (Mg)	-	22	20	25
Sodium and potassium (Na + K)	-	23	13	9.7
Bicarbonate (HCO_3)	312	306	260	200
Sulfate (SO_4)	-	24	24	18
Chloride (Cl)	11	21	9.0	6.0
Fluoride (F)	-	0.4	0.2	0.2
Nitrate (NO_3)	-	0.7	4.2	2.8
Dissolved solids	-	324	272	217
Total hardness as $CaCO_3$	-	258	226	173

1. School well.
2. Sawmill supply.
3. Spring 3 miles southeast of sawmill.
4. Largest of three springs in Buell Park, 3 miles east of sawmill.