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FOR THE 31ST, 32ND, 33RD, AND 34TH FISCAL YEARS,

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STATE ENGINEER

SANTA FE, NEW MEXICO

FOUR GROUND-WATER STUDIES NEAR LORDSBURG, NEW MEXICO

1942

By

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EXPLANATORY NOTE

In 1942, the U.S. Geological Survey in cooperation with the State Engineer made several studies of ground-water conditions near Lordsburg for the United States Army, in connection with the proposed establishment of Lordsburg Army Camp, Lordsburg Airfield, and other military works once considered. The investigations were financed by the Corps of Engineers which, in 1949, released the study reports for publication. Some duplication of data containea in the separate original reports has been eliminated.

State Engineer Office

In cooperation with United States Geological Survey

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ILLUSTRATIONS

GROUND-WATER CONDITIONS NEAR LORDSBURG NEW MEXICO

By

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U. S. Geological Survey

February 17, 1942

Ground-water supplies, in the vicinity of Lordsburg, are derived chiefly from deposits of alluvium that underlie the wide valley between the Pyramid Mountains, south of Lordsburg, and the Burro Mountains northeast of the city. The valley is drained by Lordsburg Draw, which extends northwestward from the southeastern part of T. 24 S., R. 17 W., to a point 2 miles northeast of Lordsburg, thence westward to the north end of Lower Animas Valley. The alluvium thickens from a feather edge, where it laps up against the mountains 3 to 10 miles from the axis of Lordsburg Draw, to more than 340 feet beneath the draw, which appears to overlie an ancient stream valley. The alluvium is coarsest near the mountains and becomes finer textured toward the center of the valley, where it consists of interbedded silt, clay, sand, and gravel. The logs of wells, along the axis of Lordsburg Draw, indicate that the alluvium there is made up largely of silt, clay, silty sand, and gravel, but most wells have encountered one or more beds of clean, coarse sand and gravel.

Ground water is obtained from beds and lenses of sand and gravel encountered in the alluvium at about 70 feet along the axis of Lordsburg Draw, and at gradually increasing depths up the slope away from the draw. Southwest of Lordsburg Draw, between Lordsburg and the east boundary of Range 18 West, the water table slopes toward the draw at about 20 to 30 feet to the mile. The land surface in that area slopes toward the draw at a gradient of 50 to 70 feet to the mile, and the depth to water consequently increases away from the draw, owing to the divergence of the water table and land surface (see Fig. 1).

The relatively impermeable bedrock that underlies the alluvium in Lordsburg Valley has an average slope of about 150 feet per mile toward the center of the valley. The water table, which has a slope of about 20 to 30 feet to the mile, and the bedrock surface converge rapidly to the southwest away from Lordsburg Draw. The thickness of saturated alluvium from which ground water can be withdrawn, therefore decreases rapidly in a short distance away

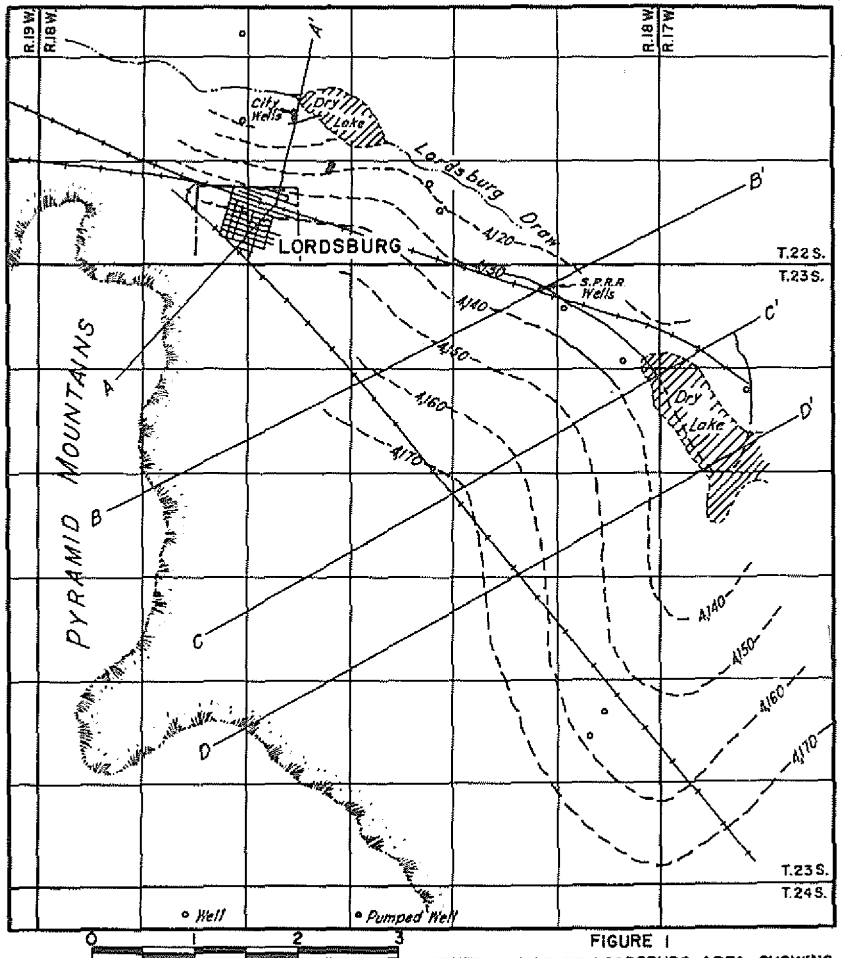

FIGURE I
GENERAL MAP OF LORDSBURG AREA SHOWING LOCATION OF TYPICAL CROSS SECTIONS

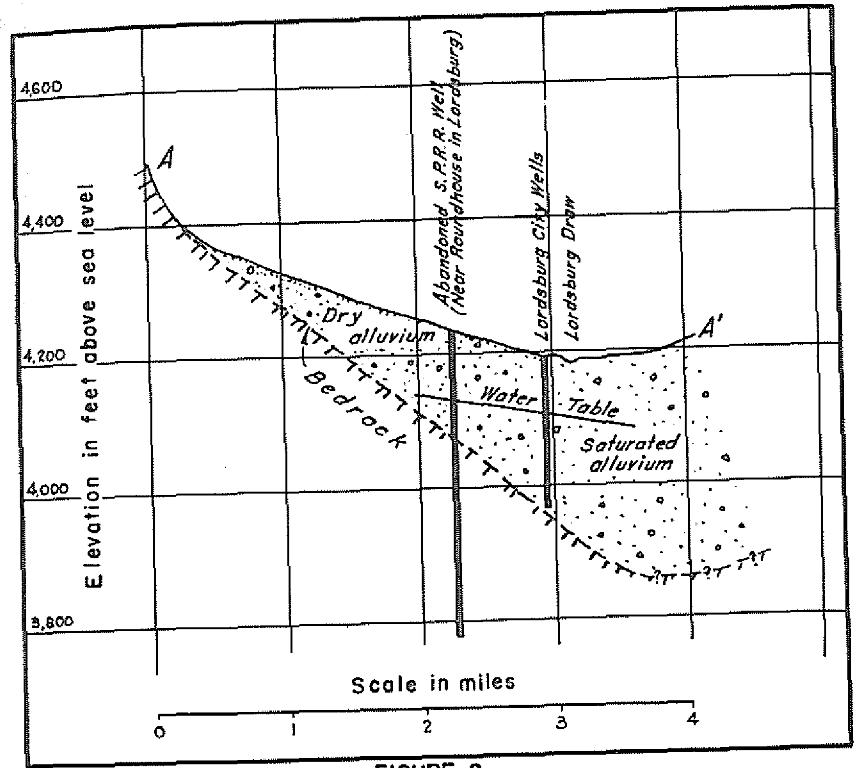

FIGURE 2
CROSS SECTION A-A'

from the draw. The thickness of saturated alluvium decreases from 145 feet in the Lordsburg city wells to less than 40 feet in a well drilled by the Southern Pacific Railroad Co., near the roundhouse in Lordsburg (see cross section A-A , Fig. 2). The city wells are located on the bottom land along Lordsburg Draw, and the railroad well is located 0.8 of a mile up the slope, south of the draw.

The pumping plant of the Southern Pacific Railroad is located in the NE¼ sec. 2, T. 23 S., R. 18 W., near the floor of Lordsburg Draw. The wells at the pumping station penetrated 320 to 340 feet of alluvium and did not reach bedrock. All the wells contained two or more water-bearing beds of sand and gravel interbedded in the 260 feet of saturated alluvium that lies below the water table. An average slope of about 150 feet to the mile is necessary to carry the bedrock below the bottom of the wells at this location (see cross section B-B', Fig. 3).

A well site in the NE¼ sec. 12, T. 23 S., R. 18 W., should occupy the same position with respect to the Pyramid Mountains and Lordsburg Draw as does the Southern Pacific Pump Station, and it is believed that a well at that site would encounter approximately the same thickness and type of alluvium (see cross section C-C', Fig. 4). If the slope of the bedrock surface from outcrops in the Pyramid Mountains into Lordsburg Valley maintains the indicated gradient of 150 feet to the mile, it is possible that a thickness of saturated alluvium, sufficient to deliver the required quantity of water, may extend 1 to 1½ miles back from the draw into the west half of section 13. A projection of the bedrock surface and the water table into sec. 13 (cross section D-D', Fig. 5) indicates a thickness of saturated alluvium of 100 to 140 feet along the 4,250 foot surface contour in section 13. There are no wells in the area to provide a check on this possibility, but it may be worth investigating by drilling a test well along this line.

There are only three pumping plants in the vicinity of Lordsburg that pump water in quantity from wells in the alluvium in Lordsburg Valley. The two city wells, 250 feet deep, located in the NE¼SW¼ sec. 28, T. 22 S., R. 18 W., are reported to yield 380 gallons per minute each. The power company has two wells about 190 feet deep in the NE¼ of sec. 33, T. 22 S., R. 18 W., which are reported to yield 125 gallons per minute each. The Southern Pacific Railroad pumping station derives its water at present from one well 320 feet deep, which is reported to yield 350 gallons per minute. All three pumping plants are located near the bottom of Lordsburg Draw. The south city well, when pumping alone, has a drawdown of between 40 and 50 feet, indicating a specific capacity of between 7.5 and 9.5 gallons per minute per foot of drawdown. The

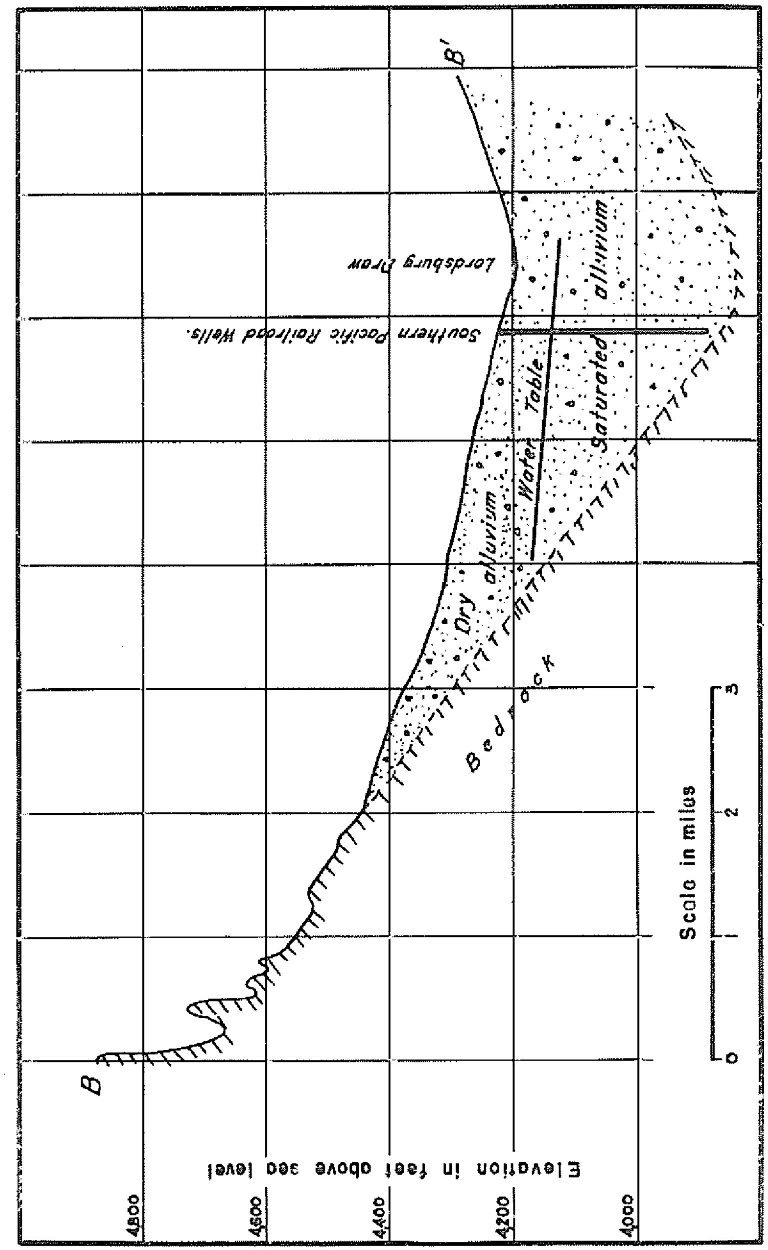

FIGURE 3

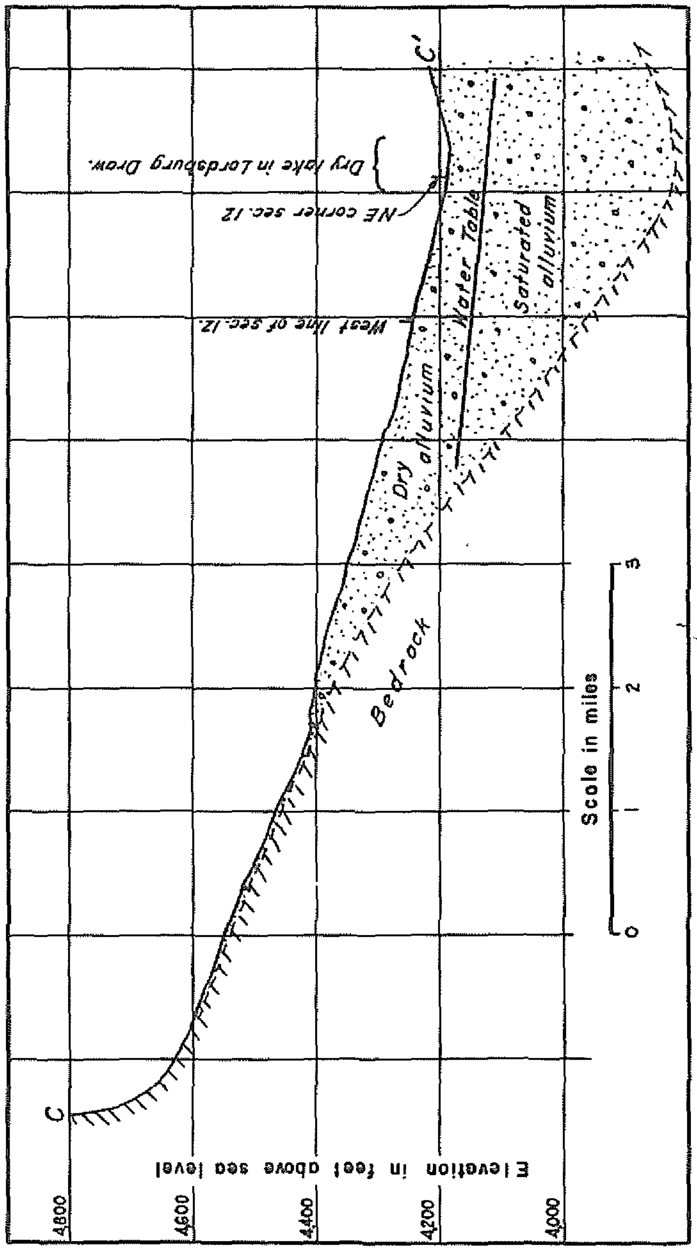

FIGURE 4
CROSS SECTION C-C'

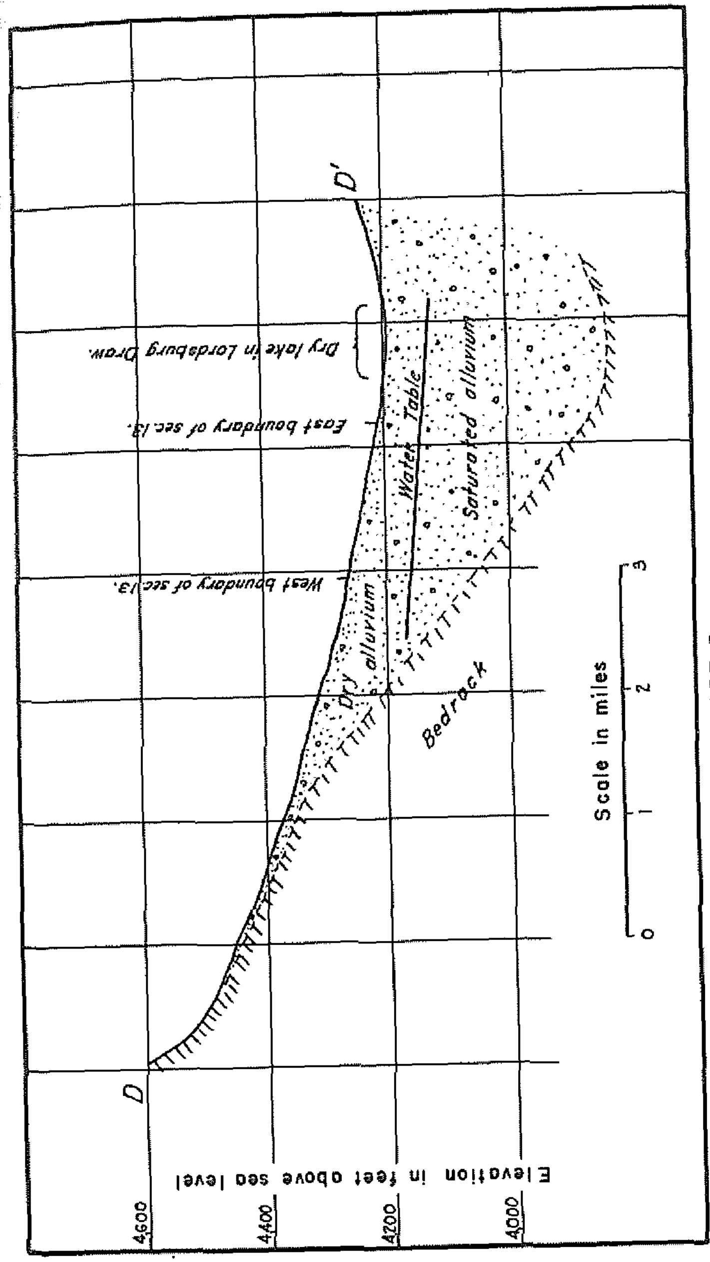

FIGURE 5
CROSS SECTION D-D'

Southern Pacific well has a drawdown of at least 34 feet below the static level of about 85 feet, indicating a specific capacity of not more than 10 gallons per minute per foot of drawdown.

It is probable that wells drilled at the proposed campsite will have about the same capacities as the city wells and the railroad wells. It may be possible to develop 700,000 gallons per day from a single well at the campsite, but it is probable that two wells will be necessary, particularly if the wells are located above the 4,225 foot surface contour.

An analysis of the water from a well 340 feet deep, located in the SW¼SE¼ sec. 1, T. 23 S., R. 18 W., is given in Water-Supply Paper 422 (Well 21, Table 2, p. 142). The analysis, in parts per million, follows: dissolved solids 477; calcium 11; magnesium 11; sodium and potassium 135; carbonate 56; bicarbonate 180; sulfate 81; chloride 29; total hardness (as $CaCO_3$) 73. Water from wells in sections 12 and 13 probably will have similar chemical composition.

REPORT ON PUMPING TESTS CONDUCTED FOR U.S. CORPS OF ENGINEERS ON LORDSBURG ARMY CAMP WELL NO. 1 IN NEW MEXICO

By

C. Richard Murray

U. S. Geological Survey

April 1942

A series of pumping tests were made on completion of the first well at the Lordsburg Army Campsite, N.Mex. These consisted of a 10-hour pumping test followed by a 24-hour rest period, another 10-hour pumping period and 24-hour rest period, and finally a 24-hour pumping period.

The well on which the tests were performed is approximately 880 feet east of the west line, and 330 feet south of the north line of sec. 13, T. 23 S., R. 18 W., N.M.P.M. The altitude of the land surface at the well is approximately 4,238 feet. The well was drilled by Wininger Bros., who logged the formations penetrated as follows:

Material	Thickness *(feet)*	Depth *(feet)*
Conglomerate with excess clay, light blue, medium soft	15	15
Conglomerate, medium soft	75	90
Clay conglomerate, medium soft	5	95
Water gravel, medium soft	5	100
Water sand with strips of clay, medium soft	40	140
Conglomerate with strata of sticky clay, medium soft	28	168
Conglomerate with clay strata, medium soft	37	205
Sticky clay, red, hard	7	212
Conglomerate	15	227
Conglomerate, hard, red	15	242
Conglomerate, hard	60	302
Conglomerate, black, very hard	8	310
Conglomerate, very hard	5	315
Conglomerate, hard, fractures in formation;large/wide crevice 322'	7	322

The well is 16 inches in diameter and cased to 322 feet with 14-inch O.D. steel casing, with machined and welded collars, perforated as follows:

From	To	
feet		
0	100	Blank casing.
100	220	Four slots, $\frac{5}{8}$× 6 inches, spaced 11 inches apart around pipe and every 2 feet along pipe.
220	300	Three slots, $\frac{5}{8}$× 6 inches, spaced 14 inches apart around pipe and every 4 feet along pipe.
300	322	Blank casing.

The test pump was a used Fairbanks-Morse 7-stage turbine pump with a 6½-inch I.D. column pipe and equipped with a Johnson geared pump head. The length of column pipe installed was 240 feet, the bowls 7 feet, and the suction pipe 10 feet. The pump was driven by means of a flat belt powered by a Buda gas engine which had furnished power to the Bucyrus-Erie portable cable-tool rig used in drilling the well. The speed of the engine varied somewhat, resulting in variations in water level during pumping (see Figs. 6-8).

Water-level measurements were made with a steel tape during the pumping and rest periods in order to obtain information on the rate and amount of drawdown and recovery of water level in the well. Discharge was measured by means of a 4⅜-inch orifice meter placed on the 6-inch standard discharge pipe. The discharge measurements were supplemented and checked by determining with a stopwatch the time required to fill a 55-gallon oil drum. The reference point from which all water-level measurements were made was the top of the casing on the north side, which point was approximately 1.5 feet above the land surface.

In the first 10-hour test (Fig. 6), the amount of water discharged increased as the test proceeded. An initial discharge of 160 gallons a minute was obtained with the pump turning at 1,220 revolutions a minute. The discharge increased to 220 gallons a minute with the pump rotating 1,255 rpm. The static water level before pumping began was 89.95 feet. At the end of the test the water level was approximately 106.4 feet, when 220 gallons a minute were being discharged. The static water level, after the test, was approximately 89.7 feet, a rise of about 0.25 feet. The specific capacity of the well was approximately 13.2 gallons per minute per foot of drawdown. Recovery of the water level on completion of the first 10-hour period of pumping was too irregular to permit computing a coefficient of transmissibility for the aquifer.

For the second 10-hour pumping test (Figs. 7-9), the 10-inch pulley on the driveshaft of the Buda engine was replaced by an 8 inch pulley so that the engine could develop more speed. In this test the pump made approximately 1,320 revolutions a minute with

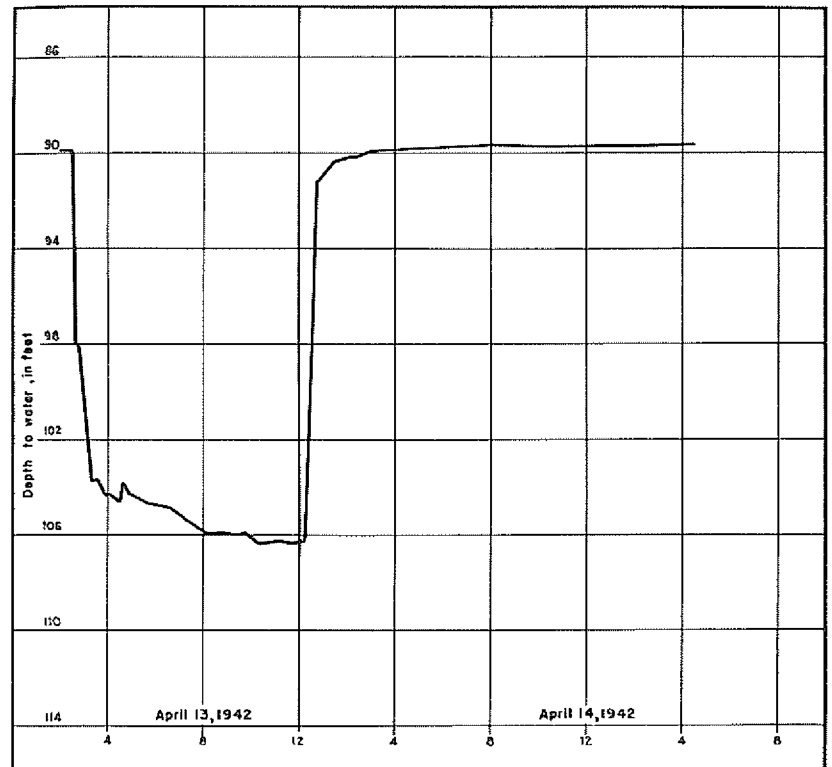

FIGURE 6
CHANGE IN WATER LEVELS, FIRST 10-HOUR PUMPING PERIOD

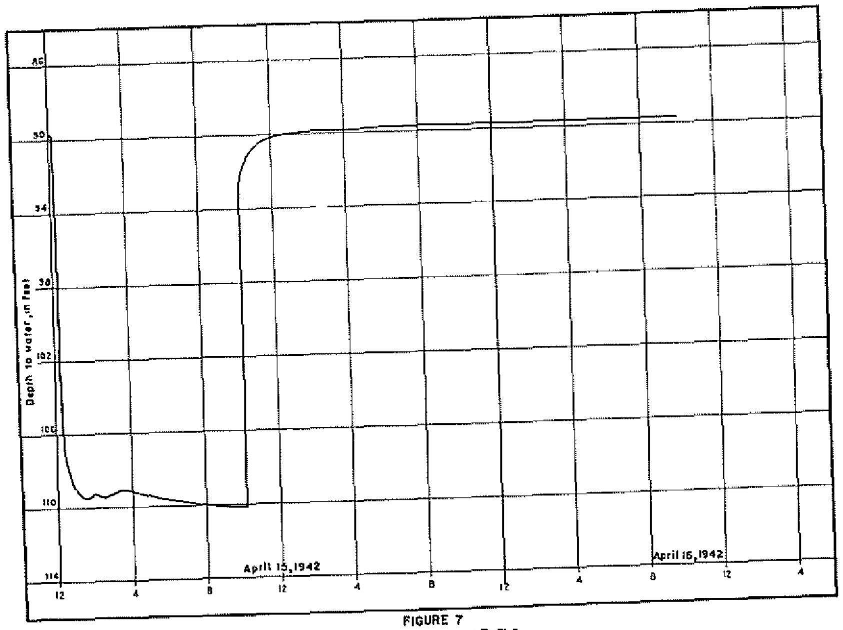

FIGURE 7
CHANGE IN WATER LEVELS,
SECOND 10-HOUR PUMPING PERIOD

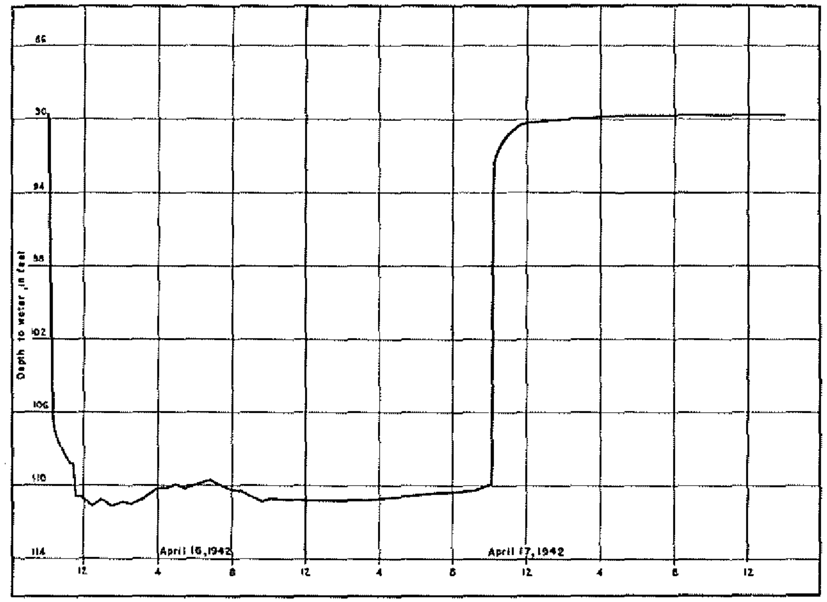

FIGURE 8
CHANGE IN WATER LEVELS,
24-HOUR PUMPING PERIOD

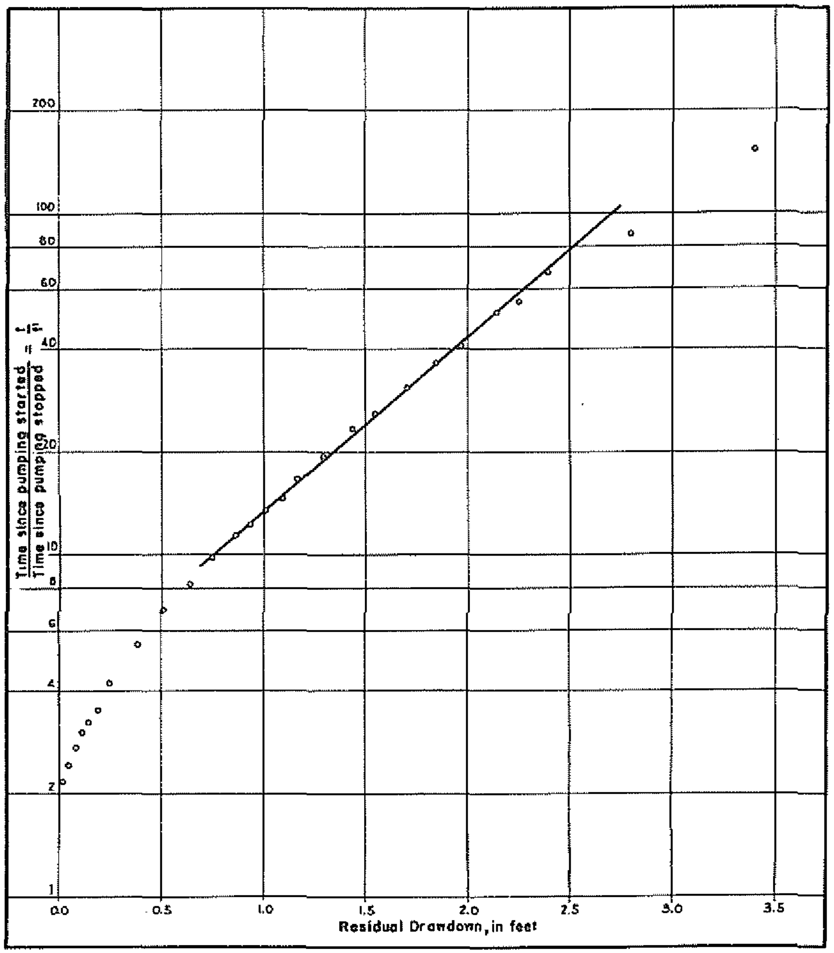

FIGURE 9
RECOVERY CURVE,
SECOND 10-HOUR PUMPING PERIOD

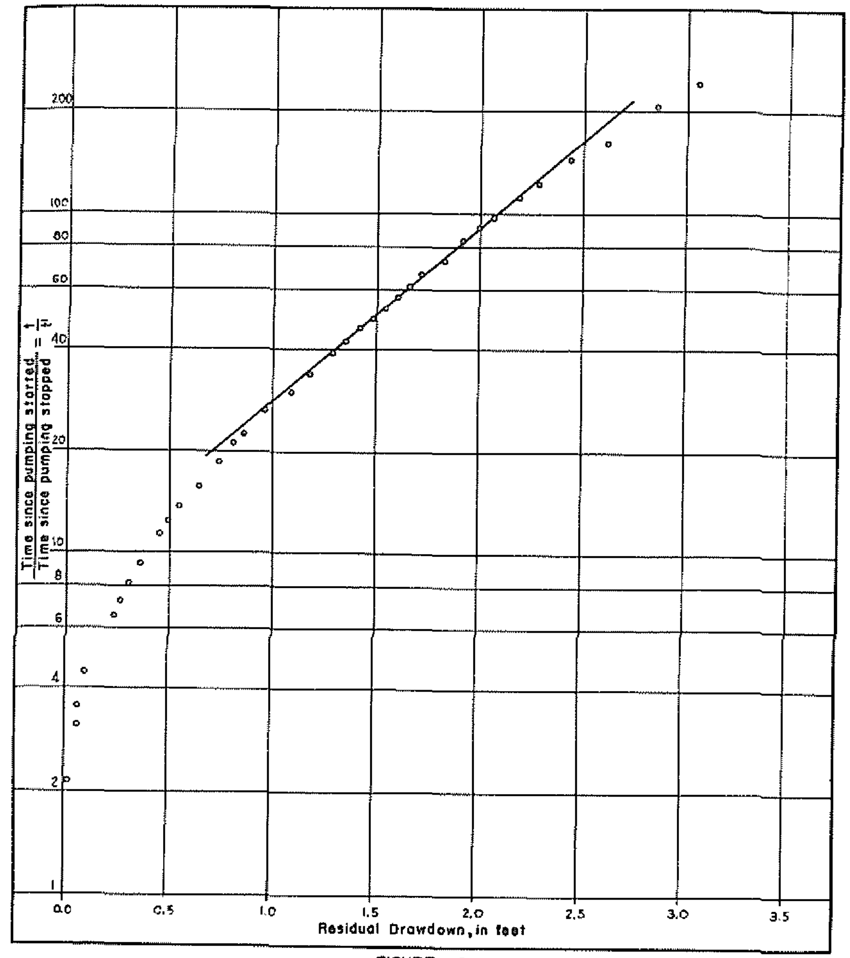

FIGURE 10
RECOVERY CURVE,
24-HOUR PUMPING TEST

a discharge of about 265 gallons a minute. The pumping level was at about 110 feet, thus giving a drawdown of 20.3 feet and a specific capacity of 13.1 gpm/ft. The coefficient of transmissibility of the aquifer was computed by Theis' recovery formula, which can be stated as follows:

$$T = \frac{264q}{s} \log \frac{t}{t'}$$

where

T is the coefficient of transmissibility
q is the discharge rate, in gallons per minute
t is the time since pumping started, in any time unit
t' is the time since pumping stopped, in the same time unit
s is the residual drawdown, in feet, in an interval equivalent to $\log \frac{t}{t'}$

The value obtained for T was approximately 35,000 gallons per day per foot (see Fig. 9.) This is believed to be a close approximation; however, the plot of the values of drawdown, against log t/t approximates a straight line over only a portion of the observed values, which casts some doubt on the accuracy of the determination.

In the third test, which lasted 24 hours (Figs. 8 and 10), the pump was driven at about 1,310 revolutions a minute for 1½ hours, the discharge amounting to about 245 gallons per minute. For the next 2 hours the pump was driven at about 1,335 revolutions per minute, the discharge being about 285 gallons per minute. The pumping level was at 111 feet, the drawdown was 21.3 feet, and the specific capacity, 13.4 gpm/ft. For the remainder of the test the pump speed averaged about 1,320 rpm and the discharge about 275 gpm. The coefficient of transmissibility of the aquifer, again as computed by Theis' recovery formula (Fig. 10), was approximately 36,000 gpd/ft. It can be observed that the plot of the values of residual drawdown against log t/t' again approximates a straight line through a limited range.

Because the aquifer has a high coefficient of transmissibility with respect to the specific capacity, it appears that the water occurs under artesian conditions. The clay conglomerate logged from 90 to 95 feet probably serves at least as a semiconfining bed. Thus, it is believed that interference and resulting drawdown effects will take place more rapidly between the wells drilled at the campsite than if the water occurred under strictly water-table conditions. It is believed that the amount of this interference will be insignificant for the amount of pumping necessary to furnish the water required by the camp.

REPORT ON TESTING OF WATER-SUPPLY WELL FOR LORDSBURG AIRFIELD, LORDSBURG, NEW MEXICO

By

O. J. Loeltz and C. Richard Murray
U. S. Geological Survey
July 1942

INTRODUCTION

During the latter part of June 1942, the U. S. Geological Survey, at the request of the U. S. Army Engineers, made a pumping test of a newly drilled well which was to furnish a part of the water supply for the Lordsburg Airfield.

The well is at an altitude of 4,248 feet and is about 1½ miles east and ½ mile south of Lordsburg, in the NE¼NE¼SE¼ sec. E, T. 23 S., R. 18 W. The log is given below:

Material	Thicknes *(feet)*	Depth *(feet)*
Conglomerate	97	97
Conglomerate, harder	8	105
Conglomerate, hard	22	127
Conglomerate, soft	3	130
Water sand and gravel (water first observed at 130 feet)	10	140
Clay and gravel	10	150
Sand and gravel	5	155
Clay and gravel	5	160
Sand and gravel	10	170
Clay and gravel, hard	5	175
Clay and gravel, harder	45	220
Clay and gravel	10	230
Sand and gravel	6	236
Soft clay and conglomerate	7	243
Hard clay and conglomerate	3	246
Clay	4	250
Hard clay		

When the well was completed, the water level was 118 feet below land surface. The well was cased from land surface to the bottom of the hole with 14-inch O.D. steel casing, perforated from

130 to 250 feet below land surface. An acetylene torch was used to burn slots ¼-inch by 8 inches, four in each row around the pipe, the rows being staggered and spaced about 20 inches apart from center to center along the pipe.

PUMPING TESTS

The pumping test was made in accordance with provisions of section 2-09 of "Airfield Construction Specifications for Drilling, Casing, and Testing Wells, Lordsburg Airfield, Lordsburg, New Mexico." Section 2-09 required that the well be pumped according to the following schedule: pump 10 hours, rest 24 hours; pump 10 hours, rest 24 hours; pump 24 hours.

The test pump was a 5-stage No. 10 Johnston deep-well turbine pump, belt-driven by a Waukesha gasoline engine. The intake screens were about 177 feet below land surface. The remainder of the pump unit consisted of 150 feet of 7-inch O.D. pump column, 5 feet of bowls, and 20 feet of 7-inch O.D. suction pipe.

Discharge measurements were made with a circular orifice, 4⅜ inches in diameter, attached to the end of a 6-inch standard discharge pipe about 8 feet long. The reference point for all water-level measurements was the top edge of the well casing, 0.70 foot above land surface. Measurements were made by means of an air gage, electric sounder, and steel tape. Only the measurements made with a steel tape are recorded to the nearest hundredth of a foot.

Just before pumping began the water level was 118.72 feet below the measuring point. When pumping began the water had a dark gray color, probably due to clay carried in suspension. The amount of sand pumped was so small that it was difficult to detect. After about 45 minutes the water became noticeably clearer, and at the end of 6½ hours of pumping it was quite clear. Surging at this time did not increase the turbidity of the water, indicating that most of the development had already taken place. Production-drawdown data obtained during later tests also show that the performance of the well did not materially improve after the first 6 hours of pumping. At the end of the first 10-hour pumping period the well was producing 257 gallons a minute with a drawdown of 43 feet, which was equivalent to a specific capacity of 6 gallons a minute per foot of drawdown. Thirty minutes after pumping was stopped the water level had returned to within a foot of the level observed just prior to pumping. Seven hours after pumping stopped the water level had recovered to its initial position.

Just prior to the second 10-hour test the water level was 118.65 feet below the measuring point, or about 0.07 foot higher than before the first 10-hour test. Discharge during this run varied from 250-260 gallons a minute except for brief periods when the pump was stopped in order to make emergency repairs to the engine. The pumping time was extended to compensate for these shutdowns. An average discharge of 257 gallons a minute was obtained with a drawdown of 43.3 feet, giving a specific capacity of 6 gallons a minute per foot of drawdown.

At the beginning of the 24-hour run the static level was 118.73 feet below the measuring point. This run was used to determine a production-lift curve for the well. The well was pumped at the maximum rate obtainable with the testing equipment at hand until the rate of decline of water level became small. At the end of 2 hours the rate of drawdown was small, so the discharge of the well and the corresponding lift at this time were used as part of the data for determining the production-lift curve. The rate of discharge was then reduced to about 237 gallons a minute. There being no appreciable change in the discharge and lift at the end of 2 hours, these parameters were considered to represent the characteristics of the well. Further reductions in discharge were made and the corresponding lifts observed until a minimum discharge of about 150 gallons a minute was reached. Figure 11 is a production-lift plot of these values. From it the probable lift for any given discharge, after only a few hours of pumping, can be approximately ascertained. Data obtained near the end of the 24-hour run indicate that the slope of the line should be somewhat steeper. The correction is small; however, the drawdown for a production of 250 gallons a minute as shown being only about a foot too small. The reciprocal of the slope of the line indicates the specific capacity (the number of gallons per minute for each foot of drawdown) to be very nearly 6 for the pumping times and rates involved in these tests.

During the last 18 hours of the 24-hour run the discharge was maintained at about 260 gallons a minute. The drawdown during this time averaged about 44 feet, likewise giving a specific capacity of 6 gpm/ft. Recovery measurements were made at various intervals during the 24 hours following the 24-hour pumping period, to obtain a value for the transmissibility of the materials penetrated by the well. The transmissibility[1] of the aquifer, an indication

[1]Theis, C. V., *The Significance and Nature of the Cone of Depression in Ground-Water Bodies:* Econ. Geology, Vol. 33, No. 8, p. 889—902, Dec. 1938.

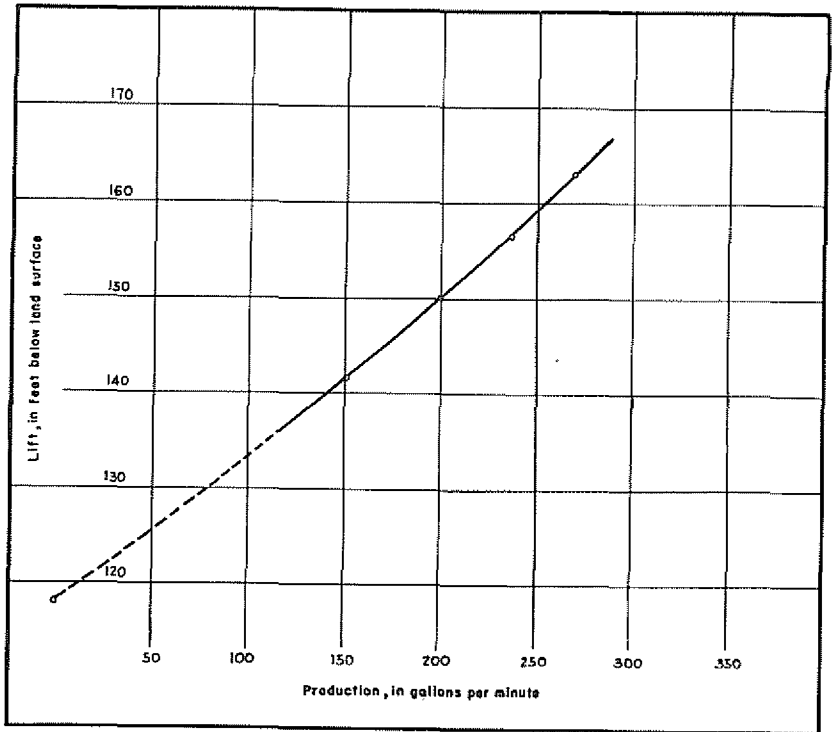

FIGURE 11
PRODUCTION-LIFT GRAPH
FOR LORDSBURG AIRFIELD WELL NUMBER 1

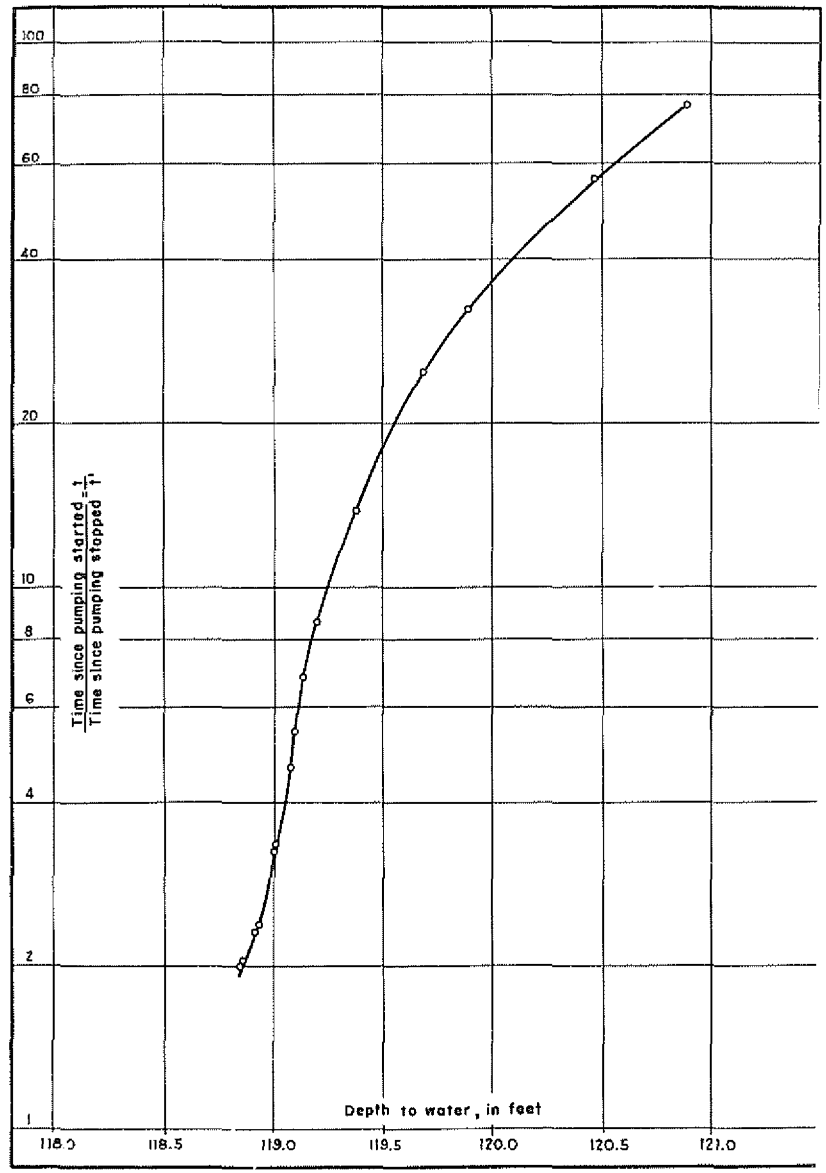

FIGURE 12
RECOVERY OF WATER LEVEL AFTER PUMPING

of its ability to transmit water, is expressed quantitatively by a "coefficient of transmissibility," which is defined as the number of gallons of water which will move in 1 day through a vertical strip of the aquifer 1 foot wide and having the height of the aquifer when the hydraulic gradient is unity. The coefficient of transmissibility is approximately the average coefficient of permeability multiplied by the thickness of the aquifer in feet. Figure 12 is a plot of the recovery of water level, using the logs of t/t' as ordinates and depths to water as abscissas, where t is the time since pumping started and t' is the time since pumping stopped. Ideally, the recovery curve should be a straight line when so plotted and the coefficient of transmissibility would be indicated by the formula $T = (264\ q/s) \log t/t'$, where q is the discharge in gallons a minute and s is the change in water level in feet, in an interval equivalent to log t/t'. Inasmuch as the recovery curve in this case departs markedly from a straight line, little reliance can be placed on the results obtained by use of the formula. The curve indicates possible values for the coefficient of transmissibility ranging from about 20,000 to 200,000 and averaging perhaps 130,000 gallons a day per foot. A well penetrating an aquifer having a coefficient of transmissibility of 130,000 gallons a day per foot should have a specific capacity considerably higher than 6 gallons a minute per foot of drawdown. This may indicate that the lower value for the coefficient of transmissibility indicated by the flatter portion of the recovery curve may be most nearly correct; or it may indicate that full capacity of the aquifer has not been obtained at this well, either because of the well construction itself, or because the aquifer is less permeable in the vicinity of the well than it is some distance away.

The recovery of the water level after prolonged pumping was quite rapid and complete, indicating that the amount of water to be pumped probably will not cause a rapid depletion of the available supply. It seems that the performance of the well might have been better had the well been drilled 30 to 50 feet deeper, or entirely through the alluvial fill, or had the location been somewhat different; nevertheless, the well probably will continue to meet satisfactorily the needs for which it was drilled.

Significant pumping and recovery data obtained during the test are given in the following tables:

PUMPING DATA FOR LORDSBURG AIRFIELD WELL NO. 1

Date *(1942)* Time	Discharge *(gpm)*	Depth to Water *(feet below top of casing, 0.7 foot above land surface)*	Pump Speed *(rpm)*	Remarks
June 30				
7:30 a.m.		118.78		Static level
12:05 p.m.		118.72		Do.
1:02				Began first 10-hour pumping test
1:15	171	146.20		Water very dirty, dark gray in color
1:24	174	147.00	1,786	
1:42	190	149.40	1,792	Water beginning to clear
2:43	218	154.40	1,838	
3:43	218	154.50		
4:31	240	157.60		
5:42	260	162.20		Water quite clear
6:18	251	160.90		
7:35	250	160.40	1,835	Water clear
9:42	253	161.70	1,845	
10:16	253	161.60		
11:02	257	161.70		
11:05				Ended first 10-hour pumping test
July 1				
11:30 p.m.		118.65		Static level
11:49				Began second 10-hour pumping test
11:53	237	140.0		
July 2				
12:12 a.m.	264	158.0		
12:22	270	163.6		
12:30	277	160.7		
12:43	257	162.6	1,875	
12:50				Engine stopped by heavy rain
12:58				Engine started, but not running properly
1:04				Stopped engine for repair
1:15				Resumed pumping
1:29	252	158.5		
1:35	252	160.1		
2:00	259	162		
3:10	256	162	1,875	

PUMPING DATA FOR LORDSBURG AIRFIELD WELL NO. 1 – continued

Date	Discharge	Depth to Water	Pump Speed	Remarks
4:20	257	162	1,875	
6:00	257	162	1,875	
6:03				Repaired fan on engine
6:38				Resumed pumping
6:41	241	149		
6:56	259	162	1,875	
7:00	257	162		
8:00	261	163		
8:45	257	162		
10:48	257	162.5		
10:57		162.8		Ended second 10-hour pumping test
July 3				
12:46 p.m.		118.73		Static level
12:47				Began 24-hour pumping test
12:51	257	152.5		
12:55	256	156		
1:00	257	158.2		
2:00	267	163	1,893	
3:00	269	163.7		Reduced pump speed at 3:02 p.m.
3:27	237	157.6		
4:50	237	157.4	1,850	
4:51				Reduced pump speed
5:14	198	150.5	1,815	
5:48	200	150.8		
5:50				Do.
6:23	159	143.5	1,768	
6:50	151	142.3		
6:52				Increased pump speed
7:20	257	161.0	1,900	
8:15	259	161.9		
10:45	257	161.75	1,895	
July 4				
12:10 a.m.	259	162.3		
2:20	261	162.6		
4:00	261	162.8		
6:00	261	162.9		
7:45	261	162.8		
10:07	251	161.3		
10:50	261	163.0		
11:50	257	162.2		
12:37 p.m.	256	162.2		
12:49				Ended 24-hour pumping test

RECOVERY MEASUREMENTS FOR LORDSBURG AIRFIELD WELL NO. 1

Date *(1942)* Time	Time after pump stopped *(hr:min:sec)*	Depth to Water *(feet below top of casing 0.7 foot above land surface)*	Atmospheric pressure *(inches of mercury)*	Remarks
June 30				
12:05 p.m.		118.72	25.840	Static level prior to first 10-hr pump test
11:05	00:00:00	161.7		End of first 10-hr pumping test
	:50	139		
	1:45	134		
	2:30	133		
	5:00	125.98		
	10:00	121.77		
	15:00	120.77		
	23:00	120.13		
	32:00	119.77		
	44:00	119.48		
	1:10	119.20		
	2:25	118.91	25.825	
	4:10	118.80	25.800	
	6:55	118.74	25.828	
	10:25	118.69	25.840	
	12:25	118.68	25.830	
	15:25	118.64	25.755	
	16:55	118.63	25.680	
	20:25	118.65	25.679	
	21:25	118.64	25.668	
July 1				
11:00 p.m.			25.820	
11:30	24:25	118.65		
11:49	24:44			Began second 10-hr pumping test
July 1				
11:30 p.m.		118.65		Static level prior to second 10-hr pump test
July 2				
10:57 a.m.	00:00:00	162.8		End of second 10-hr pump test
	:30	142.8		
	1:00	140.5		
	2:00	134.8		
	3:00	132.8		
	4:00	129.8		
	5:00	128.8		
	6:00	127.0		
	8:30	122.68		
	10:05	121.97		

RECOVERY MEASUREMENTS
FOR LORDSBURG AIRFIELD WELL NO. 1 – continued

Date	Time after pump stopped	Depth to Water	Atmospheric Pressure	Remarks
	14:07	121.09		
	19:00	120.56		
	25:00	120.20		
	45:00	119.63		
July 2 12:03 p.m.	1:06:00	119.39		
	2:33	119.04		
	4:03	118.97		
	5:33	118.87	25.635	
	9:33	118.81	25.660	
	12:43	118.76	25.672	
July 3 3:27 a.m.	16:30	118.75	25.673	
	20:56	118.74	25.715	
11:00	24:03	118.73	25.730	
12:47 p.m.				Began 24-hr pump test
July 3 11:00 a.m.		118.73	25.730	Static level prior to 24-hr pump test
July 4 12:49 p.m.	00:00:00	162.2		End of 24-hr pump test
	1:30	138.5		
	2:00	133.8		
	3:00	131.0		
	4:00	129.0		
	5:00	127.6		
	6:00	126.0		
	8:00	124.1		
	10:00	122.35		
	13:00	121.60		
	19:00	120.89		
	26:00	120.46		
	46:00	119.89		
	1:00:00	119.68		
	1:51	119.38		
	3:07	119.20		
	4:07	119.14	25.72	
	5:26	119.10	25.73	
	6:36	119.08	25.74	
	10:11	119.01	25.82	
	10:26	119.00	25.82	
	10:41	119.00	25.82	
July 5 6:05 a.m.	17:16	118.94	25.83	
	17:45	118.932	25.83	
	18:13	118.928	25.83	
	23:41	118.86	25.80	
12:55 p.m.	24:06	118.85	25.80	Final recovery measurement

GROUND-WATER CONDITIONS NEAR LORDSBURG, NEW MEXICO

By

Charles V. Theis
U. S. Geological Survey
September 9, 1942

INTRODUCTION

The vicinity of Lordsburg, N. Mex., is being considered as a possible site for an Army cantonment, for which the need of water is estimated to be 3,000 gallons a minute, maximum, and 2,000 gallons a minute, as an average. The tentative site for the camp is 2 or 3 miles north of Lordsburg.

Two previous memoranda on this area have been submitted by the Geological Survey to the Albuquerque District, U. S. Corps of Engineers. These are (1) "Ground-water conditions near Lordsburg," by A. M. Morgan, dated February 17, 1942; and (2) "Report on pumping tests.... on Lordsburg Army Camp Well No. 1, April 1942," by C. R. Murray.

GENERAL HYDROLOGIC CONDITIONS

The general hydrologic conditions described by Mr. Morgan in his memorandum pertain particularly to conditions southwest of Lordsburg Draw. However, this description also outlines the general conditions northeast of the draw, where the campsite probably would be chosen, with the exception that the altitude of the bedrock surface underlying the alluvium to the northeast of the draw is not known. However, the greater distance to the mountains to the northeast, the gentle slopes where bedrock is exposed, and the fact that no wells northeast of the draw are known to have encountered bedrock, suggest that it is at considerable depth in the vicinity of the tentative site and that, as a consequence, a considerable thickness of saturated alluvium will be found.

Lordsburg lies only a short distance west of the Continental Divide. As a consequence, the streams that built up the alluvial deposits in the vicinity probably had less drainage area and less volume than those that built up the deposits in either the Deming area to the east, or along the Gila River to the west. As a further consequence, the proportion of coarse deposits in the alluvium in the Lordsburg area appears to be less than that in the adjoining areas, and the wells in the Lordsburg area to be less productive.

The water table in the vicinity of the proposed site is at an altitude of about 4,120 feet.

The description and characteristics of the existing wells in the area are given in preceding memoranda. Following is the log of one of the railroad wells which has not been previously reported:

DRILLER'S LOG OF SOUTHERN PACIFIC RAILROAD WELL, NE ¼, sec. 2, T. 23 S., R. 18 W.

Material	Thickness (*feet*)	Depth (*feet*)
Clay and gravel	20	20
Coarse gravel	10	30
Clay and gravel	58	88
Cemented gravel	20	108
Clay and gravel	2	110
Coarse gravel	11	121
Fine sand	2	123
Coarse gravel and brown clay	5	128
Clay and gravel	36	164
Coarse gravel	11	175
Clay and gravel	9	184
Cemented gravel and clay	16	200
Clay and coarse gravel	62	262
Clay and sand	21	283
Sand	4	287
Sand and coarse gravel	53	340

QUALITY OF WATER

The water found under Lordsburg Draw is a sodium bicarbonate water, unusually soft for New Mexico. The following analysis from U.S. Geological Survey Water-Supply Paper 422 [2] is for water from a well 192 feet deep belonging to Frank R. Coom in the SE¼ sec. 34, T. 22 S., R. 18 W., and indicates the chemical nature of the water. The analysis, in parts per million, is: calcium 7; magnesium 6; sodium and potassium 141; carbonate 14; bicarbonate 256; sulfate 78; chloride 26; total hardness as $CaCO_3$ 43; and dissolved solids 452.

CONCLUSIONS

(1) Enough water to satisfy the demand of 3,000 gallons a minute, maximum, and 2,000 gallons a minute, average, can, with little doubt, be obtained in the close vicinity of Lordsburg.

(2) The average production of the wells probably will be about 300 gallons a minute, and a battery of about 10 wells probably will be needed to satisfy the demand.

(3) The wells should be spaced about 250 feet apart, preferably along one line, in order to reduce mutual interference.

(4) Specific capacities of 7 to 12 gallons a minute per foot of drawdown may be expected.

(5) Wells to produce about 300 gallons a minute should be approximately 300 feet deep. However, the water-producing characteristics of the lower part of the alluvium have not been explored in this vicinity and one of the first wells should, if feasible, be drilled deeper until either bedrock or thick, clayey sediments are reached. If additional aquifers are found, fewer wells would produce the requisite water.

[2] Schwennesen, A. T., and Hare, R. F. *Ground Water in the Animas, Playas Hachita, and San Luis Basins, New Mexico,* U.S. Geol. Survey Water-Supply Paper 422, 1918, Washington, D.C.