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Water Supply at Los Alamos During 1977

University of California



LOS ALAMOS SCIENTIFIC LABORATORY

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Informal Report

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William D. Purtymun



WATER SUPPLY AT LOS ALAMOS DURING 1977

by

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ABSTRACT

The Los Alamos water supply for 1977 consisted of 1474×10^6 gal from wells in three fields and 57×10^6 gal from the gallery in Water Canyon. The production from the well fields was at its lowest volume since 1970. Water-level trends were as anticipated under current production practices. Well rehabilitation should be continued to ensure an adequate and reliable supply from wells that are 10 to over 25 yr old.

I. INTRODUCTION

This report summarizes pumpage and aquifer conditions for wells in the Los Alamos, Guaje, and Pajarito well fields (Fig. 1). These wells supply most of the water used for municipal and industrial purposes in Los Alamos. The gallery in Water Canyon that supplies the balance to the system is also discussed. This report is a joint effort between Group H-8 of the Los Alamos Scientific Laboratory (LASL) and the Utilities and Engineering Division of the Zia Company (Zia U/E). Its purpose is to ensure a continuing historical record and to provide guidance for management of water resources and long-range planning for the water supply system. One summary report and six annual reports have been issued as the result of these studies.¹⁻⁷ The eighth report extrapolates water-level trends in the well fields to 1983 under current production.⁸

The Zia U/E, the Department of Energy (DOE) support contractor at Los Alamos, maintains and operates the water supply system. Water is pumped from wells, through transmission lines, and lifted by booster pumps into reservoirs for storage and distribution to the community and Laboratory areas

(Fig. 1). Water from the gallery flows by gravity through a microfilter station and is pumped into one of the system reservoirs for distribution. Zia U/E maintains monthly records of hours of operation on each well, along with daily and monthly production records. Monthly average nonpumping and pumping water levels are computed from air-line pressure data recorded continuously at each well. These data provide input for calculating pumping rates, drawdown (difference between nonpumping and pumping water levels), specific capacity (pump rate per unit drawdown), and other well-field statistics included in this report.

Hydrographs have been prepared for one observation well, one standby supply well, 15 supply wells, and the gallery in Water Canyon. The hydrographs for the wells show annual average nonpumping and pumping water levels, specific capacity, and annual pumpage for the years during which the wells have been in production. The hydrograph for the gallery presents annual production and the annual average discharge rate. Appendixes A and B contain basic pumping and production information for each supply well, monthly for 1977 and annually for the period of record.

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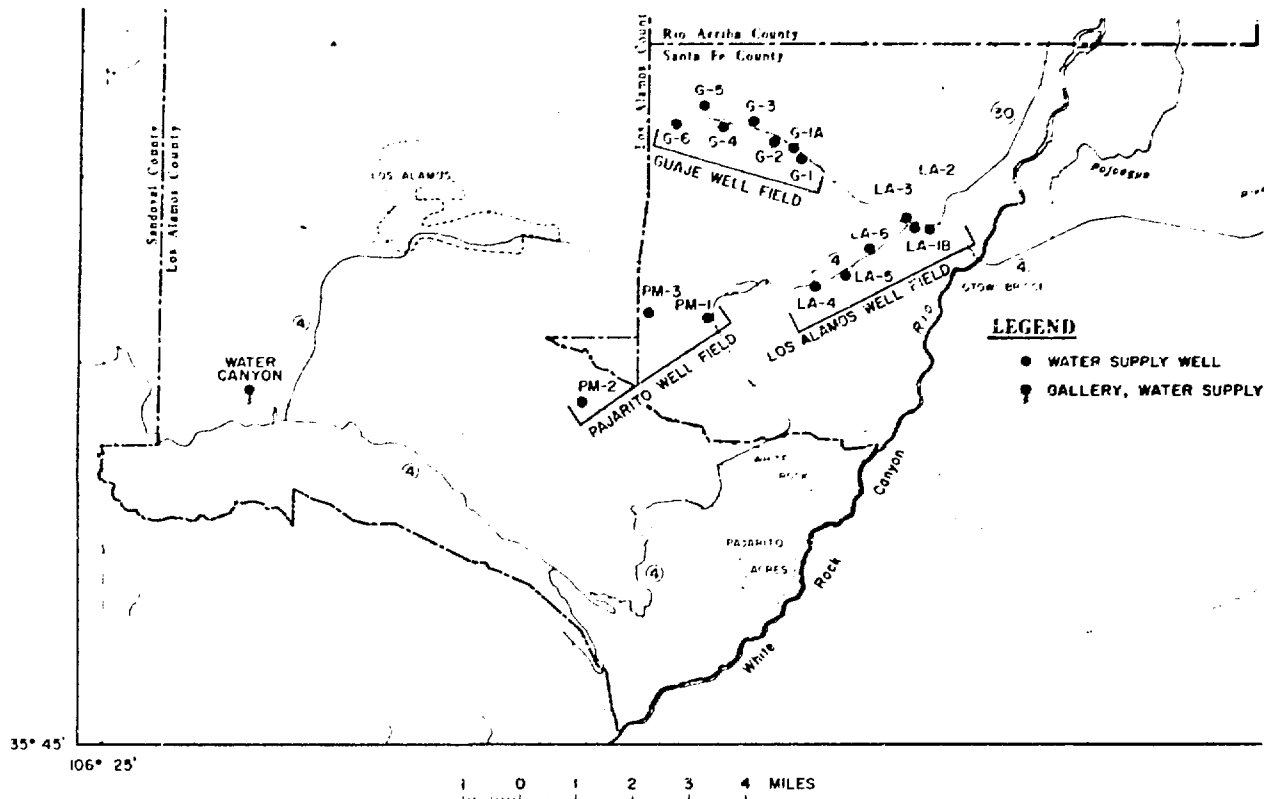


Fig. 1.
Location of well fields, supply wells, and gallery water supply.

II. WELL-FIELD CHARACTERISTICS

Production from the three well fields decreased 217×10^6 gal from 1691×10^6 gal in 1976 to 1474×10^6 gal in 1977 (Table I). The production declined to its lowest point since 1970 in spite of a larger number of residents, as represented by the completion of 140 housing units in Los Alamos and 117 units in White Rock. This decline was partly because of early summer rains, which reduced demand for lawn irrigation, and partly because of conservation by residents of Los Alamos County, possibly encouraged by increased water rates. The decline was accompanied by a relative shift in area of demand. Production into Los Alamos from the Los Alamos and Guaje Fields decreased only 14×10^6 gal, whereas that in White Rock from the Pajarito Field decreased 203×10^6 gal. Water production in 1977 fell below the projected demand by 620×10^6 gal (Fig. 2).⁹

The peak demand period in 1977 was for the 19 day period of May 31 through June 18 when pumpage was about 149×10^6 gal, or 7.8×10^6 gal/day. Voluntary reduction of water use by the residents ended the peak demand period during the La Mesa fire, in order to maintain maximum storage for fire protection. The production decreased 4×10^6 gal/day when the emergency was announced. Daily production during the 19 day period exceeded 10×10^6 gal for 2 days, 9×10^6 gal for 4 days, and 8×10^6 gal for 4 days. During the remaining 9 days, production was less than 8×10^6 gal/day. In comparison, the peak demand period in 1976 was for 32 days when production was 299×10^6 gal for an average of 9.4×10^6 gal/day. During this period, the production exceeded 10×10^6 gal/day for 14 days, 9×10^6 gal/day for 9 days, and 8×10^6 gal/day for 4 days. During the remaining 5 days, production was less than 8×10^6 gal/day.

TABLE I
PRODUCTION IN MILLIONS OF GALLONS
FROM WELLS AND GALLERY
1947 1977

Year	Los Alamos Field	Guaje Field	Pajarito Field	Water Canyon Gallery	Production Total
1947	147	0	0	84	231
1948	264	0	0	97	361
1949	302	0	0	92	394
1950	547	3	0	54	604
1951	702	68	0	39	809
1952	448	350	0	48	846
1953	444	372	0	39	855
1954	380	374	0	40	794
1955	407	375	0	33	815
1956	437	506	0	23	966
1957	350	378	0	40	768
1958	372	395	0	60	827
1959	391	478	0	54	923
1960	530	533	0	48	1111
1961	546	624	0	54	1224
1962	577	597	0	67	1241
1963	539	654	0	51	1244
1964	627	665	0	45	1337
1965	447	571	99	72	1189
1966	450	613	127	82	1272
1967	373	464	481	56	1374
1968	345	474	584	65	1468
1969	331	435	569	80	1415
1970	360	423	595	65	1443
1971	412	484	657	37	1590
1972	380	467	662	40	1549
1973	406	475	685	49	1615
1974	369	453	802	35	1659
1975	356	431	749	42	1578
1976	343	531	817	41	1732
1977	345	515	614	57	1531
Total	12 927	12 708	7441	1689	34 765

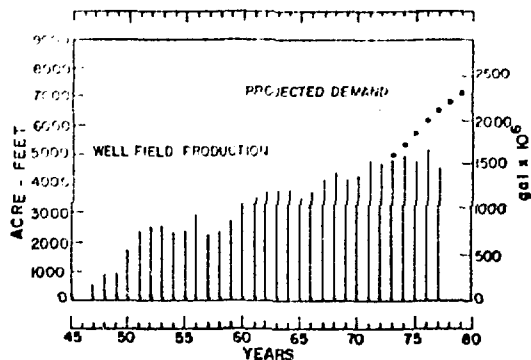


Fig. 2
Well-field production 1947-77 and projected demand 1973-79.

The heaviest demand for water in 1977 was in May, June, and July, when about 578×10^6 gal were used, representing about 38% of the total production of 1977. The months of least demand were December, January, and February, when production was 260×10^6 gal, representing about 17% of the total production. Water levels in the wells fluctuated with pumpage. The highest water levels were during the months of least pumpage (December, January, and February), whereas lowest water levels were during months of greatest pumpage (May, June, and July).

Total production from the well fields and gallery since 1947 has been $34\,765 \times 10^6$ gal. Of this, the wells have produced $33\,076 \times 10^6$ gal, or 95% (Table I). The annual production, per cent pumpage by field, and per cent of pumpage of individual wells are given in Table II. The average annual pumping rate for individual wells for the period 1973 through 1977 is shown in Table III.

A. Los Alamos Field

The Los Alamos well field is composed of six supply wells and one observation well. The production in 1977 was from five supply wells; the sixth is on standby status for emergency use only.¹⁰ Pumpage from the field increased by 2×10^6 gal, from 343×10^6 gal in 1976 to 345×10^6 gal in 1977. The field produced about 22% of the total for the year (Table II).

Pumpage from the individual wells increased only slightly above the 1976 productions. The water levels in wells LA-1, LA-1B, LA-2, LA-3, LA-4, and LA-5 varied slightly, but did not change significantly (Figs. 3 through 8, respectively).

Well LA-6, on standby status, was pumped only three times during the year for testing and maintenance of the pump. About 1.7×10^6 gal of water was pumped to waste during the year. The restricted use of the well has resulted in higher water levels in 1977 than in 1975 or 1976 (Fig. 9). The water levels in LA-6 rose about 14 ft during the year, whereas in the upper portion of the field (LA-4 and -5) there was no significant change (Fig. 1). In the lower part of the field (LA-1, -1B, -2, and -3), the average water level decline was about 2 ft.

The average annual pumping rate from the five producing wells in the field declined about 27 gpm from 2124 gpm in 1976 to 2097 gpm in 1977. The largest decline occurred at Well LA-1B (Table III). It appears that the meter may have been reading 3 to 5% low, which would account for the decreased pumping rate. If this is so, production for the year would be about 4×10^6 gal greater than reported. The specific capacities of the five producing wells also showed no significant change in 1977 from 1976 data.

B. Guaje Well-Field

The Guaje well field is composed of seven wells (Fig. 1). The pumpage from the field decreased 16×10^6 gal from 531×10^6 gal in 1976 to 515×10^6 gal in 1977 (Table I). The field produced 34% of the total production (Table II). The pumpage declined in all wells except G-4 where pumpage increased 15×10^6 gal above the pumpage of 1976.

There was no significant change in annual average nonpumping levels in wells G-1, -1A, -2, -3, -4, -5, and -6 (Figs. 10 through 16, respectively) when compared to 1976 water levels. The pumping level in well G-1 shows a continuing decline accompanied by a continuing decrease in specific capacity (Fig. 10). Rehabilitation of the pump and well was performed in early 1977. The intake of the pump was set 20 ft higher at 500 ft, about 4 ft above the reduction of the casing from 12 to 10 in., to allow free intake of water to the pump. Cleaning the casing and removal of

TABLE II
PRODUCTION PERCENTAGES
1977

	<u>Production in Million Gal</u>	<u>Per Cent by Well Field</u>	<u>Per Cent of Total Production</u>
Los Alamos Well Field			
LA-1	0.0	0.00	0.00
LA-1B	84.2	24.39	5.50
LA-2	42.5	12.32	2.78
LA-3	47.3	13.71	3.09
LA-4	96.4	27.92	6.30
LA-5	74.8	21.66	4.89
LA-6	0.0	0.00	0.00
<i>Subtotal</i>	345.2	100.00	22.56
Guaje Well Field			
G-1	57.9	11.24	3.78
G-1A	88.7	17.23	5.79
G-2	80.4	15.62	5.25
G-3	78.9	15.33	5.15
G-4	62.4	12.11	4.08
G-5	92.1	17.89	6.02
G-6	54.4	10.58	3.55
<i>Subtotal</i>	514.8	100.00	33.62
Pajarito Well Field			
PM-1	105.4	17.17	6.88
PM-2	272.8	44.45	17.82
PM-3	235.5	38.38	15.38
<i>Subtotal</i>	613.7	100.00	40.08
Water Canyon Gallery			
<i>Subtotal</i>	57.3	100.00	3.74
Total	1531.0		100.00

sediments from the well did not improve the specific capacity. The decline in the nonpumping water level and specific capacity results from interference by the nearby well G-1A.

The pumping level in well G-4 declined with increased pumpage, whereas the nonpumping level remained about the same (Fig. 14). As the pumping rate was decreased, the specific capacity did not change significantly.

The average annual pumping rate from the field decreased about 42 gpm from 2991 gpm in 1976 to

2949 gpm in 1977. The rates from individual wells during 1977 were only slightly different than in 1976 (Table III). The pumping rate of well G-6 has been reduced to keep the pumping level above the top of the pump. The specific capacity of the well has remained about the same; however, inspection of sand samples indicates some metal, line shaft, or pump wear.

TABLE III
AVERAGE ANNUAL PUMPING RATE OF WELLS
AND DISCHARGE FROM GALLERY
1973—1977
(in gpm)

	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
Los Alamos Well Field					
LA-1	0	0	0	0	0
LA-1B	553	540	537	526	504
LA-2	297	302	290	267	255
LA-3	346	316	313	285	284
LA-4	589	594	591	584	586
LA-5	460	460	459	462	468
LA-6	572	569	551	486	0
<i>Subtotal</i>	2817	2781	2742	2610	2097
Guaje Well Field					
G-1	375	375	376	366	353
G-1A	531	520	519	512	502
G-2	429	447	456	452	450
G-3	277	273	273	463	444
G-4	206	214	346	337	352
G-5	541	560	549	536	541
G-6	364	360	348	325	307
<i>Subtotal</i>	2723	2750	2867	2991	2949
Pajarito Well Field					
PM-1	459	606	616	607	592
PM-2	1388	1381	1383	1369	1375
PM-3	1320	1313	1312	1410	1406
<i>Subtotal</i>	3166	3299	3310	3386	3373
Water Canyon Gallery					
<i>Subtotal</i>	93	67	80	78	108
Total	8800	8896	8999	9065	8528

C. Pajarito Well Field

The Pajarito well field is composed of three wells (Fig. 1). The pumpage from the wells decreased 203 $\times 10^6$ gal from 817×10^6 in 1976 to 614×10^6 gal in 1977. The decreases in individual wells were 1.4×10^6 gal from PM-1, 169.2×10^6 gal from PM-2, and 32.8×10^6 gal from PM-3. The field produced 40% of total production (Table II).

Water levels remained about the same as in 1976 in wells PM-1, -2, and -3 (Figs. 17 through 19, respectively) in spite of the decrease in pumpage. The average annual pumping rate from the field declined about 13 gpm from 3386 gpm in 1976 to 3373 gpm in 1977. This change was not considered significant, as the largest decrease (15 gpm) occurred at PM-1 and was the result of a change in back pressure in the transmission line when PM-3 was

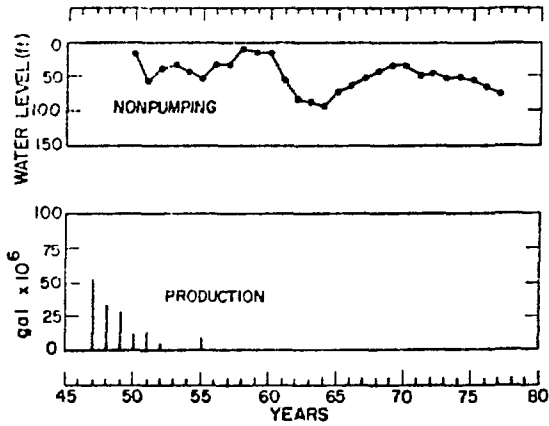


Fig. 3.
Annual average nonpumping water level and annual production, Los Alamos Well LA-1

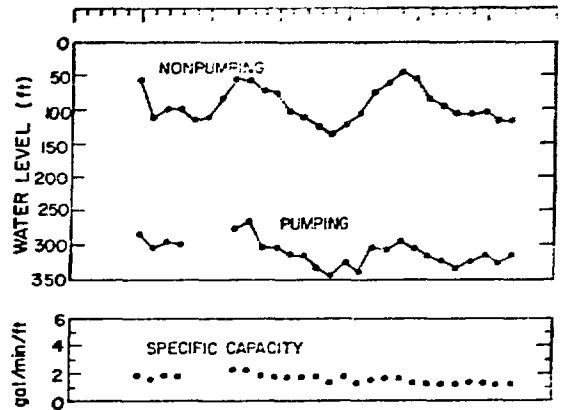


Fig. 5.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Los Alamos Well LA-2.

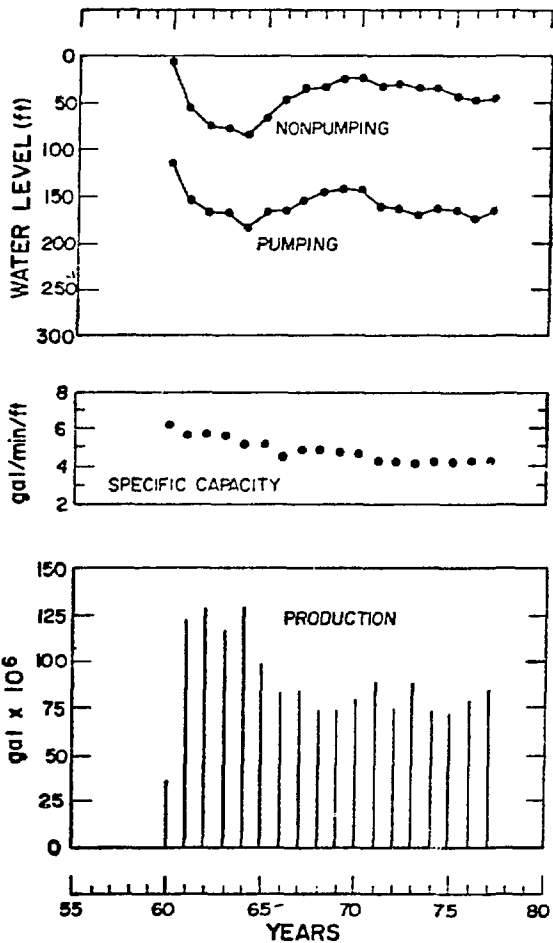


Fig. 4.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Los Alamos Well LA-1B.

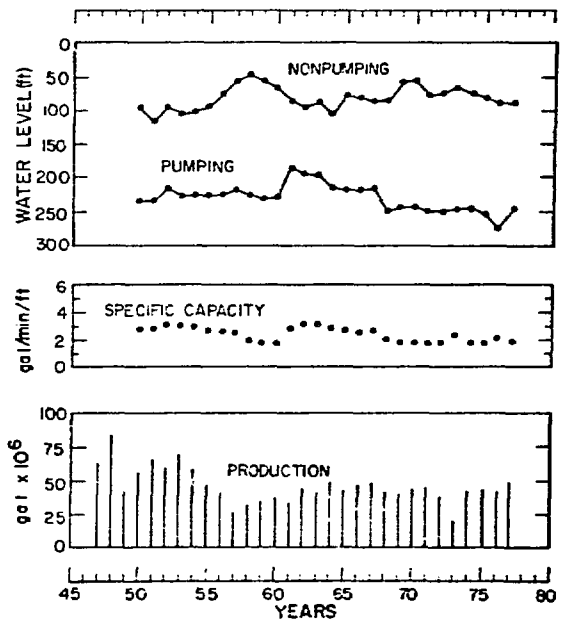


Fig. 6.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Los Alamos Well LA-3.

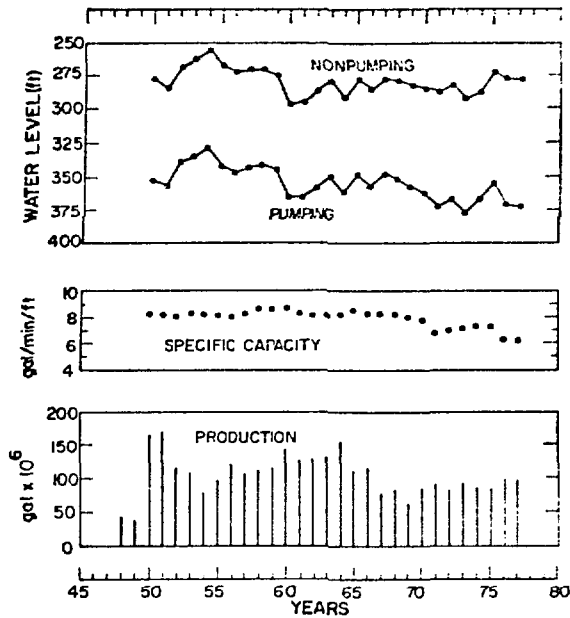


Fig. 7.
Annual average nonpumping and pumping water levels,
annual average specific capacity, and annual production,
Los Alamos Well LA-1.

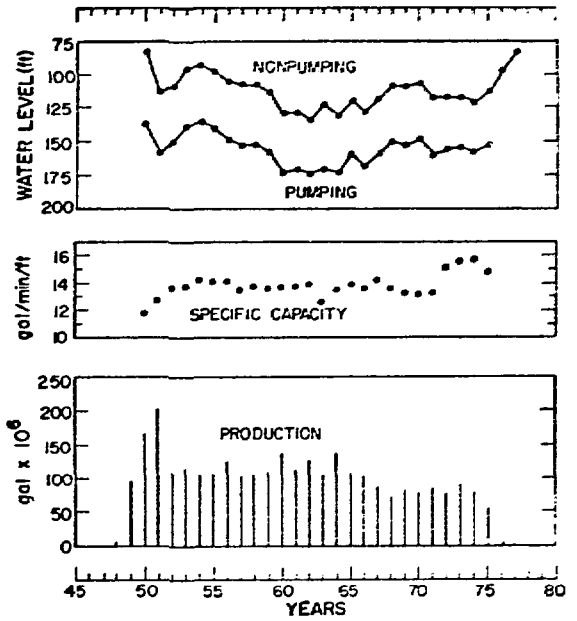


Fig. 9.
Annual average nonpumping and pumping water levels,
annual average specific capacity, and annual production,
Los Alamos Well LA-6.

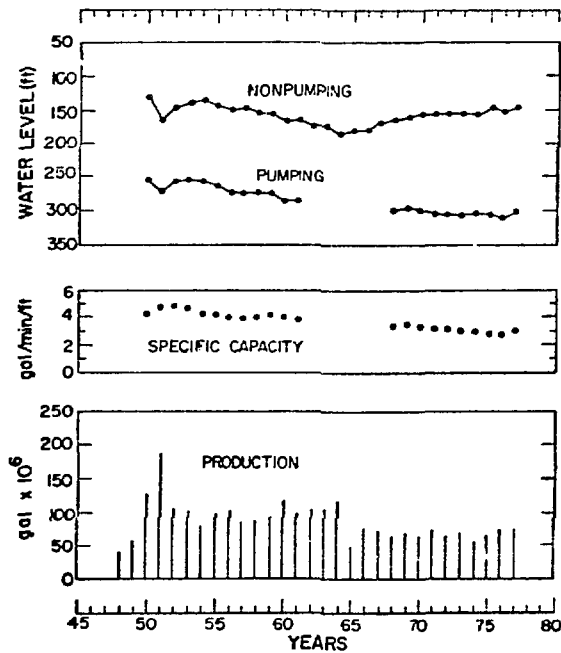


Fig. 8.
Annual average nonpumping and pumping water levels,
annual average specific capacity, and annual production,
Los Alamos Well LA-5.

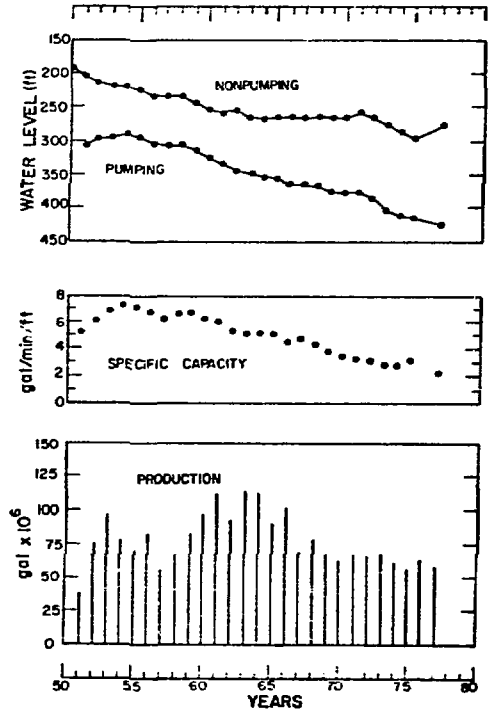


Fig. 10.
Annual average nonpumping and pumping water levels,
annual average specific capacity, and annual production,
Guaje Well G-1.

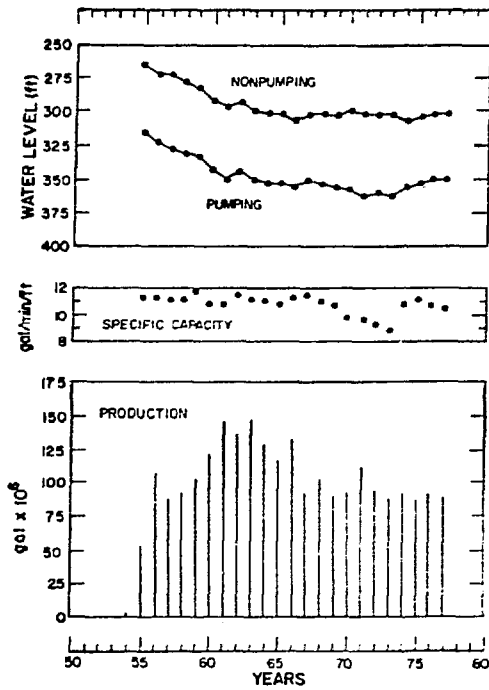


Fig. 11.

Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-1A.

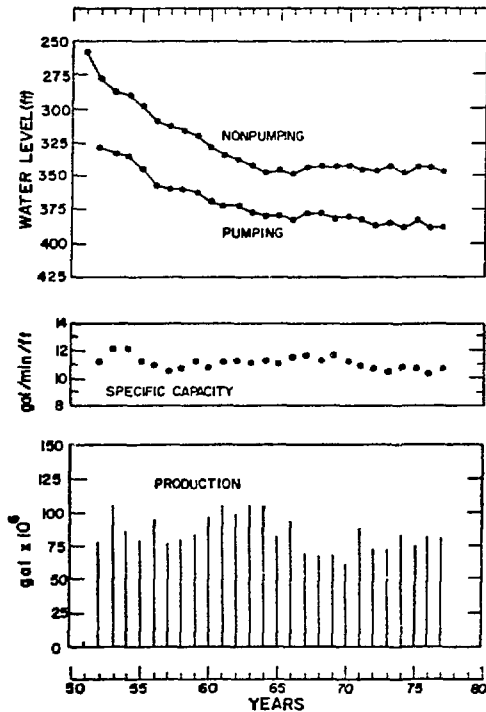


Fig. 12.

Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-2.

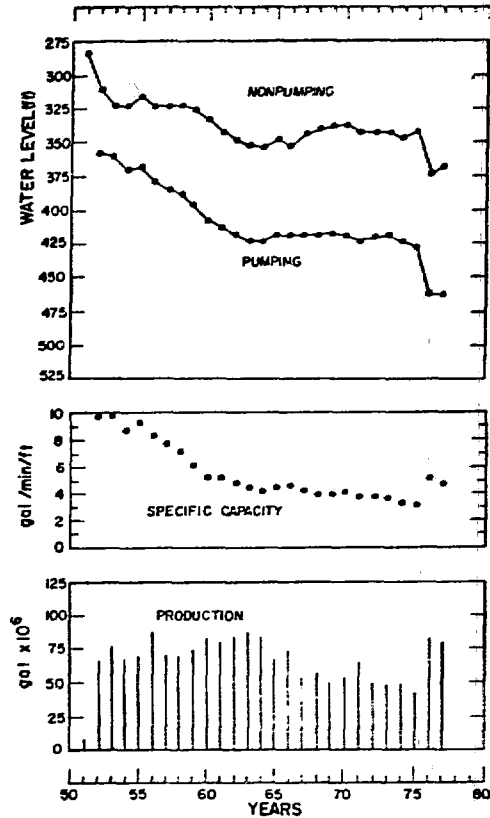


Fig. 13.

Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-3.

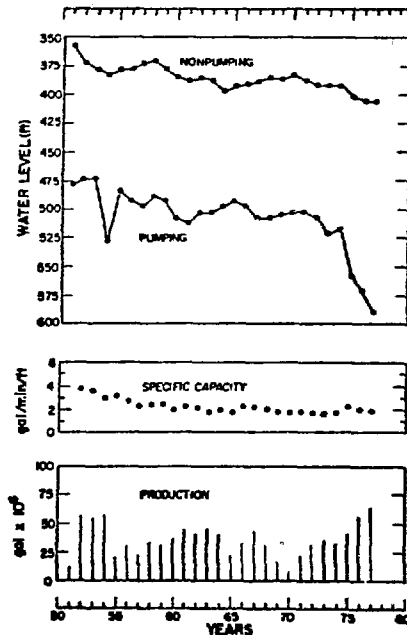


Fig. 14.

Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-4.

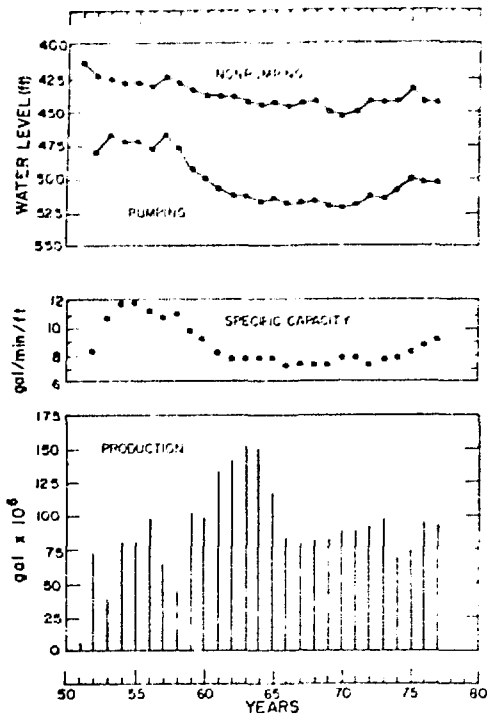


Fig. 15

Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-5

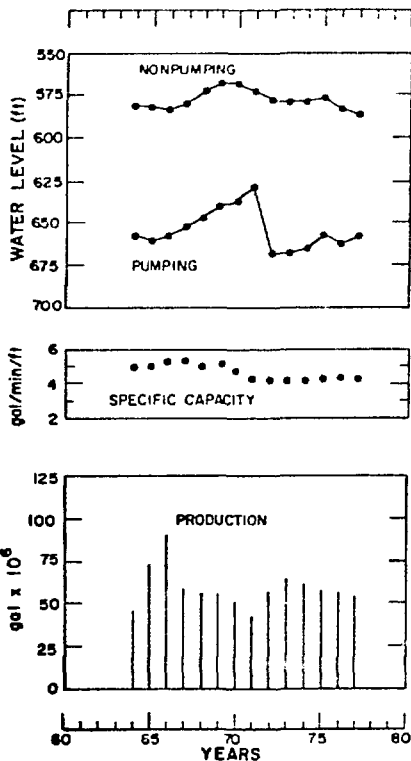


Fig. 16.

Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-6.

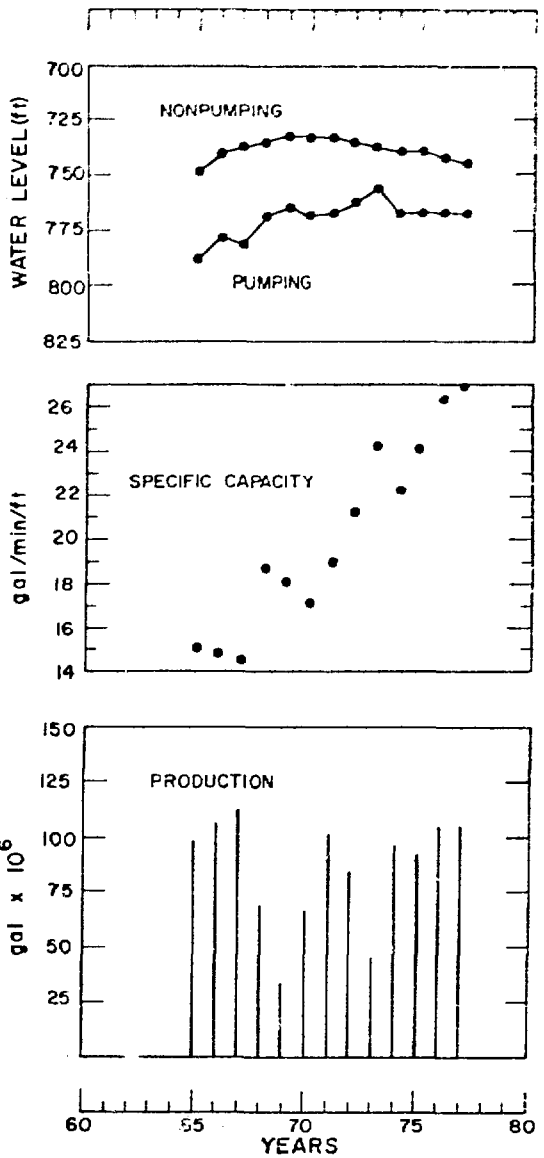


Fig. 17.

Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Pajarito Well PM-1.

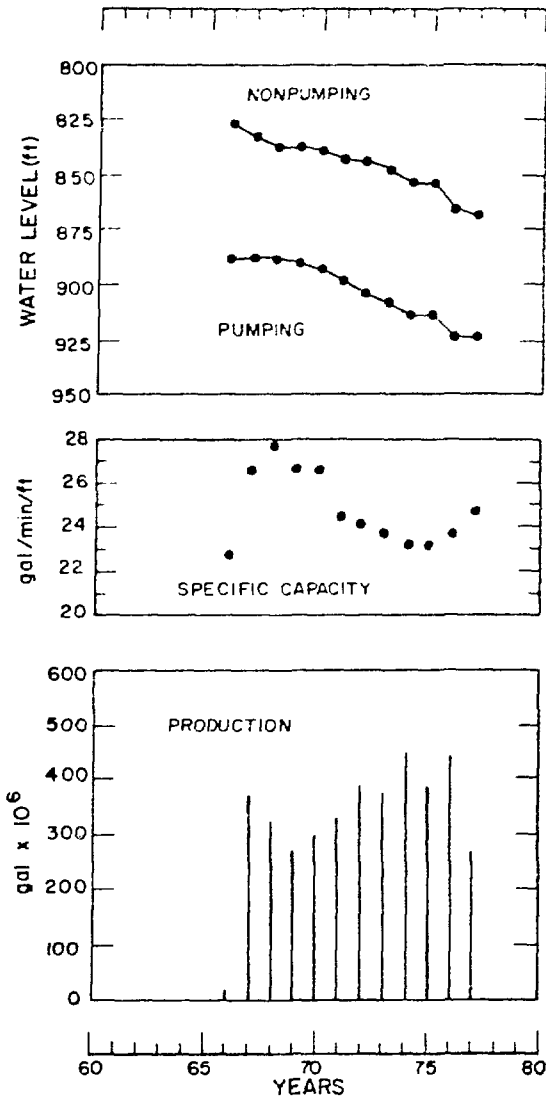


Fig. 18.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Pajarito Well PM-2.

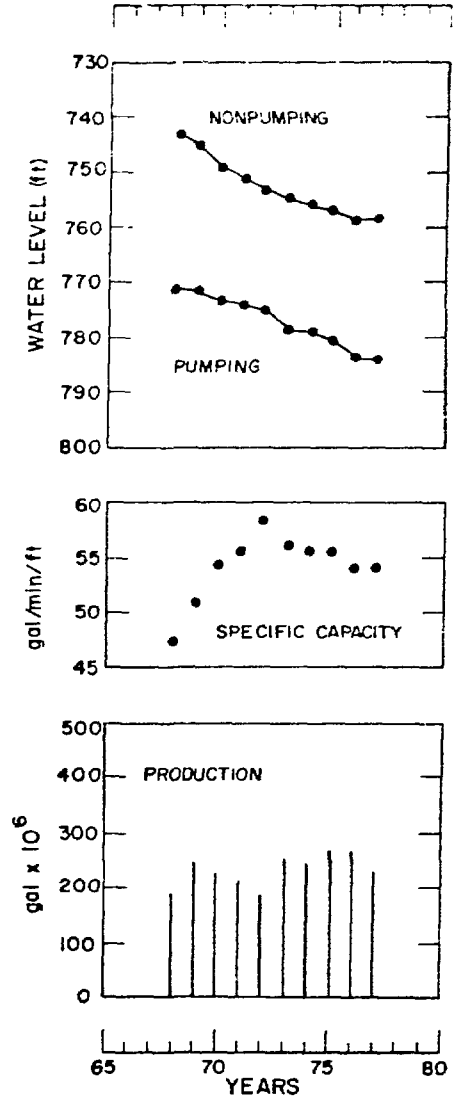


Fig. 19.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Pajarito Well PM-3.

pumping. The pumping rate of PM 2 increased slightly, while the rate of PM 3 decreased (Table III). There were no significant changes in specific capacities in the three wells.

III. WATER CANYON GALLERY

Production from the gallery in Water Canyon increased 16×10^6 gal from 41×10^6 gal in 1976 to 57×10^6 gal in 1977 (Table I). The production for 1977 was the highest since 1970 (Fig. 20). The discharge from the gallery was over 100 gpm during 1977. Recharge to the gallery is from precipitation on the flanks of the mountains west of the gallery. The gallery produced about 4% of the total supply to Los Alamos during 1977.

The gallery was rehabilitated in late 1977. Retaining walls were built outside the tunnel and the tunnel support was strengthened. The collection basin was rebuilt to collect all of the ground water discharge.

IV. SUMMARY AND RECOMMENDATIONS

Well-field operations in 1977 were very satisfactory. Production from the three well fields declined about 217×10^6 gal from 1976 to 1977. Water levels in wells in the Los Alamos, Guaje, and Pajarito fields were as expected under current production.

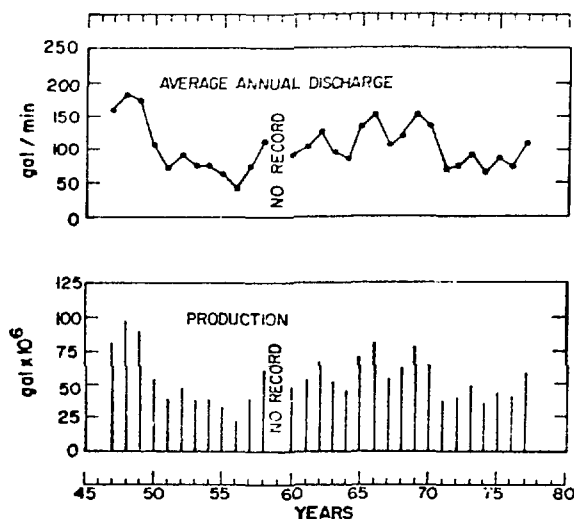


Fig. 20.

Annual average discharge and annual production from the gallery in Water Canyon.

The production from the well tends to be the lowest level since 1970. This was a dry year in terms of timing of precipitation and other factors and should not be construed to mean that additional wells are not needed for the system. There has been, and will continue to be, expansions of LASL facilities and increases in population and housing in the county that will require additional water. Even at the present time an exceedingly dry year or loss of a high yield well during peak demand period could result in a shortage of water. In planning, consideration must be given to the 18-24 month delay between the start of construction of a well and the time when it is complete and can be added to the system.

Rehabilitation of wells by removing sediment accumulation, additional development, and repair of casing and pumps should be continued. Ten of the 15 wells in use are more than 25 yr old; thus rehabilitation of these wells is necessary to maintain the already established system.

Wells that should be considered for rehabilitation are G-6, PM-2, and LA-5. The pump was pulled from well G-6 in 1972 and about 45 ft of sediments were removed from the well. The pumping rate has been reduced from about 378 gpm in 1972 to 307 gpm to control the entry of sand into the well. Metal collected in the sand sampler indicates wear on line shaft or pump. About 6×10^6 gal of water is pumped to waste at the start of the pumping period to keep the sand out of the main transmission line. Consideration should be given to installation of a filter or line to the sand trap at Booster Station 1 to utilize the water pumped to waste.

Well PM-2 is a high yield well that has been in operation since 1966. The pumping characteristics indicate no problems with the pump; however, the period of operation (35 000 h), as recommended life of pump by the manufacturer, has been exceeded. As the well is a high-yield producer ($\approx 18\%$ of total production), the pump should be pulled for inspection.

Well LA-5 was pulled for inspection in 1962. Pumping rates have declined from about 480 gpm to 468 gpm since that period, with only a slight change in specific capacity. Zia U/E reports that a larger line shaft is needed to keep the pump in adjustment and that the motor needs to be rewound from 125 to 150 hp, as the motor is presently drawing 152 to 155A on a 150A rating.

Zia U. E recommends the following: (1) the motor on well G-1A should be rewound from 150 to 175 hp, as the motor is drawing 170A on a 170A rating; (2) electric starters on pump motors on wells in the Los Alamos and Gage Fields and on pump motors in the Los Alamos booster stations should be replaced as they have had extended service, are obsolete, and when repairs are needed, parts are not available.

ACKNOWLEDGMENTS

Pumping statistics were compiled by Glenn Bryant (Zia U. E), Max Maes (H-8), and Charlene Wardlaw (H-8). Computer processing of data was handled by Ron Griego (H-12).

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APPENDIX A
MONTHLY AQUIFER CHARACTERISTICS

WELL LA-1
1977

<u>Month</u>	<u>Water Level Non Pump Feet</u>
Jan	50
Feb	47
Mar	47
Apr	54
May	76
June	105
July	110
Aug	99
Sep	80
Oct	85
Nov	71
Dec	59

WELL LA-1B
1977

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	133	4355	546	22	146	124	4.4
Feb	129	4204	543	22	147	125	4.3
Mar	171	5612	547	21	145	124	4.4
Apr	192	6104	530	24	152	128	4.1
May	372	11 322	507	49	171	122	4.2
June	434	12 574	483	78	206	128	3.8
July	340	9818	481	85	199	114	4.2
Aug	298	8715	487	72	192	120	4.1
Sep	211	6281	496	60	180	120	4.1
Oct	203	6094	500	56	172	116	4.3
Nov	157	4758	505	44	167	123	4.1
Dec	142	4364	512	32	123	93	5.5

APPENDIX A (cont)

**WELL LA-2
1977**

<u>Month</u>	<u>Pump Time (hr)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	133	2433	305	90	301	211	1.4
Feb	128	2232	291	83	298	215	1.4
Mar	171	2998	292	85	301	216	1.4
Apr	193	3312	286	94	308	214	1.3
May	371	5595	251	127	320	193	1.3
June	435	5842	224	166	362	196	1.1
July	340	4535	222	166	332	166	1.3
Aug	298	4224	236	147	327	180	1.3
Sep	213	3204	251	133	318	185	1.4
Oct	203	3049	250	127	296	169	1.5
Nov	157	2653	282	108	306	198	1.4
Dec	133	2433	305	90	301	211	1.4

**WELL LA-3
1977**

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	133	2644	331	66	250	184	1.8
Feb	128	2526	329	61	246	185	1.8
Mar	171	3382	330	63	247	184	1.8
Apr	192	3687	320	69	248	179	1.8
May	370	6299	284	95	253	158	1.8
June	435	6101	234	122	258	136	1.7
July	340	5118	251	125	258	133	1.9
Aug	298	4821	270	113	256	143	1.9
Sep	211	3665	289	102	251	149	1.9
Oct	202	3564	294	95	254	159	1.8
Nov	157	2875	305	82	253	171	1.8
Dec	142	2644	310	72	205	133	2.3

APPENDIX A (cont)

WELL LA-4

1977

<u>Month</u>	<u>Pump Time (hr)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	132	4746	599	264	361	97	6.2
Feb	123	4437	601	263	360	97	6.2
Mar	162	5844	601	261	360	99	6.1
Apr	182	6558	601	266	365	99	6.1
May	362	12 778	588	278	376	98	6.0
June	446	15 105	564	304	395	91	6.2
July	342	11 787	574	302	395	93	6.2
Aug	280	9763	581	295	387	92	6.3
Sep	211	7440	588	281	375	94	6.3
Oct	199	7061	591	281	375	94	6.3
Nov	164	5866	596	274	369	95	6.3
Dec	138	4976	601	270	366	96	6.3

WELL LA-5

1977

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	132	3803	480	143	302	159	3.0
Feb	123	3537	479	141	302	161	3.0
Mar	164	4714	479	139	300	161	3.0
Apr	173	4973	479	141	301	160	3.0
May	285	7953	465	144	306	162	2.9
June	442	11 939	450	157	310	153	2.9
July	342	9408	458	157	311	154	3.0
Aug	292	8125	464	152	304	152	3.1
Sep	213	6001	470	149	302	153	3.1
Oct	199	5667	475	149	303	154	3.1
Nov	163	4670	478	145	301	156	3.1
Dec	137	3979	484	145	299	154	3.1

APPENDIX A (cont)

**WELL LA-6
1977**

<u>Month</u>	<u>Water Level Non Pump (ft)</u>
Jan	81
Feb	---
Mar	75
Apr	76
May	75
June	79
July	87
Aug	87
Sep	87
Oct	86
Nov	82
Dec	82

**WELL G-1
1977**

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	140	3172	378	---	---	---	---
Feb	101	2250	371	---	---	---	---
Mar	0	0	0	---	---	---	---
Apr	175	3930	374	272	419	147	2.5
May	402	8742	362	274	419	145	2.5
June	473	9581	338	280	429	149	2.3
July	355	7267	341	280	433	153	2.2
Aug	293	6045	344	279	432	153	2.2
Sep	215	4530	351	274	426	152	2.3
Oct	236	4994	353	277	429	152	2.3
Nov	178	3803	356	272	423	151	2.4
Dec	166	3558	357	271	420	149	2.4

APPENDIX A (cont)

**WELL G-1A
1977**

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	133	4040	506	298	348	50	10.1
Feb	152	4491	492	299	348	49	10.0
Mar	166	4977	500	296	341	45	11.1
Apr	174	5372	515	297	346	49	10.5
May	402	12 153	504	300	350	50	10.1
June	473	14 248	502	308	356	48	10.5
July	355	10 599	498	309	358	49	10.2
Aug	293	8785	500	306	355	49	10.2
Sep	215	6428	498	303	354	51	9.8
Oct	236	7177	507	303	350	47	10.8
Nov	178	5428	508	302	347	45	11.3
Dec	165	4999	505	300	347	47	10.7

**WELL G-2
1977**

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	136	3785	464	341	387	46	10.1
Feb	176	4840	458	341	386	45	10.2
Mar	178	4901	459	341	383	42	10.9
Apr	174	4901	469	341	385	44	10.7
May	402	10 731	445	344	387	43	10.3
June	473	12 317	434	354	396	42	10.3
July	355	9396	441	354	394	40	11.0
Aug	293	7816	445	352	392	40	11.1
Sep	215	5809	450	349	390	41	11.0
Oct	236	6452	456	349	386	37	12.3
Nov	177	4915	463	346	388	42	11.0
Dec	166	4562	458	345	387	42	10.9

APPENDIX A (cont)

**WELL G-3
1977**

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	142	4026	473	373	467	94	5.0
Feb	161	4624	479	352	442	90	5.3
Mar	166	4660	468	350	444	94	5.0
Apr	175	4979	474	351	447	96	4.9
May	396	10 746	452	364	456	92	4.9
June	479	12 281	427	387	473	86	5.0
July	357	9140	427	389	477	88	4.8
Aug	291	7529	431	381	471	90	4.8
Sep	215	5651	438	372	467	95	4.6
Oct	234	6138	437	371	466	95	4.6
Nov	178	4708	441	364	462	98	4.5
Dec	167	4440	443	359	485	126	3.5

**WELL G-4
1977**

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	127	2802	368	396	582	186	2.0
Feb	171	3828	373	395	583	188	2.0
Mar	176	4030	382	397	579	182	2.1
Apr	175	3850	367	397	582	185	2.0
May	396	8439	355	405	594	189	1.9
June	470	9232	327	424	595	171	1.9
July	357	7336	342	425	595	170	2.0
Aug	290	6044	347	417	595	178	2.0
Sep	215	4551	353	406	590	184	1.9
Oct	234	4939	352	406	588	182	1.9
Nov	178	3846	360	405	590	185	1.9
Dec	165	3466	350	401	591	190	1.8

APPENDIX A (cont)

**WELL G-5
1977**

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	138	4526	547	437	496	59	9.3
Feb	64	2077	541	438	496	58	9.3
Mar	176	5761	546	437	497	60	9.1
Apr	175	5738	546	437	497	60	9.1
May	393	12 598	534	444	505	61	8.8
June	477	14 995	524	457	522	65	8.1
July	357	11 343	530	456	516	60	8.8
Aug	290	9270	533	450	512	62	8.6
Sep	215	6951	539	446	506	60	9.0
Oct	234	7597	541	446	506	60	9.0
Nov	178	5819	545	442	501	59	9.2
Dec	166	5397	542	439	499	60	9.0

**WELL G-6
1977**

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	142	2729	320	579	661	82	3.9
Feb	160	3181	331	578	653	75	4.4
Mar	175	3436	327	579	650	71	4.6
Apr	172	3420	331	579	655	76	4.4
May	394	7366	312	585	660	75	4.2
June	477	8550	299	604	674	70	4.3
July	353	6344	300	603	678	75	4.0
Aug	291	5265	302	594	666	72	4.2
Sep	212	3810	300	586	658	72	4.2
Oct	234	4171	297	588	656	68	4.4
Nov	178	3225	302	582	650	68	4.4
Dec	166	2949	296	580	648	68	4.4

APPENDIX A (cont)

**WELL PM-1
1977**

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm-ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	195	7003	599	742	762	20	29.9
Feb	161	5807	601	743	764	21	28.6
Mar	153	5434	592	742	762	20	29.6
Apr	179	6373	593	742	764	22	27.0
May	430	15 519	602	744	769	25	24.1
June	440	15 842	600	751	773	22	27.3
July	339	12 088	594	748	772	24	24.8
Aug	331	11 060	557	747	771	24	23.2
Sep	268	9556	594	747	770	23	25.8
Oct	219	7765	591	745	768	23	25.7
Nov	125	4367	582	744	766	22	26.5
Dec	129	4571	591	742	763	21	28.1

**WELL PM-2
1977**

<u>Month</u>	<u>Pump Time (h)</u>	<u>Pumpage (thousand gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
Jan	257	21 178	1373	868	922	54	25.4
Feb	309	25 502	1376	869	924	55	25.0
Mar	394	32 511	1375	872	928	56	24.6
Apr	299	24 666	1375	870	928	58	23.7
May	242	19 988	1377	868	927	59	23.3
June	320	26 366	1373	870	930	60	22.9
July	256	21 089	1373	869	926	57	24.1
Aug	292	24 046	1372	868	925	57	24.1
Sep	204	16 868	1378	865	918	53	26.0
Oct	232	19 175	1378	865	917	52	26.5
Nov	205	16 938	1377	866	920	54	25.5
Dec	296	24 436	1376	867	925	58	23.7

APPENDIX A (cont)

**WELL PM-3
1977**

Month	Pump Time (h)	Pumpage (thousand gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
Jan	98	8149	1386	757	780	23	60.3
Feb	103	8626	1396	757	783	26	53.7
Mar	155	12 941	1392	757	783	26	53.5
Apr	179	15 083	1404	757	784	27	52.0
May	434	36 808	1414	757	785	28	50.5
June	444	37 665	1414	760	786	26	54.4
July	337	28 527	1411	760	785	25	56.4
Aug	311	26 258	1407	759	780	27	52.1
Sep	268	22 645	1408	760	785	25	56.3
Oct	220	18 488	1401	759	785	26	53.9
Nov	125	10 476	1397	757	783	26	53.7
Dec	118	9860	1393	757	781	24	58.0

**WATER CANYON GALLERY
1977**

Month	Pump Time (h)	Pumpage (thousand gal)	Rate (gpm)
Jan	744	4631	104
Feb	672	4497	112
Mar	744	2936	66
Apr	720	4344	101
May	744	5049	113
June	720	5942	138
July	744	3315	74
Aug	744	2662	60
Sep	720	7965	184
Oct	744	7065	158
Nov	720	5683	132
Dec	744	3221	72

APPENDIX B
ANNUAL AQUIFER CHARACTERISTICS

WELL LA-1

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)
1947	3468	54.0	259.5	---
1948	2988	34.7	193.6	---
1949	1361	26.7	327.0	---
1950	563	10.5	310.8	19.0
1951	1215	14.6	200.3	59.0
1952	286	3.4	198.1	40.0
1953	0	0.0	0.0	36.0
1954	0	0.0	0.0	44.0
1955	690	9.7	234.3	51.0
1956	39	0.0	0.0	33.0
1957	0	0.0	0.0	33.0
1958	0	0.0	0.0	10.0
1959	0	0.0	0.0	13.0
1960	0	0.0	0.0	13.0
1961	0	0.0	0.0	59.0
1962	0	0.0	0.0	84.0
1963	0	0.0	0.0	90.0
1964	0	0.0	0.0	95.0
1965	0	0.0	0.0	76.0
1966	0	0.0	0.0	70.0
1967	0	0.0	0.0	52.0
1968	0	0.0	0.0	42.0
1969	0	0.0	0.0	38.0
1970	0	0.0	0.0	37.0
1971	0	0.0	0.0	51.0
1972	0	0.0	0.0	49.0
1973	0	0.0	0.0	55.0
1974	0	0.0	0.0	53.0
1975	0	0.0	0.0	58.0
1976	0	0.0	0.0	69.0
1977	0	0.0	0.0	74.0

APPENDIX B (cont)

WELL LA-1B

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1960	415	36.3	1457.8	7.0	111.0	104.0	14.0
1961	3727	124.7	557.6	54.0	154.0	100.0	5.6
1962	3936	129.1	546.7	72.0	169.0	97.0	5.6
1963	3649	117.4	536.2	74.0	170.0	96.0	5.6
1964	4174	130.3	520.3	81.0	183.0	102.0	5.1
1965	3007	97.9	542.6	63.0	170.0	107.0	5.1
1966	2589	83.9	540.1	50.0	169.0	119.0	4.5
1967	2519	84.9	561.7	39.0	153.0	114.0	4.9
1968	2183	74.0	565.0	32.0	147.0	115.0	4.9
1969	2244	75.7	562.2	22.0	142.0	120.0	4.7
1970	2369	79.7	560.7	22.0	143.0	121.0	4.6
1971	2633	89.1	564.0	31.0	162.0	131.0	4.3
1972	2215	75.3	566.6	31.0	163.0	132.0	4.3
1973	2628	87.2	553.0	37.0	170.0	133.0	4.2
1974	2282	73.9	539.7	35.0	161.0	126.0	4.3
1975	2308	74.4	537.3	42.0	168.0	126.0	4.3
1976	2521	79.6	526.2	50.0	176.0	126.0	4.2
1977	2782	84.2	504.4	47.0	167.0	120.0	4.2

APPENDIX B (cont)

WELL LA-2

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1947	963	27.6	477.7	---	---	---	---
1948	3659	59.3	270.1	---	---	---	---
1949	1654	41.8	421.2	---	---	---	---
1950	614	15.6	423.5	59.0	285.0	226.0	1.9
1951	2415	57.7	398.2	111.0	305.0	194.0	2.1
1952	1980	46.3	389.7	101.0	300.0	199.0	2.0
1953	2201	47.2	357.4	100.0	301.0	201.0	1.8
1954	2601	56.8	364.0	116.0	---	---	---
1955	2223	49.4	370.4	110.0	---	---	---
1956	1805	44.2	408.1	84.0	---	---	---
1957	1066	29.6	462.8	53.0	277.0	224.0	2.1
1958	1166	31.1	444.5	60.0	270.0	210.0	2.1
1959	1599	40.7	424.2	71.0	303.0	232.0	1.8
1960	2169	51.6	396.5	76.0	305.0	229.0	1.7
1961	2149	44.4	344.3	101.0	313.0	212.0	1.6
1962	1823	35.7	326.4	111.0	314.0	203.0	1.6
1963	1999	40.7	339.3	127.0	332.0	205.0	1.7
1964	1924	34.2	296.3	137.0	347.0	210.0	1.4
1965	1911	39.8	347.1	121.0	330.0	209.0	1.7
1966	1070	21.4	333.3	108.0	340.0	232.0	1.4
1967	238	4.9	343.1	78.0	304.0	226.0	1.5
1968	502	11.3	375.2	64.0	305.0	241.0	1.6
1969	155	3.8	408.6	50.0	297.0	247.0	1.7
1970	341	7.2	351.9	59.0	310.0	251.0	1.4
1971	1787	31.8	296.6	88.0	318.0	230.0	1.3
1972	2189	39.3	299.2	96.0	322.0	226.0	1.3
1973	2625	46.7	296.5	106.0	334.0	228.0	1.3
1974	2033	36.8	301.7	109.0	325.0	216.0	1.4
1975	2310	40.2	290.0	103.0	320.0	217.0	1.3
1976	2488	39.9	267.3	113.0	322.0	209.0	1.3
1977	2775	42.5	255.3	118.0	314.0	196.0	1.3

APPENDIX B (cont)

WELL LA-3

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1947	1476	64.9	732.8	---	---	---	---
1948	3647	82.5	277.0	---	---	---	---
1949	1505	41.7	461.8	---	---	---	---
1950	2793	57.8	344.9	97.0	231.0	134.0	2.6
1951	3554	66.9	313.7	116.0	233.0	117.0	2.7
1952	2514	58.6	388.5	94.0	218.0	124.0	3.1
1953	3104	69.7	374.2	103.0	229.0	126.0	3.0
1954	2595	57.3	368.0	101.0	225.0	124.0	3.0
1955	2195	48.7	369.8	91.0	226.0	135.0	2.7
1956	1849	42.1	379.5	74.0	222.0	148.0	2.6
1957	1080	26.1	402.8	56.0	219.0	163.0	2.5
1958	1612	33.6	347.4	49.0	225.0	176.0	2.0
1959	1821	35.0	320.3	54.0	231.0	177.0	1.8
1960	2174	38.4	294.4	68.0	230.0	162.0	1.8
1961	1939	34.7	298.3	85.0	189.0	104.0	2.9
1962	2361	45.4	320.5	93.0	192.0	99.0	3.2
1963	2128	42.5	332.9	81.0	197.0	116.0	2.9
1964	2574	50.4	326.3	104.0	217.0	113.0	2.9
1965	1961	43.4	368.9	79.0	220.0	141.0	2.6
1966	2236	46.1	343.6	81.0	219.0	138.0	2.5
1967	2274	47.4	347.4	86.0	218.0	132.0	2.6
1968	2127	42.7	334.6	82.0	251.0	169.0	2.0
1969	2072	40.1	322.6	58.0	246.0	188.0	1.7
1970	2303	44.0	318.4	55.0	241.0	186.0	1.7
1971	2556	45.4	296.0	77.0	250.0	173.0	1.7
1972	2205	39.7	300.1	73.0	251.0	178.0	1.7
1973	977	20.3	346.3	65.0	248.0	183.0	1.9
1974	2291	43.5	316.5	73.0	244.0	171.0	1.9
1975	2306	43.3	313.0	80.0	253.0	173.0	1.8
1976	2474	42.3	285.0	88.0	260.0	172.0	1.7
1977	2779	47.3	283.7	89.0	248.0	159.0	1.8

APPENDIX B (cont)

WELL LA-1

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1948	1570	42.7	453.3	---	---	---	---
1949	940	37.5	664.9	---	---	---	---
1950	4350	164.9	631.8	278.0	353.0	75.0	8.4
1951	4909	173.6	589.4	285.0	357.0	72.0	8.2
1952	3429	119.6	581.3	267.0	339.0	72.0	8.1
1953	3034	109.1	599.3	264.0	335.0	71.0	8.4
1954	2133	78.2	611.0	255.0	329.0	74.0	8.3
1955	2647	94.5	595.0	268.0	341.0	73.0	8.2
1956	3402	120.2	588.9	273.0	346.0	73.0	8.1
1957	2844	105.4	617.7	270.0	345.0	75.0	8.2
1958	2973	110.3	618.3	270.0	342.0	72.0	8.6
1959	3084	113.5	613.4	275.0	346.0	71.0	8.6
1960	4084	145.6	594.2	296.0	365.0	69.0	8.6
1961	3687	129.7	586.3	296.0	365.0	69.0	8.5
1962	3688	129.3	584.3	286.0	359.0	73.0	8.0
1963	3718	130.5	585.0	280.0	351.0	71.0	8.2
1964	4500	155.0	574.1	291.0	361.0	70.0	8.2
1965	3110	111.4	597.0	279.0	349.0	70.0	8.5
1966	3279	115.6	587.6	285.0	356.0	71.0	8.3
1967	2127	77.1	604.1	278.0	350.0	72.0	8.4
1968	2276	81.7	598.3	280.0	351.0	71.0	8.4
1969	1694	61.8	608.0	282.0	358.0	76.0	8.0
1970	2333	83.5	596.5	286.0	363.0	77.0	7.7
1971	2519	89.0	588.9	287.0	373.0	86.0	6.8
1972	2322	82.6	592.9	282.0	367.0	85.0	7.0
1973	2616	92.4	588.7	294.0	377.0	83.0	7.1
1974	2306	82.2	594.1	286.0	367.0	81.0	7.3
1975	2319	82.3	591.5	272.0	355.0	83.0	7.1
1976	2802	98.2	584.1	277.0	373.0	96.0	6.1
1977	2741	96.4	586.2	278.0	374.0	96.0	6.1

APPENDIX B (cont)

WELL LA-5

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1948	1171	40.4	575.0	---	---	---	---
1949	1763	58.5	553.0	---	---	---	---
1950	4052	130.1	535.1	131.0	254.0	123.0	4.4
1951	6004	187.4	520.2	162.0	272.0	110.0	4.7
1952	3425	109.6	533.3	147.0	259.0	112.0	4.8
1953	3278	103.9	528.3	141.0	257.0	116.0	4.6
1954	2546	80.1	524.4	137.0	259.0	122.0	4.3
1955	3158	97.3	513.5	145.0	267.0	122.0	4.2
1956	3476	104.5	501.1	150.0	276.0	126.0	4.0
1957	2868	86.0	499.8	150.0	277.0	127.0	3.9
1958	3009	89.9	498.0	151.0	277.0	126.0	4.0
1959	3088	93.5	504.6	155.0	280.0	125.0	4.0
1960	4088	119.1	485.6	168.0	288.0	120.0	4.0
1961	3534	100.3	473.0	165.0	288.0	123.0	3.8
1962	3735	107.7	480.6	172.0	---	---	---
1963	3726	105.0	469.7	171.0	---	---	---
1964	4236	118.8	467.4	184.0	---	---	---
1965	1740	50.5	483.7	180.0	---	---	---
1966	2817	79.3	469.2	180.0	---	---	---
1967	2533	73.7	484.9	168.0	---	---	---
1968	2233	63.3	472.5	161.0	300.0	139.0	3.4
1969	2402	68.5	475.3	161.0	298.0	137.0	3.5
1970	2353	66.1	468.2	157.0	300.0	143.0	3.3
1971	2659	74.4	466.3	155.0	302.0	147.0	3.2
1972	2301	64.4	466.5	153.0	304.0	151.0	3.1
1973	2476	68.3	459.7	156.0	308.0	152.0	3.0
1974	1903	52.5	459.8	154.0	306.0	152.0	3.0
1975	2318	63.9	459.4	149.0	309.0	160.0	2.9
1976	2799	77.6	462.1	150.0	310.0	160.0	2.9
1977	2665	74.8	467.8	147.0	303.0	156.0	3.0

APPENDIX B (cont)

WELL LA-6

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1948	116	4.9	704.0	---	---	---	---
1949	2451	95.8	651.4	---	---	---	---
1950	4490	167.9	623.2	83.0	136.0	53.0	11.8
1951	5882	201.6	571.2	115.0	160.0	45.0	12.7
1952	3168	110.3	580.3	108.0	151.0	43.0	13.5
1953	3177	113.8	597.0	95.0	139.0	44.0	13.6
1954	2894	107.1	616.8	92.0	135.0	43.0	14.3
1955	2911	108.0	618.3	97.0	140.0	43.0	14.4
1956	3438	125.8	609.9	106.0	149.0	43.0	14.2
1957	2833	102.4	602.4	107.0	152.0	45.0	13.4
1958	2957	106.9	602.5	108.0	131.0	43.0	14.0
1959	3096	108.3	583.0	115.0	158.0	43.0	13.6
1960	4084	138.6	565.6	130.0	172.0	42.0	13.5
1961	3284	112.5	571.0	129.0	171.0	42.0	13.6
1962	3886	129.4	555.0	135.0	175.0	40.0	13.9
1963	2953	102.9	580.8	125.0	171.0	46.0	12.6
1964	4244	138.3	543.1	132.0	172.0	40.0	13.6
1965	3145	103.8	550.1	120.0	160.0	40.0	13.8
1966	3173	104.0	546.3	129.0	169.0	40.0	13.7
1967	2511	85.4	566.8	118.0	158.0	40.0	14.2
1968	2111	71.6	565.3	109.0	150.0	41.0	13.8
1969	2402	81.6	566.2	109.0	151.0	42.0	13.5
1970	2337	79.1	564.1	106.0	149.0	43.0	13.1
1971	2472	82.5	556.2	119.0	160.0	41.0	13.6
1972	2317	79.2	569.7	117.0	155.0	38.0	15.0
1973	2638	90.6	572.4	118.0	155.0	37.0	15.5
1974	2337	79.8	569.1	120.0	156.0	36.0	15.8
1975	1571	51.9	550.6	113.0	151.0	38.0	14.5
1976	175	5.1	485.7	96.0	---	---	---
1977	---	---	---	82.0	---	---	---

APPENDIX B (cont)

WELL G-1

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1950	0	2.8	0.0	195.0	---	---	---
1951	1168	37.7	538.0	202.0	309.0	107.0	5.0
1952	2476	75.5	508.2	213.0	295.0	82.0	6.2
1953	3275	97.3	495.2	221.0	292.0	71.0	7.0
1954	2616	77.8	495.7	221.0	290.0	69.0	7.2
1955	2406	70.5	488.4	226.0	295.0	69.0	7.1
1956	2958	83.2	468.8	235.0	303.0	68.0	6.9
1957	2098	55.9	444.1	236.0	307.0	71.0	6.3
1958	2460	68.1	461.4	238.0	308.0	70.0	6.6
1959	2952	82.4	465.2	245.0	314.0	69.0	6.7
1960	3564	96.0	448.9	254.0	325.0	71.0	6.3
1961	4236	112.4	442.2	260.0	333.0	73.0	6.1
1962	3431	93.6	454.7	258.0	342.0	84.0	5.4
1963	4519	114.9	423.8	265.0	348.0	83.0	5.1
1964	4374	113.8	433.6	269.0	352.0	83.0	5.2
1965	3530	90.7	428.2	268.0	352.0	84.0	5.1
1966	4074	102.6	419.7	269.0	363.0	94.0	4.5
1967	2615	69.9	445.5	266.0	362.0	96.0	4.6
1968	2996	78.9	438.9	264.0	366.0	102.0	4.3
1969	2657	68.3	428.4	266.0	376.0	110.0	3.9
1970	2712	64.7	397.6	264.0	377.0	113.0	3.5
1971	2908	67.9	389.2	258.0	378.0	120.0	3.2
1972	2865	66.1	384.5	264.0	389.0	125.0	3.1
1973	2997	67.5	375.4	271.0	403.0	132.0	2.8
1974	2767	62.3	375.3	283.0	412.0	129.0	2.9
1975	2467	55.7	376.3	293.0	411.0	118.0	3.2
1976	2962	65.1	366.3	---	---	---	---
1977	2734	57.9	353.0	275.0	426.0	151.0	2.3

APPENDIX B (cont)

WELL G-1A

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1954	108	4.6	709.9	---	---	---	---
1955	1531	53.0	577.0	265.0	316.0	51.0	11.3
1956	3130	107.7	573.5	273.0	323.0	50.0	11.5
1957	2470	87.0	587.0	274.0	327.0	53.0	11.1
1958	2670	92.5	577.4	279.0	331.0	52.0	11.1
1959	2965	102.7	577.3	284.0	333.0	49.0	11.8
1960	3641	122.8	562.1	291.0	342.0	51.0	11.0
1961	4297	147.3	571.3	298.0	350.0	52.0	11.0
1962	3972	136.1	571.1	295.0	344.0	49.0	11.7
1963	4525	149.7	551.4	301.0	350.0	49.0	11.3
1964	3852	129.3	559.4	302.0	353.0	51.0	11.0
1965	3505	116.5	554.0	302.0	353.0	51.0	10.9
1966	3964	133.4	560.9	306.0	355.0	49.0	11.4
1967	2720	91.3	559.4	302.0	351.0	49.0	11.4
1968	3089	103.2	556.8	302.0	352.0	50.0	11.1
1969	2695	90.7	560.9	303.0	356.0	53.0	10.6
1970	2772	92.5	556.2	300.0	357.0	57.0	9.8
1971	3313	111.8	562.4	303.0	361.0	58.0	9.7
1972	2879	94.0	544.2	302.0	361.0	59.0	9.2
1973	2760	87.9	530.8	302.0	362.0	60.0	8.8
1974	2974	92.7	519.5	307.0	355.0	48.0	10.8
1975	2740	85.3	518.9	304.0	351.0	47.0	11.0
1976	2983	91.6	511.8	302.0	350.0	48.0	10.7
1977	2942	88.7	502.5	302.0	350.0	48.0	10.5

APPENDIX B (cont)

WELL G-2

<u>Year</u>	<u>Pump Time (h)</u>	<u>Pumpage (million gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
1951	123	3.9	528.5	259.0	---	---	---
1952	2372	78.3	550.2	279.0	327.0	48.0	11.5
1953	3254	105.6	540.9	290.0	334.0	44.0	12.3
1954	2682	86.3	536.3	291.0	335.0	44.0	12.2
1955	2487	78.8	528.1	299.0	345.0	46.0	11.5
1956	3109	95.8	513.6	310.0	357.0	47.0	10.9
1957	2458	76.1	516.0	311.0	360.0	49.0	10.5
1958	2707	80.1	493.2	315.0	361.0	46.0	10.7
1959	2938	84.6	479.9	320.0	363.0	43.0	11.2
1960	3535	96.6	455.4	328.0	370.0	42.0	10.8
1961	3982	105.3	440.7	336.0	375.0	39.0	11.3
1962	4076	99.8	408.1	338.0	374.0	36.0	11.3
1963	4563	105.7	386.1	344.0	379.0	35.0	11.0
1964	4541	105.3	386.5	346.0	380.0	34.0	11.4
1965	3535	82.6	389.4	346.0	381.0	35.0	11.1
1966	3994	94.7	395.2	349.0	383.0	34.0	11.6
1967	2743	67.6	410.7	344.0	379.0	35.0	11.7
1968	2732	66.5	405.7	344.0	379.0	35.0	11.6
1969	2679	68.6	426.8	344.0	381.0	37.0	11.5
1970	2431	62.8	430.5	343.0	381.0	38.0	11.3
1971	3420	87.4	425.9	345.0	384.0	39.0	10.9
1972	2897	73.4	423.7	348.0	388.0	40.0	10.6
1973	2816	72.4	428.5	344.0	385.0	41.0	10.5
1974	3056	82.0	447.2	347.0	390.0	43.0	10.4
1975	2724	74.5	455.8	341.0	384.0	43.0	10.6
1976	2990	81.1	452.1	344.0	388.0	44.0	10.3
1977	2981	80.4	449.5	346.0	388.0	42.0	10.7

APPENDIX B (cont)

WELL G-3

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1951	192	7.3	633.7	281.0	---	---	---
1952	2379	65.4	458.2	310.0	358.0	48.0	9.5
1953	3192	76.4	398.9	322.0	360.0	38.0	10.5
1954	2675	66.1	411.8	322.0	370.0	48.0	8.6
1955	2369	69.4	488.3	316.0	368.0	52.0	9.4
1956	3149	87.9	465.2	324.0	380.0	56.0	8.3
1957	2517	70.2	464.8	324.0	385.0	61.0	7.6
1958	2562	69.5	452.1	323.0	386.0	63.0	7.2
1959	2931	74.6	424.2	326.0	395.0	69.0	6.1
1960	3591	82.5	382.9	335.0	407.0	72.0	5.3
1961	3612	79.9	368.7	343.0	414.0	71.0	5.2
1962	4057	83.7	343.9	348.0	418.0	70.0	4.9
1963	4555	86.7	317.2	352.0	422.0	70.0	4.5
1964	4487	78.6	292.0	355.0	424.0	69.0	4.2
1965	3498	65.6	312.6	350.0	419.0	69.0	4.5
1966	3991	73.7	307.8	353.0	420.0	67.0	4.6
1967	2752	52.9	320.4	344.0	418.0	74.0	4.3
1968	3086	56.5	305.1	341.0	418.0	77.0	4.0
1969	2672	50.8	316.9	338.0	417.0	79.0	4.0
1970	2736	55.4	337.5	336.0	419.0	83.0	4.1
1971	3337	64.2	320.6	342.0	423.0	81.0	4.0
1972	2838	50.9	298.9	341.0	421.0	80.0	3.7
1973	2843	47.3	277.3	341.0	418.0	77.0	3.6
1974	3006	49.3	273.3	342.0	424.0	82.0	3.3
1975	2632	43.1	272.9	341.0	428.0	87.0	3.1
1976	2971	82.6	463.4	374.0	462.0	88.0	5.3
1977	2961	78.9	444.1	368.0	463.0	95.0	4.7

APPENDIX B (cont)

WELL G-4

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1951	---	12.5	---	357.0	477.0	120.0	---
1952	2401	56.9	395.0	374.0	474.0	100.0	3.9
1953	2677	55.2	343.7	380.0	472.0	92.0	3.7
1954	2256	58.8	434.4	383.0	526.0	143.0	3.0
1955	1172	22.7	322.8	378.0	481.0	103.0	3.1
1956	1800	33.9	313.9	377.0	491.0	114.0	2.8
1957	1324	24.2	304.6	373.0	498.0	125.0	2.4
1958	1970	35.9	303.7	370.0	490.0	120.0	2.5
1959	1819	31.6	289.5	378.0	494.0	116.0	2.5
1960	2457	37.0	251.0	385.0	509.0	124.0	2.0
1961	2787	45.0	269.1	389.0	512.0	123.0	2.2
1962	2738	41.7	253.8	386.0	505.0	119.0	2.1
1963	3519	46.4	219.8	388.0	504.0	116.0	1.9
1964	3561	42.9	200.8	396.0	499.0	103.0	1.9
1965	2100	23.8	188.9	394.0	492.0	98.0	1.9
1966	2219	33.6	252.4	391.0	498.0	107.0	2.4
1967	2690	44.8	277.6	388.0	509.0	121.0	2.3
1968	2083	31.4	251.2	386.0	509.0	123.0	2.0
1969	1309	17.4	221.5	387.0	505.0	118.0	1.9
1970	606	7.7	211.8	384.0	504.0	120.0	1.8
1971	1640	21.0	213.4	389.0	503.0	114.0	1.9
1972	2840	33.3	195.4	391.0	507.0	116.0	1.7
1973	3006	37.2	206.3	392.0	521.0	129.0	1.6
1974	2672	34.3	213.9	392.0	519.0	127.0	1.7
1975	1977	41.0	345.6	403.0	559.0	156.0	2.2
1976	2859	57.8	336.9	406.0	571.0	165.0	2.0
1977	2954	62.4	352.1	406.0	589.0	183.0	1.9

APPENDIX B (cont)

WELL G-5

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1951	---	6.7	---	414.0	---	---	---
1952	2579	73.8	476.9	422.0	480.0	58.0	8.2
1953	1433	37.8	439.6	425.0	467.0	42.0	10.5
1954	2617	80.9	515.2	429.0	473.0	44.0	11.7
1955	2529	80.4	529.9	427.0	472.0	45.0	11.8
1956	3052	97.0	529.7	431.0	478.0	47.0	11.3
1957	2385	64.1	447.9	424.0	466.0	42.0	10.7
1958	1523	49.1	537.3	428.0	477.0	49.0	11.0
1959	2917	101.7	581.1	435.0	495.0	60.0	9.7
1960	2828	98.0	577.6	437.0	501.0	64.0	9.0
1961	3908	134.0	571.5	438.0	507.0	69.0	8.3
1962	4186	142.0	565.4	440.0	511.0	71.0	8.0
1963	4528	151.0	555.8	441.0	513.0	72.0	7.7
1964	4532	150.4	553.1	446.0	516.0	70.0	7.9
1965	3520	117.1	554.5	443.0	516.0	73.0	7.6
1966	2555	83.2	542.7	445.0	520.0	75.0	7.2
1967	2405	80.0	554.4	444.0	519.0	75.0	7.4
1968	2513	81.2	538.5	443.0	517.0	74.0	7.3
1969	2649	83.3	524.1	450.0	520.0	70.0	7.5
1970	2771	88.9	534.7	453.0	521.0	68.0	7.9
1971	2657	88.3	553.9	450.0	521.0	71.0	7.8
1972	2902	92.4	530.7	441.0	514.0	73.0	7.3
1973	3003	97.5	541.1	444.0	515.0	71.0	7.6
1974	2054	69.0	559.9	440.0	513.0	73.0	7.7
1975	2266	74.7	549.4	433.0	500.0	67.0	8.2
1976	2955	95.0	535.8	442.0	504.0	62.0	8.6
1977	2836	92.1	541.3	444.0	504.0	60.0	9.0

APPENDIX B (cont)

WELL G-6

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1964	1912	45.0	392.3	581.0	659.0	78.0	5.0
1965	3200	74.9	390.1	582.0	660.0	78.0	5.0
1966	3931	92.2	390.9	585.0	658.0	73.0	5.4
1967	2454	57.8	392.6	580.0	653.0	73.0	5.4
1968	2597	56.2	360.7	574.0	647.0	73.0	4.9
1969	2698	55.6	343.5	568.0	636.0	68.0	5.1
1970	2765	51.0	307.4	569.0	634.0	65.0	4.7
1971	2932	42.8	243.3	573.0	629.0	56.0	4.3
1972	2516	57.0	377.6	578.0	670.0	92.0	4.1
1973	2991	65.3	363.9	579.0	667.0	88.0	4.1
1974	2950	63.8	360.5	579.0	665.0	86.0	4.2
1975	2717	56.7	347.8	577.0	659.0	82.0	4.2
1976	2966	57.8	324.8	584.0	662.0	78.0	4.2
1977	2954	54.4	306.9	586.0	659.0	73.0	4.2

WELL PM-1

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level		Draw Down	Specific Capacity (gpm/ft)
				Non Pump (ft)	Pump (ft)		
1965	2754	99.2	600.3	746.0	786.0	40.0	15.0
1966	3086	108.0	583.3	740.0	779.0	39.0	15.0
1967	2870	111.0	644.6	737.0	781.0	44.0	14.6
1968	1846	68.1	614.8	735.0	769.0	34.0	18.1
1969	951	34.4	602.9	733.0	766.0	33.0	18.3
1970	1781	66.2	619.5	733.0	769.0	36.0	17.2
1971	2728	101.0	617.1	733.0	766.0	33.0	18.7
1972	2415	84.9	585.9	735.0	762.0	27.0	21.7
1973	1688	46.5	459.1	736.0	755.0	19.0	24.2
1974	2649	96.3	605.9	740.0	768.0	28.0	21.6
1975	2567	94.8	615.5	741.0	766.0	25.0	24.6
1976	2933	106.8	606.9	744.0	767.0	23.0	26.4
1977	2969	105.4	591.7	745.0	767.0	22.0	26.9

APPENDIX B (cont)

WELL PM-2

<u>Year</u>	<u>Pump Time (h)</u>	<u>Pumpage (million gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
1966	221	18.9	1425.3	826.0	889.0	53.0	22.6
1967	4336	370.0	1422.2	834.0	888.0	54.0	26.3
1968	3865	328.2	1415.3	838.0	889.0	51.0	27.8
1969	3304	279.9	1411.9	838.0	890.0	52.0	27.2
1970	3529	300.6	1419.7	839.0	893.0	54.0	26.3
1971	4035	339.5	1402.3	841.0	898.0	57.0	24.6
1972	4611	385.3	1392.7	845.0	902.0	57.0	24.4
1973	4571	380.6	1387.7	849.0	907.0	58.0	23.9
1974	5443	450.9	1380.7	853.0	912.0	59.0	23.4
1975	4644	385.3	1382.8	854.0	913.0	59.0	23.4
1976	5382	442.0	1368.8	866.0	924.0	58.0	23.6
1977	3306	272.8	1375.3	868.0	924.0	56.0	24.6

WELL PM-3

<u>Year</u>	<u>Pump Time (h)</u>	<u>Pumpage (million gal)</u>	<u>Pump Rate (gpm)</u>	<u>Water Level</u>		<u>Draw Down</u>	<u>Specific Capacity (gpm/ft)</u>
				<u>Non Pump (ft)</u>	<u>Pump (ft)</u>		
1968	2327	187.4	1342.2	743.0	771.0	28.0	47.9
1969	3241	254.7	1309.8	746.0	772.0	26.0	50.4
1970	2905	227.8	1306.9	750.0	774.0	24.0	54.5
1971	2774	216.3	1299.6	751.0	774.0	23.0	56.5
1972	2445	192.1	1309.5	752.0	775.0	23.0	56.9
1973	3256	257.8	1319.6	755.0	778.0	23.0	57.4
1974	3241	255.3	1312.9	756.0	779.0	23.0	57.1
1975	3421	269.3	1312.0	757.0	780.0	23.0	57.0
1976	3171	268.3	1410.2	758.0	784.0	26.0	54.2
1977	2792	235.5	1405.8	758.0	784.0	26.0	54.1

APPENDIX B (cont)

WATER CANYON GALLERY

Year	Pump Time (h)	Pumpage (million gal)	Rate (gpm)
1947	8760	84.0	159.8
1948	8784	97.0	184.0
1949	8760	92.0	175.0
1950	8760	54.0	102.7
1951	8760	39.0	74.2
1952	8784	48.0	91.1
1953	8760	39.0	74.2
1954	8760	40.0	76.1
1955	8760	33.0	62.8
1956	8784	23.0	43.6
1957	8760	40.0	76.1
1958	8760	60.0	114.2
1959	8760	54.0	102.7
1960	8784	48.0	91.1
1961	8760	54.0	102.7
1962	8760	67.0	127.5
1963	8760	51.0	97.0
1964	8784	45.0	85.4
1965	8760	72.0	137.0
1966	8760	82.0	156.0
1967	8760	56.0	106.5
1968	8784	65.0	123.3
1969	8760	80.0	152.2
1970	8760	65.0	123.7
1971	8760	37.0	70.4
1972	8784	40.0	75.9
1973	8760	49.0	93.2
1974	8760	35.0	66.6
1975	8760	42.0	79.9
1976	8784	41.0	77.8
1977	8760	57.0	108.4