1506-00011

GROUNDWATER EXPLORATION
CONSTRUCTION and TESTING REPORT

HORIZON HILLS BACK-UP WELL

Prepared for
Horizon Hills General Improvement District

TH #1-3 5948
TH #4-5 4426
Conductor 13825
24,199

Test well 12101
Pumping 6033
18,134

42,333

Prepared by
Washoe County Utility Division
January 1986

Contents

List of Tables and Figures

Summary and Recommendations

1. Exploratory test holes were drilled up to 400 feet in fractured rhyolite and/or metavolcanics. Extensive fracturing occurs in the interval 280-380 feet below land surface. This interval appeared to have adequate water producing potential.
2. An 8-inch test well with 165 feet of 16-inch conductor casing was installed to 396 feet. A sanitary seal around the conductor casing was installed to a depth of 165 feet. The well has triple mill-slot casing from 270 feet to 390 feet. This well produces from fractures in the bedrock.
3 A step drawdown test determined the well to be inefficient at moderate pumping rates. The inefficiency is due to large friction losses in the fractures that serve as an extended well rather than the well construction itself. A constant discharge test was run at 209 gpm and 186 gpm for 72 hours. Drawdown rates never stabilized and at least two impermeable boundaries or dewatered fractures were encountered.
4 The water quality was generally good except for iron and manganese. During the pumping test manganese levels remained constant at 0.22 ppm while iron levels dropped from 0.94 ppm to 0.42 ppm. Secondary drinking water standards for iron and manganese are 0.60 and 0.1 respectively.
5 This well could be equipped with a 150 gpm pump and used as an alternate supply to the existing well. Pumping should never exceed an average of 80 gpm on a continuous basis. Water treatment is necessary to meet State requirements for iron and manganese.

INTRODUCTION

The Horizon Hills General Improvement District Board of Trustees authorized the Washoe County Utility Division to conduct an investigation in locating a secondary source of water supply for its subdivision. A "back-up" well is necessary to comply with State regulations and County codes for subdivision water supplies. The goal of the investigation was to locate a water source that would meet the water quantity and quality requirements of the subdivision. This report documents the investigation, which included exploratory drilling, test well construction and aquifer testing.

The location of Horizon Hills Subdivision at the base of Peavine Mountain lends itself to groundwater quality and quantity problems. The highly mineralized and hydrothermal altered rock of Peavine Mountain causes mineralized water, specifically dissolved iron and manganese. Because there are no sizeable alluvial aquifers or surface streams in the vicintiy, fractured bedrock is the only reliable source of water supply. However, locating such a well is quite often a risk. Washoe County chose a site for exploratory drilling in an area close to the subdivision in a rhyolite plug that appeared highly fractured and without evidence of hydrothermal alteration.

A contract was awarded to Sargent Irrigation in January 1985 for an exploratory test hole and air lift pumping test to determine water quality and quantity. Because of the highly fractured nature of the geology, and favorable indications for water quality and quantity, an 8-inch test well was constructed and tested. A pumping test was completed in December 1985 and the results, analysis and recommendations are included herein.

Exploratory Drilling

The exploratory drilling contract called for one 500 foot test hole. Five test holes were eventually drilled. The following is a synopsis of each test hole.

Test Hole No.1 was drilled to 200 feet with a reverse rotary air drill rig. Alternating lenses of iron stained rhyolite and clay were encountered. The project geologist (Michael Widmer) terminated the test hole at 200 feet because of unfavorable hydrogeologic condtions.

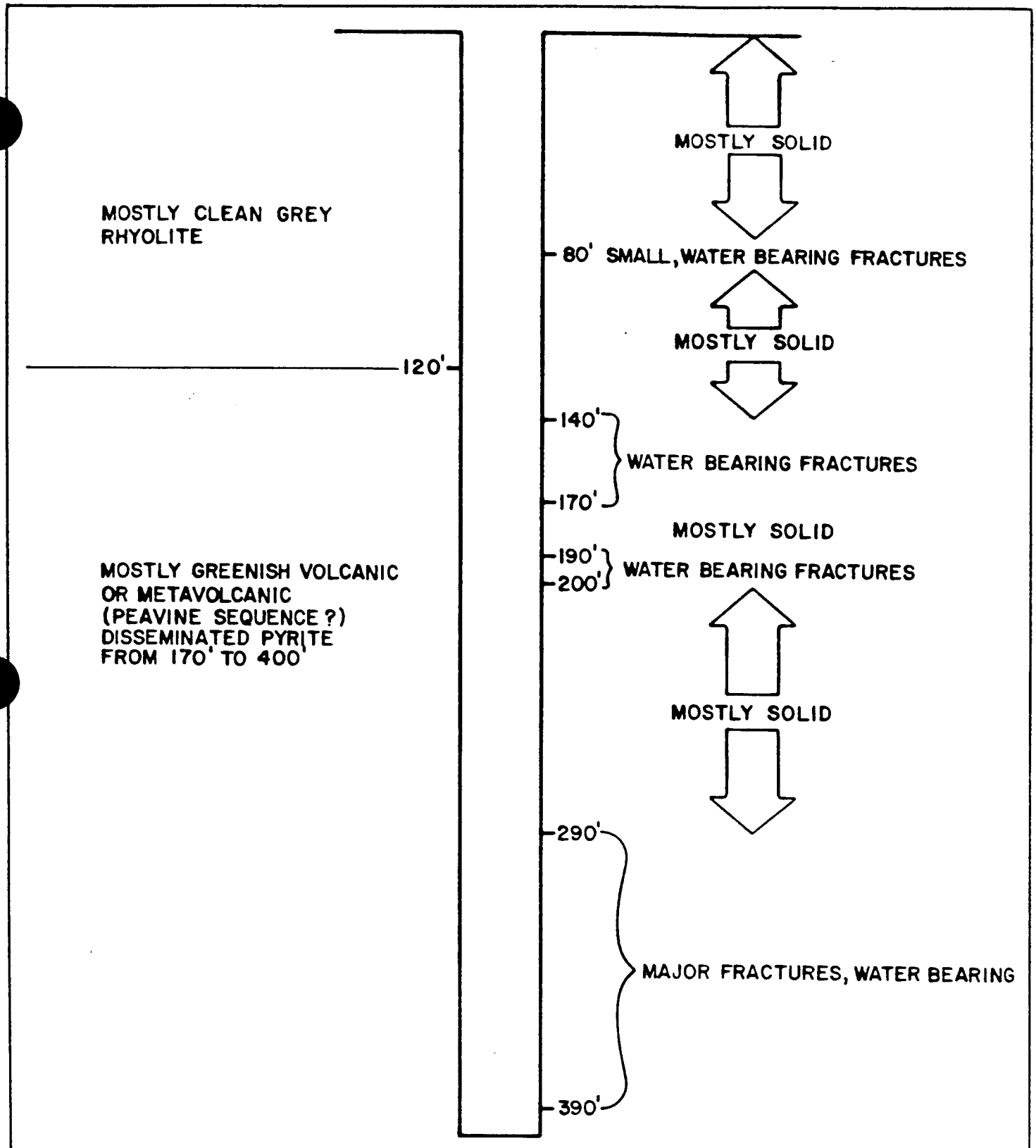
Test Hole No. 2 was drilled approximately 200 feet to the south of Test Hole No. 1 and drilled to a depth of 350 feet before the rollers of the tri-cone drill bit were lost in the hole. This test hole encountered highly fractured rhyolite and metamorphosed volcanics with apparent good water bearing potential.

Test Hole No. 3 was drilled approximately 6 feet to the east of Test Hole No. 2 to a depth of 403 feet. The same geology and water bearing fractures as in test hole No. 2 were encountered. This test hole was drilled air-reverse with a hammer bit and tri-cone bits. Several bits were ruined due to the hardness and fractured state of the geology. The hammer bit became inoperable below 300 feet due to excessive water pressure. A mud rotary rig was set up over the hole and never drilled deeper than 80 feet because of lost circulation problems. This circulation problem was such that the drilling mud flowed into non-water bearing fractures at a greater rate than drilling mud could be provided at the surface. Cement was used to try and plug the fractures, but was unsuccessful.

Test Hole No. 4 was drilled to 80 feet by a mud rotary rig and encountered the same problems of lost circulation. This test hole was located 25-feet from Test Hole No. 3.

Test Hole No. 5 was drilled to 300 feet by the air-reverse rotary rig with an air hammer bit. Excessive water pressures inhibited the hammer bit operation below 300 feet. Sargent decided not to drill below 300 feet with a tri-cone bit.

Based on the information obtained from the exploratory drilling, it was agreed upon to drill and construct a test well to 400 feet with a reverse rotary mud rig. The lost circulation zones would be circumvented by installing a 16 inch conductor casing to 165-feet with a cable tool drill rig. A lithologic log is shown in figure 1. Test holes 2-5 all encountered the same geology. Test holes 1, 2, 4, and 5 were plugged with neat cement.



WASHOE COUNTY DEPARTMENT OF PUBLIC WORKS

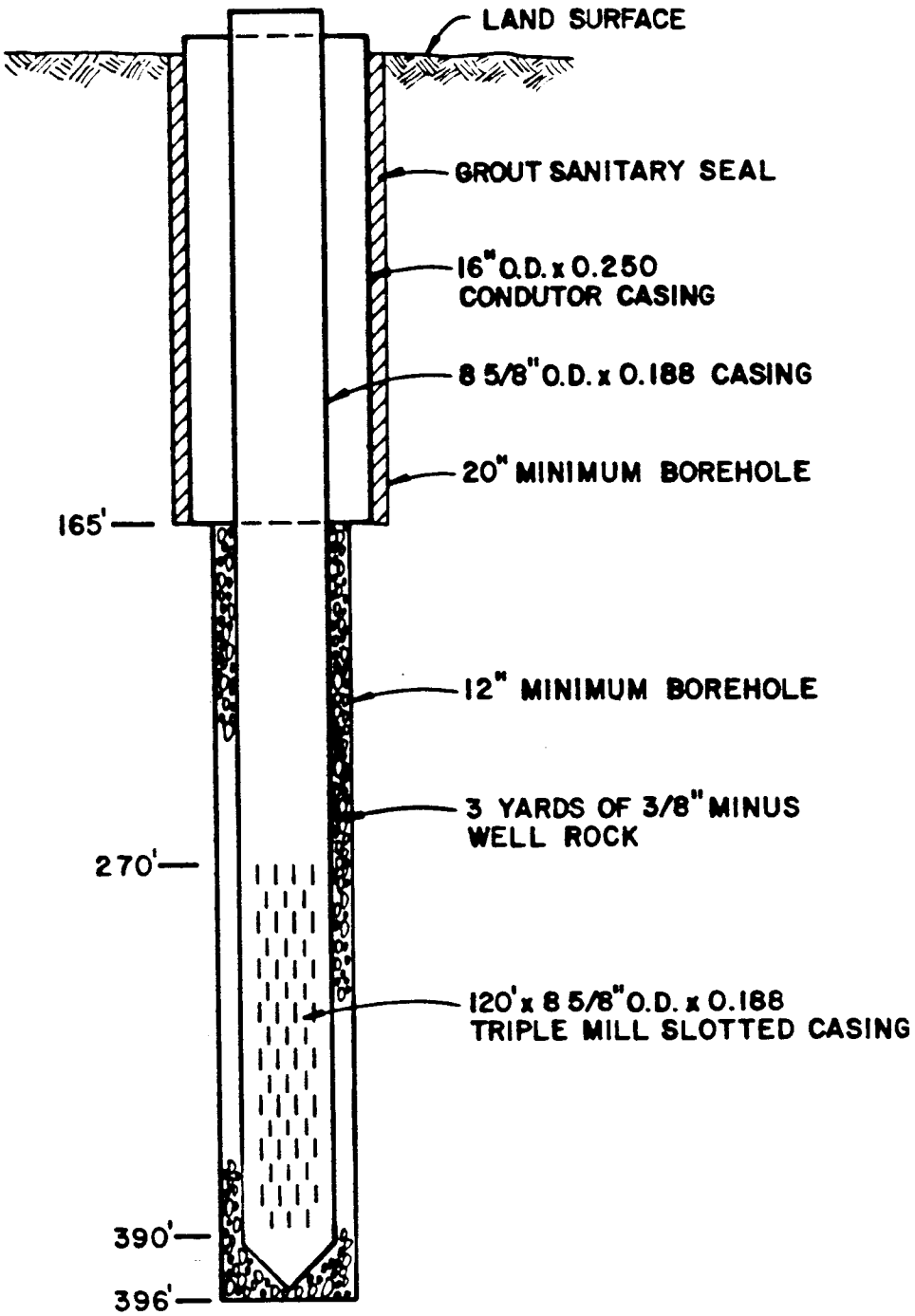
REVISIONS	DATE	UTILITY DIVISION		FIGURE I	SHEET NO. 1 OF 1 SHEETS
		DATE JAN. 1986	BY MCW / JR	LITHOLOGIC LOG EXPLORATION HOLE # 3	
		Scale NONE	APPROVED		

Test Well Construction and Development

Construction of a test well began August 8, 1985 in Test Hole No. 3 with the drilling of a 20 inch hole by a cable tool rig. A 16-inch conductor casing was inserted to a depth of 165 feet and completed September 11th. On September 12th, eight yards of grout (neat cement) was used for a sanitary seal to a depth of 165 feet to land surface. This conductor casing work was subcontracted to MacKay Drilling.

On October 23rd, Sargent Irrigation set-up a reverse rotary mud rig and began drilling a 12 inch borehole in Test Hole No. 3. The borehole was completed to a depth of 400 feet on October 31st. Well construction was completed November 1st (see figure 2). Two fifty pound bags of sodium acid-pyrophosphate were added to the well to help breakdown the drilling fluids (bentonite clay mud). Four hours of well development (pumping and air-lifting) occurred on November 1st and 2nd. On November 4th, three yards of pea gravel was installed in the well-borehole annular space to serve as a formation stabilizer. Downhole problems prevented a drawdown tube from being included in the well construction.

Four hours of additional well development occurred on December 15th. A turbine line-shaft pump was installed to a depth of 350 feet. The well was pumped at rates varying from 160 gpm to 240 gpm with periods of surging. This pumping and surging (turning pump off to create a backwash effect) helps to remove sediment from the well and to create a better filter from the gravel pack or formation stabilizer. Drilling fluids are also removed from the well/aquifer. After development the water was clear and had very little sediment.



WASHOE COUNTY DEPARTMENT OF PUBLIC WORKS

REVISIONS	DATE	UTILITY DIVISION		FIGURE 2	SHEET NO 1 OF 1 SHEET(S)
		DATE JAN. 1986	BY MCW / JR	AS BUILT CONSTRUCTION DETAILS	
		Scale NONE	APPROVED		

Pumping Test

Two pumping tests were conducted from December 16th to December 20th. The line-shaft turbine test pumping equipment consisted of 350 feet of 4-inch pump column with twelve stages of 7 inch bowl assembly and engine. The discharge rate was measured by a 4.124-inch I.D. horizontal discharge pipe with a 3.375-inch I.D. orifice plate. A manometer was attached to the discharge pipe and adjustments to flow were made by a gate valve or engine r.p.m. adjustments. Water level measurements were made via a drawdown tube provided to a depth of 333 feet and were made to the nearest 1/100 foot.

Step-Drawdown Test

A step-drawdown test is used to determine well efficiency, well yield, specific capacity and pumping levels at various pumping rates. Various and increasing pumping rates are established for a minimum period of 100 minutes with a minimum of three periods. This test was conducted December 16th for 400 minutes (6 2/3 hours) at pumping rates of 115 gpm, 162 gpm, 209 gpm and 242 gpm. The data is shown in figures 3-5.

Figure 3 shows the drawdown in the well versus time and pumping rate. For each step the pumping rate is noted as well as the specific capacity for each step. Specific capacity describes the well capability to pump water at a pumping rate per foot of drawdown in the well. The drawdown in a well is a function of head losses in the well and head losses in the aquifer formation and the pumping rate - this in turn is used to determine its efficiency. It is standard practice to determine these losses by the equation:

$$S_W = BQ + CQ^2 \qquad (1)$$

where S_W is the drawdown in the well, Q is the pumping rate or discharge, B is the coefficient of well loss and C is the coefficient of formation loss. When the specific drawdown (inverse of specific capacity) is plotted versus

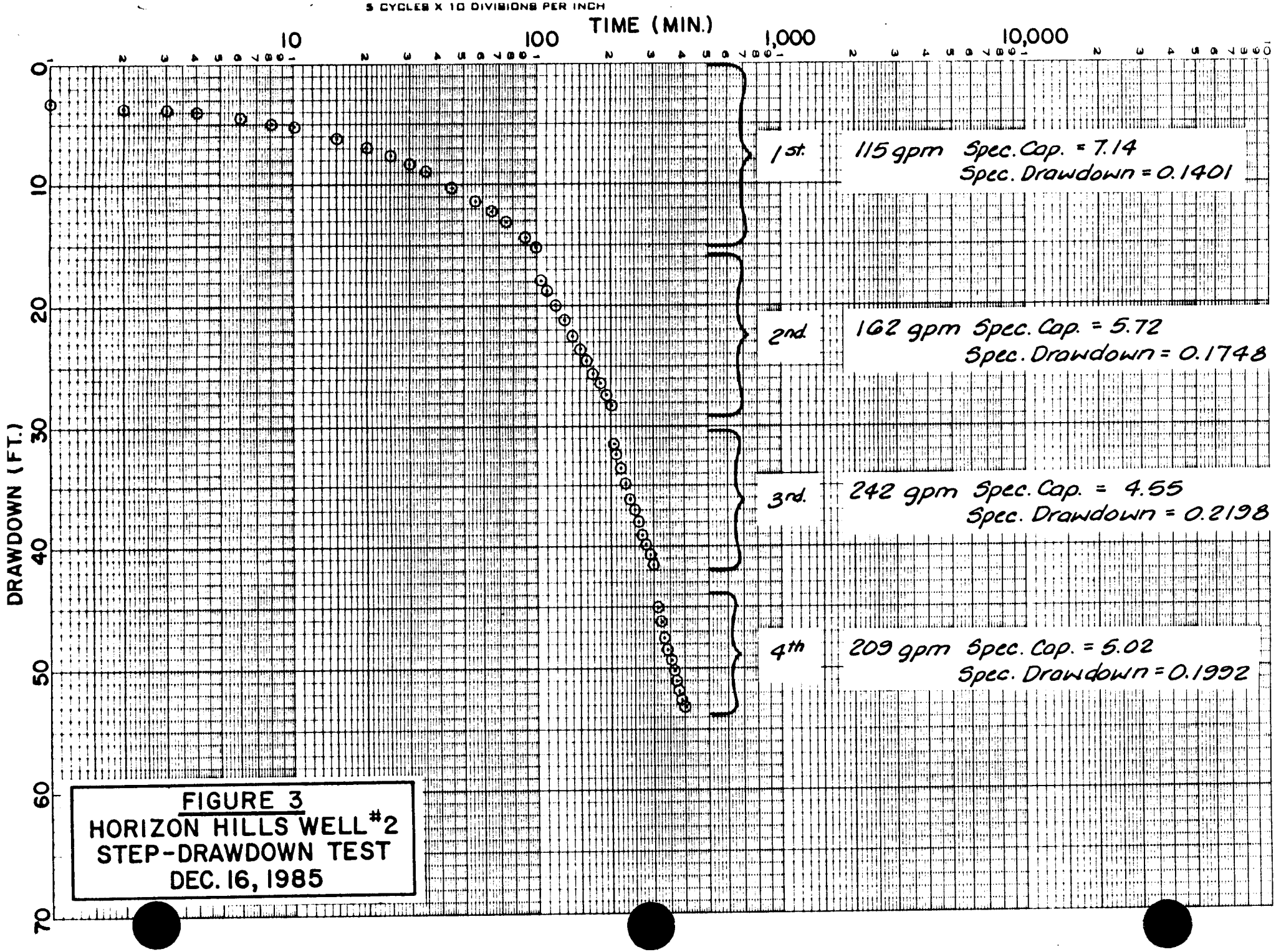


FIGURE 3
HORIZON HILLS WELL #2
STEP-DRAWDOWN TEST
DEC. 16, 1985

discharge, a straight line can be drawn through these points as depicted in figure 4. The slope of this line is equal to the formation loss coefficient and the line intercept with the graph is equal to the well loss coefficient. Table 1 shows the calculations used to determine these coefficients.

Table 1

Step Drawdown Tests - Specific Capacity

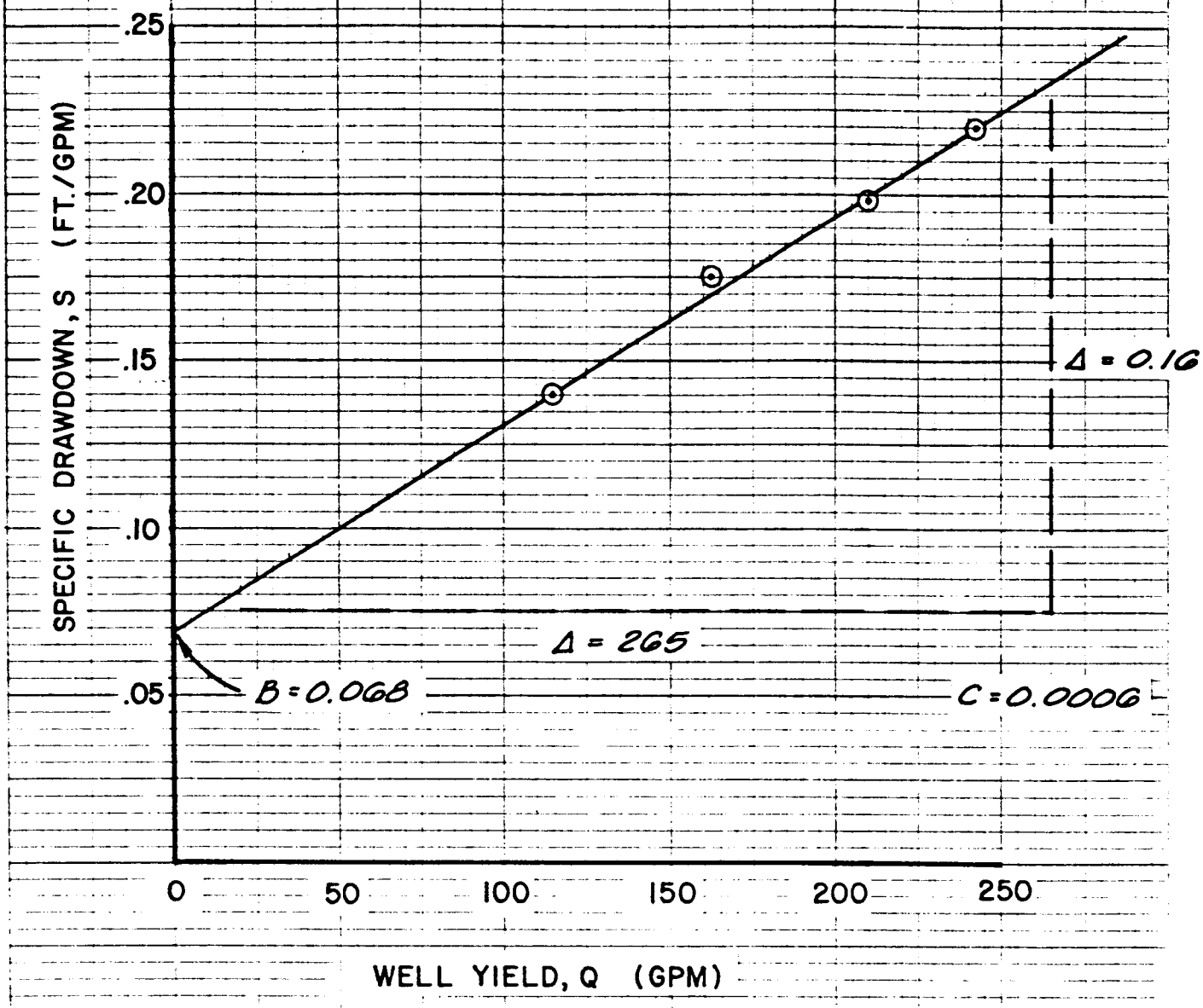
Step	Q Well Yield (gpm)	S_w Drawdown after 100 min. (ft)	Q/S Specific Capacity (gpm/ft)	S/Q Specific Drawdown (ft/gpm)
1	115	15.27	7.14	0.1401
2	162	28.30	5.72	0.1748
3	209	41.65	5.02	0.1992
4	242	53.16	4.55	0.2198

Well efficiency is ultimately described by this graphical method from the equation

$$E = \frac{1}{1 + (C/B)\ Q} \qquad (2)$$

Table 2 shows these calculations and figure 5 graphically displays the results.

FIGURE 4
SPECIFIC DISCHARGE VERSUS WELL YIELD DATA FROM STEP-DRAWDOWN TEST



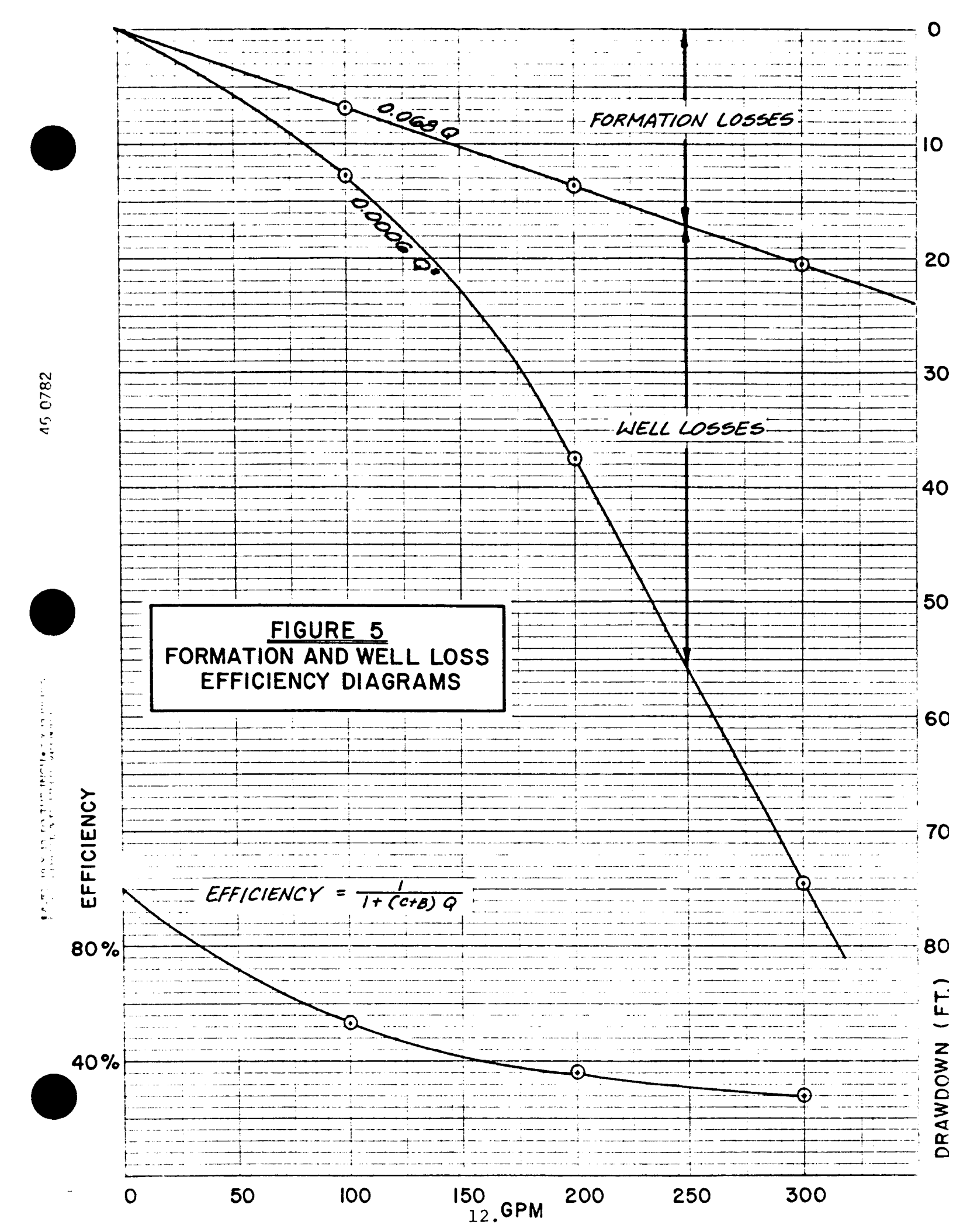


FIGURE 5
FORMATION AND WELL LOSS
EFFICIENCY DIAGRAMS

Table 2 Calculated Drawdown and Well Efficiency		
Q Well Yield (gpm)	S_W Calculated Drawdown (ft)	E Well Efficiency (%)
100	12.8	53
200	37.6	36
300	74.4	27

$$S_W = (0.068)Q + (0.0006)Q^2$$

$$E = \frac{1}{1 + (C/B)\,Q}$$

As can be seen in figure 5, well losses account for most of the drawdown as the discharge rate is increased. Well losses should be a minor portion of the total drawdown. These losses reflect the construction of the well among other things. At the designed pumping rate of the well, efficiencies should be in the range of 70-90%. As can be seen from the graph, an efficiency of only 42% is achieved at a pumping rate of 150 gpm. The physical reason for such low efficiencies and high well losses stems from the well penetrating fractured bedrock. These water bearing fractures actually serve as an extension of the well itself. Such low efficiencies typify fracture flow wells. The efficiency of this well may initially increase due to more development of the fractures through pumping. Well efficiency should be tested on an annual basis in order to insure proper maintenance and longevity of the well.

Constant Discharge Test

A constant discharge test is run in order to determine aquifer parameters and discover any boundary conditions. Aquifer parameters describe how well the aquifer transmits water and its storage capabilities. Transmissibility

is used to predict future drawdowns or pumping levels in the well. Obviously, for a well being used for twenty years or longer, this information is invaluable. Boundary conditions such as faults (impermeable boundary) or large bodies of water - rivers, lakes and streams (recharge boundary) have a cause and effect on the aquifer's natural condition and flow pattern. A pumping well's drawdown rate will be effected by these boundary conditions with either an increase or decrease in drawdown over time. An increase in the drawdown rate infers that an impermeable boundary of the aquifer has been reached by the well drawing water from the aquifer. In a fracture flow well, this may mean that certain fractures may be entirely dewatered.

On December 17th, a 72-hour pumping test was initiated. A pumping rate of 209 gpm was chosen, but later reduced to 185 gpm because the pump was not capable of sustaining the higher pumping rate. Figure 6 shows the drawdown in the well versus time.

The early time data (20 minutes) shows a low drawdown rate before an increased, but constant drawdown rate occurs. This probably results from dewatering small upper fractures and storage effects. An increase in drawdown then results from the constant discharge drawing more water from the main production zone of fractures (280 feet - 380 feet). At 3500 minutes (2 1/2 days), an increase in the drawdown rate occurs. This doubling of the drawdown rate reflects an impermeable boundary where no flow occurs. Because of the nature of this fracture flow aquifer, it probably reflects the actual dewatering of a larger fracture.

Recovery Data

The recovery test occurs after the constant Q pumping test is ended and the pump is turned off. Water level measurements are taken at specific time

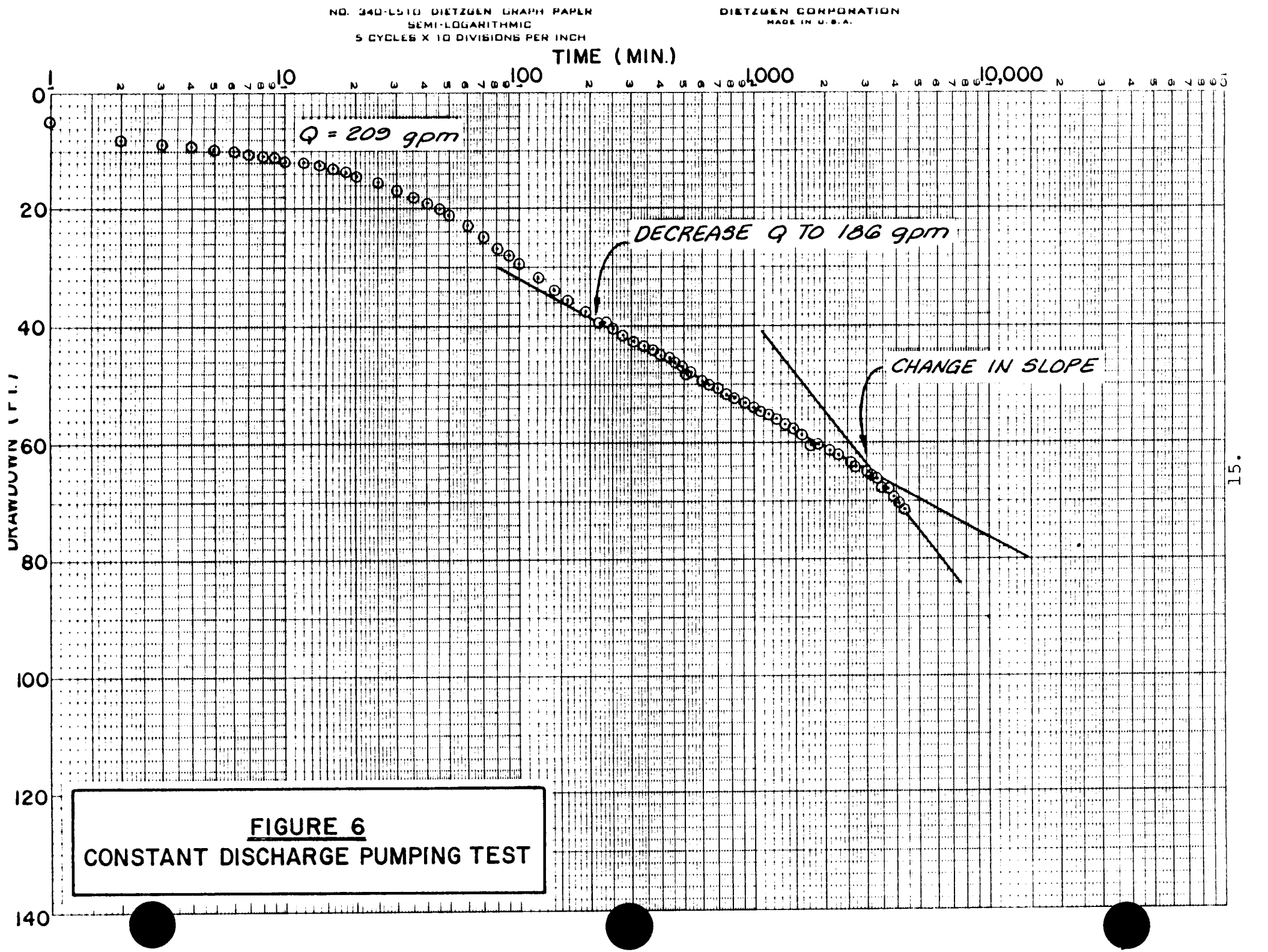


FIGURE 6
CONSTANT DISCHARGE PUMPING TEST

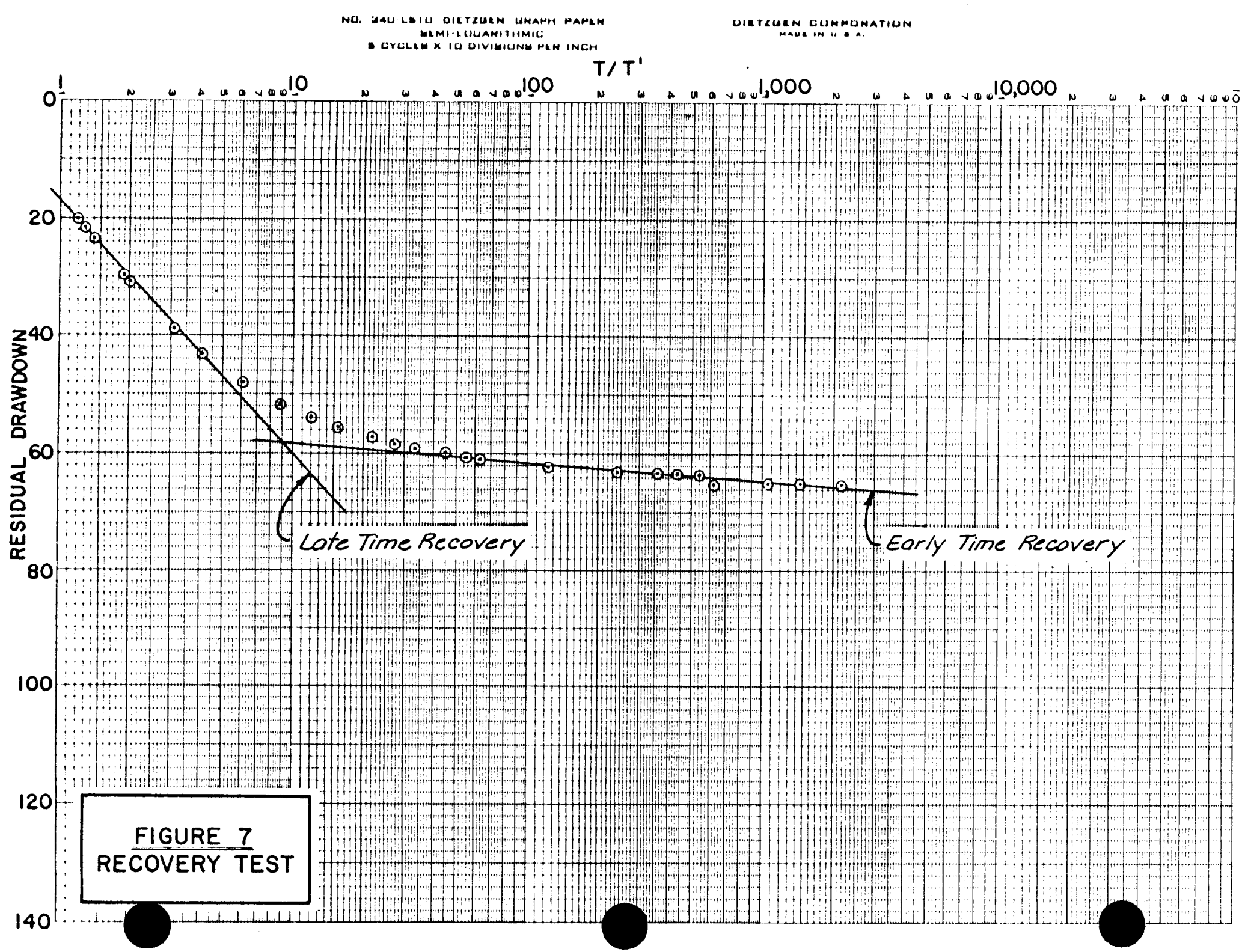


FIGURE 7
RECOVERY TEST

intervals to determine the rate at which the aquifer recovers. A plot of these data should be a mirror image of the pumping test. Figure 7 shows these results. Theoretically, the static water level should return to its original level after 72 hours. Figure 7 shows that at 72 hours after pumping stopped ($t/t' = 2$), there was still 30 feet of residual drawdown in the well. This indicates fractures were dewatered and could not contribute flow to the well as initially. After two weeks of recovery, the well still has 20 feet of residual drawdown.

The results of this test show that the well derives its water from fractures and that some fractures have been dewatered. A considerable amount of time will be required for the well to fully recover.

Results and Discussion

The step drawdown test has shown the well to be inefficient, especially at high pumping rates. The inefficiency results from high friction losses associated with fracture flow. The fractures can be considered extension of the well itself so that these friction losses show up as well losses. At a pumping rate of 150 gpm, the formation losses are nearly equal to the well losses. The efficiency of the well at this pumping rate is approximately 45%.

The constant discharge test clearly simulates fracture flow theory. During the 72 hours of pumping, the rate of drawdown remained constant or increased due to the dewatering of fractures. A total of 72 feet of drawdown occurred during this test which represents approximately 40% of available drawdown. At this rate the drawdown would reach a pumping level of 350 feet after approximately six years of constant pumping. This is also in the absence of any additional dewatering of fractures or boundary conditions and in absence of recharge.

Long term predictions of drawdown cannot be made based on the limited amount of data available. The results of the 72 hour test indicate the well would likely be subject to continually changing conditions and therefore be impossible to evaluate for long term yeld. This differs from alluvial wells which are much more predictable because of the predictability of the aquifer media. For fracture flow wells, a conservative method of analysis is to plot drawdown vs the square root of time as shown in figure 8. According to this plot, the drawdown would reach a 350 foot pumping level in approximately 100 days. However, since this well would not be pumped continuously, periods of recovery would occur as figure 8 depicts. Based on intermittent pumping as shown in figure 8, drawdown to 350 feet is reached in approximately one year. However, the above prediction is conservative because it does not consider recharge which most certainly occurs and would reduce the rate of drawdown. Transmissibility and storativity could not be determined because observation wells were not available.

An additional consideration is that before the four hours of development occurred, the static water level in the well was 131.5 feet. Eleven hours after development the static had recovered to 143.2 feet. After the step drawdown pumping test (6 3/4 hours) and about eighteen hours of recovery, the static level was 151.5 feet. Two weeks after the constant discharge test, the well's static was 172 feet; 40 feet below the original static. This indicates that probably some upper level fractures had been dewatered and no longer contributes flow to the well. These fractures are probably located above 170 feet (see Lithologic Log). Consequently, the practical static water level is closer to 170 feet below land surface.

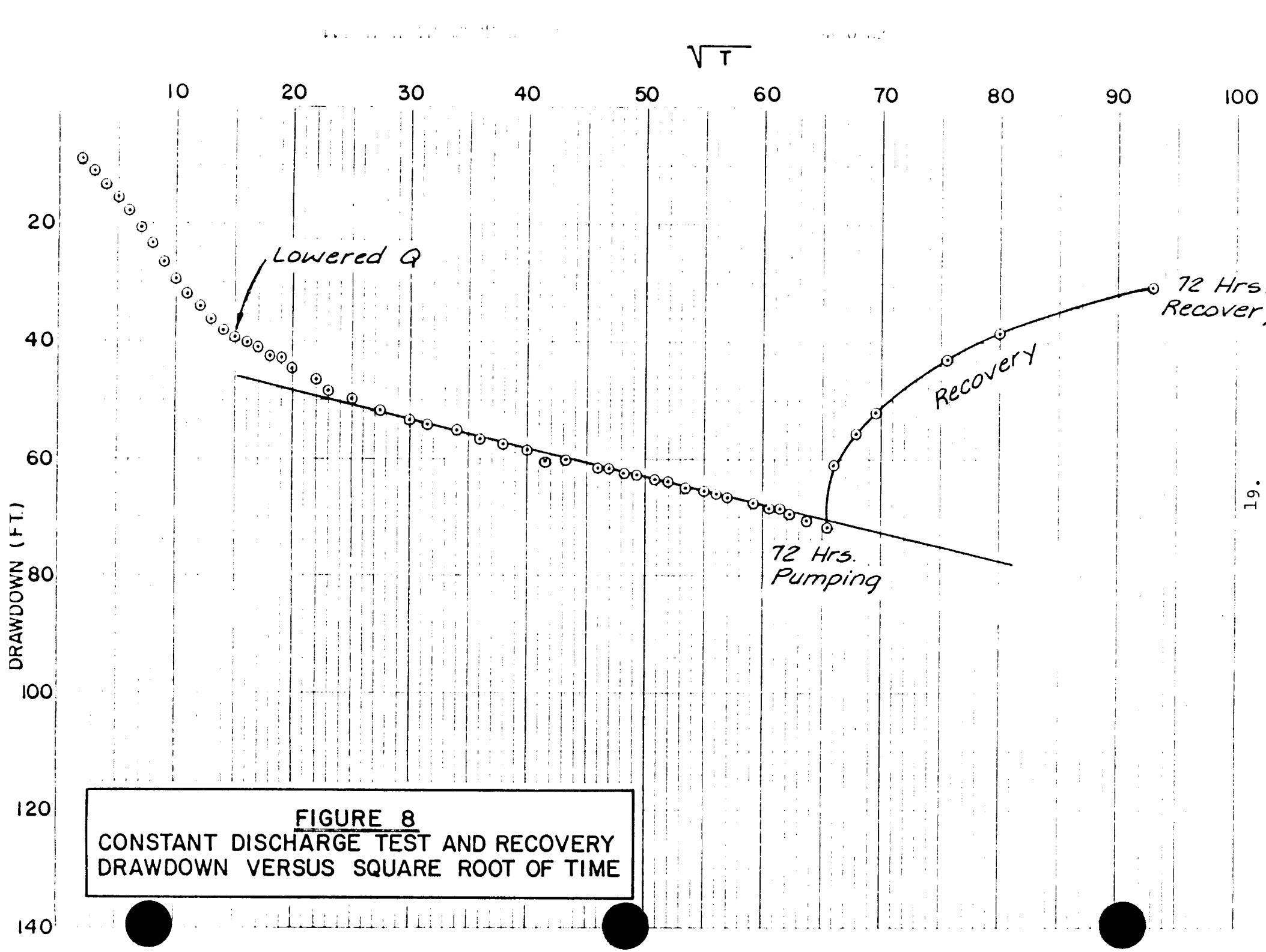


FIGURE 8
CONSTANT DISCHARGE TEST AND RECOVERY
DRAWDOWN VERSUS SQUARE ROOT OF TIME

What is important is matching the needs of the community to the well's capability. On a monthly basis, Horizon Hills demands between 15 gpm in the winter to 130 gpm in the summer. Peak demands have not been determined. The existing well is equipped to pump 225 gpm. Based on this limited information, a yearly average pumping rate of 55 gpm is used by the subdivision or approximately 0.45 gpm/unit. For comparison, Lemmon Valley Water Company currently supplies 0.65 gpm/unit. At this higher rate, Horizon Hills would need 82.5 gpm/year. This higher demand would probably occur if water quality improved.

Based on this information, it is reasonable to equip this well to pump a maximum of 150 gpm with an average annual usage of 80 gpm. Because of the uncertainty of its long term yield, the well should only be used for back up purposes until additional monitoring provides the data necessary to determine the well's long term yield.

Water Quality

A major concern with this well is water quality. A problem with iron, manganese and turbidity exists with the current well. It was hoped that these problems would be solved with this new water supply source. In much of the lithology, pyrite was disseminated throughout. Pyrite is composed of iron and sulfur.

During the constant discharge test and most of the step drawdown test, the discharge was clear and free of sediment. The temperature stayed constant at 58^{0} F. Electrical conductivities generally decreased from 500 micromhos to 470 micromhos. Water samples were taken at twelve hour intervals for iron and manganese analysis. These results are shown in Table 3 and indicate a general decrease in iron from 0.94 to 0.42 ppm. Manganese is fairly constant at 0.22 ppm. The primary drinking water standards for iron and manganese are 0.3 ppm and 0.05 ppm, respectfully. Secondary standards are 0.6 ppm and 0.1 ppm. These results show iron within secondary standards and manganese exceeding secondary standards.

During the pumping test, the Washoe County District Health Department sampled for all constituents after 56 and 72 hours of pumping. These results are shown in Table 4. Also listed, are results of analysis from the primary well taken in November 1985. The overall quality of the new well water is good with mostly ions of sulfate, bicarbonate, calcium, magnesium and sodium. Total dissolved solids are well within primary standards. This water is considered very hard with respect to calcium and manganese.

In comparison to the present well, the quality of water from the new well is slightly better in nearly all constituents. However, iron and manganese still remain a problem and exceed primary and/or secondary standards. Consequently, these waters do not meet with Washoe County District Health Department standards. If either of these waters are to be used for domestic purposes, they must be treated for iron and manganese.

Table 3

Sample Identification		Parameter	Parameter
Sample Collection Date	Time (0-2400)	Iron Units mg/l	Manganese Units mg/l
12-17-85	0845	0.94	0.23
12-17-85	1940	0.48	0.20
12-18-85	0810	0.55	0.20
12-18-85	2100	0.54	0.22
12-19-85	0800	0.55	0.22
12-19-85	2130	0.50	0.22
12-20-85	0750	0.42	0.22

Water quality analysis for new and present well with SDWA Primary Standards expressed in p.p.m.

* Expressed in standard units.

Table 4

Constituent	New Well	Present Well	SDWA Primary Standards
TDS	372	428	500
*Hardness	228	265	80–100
Calcium	50	60	———
Magnesium	25	28	125
Sodium	25	22	———
Potassium	1	2	———
Sulfate	179	190	250
Chloride	2	5	250
Nitrate	0.4	0.3	10–45
*Alkalinity	92	122	———
Bicarbonate	112	149	———
Fluoride	0.27	0.17	1.4–2.4
Arsenic	$<$0.003	0.001	0.05
Iron	0.42–0.94	0.26–1.2	0.3
Manganese	0.20–0.23	0.15–0.29	0.05
Copper	0.01	0.01	1.0
Zinc	0.02	0.01	5.0
Barium	0.02	0.01	1.0
Boron	0.0	0.0	———
Silica	30	34	———
*Color	7	7–45	15
*Turbidity	1.5	2.1	———
*pH	7.54	7.54	6.5–8.5

WHITE—DIVISION OF WATER RESOURCES
CANARY—CLIENT'S COPY
PINK—WELL DRILLER'S COPY

STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

Please complete this form in its entirety

PRINT OR TYPE ONLY

OFFICE USE ONLY
Log No.
Permit No.
Basin

HORIZON HILLS GENERAL IMPROVEMENT DISTRICT
OWNER c/o WASHOE COUNTY DEPT PUBLIC WORKS
MAILING ADDRESS 1205 MILL STREET
RENO, NEVADA 89520

NOTICE OF INTENT NO. 5579
ADDRESS AT WELL LOCATION Southwest of Horizon Hills 1 Mile

2. LOCATION ¼ ¼ Sec. 17 T. 20 (N)/S R. 19 E WASHOE County
PERMIT NO. W-55 / App 48567 (Issued by Water Resources) | Parcel No. | Subdivision Name

3. TYPE OF WORK
New Well [X] Recondition [ ]
Deepen [ ] Other [ ]

4. PROPOSED USE
Domestic [ ] Irrigation [ ] Test [ ]
Municipal [X] Industrial [ ] Stock [ ]

5. TYPE WELL
Cable [ ] Rotary [X]
Other [ ]

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
soil		0	5	5
fractured volcanics		5	400	395

*Minor corrections made to this report by Washoe Co. Utility Div.

8. WELL CONSTRUCTION
Diameter hole 12 inches Total depth 400 feet
Casing record 8-5/8 inch x .188 wall
Weight per foot 16.94 Thickness

Diameter	From	To
conductor 16 inches	+2 feet	165 feet
inches	feet	feet
12 - 8 inches	+2 feet	400 feet
inches	feet	feet
inches	feet	feet
inches	feet	feet

Surface seal: Yes [X] No [ ] Type cement grout
Depth of seal 165 feet
Gravel packed: Yes [X] No [ ]
Gravel packed from ≥165 feet to 400 feet
3/8 inch minus well rock ≥165 to 396
Perforations:
Type perforation Milled
Size perforation 1/8 inch x 3 inch double standar
From 270 feet to 390 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

9. WATER LEVEL
Static water level 128 feet below land surface
Flow G.P.M. P.S.I.
Water temperature cold° F. Quality good

Date started JULY 24, 19 85
Date completed DECEMBER 19, 19 85

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump
1440	185	71.71	72

BAILER TEST
G.P.M. Draw down feet hours
G.P.M. Draw down feet hours
G.P.M. Draw down feet hours

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.
Name CHARLES SARGENT IRRIGATION, INC. (Contractor)
Address P. O. BOX 2480 RENO, NEVADA 89505 (Contractor)
Nevada contractor's license number 21246
Nevada contractor's drillers number 1392
Nevada driller's license number 1388 (Actual Driller)
Signed [signature] (Contractor)
Date DECEMBER 20, 1985

(Rev. 6-81)
USE ADDITIONAL SHEETS IF NECESSARY

WHITE—DIVISION OF WATER RESOURCES
CANARY—CLIENT'S COPY
PINK—WELL DRILLER'S COPY

STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

PRINT OR TYPE ONLY — Please complete this form in its entirety

OFFICE USE ONLY
Log No.
Permit No.
Basin

OWNER HORIZON HILLS GENERAL IMPROVEMENT DISTRICT
MAILING ADDRESS c/o WASHOE COUNTY DEPT PUBLIC WORKS, 1205 MILL STREET, RENO, NEVADA 89520
NOTICE OF INTENT NO. 2547
ADDRESS AT WELL LOCATION Southwest of Horizon Hills 1 mile

2. LOCATION SE ¼ SE ¼ Sec. 17 T 20 (N) S R 19 E WASHOE County
PERMIT NO. W-55/App. 48567 (Issued by Water Resources) | Parcel No. | Subdivision Name

3. TYPE OF WORK: New Well ☒ Recondition ☐ Deepen ☐ Other ☐

4. PROPOSED USE: Domestic ☐ Irrigation ☐ Test ☒ Municipal ☐ Industrial ☐ Stock ☐ #1

5. TYPE WELL: Cable ☐ Rotary ☒ Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
clayey silty sand		0	80	80
intermittent clay in fractured volcanics		80	200	120
No water				
Severe lost circulation area				
Hole suspended with iron indications in formation samples				

Date started APRIL 12, 19 85
Date completed APRIL 17, 19 85

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump

BAILER TEST
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours

8. WELL CONSTRUCTION
Diameter hole 6 inches Total depth 200 feet
Casing record
Weight per foot ..... Thickness .....

Diameter	From	To
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet

Surface seal: Yes ☒ No ☐ Type cement grout
Depth of seal abandoned feet
Gravel packed: Yes ☐ No ☐
Gravel packed from ..... feet to ..... feet
Hole caved-in to 50 feet - Water table filled with natural materi
Perforations:
Type perforation
Size perforation
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet

9. WATER LEVEL
Static water level ..... feet below land surface
Flow ..... G.P.M. ..... P.S.I.
Water temperature ..... ° F. Quality .....

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.
Name CHARLES SARGENT IRRIGATION, INC. (Contractor)
Address P. O. BOX 2480 RENO, NV 89505 (Contractor)
Nevada contractor's license number 21246
Nevada contractor's drillers number 1392
Nevada driller's license number 1413 (Actual Driller)
Signed ..... (Contractor)
Date AUGUST 10, 1985

USE ADDITIONAL SHEETS IF NECESSARY

(Rev. 6-81) O-627 CR434

WHITE—DIVISION OF WATER RESOURCES
CANARY—CLIENT'S COPY
PINK—WELL DRILLER'S COPY

STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

PRINT OR TYPE ONLY

Please complete this form in its entirety

OFFICE USE ONLY
Log No.
Permit No.
Basin

NOTICE OF INTENT NO. 2542

OWNER HORIZON HILLS GENERAL IMPROVEMENT DISTRICT
MAILING ADDRESS c/o WASHOE COUNTY DEPT PUBLIC WORKS 1205 MILL STREET RENO, NEVADA 89520
ADDRESS AT WELL LOCATION Southwest of Horizon Hills 1 mile

2. LOCATION SE ¼ SE ¼ Sec. 17 T 20 (N)S R 19 E WASHOE County
PERMIT NO. W-55/App. 48567 (Issued by Water Resources) | Parcel No. | Subdivision Name

3. TYPE OF WORK: New Well ☒ Recondition ☐ Deepen ☐ Other ☐

4. PROPOSED USE: Domestic ☐ Irrigation ☐ Test ☒ #2 Municipal ☐ Industrial ☐ Stock ☐

5. TYPE WELL: Cable ☐ Rotary ☒ Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
soil		0	5	5
fractured volcanics		5	350	345
Water @ 200 feet				
Severe Lost Circulation Area				

Date started APRIL 18, 1985
Date completed APRIL 18, 1985

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump

BAILER TEST
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours

8. WELL CONSTRUCTION
Diameter hole 6 inches Total depth 350 feet
Casing record
Weight per foot ..... Thickness .....

Diameter	From	To
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet

Surface seal: Yes ☒ No ☐ Type cement grout
Depth of seal abandoned feet
Gravel packed: Yes ☐ No ☐
Gravel packed from ..... feet to ..... feet
Hole caved-in to 50 feet- Water table filled with natural mat
Perforations:
Type perforation
Size perforation
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet

9. WATER LEVEL
Static water level ..... feet below land surface
Flow ..... G.P.M. ..... P.S.I.
Water temperature ..... ° F. Quality .....

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.
Name CHARLES SARGENT IRRIGATION, INC. (Contractor)
Address P. O. BOX 2480 RENO, NEVADA 89505 (Contractor)
Nevada contractor's license number 21246
Nevada contractor's drillers number 1392
Nevada driller's license number 1388 (Actual Driller)
Signed ..... (Contractor)
Date AUGUST 10, 1985

USE ADDITIONAL SHEETS IF NECESSARY

(Rev. 6-81)

0-627 CR434

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STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

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NOTICE OF INTENT NO. 2547

OWNER HORIZON HILLS GENERAL IMPROVEMENT DISTRICT c/o WASHOE COUNTY DEPT PUBLIC WORKS
MAILING ADDRESS 1205 MILL STREET RENO, NEVADA 89520
ADDRESS AT WELL LOCATION Southwest of Horizon Hills 1 mile

2. LOCATION SE ¼ SE ¼ Sec. 17 T. 20 (N) S R. 19 E WASHOE County
PERMIT NO. W-55/App. 48567 (Issued by Water Resources) | Parcel No. | Subdivision Name

3. TYPE OF WORK: New Well ☒ Recondition ☐ Deepen ☐ Other ☐

4. PROPOSED USE: Domestic ☐ Irrigation ☐ Test ☒ #3 Municipal ☐ Industrial ☐ Stock ☐

5. TYPE WELL: Cable ☐ Rotary ☒ Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
soil		0	5	5
fractured volcanics		5	403	398
Water @ 200 feet				
Severe lost circulation				

Date started APRIL 23, 1985
Date completed MAY 1, 1985

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump

BAILER TEST
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours

8. WELL CONSTRUCTION

Diameter hole 6 inches Total depth 403 feet
Casing record
Weight per foot ..... Thickness .....

Diameter	From	To
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet

Surface seal: Yes ☒ No ☐ Type cement grout
Depth of seal abandoned feet
Gravel packed: Yes ☐ No ☐
Gravel packed from ..... feet to ..... feet
Hole caved-in to 50 feet - Water table filled with natural materi
Perforations:
Type perforation
Size perforation
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet

9. WATER LEVEL

Static water level ..... feet below land surface
Flow ..... G.P.M. ..... P.S.I.
Water temperature ..... ° F. Quality .....

10. DRILLERS CERTIFICATION

This well was drilled under my supervision and the report is true to the best of my knowledge.

Name CHARLES SARGENT IRRIGATION, INC. (Contractor)
Address P. O. BOX 2480 RENO, NEVADA 89505 (Contractor)
Nevada contractor's license number 21246
Nevada contractor's drillers number 1392
Nevada driller's license number 1413 (Actual Driller)
Signed ..... (Contractor)
Date AUGUST 10, 1985

USE ADDITIONAL SHEETS IF NECESSARY

(Rev. 6-81) O-627 CR434

WHITE—DIVISION OF WATER RESOURCES
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PINK—WELL DRILLER'S COPY

STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

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NOTICE OF INTENT NO. 2547

1. OWNER HORIZON HILLS GENERAL IMPROVEMENT DISTRICT c/o WASHOE COUNTY DEPT PUBLIC WORKS
MAILING ADDRESS 1205 MILL STREET RENO, NEVADA 89520
ADDRESS AT WELL LOCATION Southwest Horizon Hills 1 mile

2. LOCATION SE ¼ SE ¼ Sec. 17 T. 20 (N) S R. 19 E WASHOE County
PERMIT NO. W-55/App. 48567 (Issued by Water Resources) | Parcel No. | Subdivision Name

3. TYPE OF WORK
New Well ☒ Recondition ☐
Deepen ☐ Other ☐

4. PROPOSED USE #4
Domestic ☐ Irrigation ☐ Test ☒
Municipal ☐ Industrial ☐ Stock ☐

5. TYPE WELL
Cable ☐ Rotary ☒
Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
soil		0	5	5
fractured volanics		5	80	75
No water				
Severe lost circulation				

Date started JUNE 19, 1985
Date completed JUNE 24, 1985

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump

BAILER TEST
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours
G.P.M. ..... Draw down ..... feet ..... hours

8. WELL CONSTRUCTION
Diameter hole 8 inches Total depth 80 feet
Casing record
Weight per foot ..... Thickness .....

Diameter	From	To
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet
..... inches	..... feet	..... feet

Surface seal: Yes ☒ No ☐ Type cement grout
Depth of seal abandoned feet
Gravel packed: Yes ☐ No ☐
Gravel packed from ..... feet to ..... feet
Hole caved-in to 50 feet - Water table filled with natural materi
Perforations:
Type perforation
Size perforation
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet
From ..... feet to ..... feet

9. WATER LEVEL
Static water level ..... feet below land surface
Flow ..... G.P.M. ..... P.S.I.
Water temperature ..... ° F. Quality .....

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.
Name CHARLES SARGENT IRRIGATION, INC. (Contractor)
Address P. O. BOX 2480 RENO, NEVADA 89505 (Contractor)
Nevada contractor's license number 21246
Nevada contractor's drillers number 1392
Nevada driller's license number 1413 (Actual Driller)
Signed Monick Eckhart (Contractor)
Date August 10, 1985

USE ADDITIONAL SHEETS IF NECESSARY

(Rev. 6-81)

0-627 CR434

WHITE—DIVISION OF WATER RESOURCES
CANARY—CLIENT'S COPY
PINK—WELL DRILLER'S COPY

STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

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NOTICE OF INTENT NO. 2547

OWNER HORIZON HILLS GENERAL IMPROVEMENT DISTRICT
c/o WASHOE COUNTY DEPT PUBLIC WORKS
MAILING ADDRESS 1205 MILL STREET
RENO, NEVADA 89520

ADDRESS AT WELL LOCATION
Southwest Horizon Hills 1 mile

2. LOCATION SE ¼ SE ¼ Sec. 17 T. 20 (N)S R. 19 E. WASHOE County

PERMIT NO. W-55/App. 48567 (Issued by Water Resources) | Parcel No. | Subdivision Name

3. TYPE OF WORK
New Well ☒ Recondition ☐
Deepen ☐ Other ☐

4. PROPOSED USE
Domestic ☐ Irrigation ☐ Test ☒ #5
Municipal ☐ Industrial ☐ Stock ☐

5. TYPE WELL
Cable ☐ Rotary ☒
Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
soil		0	5	5
fractured volcanics		5	350	345
Water @ 200 feet				
Severe lost circulation				

Date started JULY 1, 19 85
Date completed JULY 2, 19 85

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump

BAILER TEST
G.P.M. ____ Draw down ____ feet ____ hours
G.P.M. ____ Draw down ____ feet ____ hours
G.P.M. ____ Draw down ____ feet ____ hours

8. WELL CONSTRUCTION
Diameter hole 8 inches Total depth 350 feet
Casing record
Weight per foot ____ Thickness ____

Diameter	From	To
____ inches	____ feet	____ feet
____ inches	____ feet	____ feet
____ inches	____ feet	____ feet
____ inches	____ feet	____ feet
____ inches	____ feet	____ feet
____ inches	____ feet	____ feet

Surface seal: Yes ☐ No ☒ Type
Depth of seal site for test well feet
Gravel packed: Yes ☐ No ☐
Gravel packed from ____ feet to ____ feet
Hole caved-in to 50 feet - Water table filled with natural mater
Perforations:
Type perforation
Size perforation
From ____ feet to ____ feet
From ____ feet to ____ feet
From ____ feet to ____ feet
From ____ feet to ____ feet
From ____ feet to ____ feet

9. WATER LEVEL
Static water level ____ feet below land surface
Flow ____ G.P.M. ____ P.S.I.
Water temperature ____ ° F. Quality ____

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.
Name CHARLES SARGENT IRRIGATION, INC. (Contractor)
Address P. O. BOX 2480 RENO, NV 89505 (Contractor)
Nevada contractor's license number 21246
Nevada contractor's drillers number 1392
Nevada driller's license number 1413 (Actual Driller)
Signed [signature] (Contractor)
Date AUGUST 10, 1985

USE ADDITIONAL SHEETS IF NECESSARY

(Rev. 6-81) 0-627 CR434

WASHOE COUNTY

DEPARTMENT OF PUBLIC WORKS
UTILITY DIVISION

PUMPING TEST DATA

WELL Horizon Hills
(PUMPING) / OBSERVATION WELL
(PUMPING) / RECOVERY DATA
PAGE 1 OF 2

TYPE of PUMPING TEST Step Drawdown
HOW Q MEASURED orifice plate / manometer
HOW WL's MEASURED elec. sounder
PUMPED WELL NO. _____
RADIUS of PUMPED WELL _____
DISTANCE from PUMPED WELL _____

M.P. for WL's _____ elev. _____
DEPTH of PUMP/AIRLINE 350 ft wrt _____
% SUBMERGENCE: initial _____ ; pumping _____
PUMP ON: date 12/16/85 time 0814
PUMP OFF: date 12/16/85 time 1455

TIME t = at t'=0					WATER LEVEL DATA STATIC WATER LEVEL					WATER PRODUCT.		COMMENTS
CLOCK TIME	ELAPSED TIME mins / hrs	t	t'	t/t'	READING	CONVERSIONS or CORRECTIONS	WATER LEVEL	S or S'			Q	(NOTE ANY CHANGES IN OBSERVERS)
0814		0			143.22		139.72	0				
0815		1			146.54			3.32		~	118	
0816		2			146.81			3.59				
0817		3			147.05			3.83				
0818		4			147.24			4.02				
0820		6			147.72			4.50				
0822		8			148.15			4.93				
0824		10			148.53			5.31			118	
0829		15			149.41			6.19				
0834		20			150.13			6.91				clean discharge
0839		25			150.84			7.62				minor sand
0844		30			151.49			8.27			118	
0849		35			152.08			8.86				
0859		45			153.45			10.23				
0909		55			154.54			11.32				
0919		65			155.34			12.12			115	
0929		75			156.17			12.95			115	
0934		80			156.66			13.44			115	raised R.P.M.
0944		90			157.78			14.56			118	
0954		100	0		158.49		154.99	15.27			118	
0955		101	1		160.42			17.20		~	162	increase Q
0956		102	2		160.62			17.40				
0958		104	4		160.95			17.73				
1000		106	6		161.23			18.01			162	
1002		108	8		161.66			18.44				
1004		110	10		161.95			18.73			162	
1009		115	15		162.61			19.39			162	
1014		120	20		163.25			20.02				
1020		125.5	25.5		164.00			20.77				
1024		130	30		164.45			21.23			162	cond = 500 µmhos @ 58°F
1034		140	40		165.73			22.51				
1044		150	50		166.73			23.51			162	
1054		160	60		167.69			24.47				
1104		170	70		168.71			25.49				
1114		180	80		169.48			26.26			162	
1124		190	90		170.55			27.30				
1134		200	100/0		171.52		168.02	28.30				
1135		201	0							~	209	increased Q
1136		202	1		173.90			30.68				
1137		203	2		174.16			30.94			209	

WASHOE COUNTY

DEPARTMENT OF PUBLIC WORKS
UTILITY DIVISION

PUMPING TEST DATA

WELL Horizon Hills
~~PUMPING~~/OBSERVATION WELL
~~PUMPING~~ RECOVERY DATA
PAGE 2 OF 2

TYPE of PUMPING TEST Step Drawdown
HOW Q MEASURED orifice plate/manometer
HOW WL's MEASURED elec. sounder
PUMPED WELL NO. _____
RADIUS of PUMPED WELL _____
DISTANCE from PUMPED WELL _____

M.P. for WL's _____ elev. _____
DEPTH of PUMP/AIRLINE 350 ft wrt _____
% SUBMERGENCE : initial _____ ; pumping _____
PUMP ON : date 12/16/85 time 0814
PUMP OFF : date 12/16/85 time 1455

TIME t = at t'=0					WATER LEVEL DATA STATIC WATER LEVEL					WATER PRODUCT.		COMMENTS
CLOCK TIME	ELAPSED TIME mins / hrs	t	t'	t/t'	READING	CONVERSIONS or CORRECTIONS	WATER LEVEL	S or S'			Q	(NOTE ANY CHANGES IN OBSERVERS)
1139		205	34		174.47		170.97	31.25				
1141		207	6		174.81			31.59				
1143		209	8		175.14			31.92			209	
1145		211	10		175.53			32.31				
1150		216	15		176.06			32.84				
1155		221	20		176.68			33.46				
1200		226	25		177.33			34.11				
1205		231	30.5		178.21			34.99				
1215		241	40		179.32			36.10				
1225		251	50		179.99			36.77			209	cond = 500 μmhos @ 58°F
1235		261	60		181.11			37.89				
1245		271	70		182.28			39.06				
1255		281	80		183.04			39.82			209	
1305		291	90		183.95			40.73				
1314		300	99		184.87			41.65			209	
1315		301	100/0		184.90		181.40	41.68			~242	increase Q
1316		302	1		186.98			43.76				
1317		303	2		187.04			43.82			242	
1319		305	4		187.44			44.22				
1321		307	6		187.77			44.55				
1323		309	8		188.03			44.81				
1325		311	10		188.35			45.13			244	cond = 500 μmhos @ 58°F
1330		316	15		188.97			45.75				
1335		321	20		189.59			46.37				
1340		326	25		190.17			46.95				
1345		331	30		190.66			47.44			244	
1355		341	40		191.67			48.45				
1405		351	50		192.58			49.36			242	cond. = 500 μmhos @ 58°F
1415		361	60		193.48			50.26			242	
1425		371	70		194.25			51.03			242	
1435		381	80		195.00			51.78				
1445		391	90		195.81			52.59			242	cond = 500 μmhos @ 58°F
1455		401	100		196.38		192.88	53.16			242	End test

WASHOE COUNTY

DEPARTMENT OF PUBLIC WORKS
UTILITY DIVISION

PUMPING TEST DATA

WELL Horizon Hills
(PUMPING) / OBSERVATION WELL
PUMPING / RECOVERY DATA
PAGE 1 OF 2

TYPE of PUMPING TEST Constant Discharge
HOW Q MEASURED orifice plate / manometer
HOW WL's MEASURED electric sounder
PUMPED WELL NO. _____
RADIUS of PUMPED WELL _____
DISTANCE from PUMPED WELL _____

M.P. for WL's _____ elev. _____
DEPTH of PUMP/AIRLINE 350 ft wrt _____
% SUBMERGENCE: initial _____ ; pumping _____
PUMP ON: date 12/17/85 time 0820
PUMP OFF: date 12/20/85 time 0800

TIME t = ___ at t' = 0					WATER LEVEL DATA STATIC WATER LEVEL 151.57					WATER PRODUCT.		COMMENTS
CLOCK TIME	ELAPSED TIME mins / hrs	t	t'	t/t'	READING	CONVERSIONS or CORRECTIONS	WATER LEVEL	s or s'			Q	(NOTE ANY CHANGES IN OBSERVERS)
0820		1			156.62			5.05				
0822		2			159.65			8.08				
0823		3			160.25			8.68				
0824		4			160.63			9.06				
0825		5			161.09			9.52				
0826		6			161.52			9.95				
0827		7			161.91			10.34				
0828		8			162.26			10.69			209	
0829		9			162.61			11.04				
0830		10			162.94			11.37				
0832		12			163.60			12.03				
0834		14			164.21			12.64				
0836		16			164.81			13.24			209	
0838		18			165.39			13.82				sandy, cloudy discharge
0840		20			165.92			14.35				
0845		25			167.16			15.59				Sample taken
0850		30			168.37			16.80				
0855		35			169.50			17.93				
0900		40			170.55			18.98				cond = 480 μmhos @ 58°F
0905		45			171.53			19.96				
0910		50			172.49			20.92				
0920		60			174.30			22.73			207	
0930		70			175.96			24.39			209	
0940		80			177.92			26.35			209	
0950		90			179.46			27.89				
1000		100			180.81			29.24				
1020		120			183.35			31.78			209	
1040		140			185.47			33.90				
1100		160			187.42			35.85				
1130		190			188.65			37.08			207	
1200		220			190.95			39.38			186	lowered Q
1210		230			191.14			39.57			186	
1230		250			191.73			40.16			184	
1300		280			192.76			41.22			184	
1330		310			193.82			42.25				
1400		340			194.46			42.86				
1430		370			195.36			43.79				
1500		400			196.20			44.63			184	
1530		430			196.93			45.36				
1600		460			197.76			46.19			184	

WASHOE COUNTY

DEPARTMENT OF PUBLIC WORKS
UTILITY DIVISION

PUMPING TEST DATA

WELL Horizon Hills
(PUMPING) / OBSERVATION WELL
PUMPING / RECOVERY DATA
PAGE 2 OF 2

TYPE of PUMPING TEST Constant Discharge
HOW Q MEASURED _____ M.P. for WL's _____ elev. _____
HOW WL's MEASURED _____ DEPTH of PUMP/AIRLINE _____ wrl _____
PUMPED WELL NO. _____ % SUBMERGENCE: initial _____ ; pumping _____
RADIUS of PUMPED WELL _____ PUMP ON: date 12/17/85 time 0820
DISTANCE from PUMPED WELL _____ PUMP OFF: date 12/20/85 time 0800

	TIME t = at t'=0					WATER LEVEL DATA STATIC WATER LEVEL 151.57					WATER PRODUCT.		COMMENTS
	CLOCK TIME	ELAPSED TIME mins / hrs t	t'	t/t'		READING	CONVERSIONS or CORRECTIONS	WATER LEVEL	S or S'			Q	(NOTE ANY CHANGES IN OBSERVERS)
	1630	490				198.27			46.70			184	
	1700	520				199.95			48.38			184	cond = 460 μmhos @ 56°F
	1740	560				199.45			47.88			182	adj Q
	1820	600				200.97			49.40			184	
	1900	640				201.48			49.91				
	2000	700				202.46			50.89				sample #2
	2100	760				203.30			51.73			184	
	2200	820				204.00			52.43			182	adj Q
	2330	910				204.90			53.33			184	
12/18	0100	1000				205.55			53.98			184	
	0230	1090				206.26			54.69			184	
	0400	1180				206.95			55.38			"	
	0530	1270				207.64			56.07			184	
	0700	1360				208.15			56.58			178	adj. Q
	0810	1430										186	sample #3,
	0900	1480				209.14			57.57			186	cond = 480 μmhos @ 58°F
	1100	1600				210.21			58.64			"	
	1300	1720				211.93			60.36			"	
	1530	1870				211.74			60.17			"	
	1930	2110				212.85			61.28			186	adj. Q to
	2100	2200				213.37			61.80			186	sample #4, cond = 470 μmhos
	2300	2320				213.90			62.33			"	@ 58°F
12/19	0100	2440				214.34			62.77			186	
	0315	2575				215.00			63.43			186	
	0520	2700				215.58			64.01			184	adj Q
	0745	2845				216.11			64.54			"	sample #5
	1045	3025				217.05			65.48			186	
	1245	3145				217.50			65.93			"	
	1445	3265				217.92			66.35			184	Health sample
	1900	3520				219.04			67.47			"	
	2130	3670				219.80			68.23			184	cond = 470 @ 58°F; #6
	2330	3790				220.10			68.53			182	adj R.P.M.
12/20	0100	3880				221.25			69.68			186	
	0404	4064				222.04			70.46			186	
	0745	4285				223.28			71.71			190	sample #7, cond = 470
	0800	4300											end test; Health sample; temp = 58°

WASHOE COUNTY

DEPARTMENT OF PUBLIC WORKS
UTILITY DIVISION

PUMPING TEST DATA

WELL Horizon Hills
(PUMPING / OBSERVATION WELL)
(PUMPING / RECOVERY DATA)
PAGE 1 OF 1

TYPE of PUMPING TEST Constant Discharge Recovery
HOW Q MEASURED
HOW WL's MEASURED electric sounder
PUMPED WELL NO.
RADIUS of PUMPED WELL
DISTANCE from PUMPED WELL
M.P. for WL's elev.
DEPTH of PUMP/AIRLINE wrt
% SUBMERGENCE: initial ; pumping
PUMP ON: date 12/20/85 time 0800
PUMP OFF: date time

TIME t =		at t'=0			WATER LEVEL DATA STATIC WATER LEVEL					WATER PRODUCT.		COMMENTS
CLOCK TIME	ELAPSED TIME mins / hrs	t	t'	t/t'	READING	CONVERSIONS or CORRECTIONS	WATER LEVEL	S or S'			Q	(NOTE ANY CHANGES IN OBSERVERS)
0800		4300	0									
0801		4301	1	4301	216.18		212.68	64.61				
0802		4302	2	2151	216.60			6503				
0803		4303	3	1434	216.60			65.03				
0804		4304	4	1076	216.44			64.87				
0805		4305	5	861	216.44			64.87				
0806		4306	6	718	216.33			64.76				
0807		4307	7	615	216.25			64.68				
0808		4308	8	538	215.15			63.58				
0809		4309	9	479	215.10			63.53				
0810		4310	10	431	215.00		211.50	63.43				
0812		4312	12	359	214.75			63.18				
0814		4314	14	308	214.75			63.18				
0816		4316	16	270	214.68			63.11				
0818		4318	18	240	214.51			62.94				
0820		4320	20	216	214.42			62.85				
0825		4325	25	173	214.24			62.67				
0830		4330	30	144	213.88			62.31				
0835		4335	35	124	213.63			62.06				
0840		4340	40	108	213.51			61.94				
0850		4350	50	87	213.21			61.64				
0900		4360	60	73	212.77			61.20				
0910		4370	70	62	212.38			60.81				
0920		4380	80	55	212.09			60.52				
0940		4400	100	44	211.52			59.95				
1015		4435	135	33	210.58			59.01				
1045		4465	165	27	209.83			58.26				
1130		4510	210	21	208.83			57.26				
1300		4600	300	15	207.09			55.52				
1430		4690	390	12	205.56			53.99				
1700		4840	540	9	203.46			51.89				
12/21 0740		5720	1420	4	194.67		191.17	43.10				
1830		6370	2070	3	190.23			38.66				
12/23 0820		8640	4340	2	182.15			30.58				
1100		14560	10260	1.4	175.23			23.66				
12/31 0900		20200	15900	1.3	173.08		169.58	21.51				
1/6 0815		28795	24495	1.2	171.75		168.25	20.18				
1/14 1115		40495	36195	1.1	170.68			19.11				

250

NEVADA DIVISION OF HEALTH
1660 N. Virginia Street
Reno, Nevada 89503
(702) 789-0335

70250

WATER CHEMISTRY ANALYSIS:

Attn: [redacted]es may apply to some types of samples.

TYPE OF ANALYSIS:

☒ Check here for ROUTINE DOMESTIC ANALYSIS.
Circle the constituents needed for PARTIAL ANALYSIS.

SAMPLING INSTRUCTIONS:

The sample submitted must be representative of the source. Spring and surface water samples should be as free of dirt and debri as possible. Wells should be pumped thoroughly before sampling, changing the water in the casing at least three times. Product water from filters should be sampled after running for about ten (10) minutes.

Sampled by Coulter Date 12/19/85
Owner Horizon Hills G.D. Phone
Address N. Virginia
City Reno State NV

REPORT TO:

Name WCDHD
Address 9th + Wells
City Reno
State NV Zip

All of the information below must be filled in or the analysis will not be performed.

State NV County Washoe
Township 20 Range 19 Section 17
General Location
Source Address Horizon Hills

REASON FOR ANALYSIS:

☐ Loan
☐ Personal health reasons
☐ Purchase of the property
☐ Rental or sale of property
☐ Subdivision approval
☒ Other SDWA

USE OF WATER:

☒ Domestic drinking water
☐ Geothermal
☐ Industrial or mining
☐ Irrigation
☐ Other
Initials

SOURCE OF WATER:

Filter ☐ Yes ☐ No
Public ☒ Yes ☐ No
Spring
Well X Depth ft.
Hot Cold X
IN USE ☐ Yes ☒ No

Type
Name
Surface
Casing diameter 12 in.
Casing depth ft.

EPM: 0.0240 **The results below are representative only of the sample submitted to this laboratory.** # 250

S: [redacted]395 R: 0.7032 **FOR LABORATORY USE ONLY** EC: 529

Constituent	ppm	Constituent	ppm	Constituent	ppm	Constituent	S.U.	PRINT OTHER DESIRED CONSTITUENTS BELOW Constituent	ppm
T.D.S. @ 103° C.	372 ✓	Chloride	2	Iron	0.73	Color	7 ✓	Cd	
Hardness	228	Nitrate	0.4 ✓	Manganese	0.23	Turbidity	1.5	Cr	
Calcium	50	Alkalinity	92	Copper	0.01	pH	7.54	Pb	
Magnesium	25 ✓	Bicarbonate	112	Zinc	0.02			Hg	
Sodium	25	Carbonate	0	Barium	0.02			Se	
Potassium	1	Fluoride	.0.27 ✓	Boron	0.0			As	
Sulfate	179 ✓	Arsenic	< 0.003 ✓	Silica	30				
MBAS	< 0.1	NO3 14th	0.09	BA [illegible]					

per P. Coulter 12/19/85

Fee
Collected by
PWS I.D.
SD[redacted]ri. X Sec.
1st 2nd 3rd
Date Rec'd Init.

ppm = parts per million, milligrams per liter
S.U. = Standard Units

Remarks 56 hr pump test 1400

Circled items exceeds the U.S.P.H.S. Drinking Water Stds. The limits are:

1/3/85

O-1361 (Rev. 4-84) HR117

SIERRA ENVIRONMENTAL MONITORING

GENERAL MINERAL ANALYSIS REPORT

CLIENT:	DATE OF REPORT (MON / DAY / YR.)	JOB NUMBER
Washoe County - Dept of Public Works Utilities Division P. O. Box 11130 Reno, NV 89520	11 - 13 - 85	WAS - 314

SAMPLE IDENTIFICATION DATA

IDENTIFICATION NUMBER: Horizon Hills - New Well

SAMPLE COLLECTION DATE: 11 - 4 - 85

SAMPLE COLLECTION TIME: 09:45 HRS

SAMPLE COLLECTED BY: Mike Widmer

SAMPLING LOCATION: Horizon Hills
Washoe County, NV

Preliminary Results

P. O. # 70614

PARAMETER	VALUE	CRITERIA	PARAMETER	VALUE	CRITERIA
BICARBONATE ALKALINITY mg/l	90	—	MANGANESE mg/l	0.16	0.10 [2]
CARBONATE ALKALINITY mg/l	Ø	—	NITRATE NO_3 mg/l	1.7	45 [1]
CALCIUM mg/l	35	—	PH	7.7	6.5 – 8.5 [2]
CHLORIDE mg/l	4	400 [2]	SODIUM mg/l	36	—
ARSENIC mg/l	0.003	0.05	SULFATE mg/l	130	500 [2]
FLUORIDE mg/l	0.2	** [1]	TOTAL DISSOLVED SOLIDS mg/l	322	1000 [2]
IRON mg/l	0.55	0.6 [2]	TOTAL HARDNESS mg/l	154	—
MAGNESIUM mg/l	16	150 [2]			

OTHER WATER QUALITY ANALYSIS REQUESTED

Copper mg/l	<0.02				

** CRITERIA DEPENDENT ON LOCAL ANNUAL AVERAGE MAXIMUM DAILY TEMPERATURES

1. U.S. ENVIRONMENTAL PROTECTION AGENCY PRIMARY DRINKING WATER STANDARDS.
2. STATE OF NEVADA DIVISION OF HEALTH SECONDARY DRINKING WATER STANDARDS.