92525

(25)

WELL REPORT: CONSTRUCTION AND TESTING, GUAJE REPLACEMENT WELLS GR-1, GR-2, GR-3, AND GR-4, SANTA FE COUNTY, NEW MEXICO

by

JOHN SHOMAKER & ASSOCIATES, INC.
Albuquerque, New Mexico

prepared for

University of California,
Los Alamos National Laboratory
Los Alamos, New Mexico

and

Chavez-Grieves Consulting Engineers, Inc.
Albuquerque, New Mexico

RECEIVED
JUN 20 2006
By

January 1999

14179

(26)

WELL REPORT: CONSTRUCTION AND TESTING, GUAJE REPLACEMENT WELLS GR-1, GR-2, GR-3, AND GR-4, SANTA FE COUNTY, NEW MEXICO

by

JOHN SHOMAKER & ASSOCIATES, INC.
Albuquerque, New Mexico

prepared for

University of California,
Los Alamos National Laboratory
Los Alamos, New Mexico

and

Chavez-Grieves Consulting Engineers, Inc.
Albuquerque, New Mexico

RECEIVED
JUN 20 2006
By

January 1999

WELL REPORT: CONSTRUCTION AND TESTING, GUAJE REPLACEMENT WELLS GR-1, GR-2, GR-3, AND GR-4, SANTA FE COUNTY, NEW MEXICO

SUMMARY

The Guaje Canyon municipal well field was constructed in 1950 to supplement the existing water supply for what is now Los Alamos National Laboratories (LANL). Originally, the well field consisted of five wells (G1, G2, G3, G4, and G5). Two additional wells were added later, G1-A in 1954 and G6 in 1964 (McLin, 1997). Age and deteriorating condition of the wells, coupled with the intent to improve the long-term reliability of the supply, were the motivations behind construction of the four replacement wells.

The four replacement wells are located within the general boundaries of the existing Guaje well field, and all but GR-1 are proximal to existing power and pipeline infrastructure and may be connected with minimal service extension. Design of the replacement wells is different from that of the original Guaje wells. The original wells were constructed with 12-in. mild steel casing while the replacement wells were constructed with 16-in. Type 304 stainless steel perforated casing and a combination of stainless steel and high-strength, low-alloy blank casing. Additionally, the original wells have discontinuous screened sections matched with under-reamed sections of the borehole. The replacement wells have continuous perforated intervals and a continuous borehole diameter of 26-in.

The well field produces water from the Tesuque Formation of the Tertiary Miocene-age Santa Fe Group, a sedimentary sequence of generally poorly-sorted sand and silty sand basin-fill deposits with an accumulated thickness of over 2,000 feet. As an aquifer, the Tesuque Formation is known for modest well yields; all of the Guaje replacement wells produce less than 1,000 gpm. The four replacement wells have a combined yield of approximately 2,250 gpm.

ABREVIATIONS

cfm	cubic feet per minute
cnts/sec	counts per second
cm^3	cubic centimeters
ft	foot; feet
ft bgl	feet below ground level
°F	degrees Fahrenheit
gpd/ft	gallons per day per foot
gpm	gallons per minute
gpm/ft	gallons per minute per foot
in.	inch(es)
LANL	Los Alamos National Laboratory
lb/gal	pounds per gallon
mg/l	milligrams per liter
min.	minute(s)
ntu	nephelometric turbidity units
OHM-M	ohm-meters
ppm	parts per million
psi	pounds per square inch
Q/s	pumping rate (gpm) per foot of drawdown
rpm	revolutions per minute
sec/qt	seconds per quart
TOH	tripped out of hole
µmhos/cm	micromhos per centimeter

CONTENTS

INTRODUCTION 1

WELL DRILLING METHODS 4
- Pilot Hole Drilling 4
- Borehole Alignment 9
- Surface Casing Installation 9

GEOLOGY 9
- Geophysical Logging 11
- Production Well Construction 11
  - Casing Materials and Installation 12
  - Sand Pack Installation 13

WELL DEVELOPMENT 13
- Discharge Criteria and Treatment Plant Operation 13
- Zoned Airlift Pumping 15
- Development by Pumping 15

AQUIFER TESTING 16
- Constant-Rate Test 19
- Step-Drawdown Test and Well Efficiency 20
- Borehole Velocity Surveys 23
- Water Quality 23

FINAL WELL TESTING 24
- Well Alignment 24
- Wellhead Completion and Site Cleanup 24

REFERENCES CITED 25

TABLES

page

Table 1. Discharge criteria, Guaje replacement well drilling 14

2. Summary of 48-hour constant-rate pumping test data, Guaje replacement wells 19

3. Transmissivity values estimated from constant-rate pumping tests 20

4. Step-drawdown test data representing ending measurements for each step, Guaje replacement wells 21

5. Well efficiency estimation, Guaje replacement wells 22

6. Summary of field-monitored water quality, Guaje replacement wells 23

ILLUSTRATIONS

page

Figure 1. Map showing vicinity of the Guaje well field, Santa Fe County, New Mexico 2

2. Map showing locations of production wells in the Guaje well field. 3

3. Presentation of resistivity log, location of perforated interval, drilling time, borehole velocity, and lithology, GR-1. 5

4. Presentation of resistivity log, location of perforated interval, drilling time, borehole velocity, and lithology, GR-2. 6

5. Presentation of resistivity log, location of perforated interval, drilling time, borehole velocity, and lithology, GR-3. 7

6. Presentation of resistivity log, location of perforated interval, drilling time, borehole velocity, and lithology, GR-4. 8

7. Plots of constant-rate pumping test data, Guaje replacement wells. 17

8. Plots of step-drawdown test data, Guaje replacement wells. 18

APPENDICES

(follow text)

Appendix I (Guaje Replacement Well No. 1)

- I-1 State Engineer Office Well Record, GR-1
- I-2 drilling fluid test results, GR-1 pilot hole
- I-3 deviation survey results, GR-1 pilot hole
- I-4 plots of geophysical log data, GR-1 pilot hole
- I-5 well completion diagram, GR-1
- I-6 plot of sieve analysis results, GR-1
- I-7 pumping test data, GR-1
- I-8 gyroscopic survey results, GR-1

Appendix II (Guaje Replacement Well No. 2)

- II-1 State Engineer Office Well Record, GR-2
- II-2 drilling fluid test results, GR-2 pilot hole
- II-3 deviation survey results, GR-2 pilot hole
- II-4 plots of geophysical log data, GR-2 pilot hole
- II-5 well completion diagram, GR-2
- II-6 plot of sieve analysis results, GR-2
- II-7 pumping test data, GR-2
- II-8 gyroscopic survey results, GR-2

Appendix III (Guaje Replacement Well No. 3)

- III-1 State Engineer Office Well Record, GR-3
- III-2 drilling fluid test results, GR-3 pilot hole
- III-3 deviation survey results, GR-3 pilot hole
- III-4 plots of geophysical log data, GR-3 pilot hole
- III-5 well completion diagram, GR-3
- III-6 plot of sieve analysis results, GR-3
- III-7 pumping test data, GR-3
- III-8 gyroscopic survey results, GR-3

Appendix IV (Guaje Replacement Well No. 4)

- IV-1 State Engineer Office Well Record, GR-4
- IV-2 drilling fluid test results, GR-4 pilot hole
- IV-3 deviation survey results, GR-4 pilot hole
- IV-4 plots of geophysical log data, GR-4 pilot hole
- IV-5 well completion diagram, GR-4
- IV-6 plot of sieve analysis results, GR-4
- IV-7 pumping test data, GR-4
- IV-8 gyroscopic survey results, GR-4

WELL REPORT:
CONSTRUCTION AND TESTING,
GUAJE REPLACEMENT WELLS GR-1, GR-2, GR-3, AND GR-4,
SANTA FE COUNTY, NEW MEXICO

INTRODUCTION

This report summarizes the construction and testing of four replacement wells drilled in the Guaje well field in Guaje Canyon, Santa Fe National Forest, Santa Fe County, New Mexico. The wells are part of the Los Alamos County public water supply system. Maps showing the vicinity of the Guaje well field and location of individual wells are presented as Figures 1 and 2.

Summarized information presented in this report is supported by field data and surveys attached as appendices. Appendices are grouped by well and organized as shown in the Table of Contents.

The wells were drilled by Beylik Drilling Inc., Rio Rancho, New Mexico (NMWD 1105). John Shomaker & Associates, Inc. (JSAI) provided professional hydrogeologic services related to well construction and testing under a consulting contract with Chavez-Grieves Consulting Engineers, Inc. The Guaje well field is within the Rio Grande Underground Water Basin. Replacement wells were drilled under permits issued by the Office of the New Mexico State Engineer, file numbers RG-486-S (GR-1), RG-486-S-2 (GR-3), RG-486-S-3 (GR-2), and RG-486-S-5 (GR-4). Well construction was commenced on November 2, 1997, and final testing of GR-1 was completed in July 1998. Beylik Drilling employed two drilling rigs to perform well drilling and well construction. Both drilling rigs were Cooper LT 350s with 200,000-pound mast ratings.

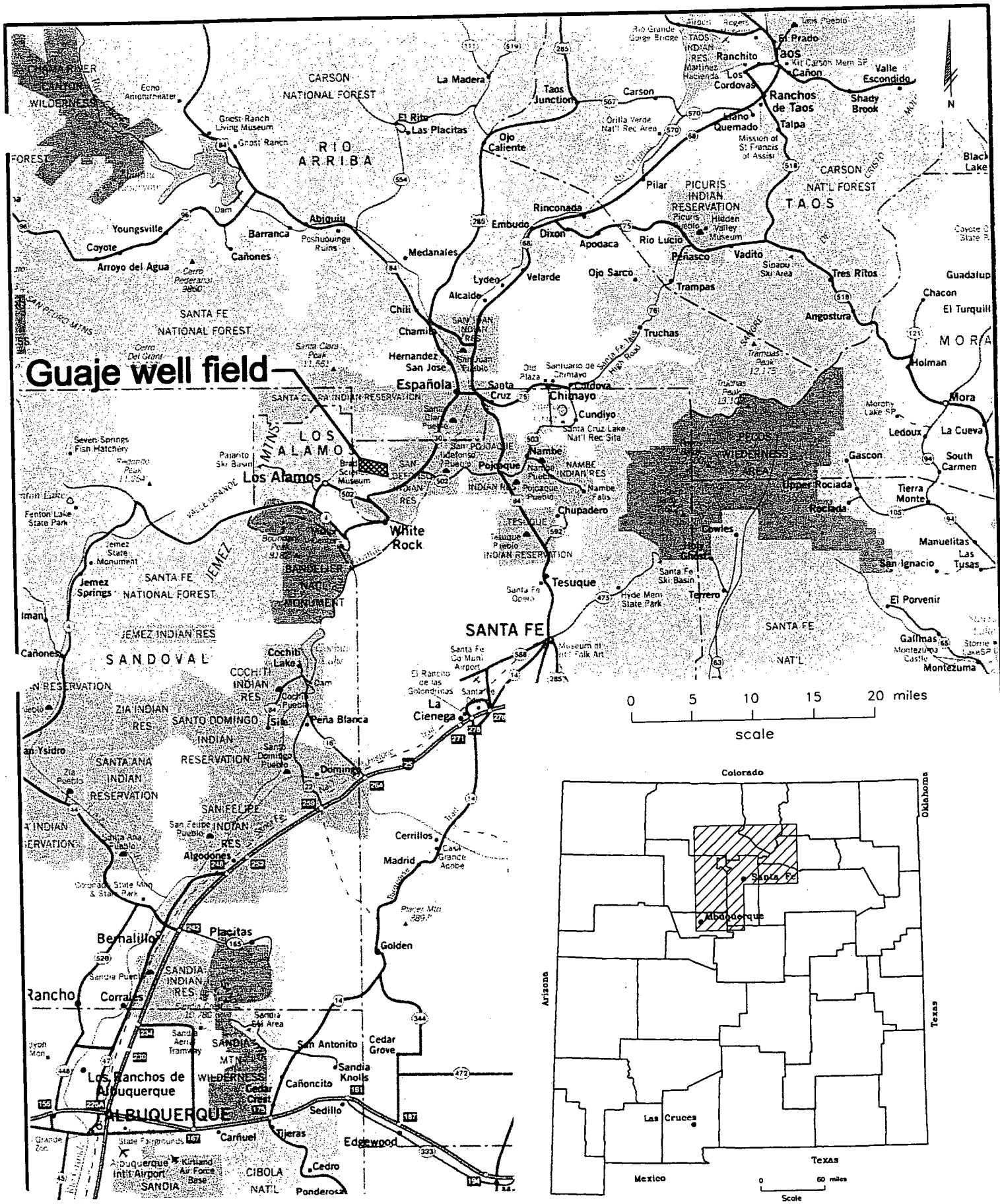


Figure 1. Map showing vicinity of the Guaje well field, Santa Fe County, New Mexico.

JOHN SHOMAKER & ASSOCIATES, INC.

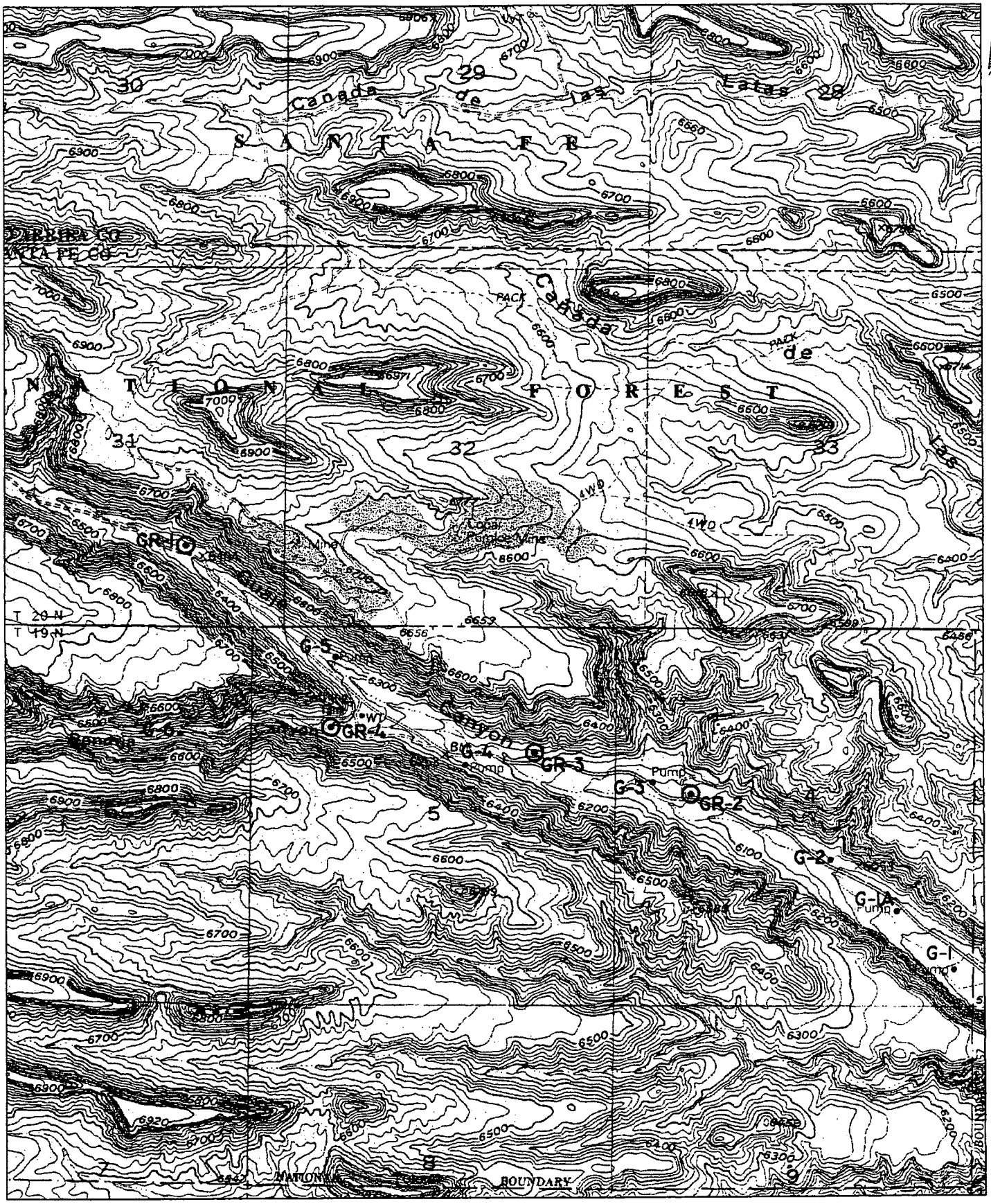


Figure 2. Map showing locations of production wells in Guaje well field.

JOHN SHOMAKER & ASSOCIATES, INC.

WELL DRILLING METHODS

Pilot Hole Drilling

Each of the four Guaje replacement wells was drilled by the reverse mud-rotary method utilizing a bentonite-based fluid system with polymer additives for filtrate control. The reverse-rotary method employs compressed air, injected down the drill pipe through an air line, to induce fluid circulation. Typical capacities of air-compressors used in fluid circulation were 150 psi @ 600 cfm. Fluid circulation rates of several hundred gallons per minute are possible with the reverse rotary method.

The drilling contractor operated a drilling-rate recorder during all pilot hole drilling and reaming. Drilling rates ranged from a minimum of about 2 minutes per foot in unconsolidated sand and gravel, to over an hour per foot in the more competent of basalt beds. Drilling time logs of the four Guaje replacement wells are presented next to plots of other geologic and construction data in Figures 3 through 6.

Drilling fluid properties were, for the most part, maintained within specified limits. The intent of the drilling fluid program was to create a low viscosity, low weight, and low filtrate fluid system that would stabilize the borehole, allow for adequate hole cleaning, and minimize the potential for aquifer formation damage. Drilling fluid tests were performed by a Baroid service company mud engineer. Mud reports provided information about drilling-fluid properties and recommendations for drilling-fluid maintenance. Test results for basic drilling fluid properties measured during pilot hole drilling of Guaje replacement wells GR-1, GR-2, GR-3, and GR-4 are presented in the appendices.

Because the reverse-rotary method provides for relatively high fluid velocity in the drill pipe, the carrying capacity of the fluid is not dependent on high-viscosity mud. The ability to use a low-viscosity drilling fluid enhances fluid cleaning. After the fluid is circulated out of the borehole and into the settling pit, cuttings and drilled solids are more easily removed from the fluid through settlement and other mechanical processes. Maintenance of low-density mud reduces formation invasion and limits aquifer damage.

Los Alamos National Labs GR-1

Hydrogeologist: JSAI

Contractor: Beylik Drilling

Drilling Method: Reverse-Mud Rotary

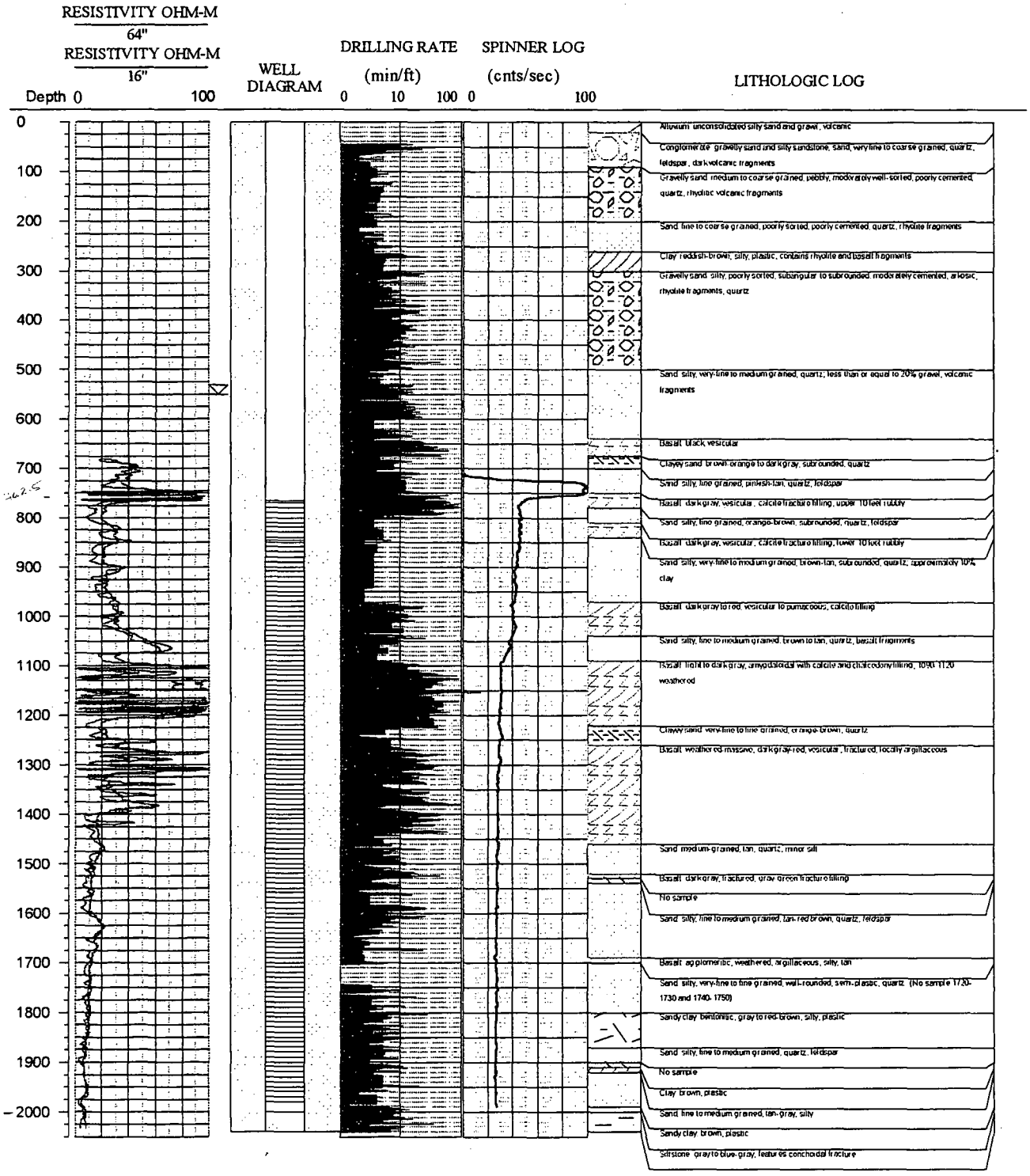


Figure 3. Presentation of resistivity log, location of perforated interval, drilling time, borehole velocity, and lithology, GR-1.

Los Alamos National Labs GR-2

Hydrogeologist: JSAI

Contractor: Beylik Drilling

Drilling Method: Reverse-Mud Rotary

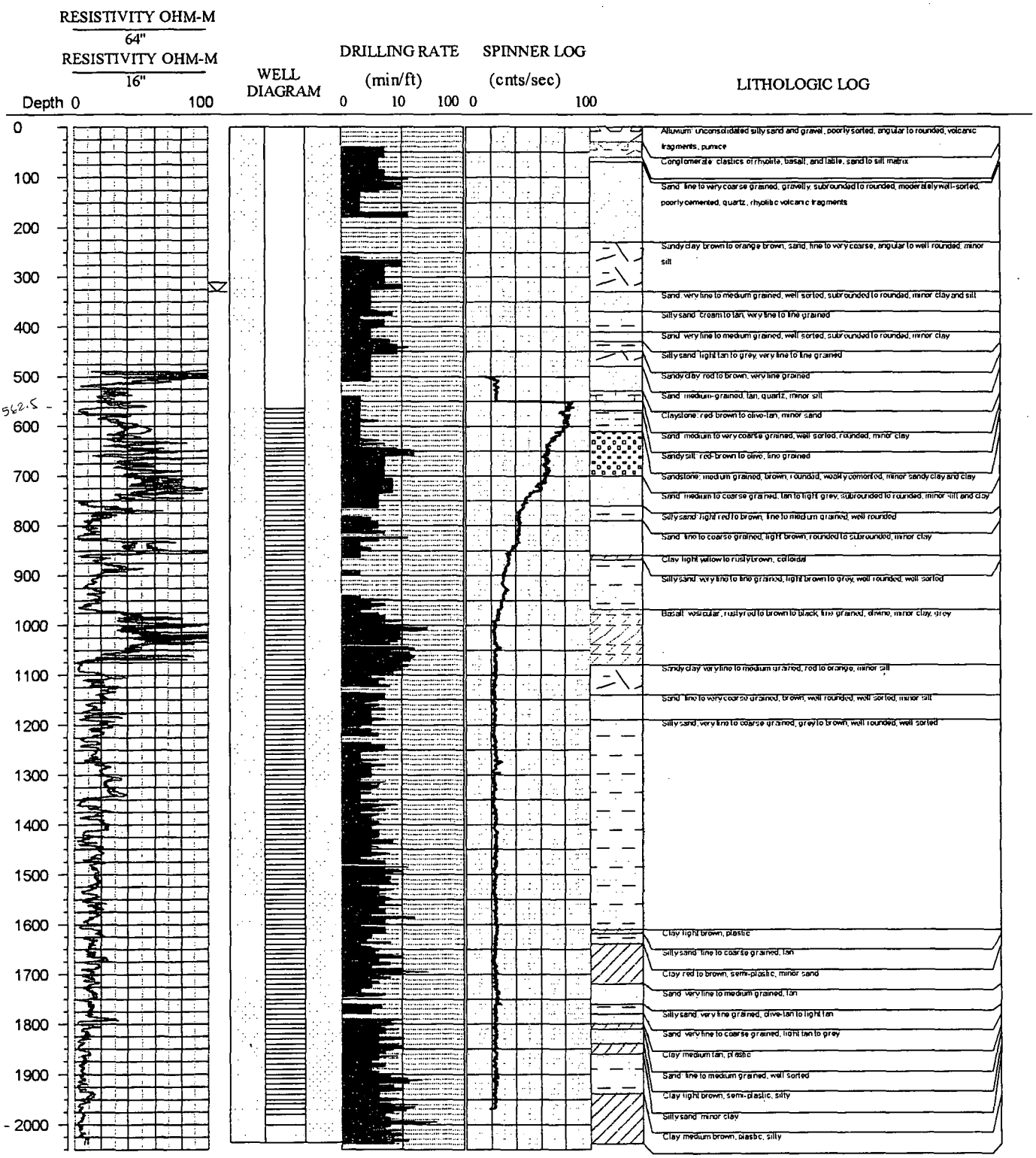


Figure 4. Presentation of resistivity log, location of perforated interval, drilling time, borehole velocity, and lithology, GR-2.

Los Alamos National Labs GR-3

Hydrogeologist: JSAI

Contractor: Beylik Drilling

Drilling Method: Reverse-Mud Rotary

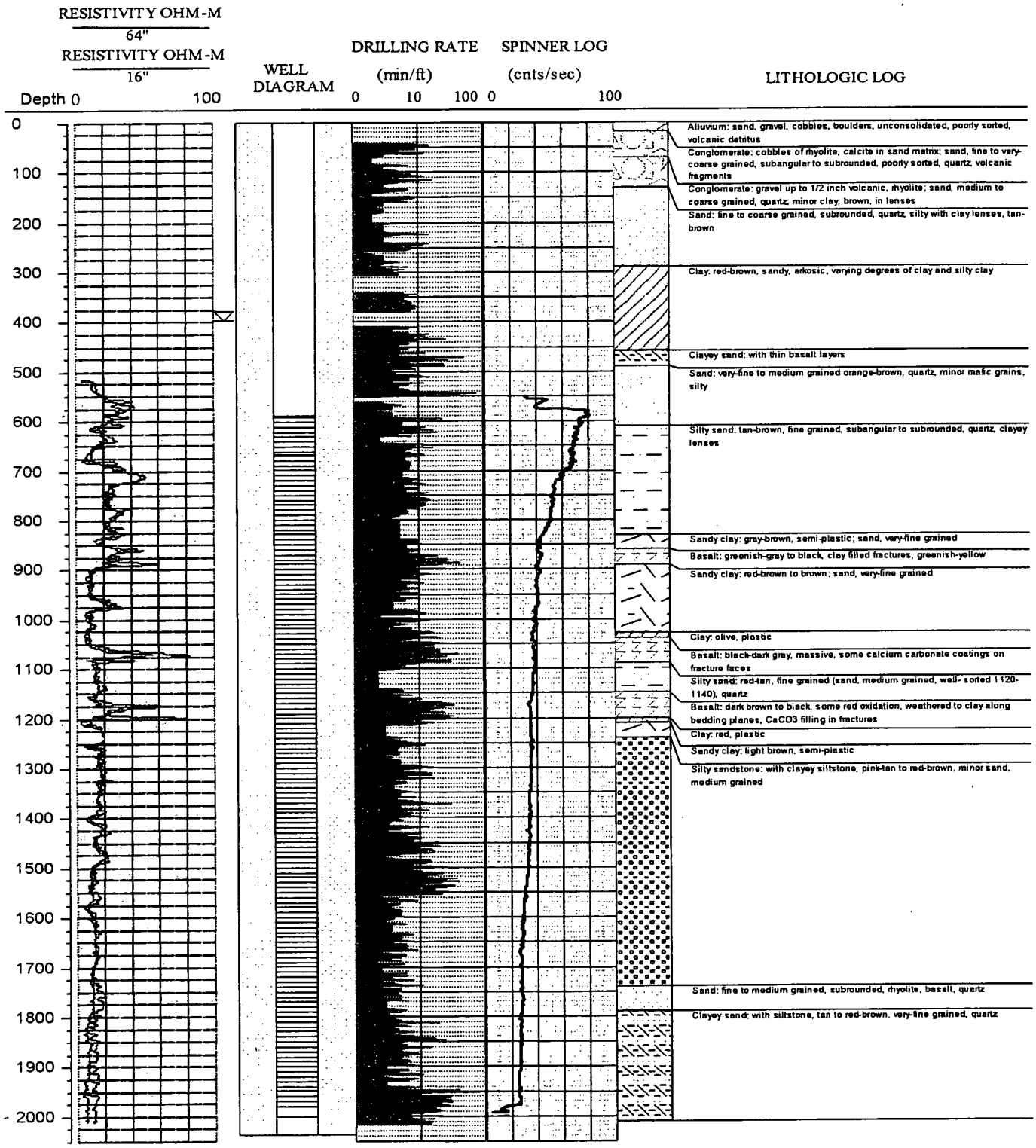


Figure 5. Presentation of resistivity log, location of perforated interval, drilling time, borehole velocity, and lithology, GR-3.

Los Alamos National Labs GR-4

Hydrogeologist: JSAI

Contractor: Beylik Drilling

Drilling Method: Reverse-Mud Rotary

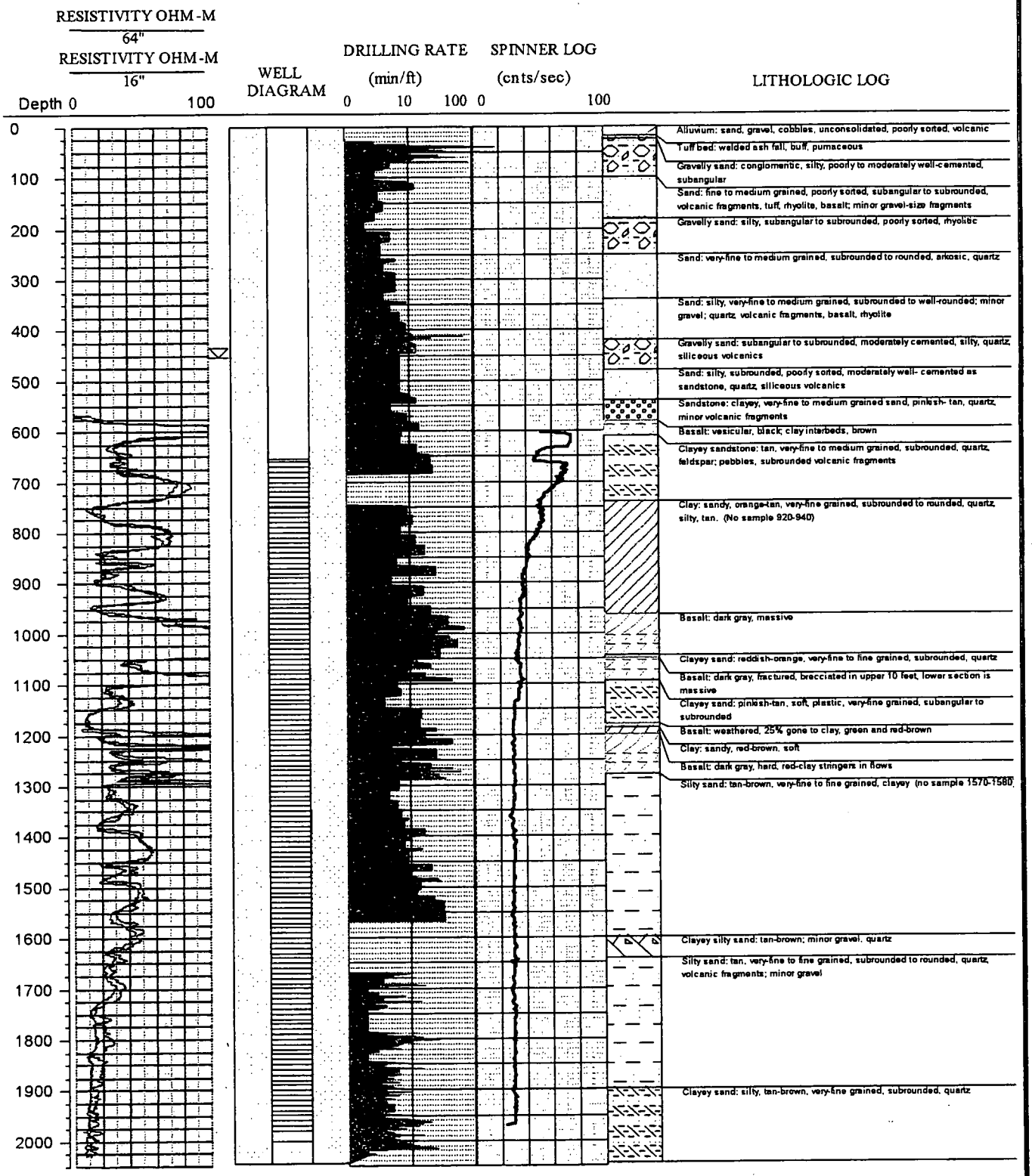


Figure 6. Presentation of resistivity log, location of perforated interval, drilling time, borehole velocity, and lithology, GR-4.

Borehole Alignment

Deviation surveys were taken at regular intervals of approximately 60 ft during the drilling of each pilot hole. Surveys were taken using a Totco self-adjusting survey tool with a 1-1/2-degree range. Specifications allowed the borehole to deviate up to 6 in. per 100 ft (0.29 degrees) from ground level to 1,000 ft, and up to 13 in. per 100 ft (0.62 degrees) between 1,000 ft and 2,000 ft. In addition to monitoring pilot-hole alignment during drilling, gyroscopic alignment surveys were performed three different times during drilling and once in each completed well. Deviation results for each of the four pilot holes, and plots of gyroscopic surveys of the completed wells, are provided in the appendices.

Pilot-hole alignment was checked with gyroscopic surveys at surface-casing depth, at 1,000 ft, and at total depth. Results in each of the wells confirmed earlier checks that indicated the pilot holes met specifications.

Surface Casing Installation

After geophysical logs were obtained, the borehole was reamed to 34-in. diameter in preparation for installation of 28-in. surface casing. Surface casing was installed and pressure grouted to a depth of at least 100 ft below the depth to water. Halliburton provided cementing services. Most of the cement pumped contained up to 50 percent pozzolanic material (light-weight aggregate) followed by enough neat cement to form a 100-ft neat-cement seal around the casing shoe.

GEOLOGY

The Guaje wells are completed in sedimentary and volcanic rocks of the Pajarito Plateau and the underlying Tertiary-age Santa Fe Group sediments. Located in Guaje Canyon, below exposures of the plateau-capping Bandelier Tuff and upper Puye Conglomerate, wells in the Guaje well field penetrate a sequence that includes, from top to bottom, alluvium, Puye Conglomerate, Chaquehui Formation, and Tesuque Formation. Because of the substantial depths to water and the well construction, production comes mostly from the upper part of the Tesuque Formation sediments. Descriptions of formation samples are provided in the appendices.

Starting at ground surface, drilling encountered 20 to 30 ft of alluvial sediments composed, not surprisingly, of volcanic detritus eroded from the Pajarito Plateau. Grain size of the alluvium ranged from silt to large boulders. The alluvium contains pockets of perched water, the presence of which was observed at well GR-1 during excavation for conductor casing.

Beneath the ribbon-like deposits of alluvial sediments occupying the canyon floor, boreholes encountered the fanglomerate member of the Pliocene-age Puye Conglomerate. The fanglomerate consists of rhyolite, latite, dacite, and tuff fragments in a poorly-sorted and poorly-cemented matrix of volcanic detritus. Grain size ranges from clay to large boulders.

The lower Puye, or Totavi Lentil, is a poorly sorted channel-like deposit but with an apparent broad area of distribution. Granitic rock types make up the Totavi, including quartz, gneiss, and quartzite in a sand matrix (Purtymun, 1995). Thickness of the Totavi in the Guaje well field is about 100 ft.

In 1992, Purtymun (1995) proposed formation status for a sequence of channel sands and axial river deposits identified in a number of deep supply wells on the plateau. Named for a canyon tributary to White Rock Canyon on the Rio Grande, the Chaquehui Formation is composed of a mixture of volcanic, arkosic, and granitic debris from local and distant sources. The Chaquehui is a fairly clean and well-sorted deposit of sand and small gravel. Lying between the Puye Conglomerate and underlying Tesuque Formation, the Chaquehui is thought to be late Miocene in age. The Chaquehui appears to be water bearing; however, in the Guaje well field area, it extends only about 100 ft below the water table and consequently, the Guaje replacement wells do not produce directly from it.

The Tesuque Formation of the Santa Fe Group lies below the Chaquehui in the vicinity of the Guaje well field. The Tesuque Formation is a basin-fill deposit consisting of red to reddish-brown, fine-grained, silty sandstone and silty clay, with interbedded lenses of medium-grained sand and sandstone. The Tesuque Formation is remarkably consistent in texture throughout the Espanola Basin. The Espanola Basin occupies an area extending from the Abiquiu embayment on the north to La Bajada Mesa to the south. The east boundary traces the mountain front of the Sangre de Cristos and the west boundary is thought to coincide with the Pajarito Fault zone (Smith, 1998).

Basalt layers and basaltic inter-flow breccias in the Tesuque Formation were encountered during drilling of the Guaje replacement wells. The basalt is generally dark gray to black, although red pumiceous transition zones are evident. Texturally, the basalt is massive to vesicular and it is often fractured. Calcite filling of fractures and vesicles is common.

Geophysical Logging

Geophysical logging of the Guaje replacement wells was provided by a combination of three different logging service companies including Schlumberger, Southwest Geophysical Services, Inc., and Welenco. In general, logs for each well included 16-in. and 64-in. resistivity, induction resistivity, SP, gamma ray, neutron, caliper, temperature, mud resistivity, sonic, and gyroscopic borehole deviation. Additionally, borehole velocity (spinner) surveys were performed in the finished wells during test pumping.

The logging suite for the first well drilled (GR-2) was performed by Schlumberger and was the most elaborate of the project. Instead of a standard resistivity and induction log combination, an array induction and microlog survey were performed. A dipole full-wave sonic log was run in place of a normal acoustic velocity log, and its data were used to generate a formation permeability log. A natural gamma-ray spectrum and a lithodensity log were also performed.

Logged intervals were from total depth, usually around 2,020 ft, to the bottom of the surface casing for the respective wells. Logs are of good quality considering the large borehole diameter. Copies of the geophysical log prints are provided in a separate volume.

Production Well Construction

Well construction recommendations were finalized and materials ordered after pilot hole information was obtained and reviewed. Total lengths of perforated and blank casing were confirmed based on review of formation samples and geophysical logs. Perforation slot-size and sand pack gradation were selected based on sieve analysis of the formation samples. Well construction began after the pilot hole was reamed from 17-1/2-in. to 26-in. diameter. Well completion diagrams are provided in the appendices.

Casing Materials and Installation: After each pilot hole was enlarged from 17-1/2-in. diameter to 26-in. diameter, in preparation for casing installation, caliper logs of the boreholes were performed in order to evaluate the condition of the hole and to establish an estimate of the annular volume. Tubing for sand pack installation was set to near total depth and suspended from the surface casing below the rig floor. Casing joints were made up by welding. Joint lengths were nominal 40-ft, with some minor variation. Because of limited working room at the sites, casing was brought in from a nearby staging location one trailer-load at a time.

Blank casing consists of 16-in. diameter stainless steel and high-strength low alloy steel manufactured and supplied by Roscoe Moss Co. Stainless steel casing was fabricated from steel meeting ASTM A409, Type 304 specifications, and the high-strength low alloy casing was produced from steel meeting ASTM A242, Type 4 specifications. Wall thickness of the blank casing is 3/8-in., and inside diameter is 15-7/8-in. Both stainless steel and high-strength, low-alloy steel casing has spiral welded seams. All casing joints were supplied with weld collars for field assembly.

Perforated casing is 16-in., Type 304 stainless steel, louver-perforated pipe manufactured and supplied by Roscoe Moss Co., meeting ASTM A409. Wall thickness is 5/16-in. and inside diameter is 16-in. Casing perforations are arranged in a modified FulFlo pattern with ten rows of perforations and 120 perforations per foot, with 0.050-in. wide slots, providing an open area of 14.25 in.^{2}/ft.

During casing installation, the weight indicator was monitored for sudden loss of weight, which would indicate a problem with the borehole or casing string, but none was noted. Centralizers were welded to the perforated section of the casing string every 80 ft to provide approximately 3 in. of offset from the borehole wall. All welding associated with field assembly of casing, gage-line transition fabrication, and wellhead completion was performed by certified welders working for Right Bit Service, Inc.

Two 2-in. gage lines make gradual transitions into the casing strings approximately 300 ft below the non-pumping water level. Transitions occur in a 6-ft long section of blank casing in the perforated interval. The gage line is threaded and coupled, assembled from 21-ft-long joints, attached to the casing by welding each coupling to the casing.

Casing installation for each well required about 24 hours of continuous work to complete. Total weight of each casing string was about 120,000 pounds. After the casing was placed, site activity shifted to preparing for sand pack installation.

Sand Pack Installation: In order to condition the drilling fluid for sand pack installation, the fluid had to be thinned with potable water. Because the wastewater generated by thinning the drilling fluid did not meet the stringent discharge criteria, it had to be treated prior to release. A discussion of the treatment plant and its operation is provided under **WELL DEVELOPMENT**, below.

Gradation of the sand pack was selected based on sieve analysis results of the formation samples. The aquifer material contains abundant fine sand and silt, and for that reason, control of sand production requires a relatively fine sand pack gradation and small perforation slot size. The recommended slot size and sand pack gradation were 0.050-in. and 8-20 respectively. The selection was successful in controlling sand production with no apparent adverse effect on well efficiency. Plots of sieve-analysis results of formation samples, and of the selected sand pack, for each well are shown in the appendices.

Sand pack was placed in the annulus by gravity feed through 2-in. tubing initially installed to near total depth. The sand pack was disinfected by adding approximately 1/2 gallon of 10-percent sodium hypochlorite solution to each cubic yard of sand. As the annulus filled, the sand pack level was monitored with the tubing, which was removed three joints (nominally 100 ft) at a time. Sand pack was placed from total depth to ground level.

WELL DEVELOPMENT

Discharge Criteria and Treatment Plant Operation

Water discharged to the environment was required to meet New Mexico Water Quality Control Commission standards for livestock watering and wildlife habitat (NMWQCC 20 NMAC 6.1 "stream standards"). In order to bring the waste drilling fluid and produced water into compliance with the discharge criteria, the Contractor fabricated and operated a treatment plant for the duration of the project. The following table presents the constituents and discharge limits.

Table 1. Discharge criteria, Guaje replacement well drilling

aluminum, mg/l (2)	arsenic, mg/l (2)	beryllium, µg/l (1)	baron, mg/l (2)	cadmium, mg/l (2)	chromium, mg/l (2)	cobalt, mg/l (2)	copper, mg/l (2)	lead, mg/l (2)	mercury, µg/l (1)	nickel, µg/l (1)	selenium, µg/l (1)	silver, µg/l (1)	vanadium, mg/l (2)	zinc, mg/l (2)	pH (3)	total chlorine, mg/l (3)	oil and grease, mg/l (3)	turbidity, ntu (3)	TDS, mg/l (3)
5	0.2	130	5	0.05	1	1	0.5	0.1	0.002	489	0	587	0.1	25	6-9	1	15	50	500

(1) fisheries standard
(2) livestock watering standard
(3) general well discharge standard

mg/l milligrams per liter
µg/l micrograms per liter
ntu nephelometric turbidity units

The treatment plant consisted of a two-stage process. Primary treatment of fluid with high solids content, as in the case of the drilling fluid, involved separation of the bulk of suspended solids with a SWACO 2,100-rpm centrifuge. Secondary treatment involved filtration with a US Filter diatomaceous earth filter. After several days of testing and adjusting the treatment plant equipment, the Contractor succeeded in maintaining compliance with the discharge criteria.

Untreated and non-compliant fluid was contained in one or more of the nine 21,000-gallon storage tanks staged at the treatment plant site. Operators monitored filtered water at 15-minute intervals for pH, turbidity, total chlorine, and TDS prior to discharge. Water not meeting the discharge criteria was stored and retreated. Analysis for compliance with metals standards was performed periodically by LANL and by a private laboratory hired by the Contractor.

Treated water meeting the discharge criteria was pumped into (the normally dry) Guaje Creek. Metered discharge ranged from 30 to 350 gpm, depending on condition of the filter media. Storm water pollution controls including straw bales and silt fencing were placed in the creek channel to prevent erosion.

Zoned Airlift Pumping

The first application of well development was zoned air-lift pumping. The air-lift development tool consisted of two 16-in.-diameter rubber swabs, one on each end of a 7-in. diameter, 20-ft-long section of perforated pipe. The double swab tool was installed to the top of the perforated section on 5-in. or 7-in. pipe and an air line run inside the pipe to a depth sufficient to provide 40- to 50-percent submergence (500 to 900 ft depending on the depth to water in the wells). Air compressors with ratings of 900 cfm at 350 psi were used to pump the wells.

The general procedure employed for development was to set the swab tool in a section of the perforated casing and start the air compressor. After initially overcoming the static water column, discharge pressure stabilized between 170 and 230 psi, depending on air-line submergence.

The produced water was cloudy at first with initial sand production of up to 100 ppm, as measured with an Imhoff cone. With clearing of the produced water, the swab tool was raised and lowered vigorously, which liberated fines from the formation and sand pack and increased turbidity. This process was continued until little or no increase in turbidity was noted after swabbing, at which time the tool was moved to the next zone. Two complete passes of the perforated section were made during zoned air-lift pumping development.

Approximately 1 hour of development time was devoted to each 20-ft zone in the perforated interval. Field measurements included temperature of produced water, specific conductance of the water, and discharge air pressure, as well as estimates of flow rate, turbidity and sand production. Upon completion of air-lift development, the Contractor introduced a total of 50 gallons of 10-percent sodium hypochlorite solution down the drill pipe as the swab tool was removed.

Development by Pumping

During development pumping and test pumping, water levels, flow rates, and discharge characteristics were regularly monitored and recorded. Water levels were measured with a Powers electric well sounder calibrated to 0.01 ft increments; additionally, water-level data generated during the pumping tests were recorded by a transducer and data logger supplied by the Water Quality and Hydrology Group (ES&H-18) at LANL.

Flow rate was measured by means of an instantaneous and totalizing flow meter, and also with an orifice plate and manometer. Flow rate was regulated with the test engine and a gate valve located in the 8-in. discharge pipe. Sand was measured with a Rossum sand sampler.

During development pumping, the initial flow rate was restricted, usually to a pumping rate of between 200 and 400 gpm, depending on the well's reaction to pumping. Pumping continued at these low initial rates until turbidity and sand production decreased. As part of the development process, the pump was turned off at regular intervals to allow the water in the column pipe to drain back into the well. Similar to the swabbing action performed during air-lift development, surging is a development technique used to break up any remaining wall cake and promote imbrication of the sand pack.

Pumping and surging continued until there was no measurable improvement in well performance, as judged by comparing specific capacity values over time, and no change in sand production or water clarity. Development by pumping and surging was completed in 2 to 4 days at GR-2, GR-3, and GR-4. At GR-1, however, more effort was expended in attempting to increase well yield through development, including use of chemical treatment and zone pumping techniques. It was eventually determined that production from GR-1 was limited by the aquifer's properties, not low efficiency. Well efficiency is discussed in the **Step-Drawdown Test and Well Efficiency** section of this report.

AQUIFER TESTING

After well development was deemed complete, the water level in each well was allowed to recover prior to performing pumping tests. Pumping tests consisted of a 48-hour constant-rate test and a 500-minute step-drawdown test. Pumping-test data are included in the appendices. Plots of pumping test data are presented in Figures 7 and 8.

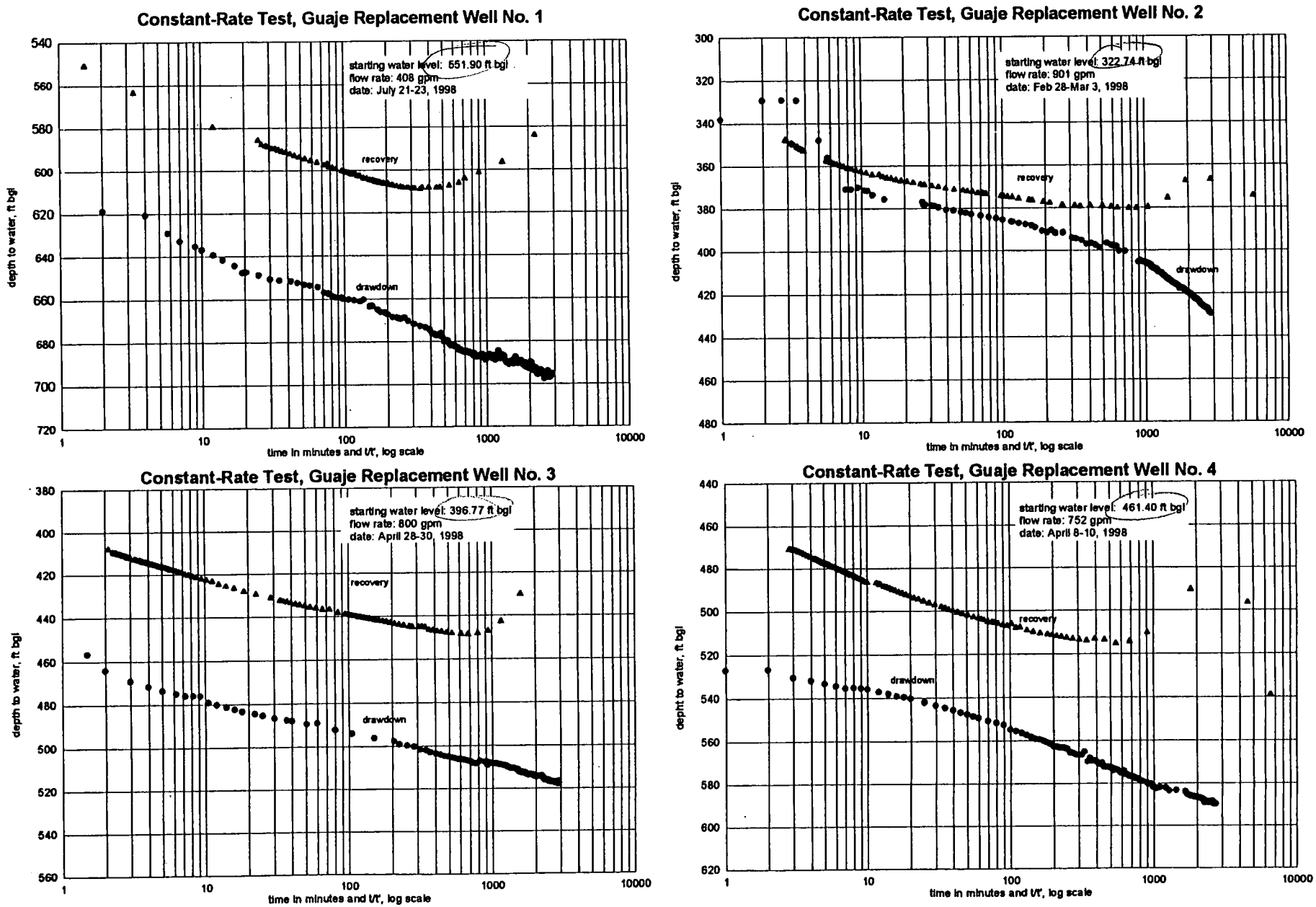
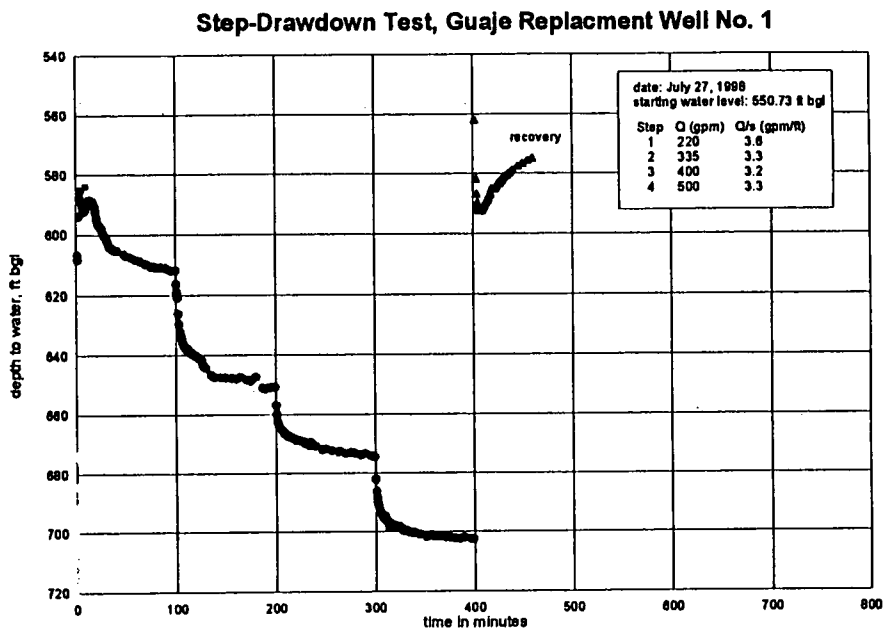
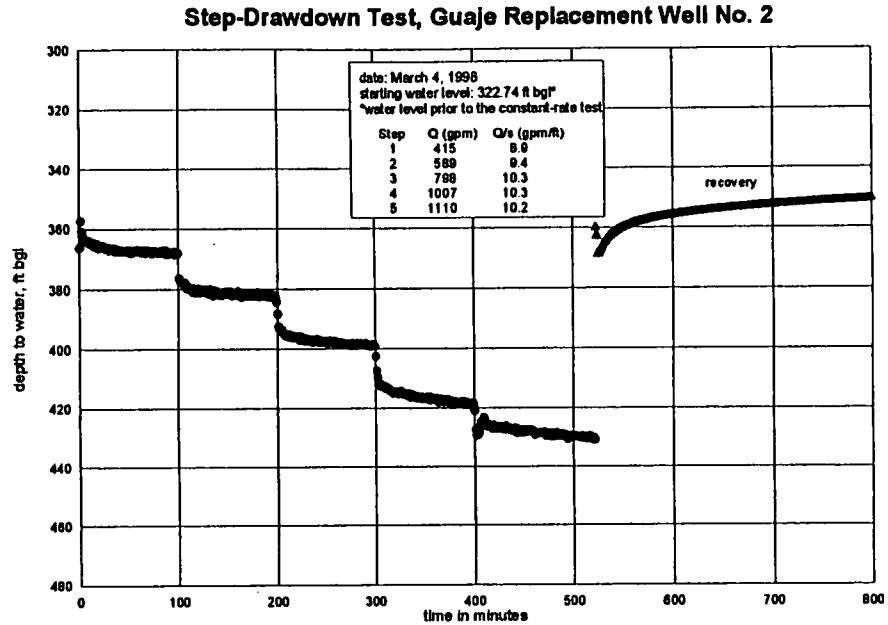
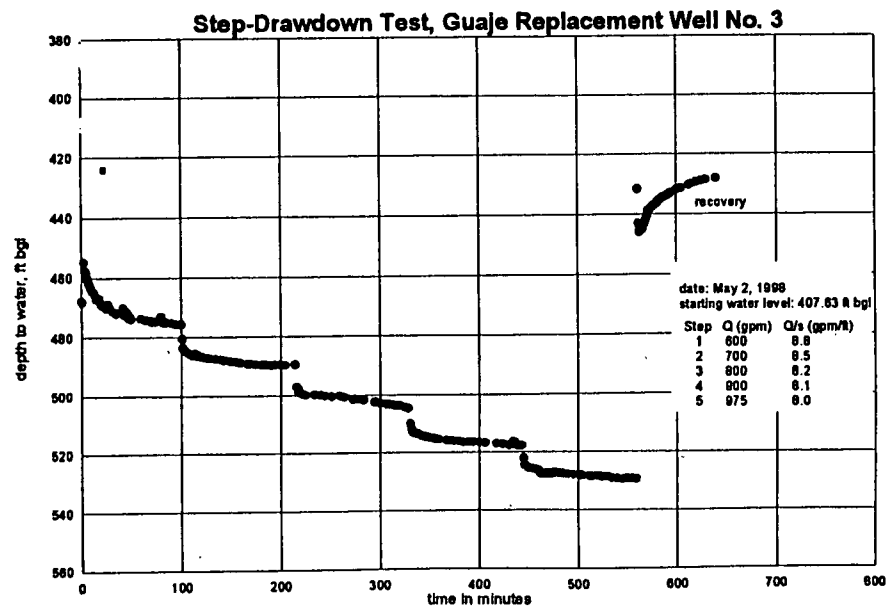


Figure 7. Plots of constant-rate pumping test data, Guaje replacement wells.







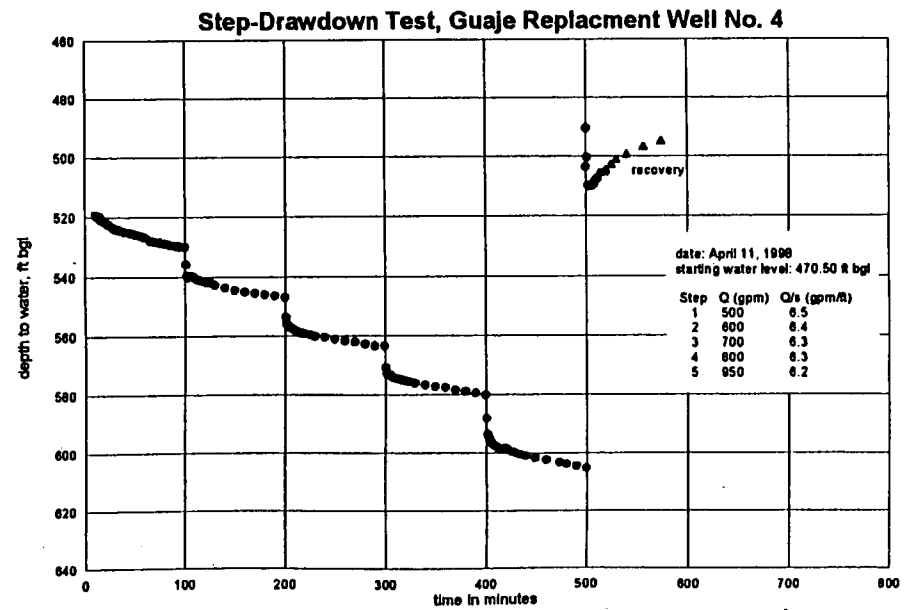


Figure 8. Plots of step-drawdown test data, Guaje replacement wells.

Constant-Rate Test

A constant-rate test was performed on each of the four Guaje replacement wells. Pumping test duration was 48 hours plus associated recovery time. The following table summarizes pumping-test results.

Table 2. Summary of 48-hour constant-rate pumping test data, Guaje replacement wells

Sfc Elev	well number	pre-pumping water level, ft bgl	pumping rate, gpm	drawdown after 48-hour test, ft	specific capacity, gpm/ft
6414	GR-1	551.90 5862.1	408	143.72	2.84
6440	GR-2	322.74 5817.26	901	106.93	8.43
6212	GR-3	396.77 5815.23	800	121.56	6.58
6279	GR-4	461.40 5837.6	752	128.85	5.84

ft bgl feet below ground level
gpm gallons per minute
gpm/ft gallons per minute per foot

Transmissivity was estimated from a semi-log plot of pumping-test data and applying the Cooper-Jacob solution (1946), illustrated below. Transmissivity values for the four Guaje replacement wells are shown in Table 3.

$$T = \frac{264 \times Q}{\Delta s}$$

where:

Δs is the change in water-level per log-cycle of time (ft/log cycle t in minutes)
Q is pumping rate in gallons per minute
T is transmissivity, gallons per day per foot
264 is a constant

Table 3. Transmissivity values estimated from constant-rate pumping tests

well number	transmissivity, gpd/ft
GR-1	4,400
GR-2	3,900
GR-3	13,200
GR-4	7,000

gpd/ft gallons per day per foot

Transmissivity values span a seemingly wide range for the relatively small well-field area, but correspond well to the equally wide-ranging specific capacity values. The constant-rate test of GR-2 revealed a barrier boundary affecting the rate of drawdown (Figure 7). The slope of the drawdown curve shown in the constant-rate test plot increases after about 800 minutes, and it is the later portion of the drawdown curve used to calculate transmissivity at GR-2. The physical manifestation of the boundary is likely either a fault or facies change. None of the tests of the other three Guaje replacement wells was affected by barrier boundaries.

Step-Drawdown Test and Well Efficiency

Step-drawdown tests were performed on each of the Guaje replacement wells following the constant-rate tests. Tests consisted of pumping the well at five progressively higher flow rates, for 100 minutes each at each rate (the step-drawdown test at GR-1 consisted of four flow rates). Total duration of each step-drawdown test was about 500 minutes (400 minutes at GR-1). Test data are summarized in Table 4. Plots of the step-drawdown data are shown in Figure 8.

Table 4. Step-drawdown test data representing ending measurements for each step, Guaje replacement wells

well number	step 1 rate and Q/s	step 2 rate and Q/s	step 3 rate and Q/s	step 4 rate and Q/s	step 5 rate and Q/s
GR-1	220 / 3.6	335 / 3.3	400 / 3.2	500 / 3.3	n/a
GR-2	415 / 8.9	589 / 9.4	798 / 10.3	1007 / 10.4	1,110 / 10.4
GR-3	600 / 8.8	700 / 8.5	800 / 8.2	900 / 8.1	975 / 8.0
GR-4	500 / 6.5	600 / 6.4	700 / 6.3	800 / 6.3	950 / 6.2

pumping rate in gallons per minute; Q/s in gallons per minute per foot

The primary reason for performing a step-drawdown test is to measure well efficiency. Well efficiency is an expression of how efficiently water flows from the aquifer to the interior of the well. Head losses in the invaded zone, in the sand-pack envelope, and across the perforated casing all contribute to well loss. High well loss leads to low well efficiency resulting in undue drawdown in the well.

Well efficiency was estimated using the step-drawdown data and applying a method developed by Bierschenk (1964). The method assumes that drawdown in the well is the sum of two components of head loss: aquifer loss and well loss. Aquifer loss is the component of drawdown caused by laminar flow in the aquifer and is dependent on aquifer transmissivity and storage coefficient. Well loss is the component of drawdown attributable to turbulent flow in and near the well, and is related to well design, construction methods, and development.

The Bierschenk method is represented by the following equation:

$$S_w = BQ + CQ^n$$

where,

S_w = total drawdown, ft
B = aquifer loss coefficient
C = well loss coefficient
Q = flow rate, gpm
n = approximately 2

Both the aquifer loss coefficient (B) and well loss coefficient (C) are determined from graphs of the step-drawdown test data, which plot specific drawdown (s/Q) against pumping rate (Q). The aquifer loss coefficient, B, is estimated as the y-intercept value at Q = 0 of a best-fit curve through the data points. The multiple of B and Q approximates the drawdown in the well due to aquifer losses. The well-loss coefficient, C, is taken as the slope of the curve. The multiple of C and Q^2 is an estimate of the drawdown in the well due to well loss.

After the step-drawdown tests of GR-2 and GR-3 were performed, it was discovered that incomplete water-level recovery from the constant-rate test had biased the drawdown data by exaggerating drawdown during the first two steps. The result was that more drawdown occurred during the first two steps than would have occurred if the water level in the well had been fully recovered. Consequently, well efficiency for GR-2 and GR-3 was estimated from data collected for steps 3 through 5 only. Well efficiency estimates are presented in Table 5.

Table 5. Well efficiency estimation, Guaje replacement wells

well number	step 1	step 2	step 3	step 4	step 5
GR-1	98 %	96 %	96 %	95 %	no data
GR-2	-	-	98 %	98 %	98 %
GR-3	-	-	91 %	92 %	89 %
GR-4	96 %	95 %	94 %	93 %	92 %

Where good test data allowed analysis by the Bierschenk method, well efficiency is shown to be high. The subtle trend of decreasing well efficiency at increasing flow rate is attributable to turbulent flow in and near the well having a greater influence at higher flow rates, and thus contributing more, as a percentage, to the total drawdown.

Borehole Velocity Surveys

Borehole velocity surveys (spinner tests) were performed in each of the wells. Flow was measured under both static and pumping conditions. Surveys indicated that all of the measurable flow into each well comes from the upper part of the perforated interval. Survey results from the final step-test rate are presented on the log plot in the appendices.

Water Quality

Water produced from the Guaje well field appears to be of very good quality. Field water-quality parameters monitored during development and test pumping included temperature, pH, and specific conductance. A summary of field-monitored water-quality parameters recorded toward the end of test pumping of each well is presented in Table 6.

Table 6. Summary of field-monitored water quality, Guaje replacement wells

well number	temperature, °F	pH	specific conductance, µmhos/cm
GR-1	91	7.4	186
GR-2	84	8.4	185
GR-3	83	8.2	210
GR-4	81	8.3	178

µmhos/cm micromhos per centimeter

The produced water is warm, presumably due to hydrothermal influence from the Jemez caldera complex. The pH is below the drinking water standard of 9 pH units, and typical for ground water. Specific conductance of the produced water is very low for ground water, an indication that dissolved mineral content is low.

Composite water samples were collected for analysis during test pumping, and discrete-interval water samples were collected during a later phase of zoned packer testing in each well. Analytical results of the sampling are not yet available and, therefore, not presented in this report. Water samples collected by ES&H-18 personnel for bacteriological analysis reportedly showed no bacteriological contamination.

FINAL WELL TESTING

Well Alignment

Alignment of the completed wells was verified with a gyroscopic survey performed by Welenco, a geophysical service company working as a subcontractor to Beylik Drilling. Each of the Guaje replacement wells met the strict alignment criteria of 6-in. of allowable horizontal drift in any 100 ft of depth. The alignment data are presented in a tabular format and as graphical plots in the appendices.

Wellhead Completion and Site Cleanup

Wellhead completion was performed by Right Bit Service under subcontract to Beylik Drilling. Completion consisted of finishing the top-of-casing elevations, gage lines, and the sand pack access pipes as specified.

In order to install the sand pack access pipes, soil around the wells was excavated to a depth of approximately 15 ft and a penetration was made into the 28-in. surface casing for access to the sand pack. A 6-in. diameter pipe was attached to the surface casing by welding to cover the penetration. The access pipes angle upward away from the well centerlines to provide sufficient distance between the well casing and the access pipe at ground level for planned construction of well-house foundations.

The four well locations and the treatment-plant site were cleaned and finish graded over a several-week period prior to final inspection on August 11, 1998. Representatives from JSAI, Beylik Drilling, and LANL attended the final site inspection. No major outstanding issues were identified, and the project was informally accepted.

REFERENCES CITED

Bierschenk, W.H., 1964, Determining well efficiency by multiple step-drawdown tests: International Association of Scientific Hydrology, Publication 64.

Cooper, H. H., and Jacob, C. E., 1946, A generalized graphical method for evaluating formation constants and summarizing well field history: American Geophysical Union, Transactions, v. 27, p. 526-534.

McLin, S. G., 1997, Water supply at Los Alamos during 1996: Los Alamos National Laboratories Progress Report LA-13371-PR, 42 p.

Purtymun, W. D., 1995, Geologic and hydrologic records of observations wells, test holes, test wells, supply wells, springs, and surface water stations in the Los Alamos Area: Los Alamos National Laboratories publication LA-12883-MS, 339 p.

Purtymun, W. D., 1998, Descriptions of formation samples, Guaje replacement wells: independent study.

Smith, G., 1998, Proceedings from Espanola Workshop, work in progress.

Appendix I

(Guaje Replacement Well No. 1)

Appendix I-1

State Engineer Office Well Record, GR-1

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Los Alamos National Laboratory Owner's Well No. GR-1

Street or Post Office Address P.O. Box 1663

City and State Los Alamos, NM 87545

Well was drilled under Permit No. RG-486 and is located in the:

a. ___ ¼ NE ¼ SW ¼ SE ¼ of Section 31 Township 20 N Range 7 E N.M.P.M.

b. Tract No. - of Map No. - of the -

c. Lot No. - of Block No. - of the -
Subdivision, recorded in - County.

d. X= - feet, Y= - feet, N.M. Coordinate System - Zone in the - Grant.

(B) Drilling Contractor Beylik Drilling, Inc. License No. WD-1105

Address 3702 B State Highway 528, Rio Rancho, NM 87124

Drilling Began 1/19/98 Completed 6/20/98 Type tools Reverse Rotary Size of hole 36/26 in.

Elevation of land surface or - at well is 6414 ft. Total depth of well 2000 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 554 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
690	2000	1310	SEE ATTACHED	1,200

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
28"	110.64	-	0	690	690	-	-	-
16 5/8"LC	65.08	-	+3	488.1	491.10	-	-	-
16 5/8"SS	66.06	-	488.1	764.6	276.5	-	-	-
16 5/8"SS	54.54	-	764.6	1980	1215.4	-	746.6	1980
16 5/8"SS	66.06	-	1980	2000	20	SE HEAD	-	-

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
0	690	36"	1198 sk. Cement	2130	Pressure Cement with
			49,050# Pozmix		Halliburton
			2453 # Bentonite		
			38 sk CC		

Section 5. PLUGGING RECORD

Plugging Contractor

Address

Plugging Method

Date Well Plugged

Plugging approved by:

State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ___ FWL ___ FSL ___

File No. ___ Use ___ Location No. ___

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

BEYLIK DRILLING, INC

Driller

Kent M. Wartick / Division Manager

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Guaje Replacement Well No. 1
Summarized Sample Description

depth, ft	thickness, ft	description
0-20	20	Alluvium, unconsolidated silty sand and gravel, poorly sorted, angular to rounded, volcanic fragments, pumice.
20-90	70	Conglomerate, gravelly sand and silty sandstone; sand, very fine to coarse grained, subangular to subrounded, quartz, feldspar, and dark volcanic fragments.
90-200	110	Gravelly sand, medium to coarse grained, pebbly, subangular, moderately well-sorted, poorly cemented; quartz, rhyolitic volcanic fragments.
200-260	60	Sand, fine to coarse grained, poorly sorted, poorly cemented, subangular to subrounded, quartz, rhyolitic fragments.
260-300	40	Clay, reddish-brown, silty, plastic, contains rhyolitic and basaltic fragments.
300-500	200	Gravelly sand, silty, poorly sorted, subangular to subrounded, moderately cemented, arkosic, rhyolitic fragments, quartz.
500-640	140	Sand, silty, very-fine to medium grained, subrounded, quartz; less than or equal to 20% gravel, volcanic fragments.
640-675	35	Basalt, black, vesicular
675-700	25	Clayey sand, brown-orange to dark gray, subrounded, quartz.
700-750	50	Sand, silty, fine grained, pinkish-tan, subangular to subrounded, gravelly, quartz, feldspar.
750-780	30	Basalt, dark gray, vesicular, calcite fracture filling, upper 10 feet rubbly.
780-810	30	Sand, silty, fine grained, orange-brown, subrounded, quartz, feldspar.
810-840	30	Basalt, dark gray, vesicular, calcite fracture filling, lower 10 feet rubbly.
840-970	130	Sand, silty, very-fine to medium grained, brown-tan, subrounded, quartz; approximately 10% clay
970-1040	70	Basalt, dark gray to red, vesicular to pumaceous, calcite filling.
1040-1090	50	Sand, silty, fine to medium grained, brown to tan, quartz, basalt fragments.
1090-1220	30	Basalt, light to dark gray, amygdaloidal with calcite and chalcedony filling, 1090-1120 weathered.
1220-1260	40	Clayey sand, very-fine to fine grained, orange-brown, moderately well-sorted, quartz.
1260-1460	200	Basalt, weathered-massive, dark gray-red, vesicular, fractured, locally argillaceous.

Guaje Replacement Well No. 1
Summarized Sample Description

1460-1520	60	Sand, medium-grained, tan, quartz, minor silt.
1520-1530	10	Basalt, dark gray, fractured, gray-green fracture filling.
1530-1540	10	No sample.
1540-1690	150	Sand, silty, fine to medium grained, tan-red brown, poorly sorted, subangular-subrounded, quartz, feldspar; silty clay.
1690-1700	10	Basalt, agglomeritic, weathered, argillaceous, silty, tan.
1700-1800	100	Sand, silty, very-fine to fine grained, well-rounded, semi-plastic, quartz. (No sample 1720-1730 and 1740-1750)
1800-1870	70	Sandy clay, bentonitic, gray to red-brown, silty, plastic.
1870-1900	30	Sand, silty, fine to medium grained, quartz, feldspar.
1900-1910	10	No sample.
1910-1920	10	Clay, brown, plastic.
1920-1990	70	Sand, fine to medium grained, tan-gray, silty.
1990-2000	10	Sandy clay, brown, plastic.
2000-2040	40	Siltstone, gray to blue-gray, features concoidal fracture.

Appendix I-2

drilling fluid test results, GR-1 pilot hole

Drilling Fluid Properties for GR-1 – Pilot Hole

date	time	depth, ft	viscosity, sec/qt	weight, lb/gal	filtrate, cm^3/30 min.	pH	activity
2/20/98	15:40	776	30	8.6	14.4	7.0	drilling
2/21/98	10:30	822	30	8.6	15.0	10.0	drilling
2/22/98	10:00	1,004	30	8.5	11.2	9.5	logging
2/23/98	11:15	1,117	30	8.6	14.4	9.0	drilling
2/25/98	10:00	1,180	31	8.5	12.8	8.0	drilling
2/26/98	10:00	1,225	27	8.5	12.8	7.0	drilling
2/28/98	8:00	1,311	29	8.5	22.4	7.0	drilling
3/1/98	13:05	1,383	30	8.5	13.6	9.0	drilling
3/2/98	11:05	1,433	31	8.5	11.2	9.0	drilling
3/3/98	10:30	1,548	31	8.5	9.6	8.5	fishing
3/4/98	11:15	1,644	30	8.5	13.6	8.5	drilling
3/5/98	10:45	1,746	29	8.5	13.6	8.0	drilling
3/6/98	13:30	1,926	31	8.5	12.0	8.0	drilling

ft feet
sec/qt seconds per quart
lb/gal pounds per gallon
cm^3/30 min cubic centimeters per 30 minutes

Appendix I-3

deviation survey results, GR-1 pilot hole

Deviation survey results, LANL Guaje Replacement Well No. 1
(from Totco surveys in pilot hole)

depth, feet	deviation, degrees
60	0.125
120	0.125
180	0.0625
240	0.0625
300	0.1875
360	0.125
420	0.0625
480	0.0
540	0.125
600	0.0625
660	0.125
720	0.0625
780	0.0625
840	0.125
900	0.125
960	0.125
1,024	0.125
1,080	0.0625
1,140	0.125
1,185	0.125
1,240	0.0625
1,325	0.125
1,380	0.05
1,445	0.125
1,500	0.4
1,545	0.0625
1,620	0.0625
1,646	0.0625
1,700	0.0625
1,766	0.1875
1,826	0.1875
1,860	0.1875
1,926	0.1875
1,987	0.46

Appendix I-4

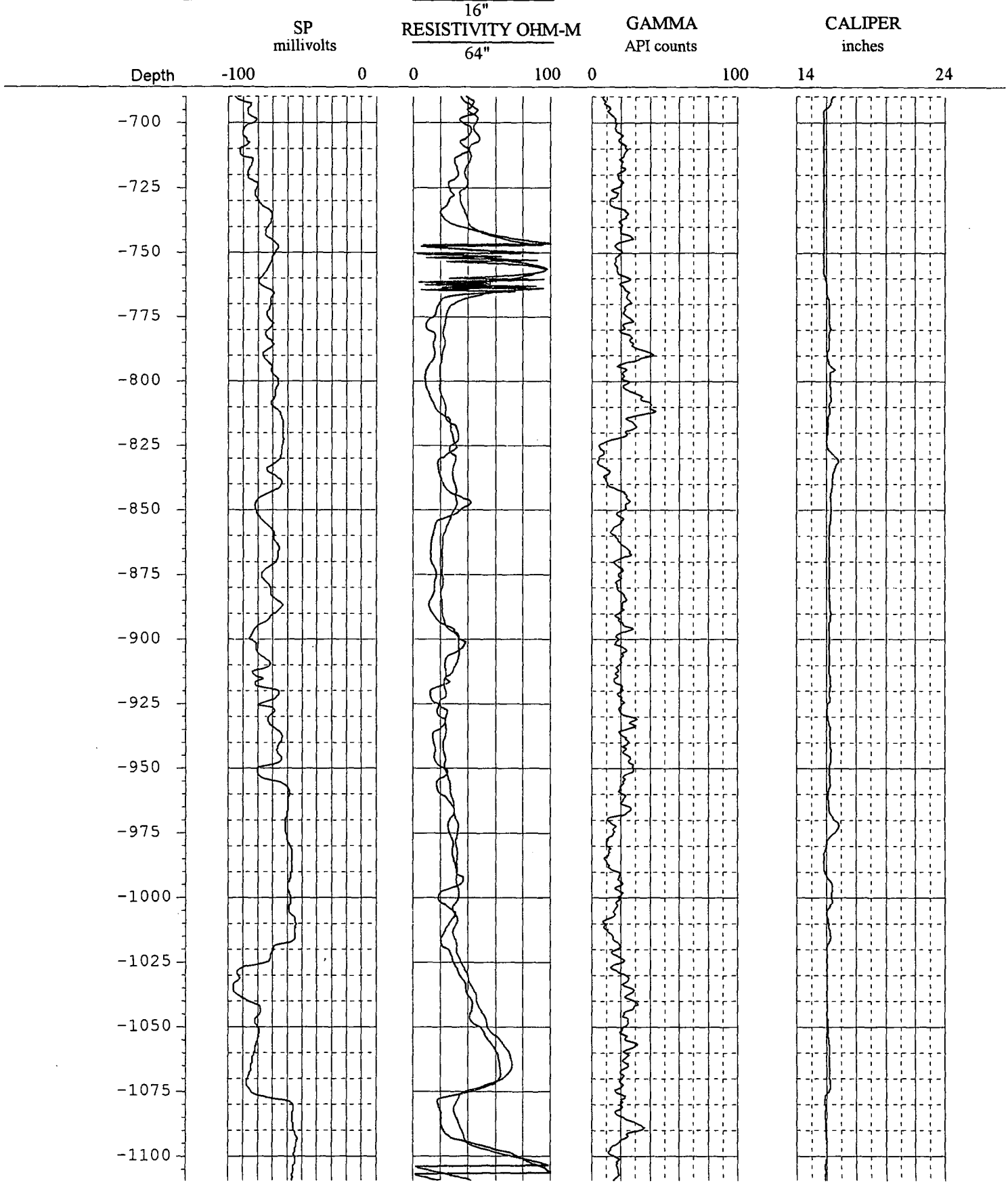
plots of geophysical log data, GR-1 pilot hole

JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-1

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Welenco
Casing: 28" to 690 ft
Bit Size: 17.5"
Date: March 7, 1998

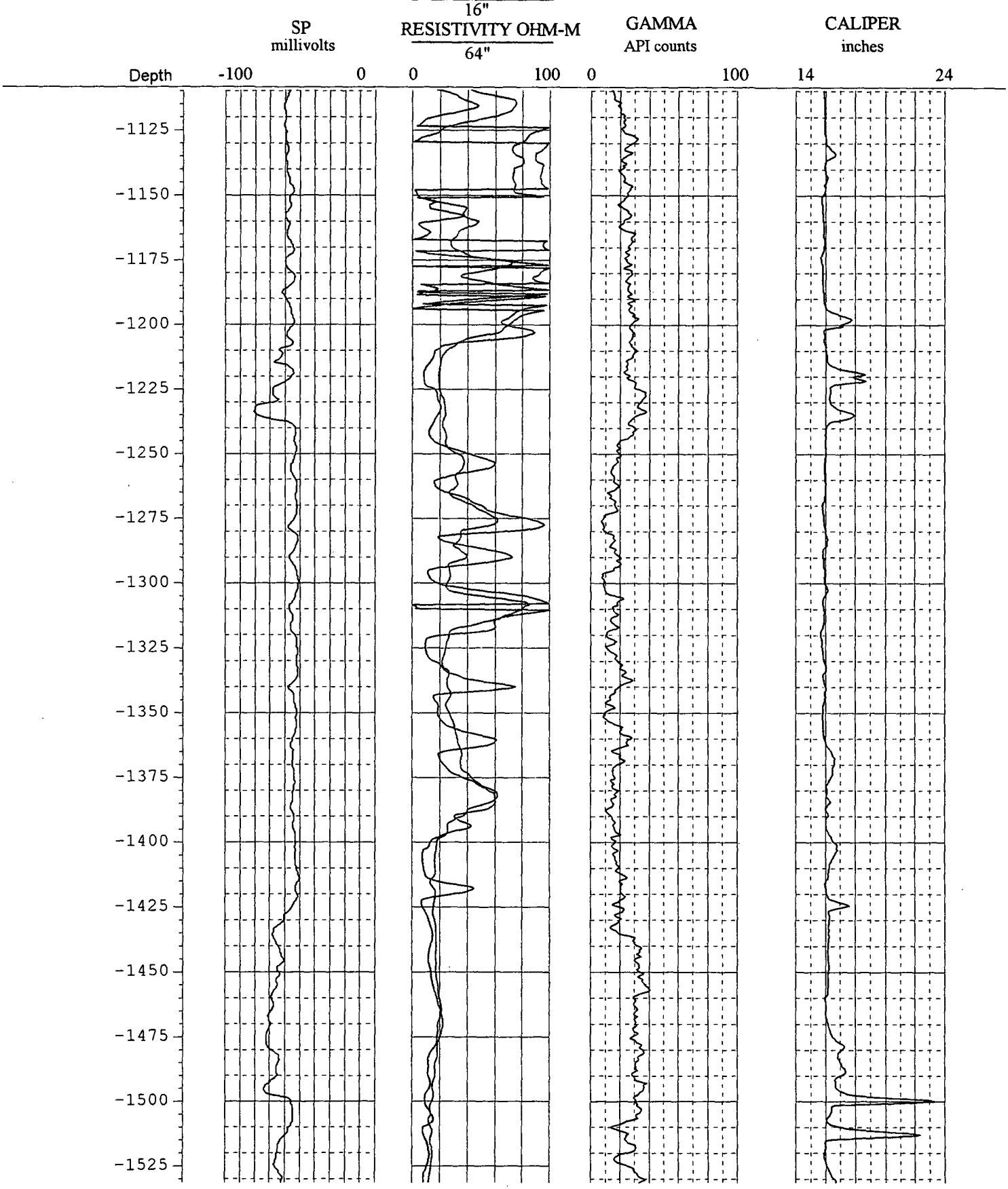


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-1

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Welenco
Casing: 28" to 690 ft
Bit Size: 17.5"
Date: March 7, 1998

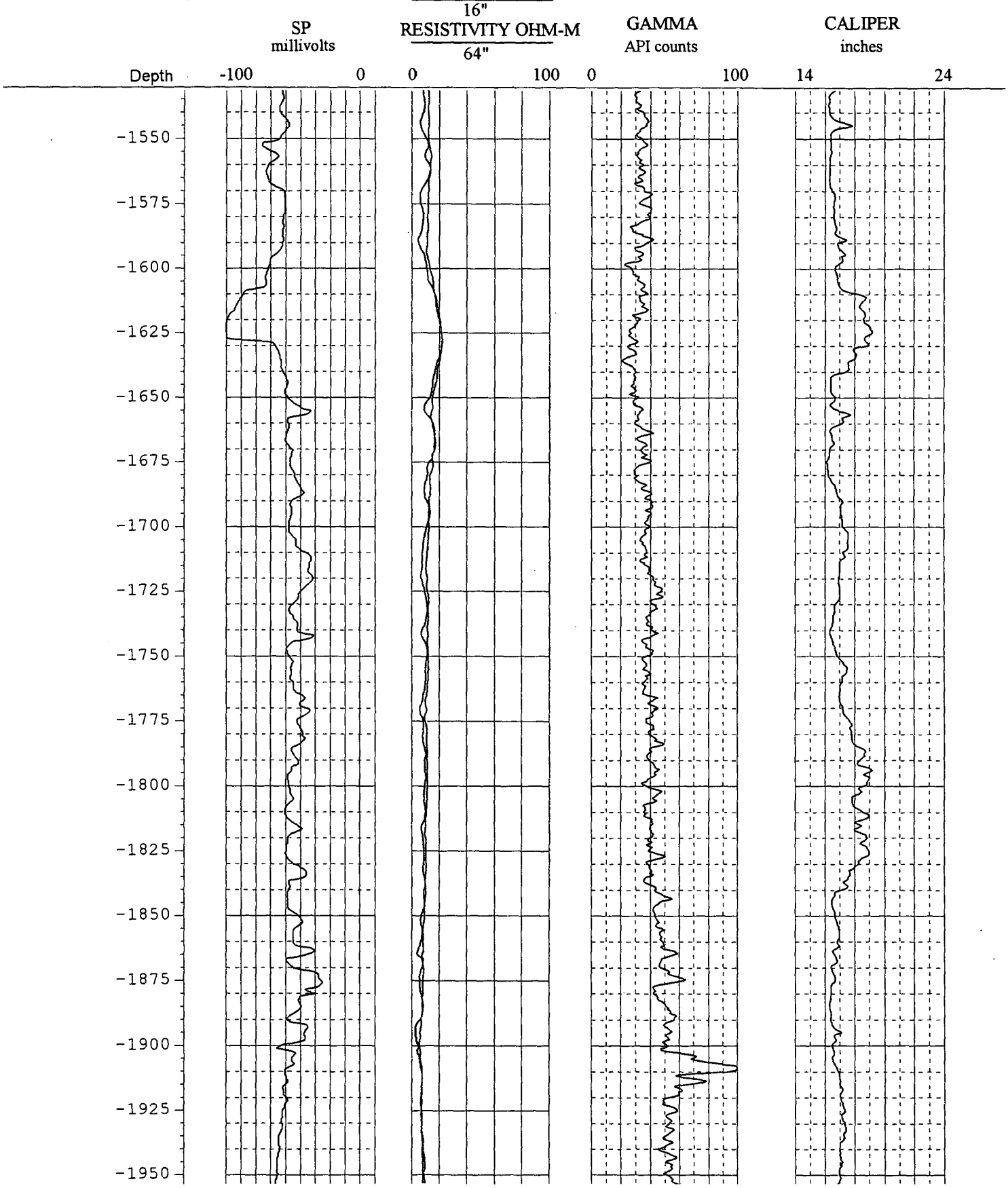


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-1

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Welenco
Casing: 28" to 690 ft
Bit Size: 17.5"
Date: March 7, 1998

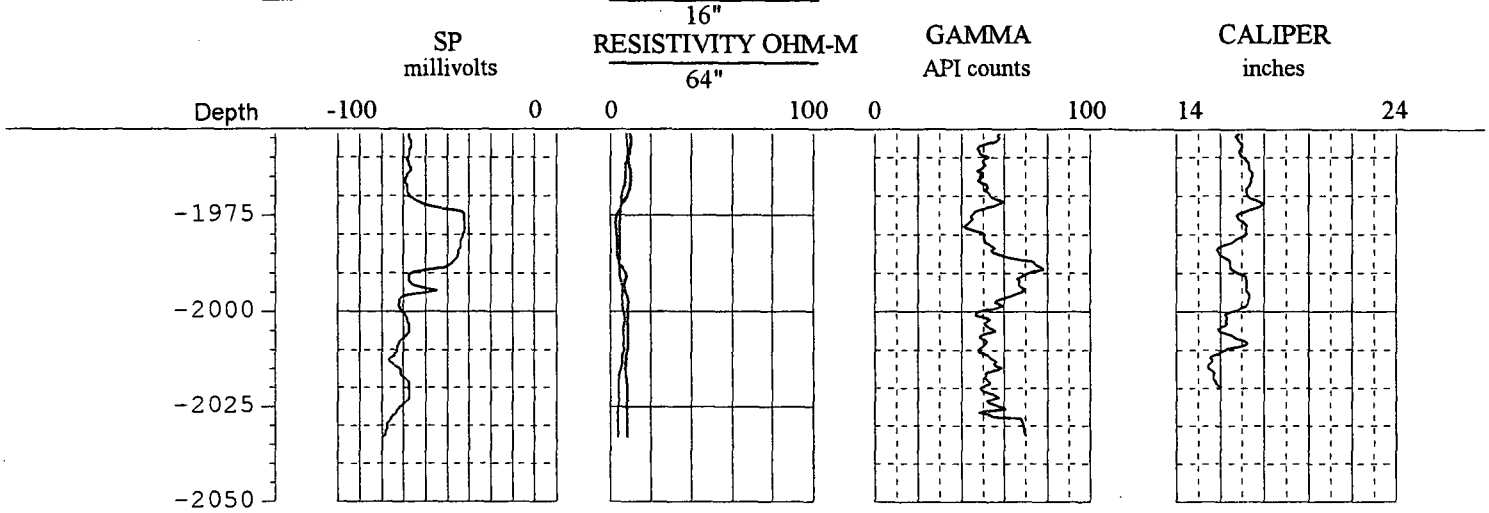


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-1

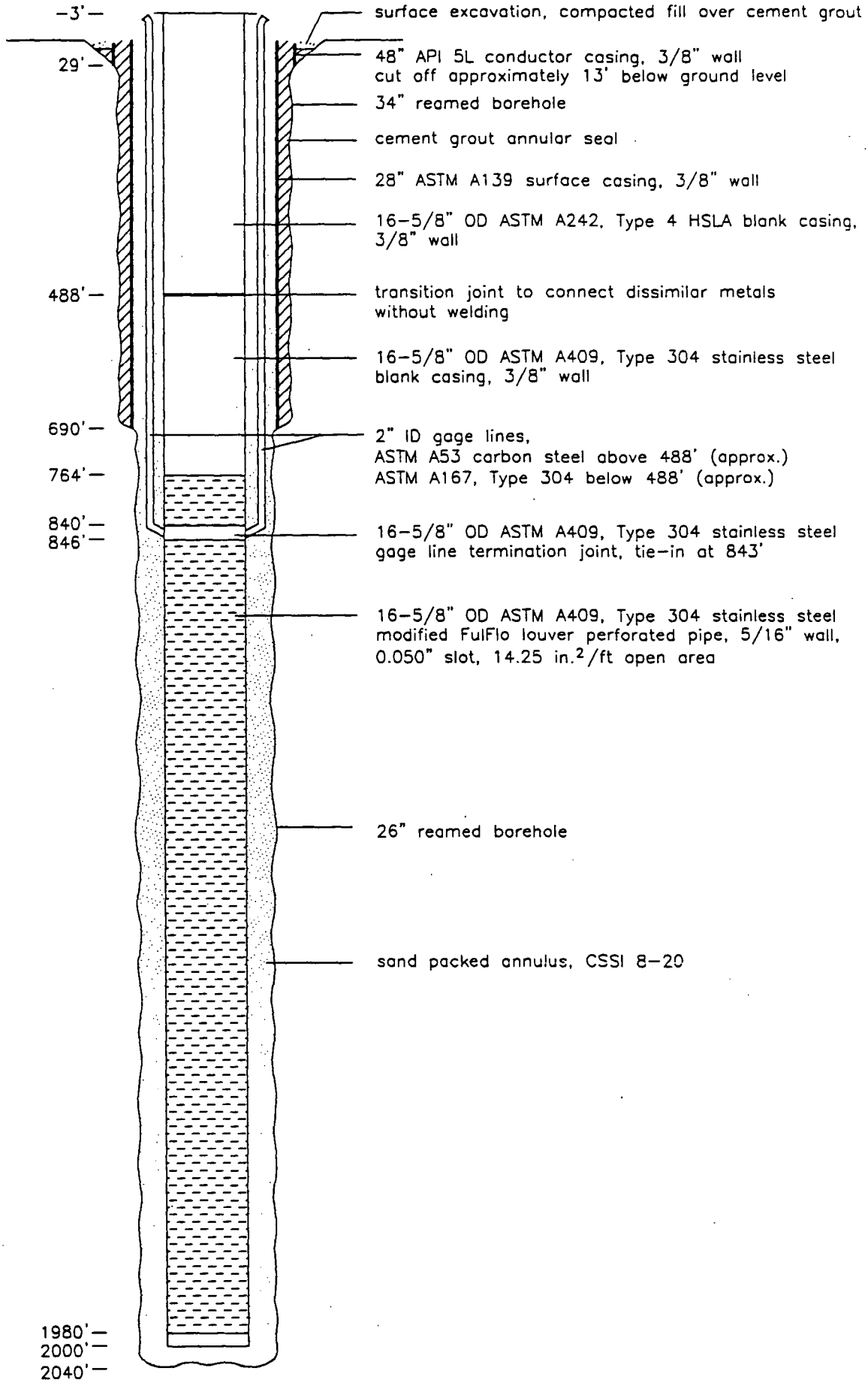
Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Welenco
Casing: 28" to 690 ft
Bit Size: 17.5"
Date: March 7, 1998



Appendix I-5

well completion diagram, GR-1



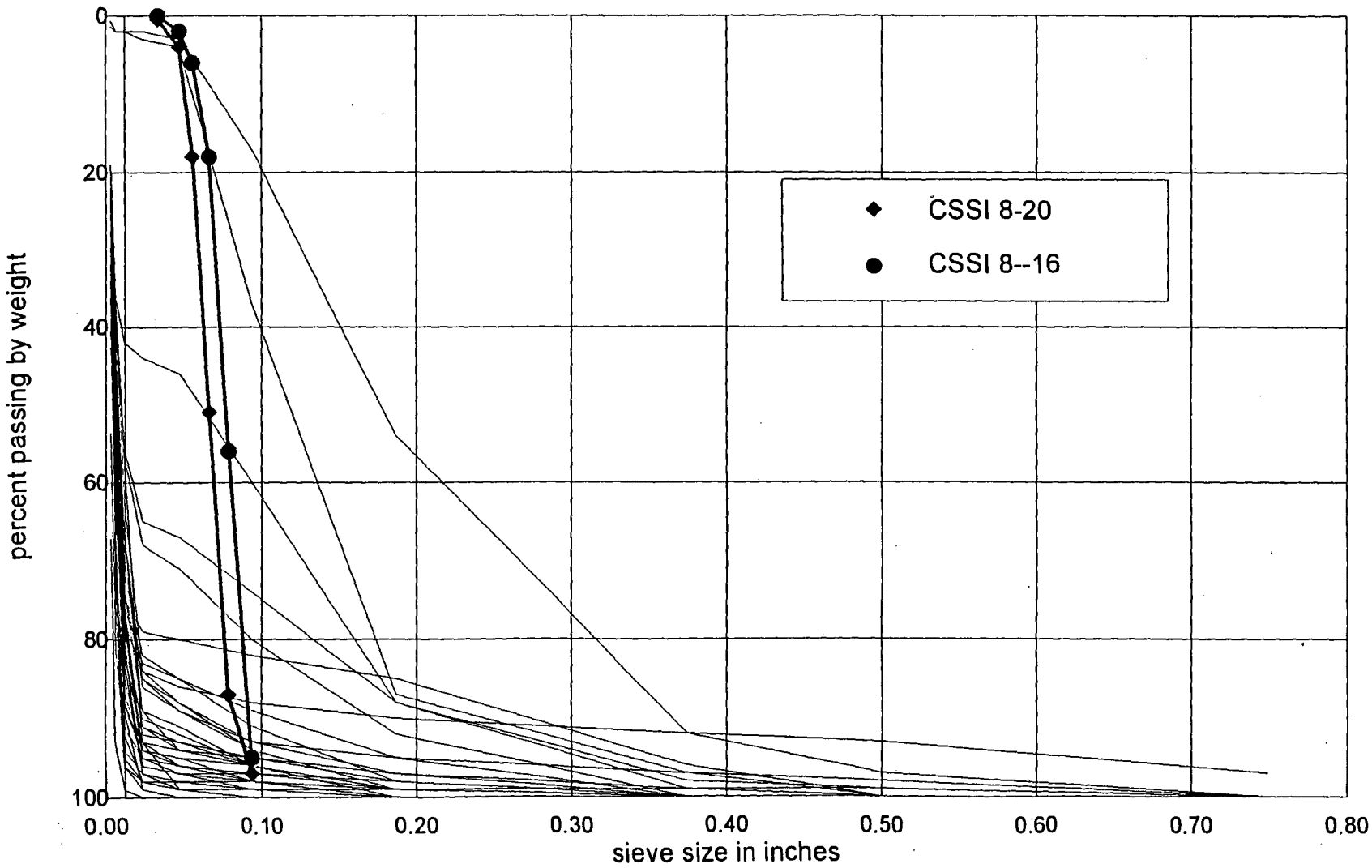
Well completion diagram, GR-1

JOHN SHOMAKER & ASSOCIATES, INC.

Appendix I-6

plot of sieve analysis results, GR-1

Sieve Analysis Results, Guaje Replacement Well No. 1



SUMMARY OF LABORATORY TEST DATA

Test Hole	Depth (feet)	Unified Classification	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
				LL	PI	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
GR-1	710-720		2.1			100	98	97	87	37	4	3	2	2	1.4	
GR-1	720-730		2.6			100	97	92	54	17	3	2	2	2	0.7	
GR-1	730-740		5.3			100	99	98	88	60	46	44	42	36	19.0	
GR-1	740-750		4.2			97	93	92	90	88	86	84	78	62	29.0	
GR-1	810-820		9.1			100	100	99	99	98	97	95	91	81	53.6	
GR-1	850-860		3.2			100	100	99	97	95	94	91	67	46	31.5	
GR-1	890-900		6.4			100	99	99	97	95	94	93	82	64	35.0	
GR-1	900-910		6.5			100	100	100	100	96	94	89	67	49	30.8	
GR-1	930-940		4.3			100	100	100	98	97	97	95	78	51	29.6	
GR-1	960-970		3.3			100	100	100	99	99	99	98	92	67	42.3	
GR-1	1050-1060		2.3			100	100	100	99	98	97	95	78	49	31.1	
GR-1	1060-1070		2.0			100	100	100	100	99	98	97	81	50	34.2	
GR-1	1070-1080		1.4			100	100	100	99	98	97	96	83	54	37.2	
GR-1	1080-1090		1.7			100	100	100	99	96	95	94	77	52	36.8	
GR-1	1220-1230		4.6			100	100	99	88	74	67	65	56	40	24.4	
GR-1	1230-1240		9.9			100	100	100	100	100	100	100	99	93	67.1	
GR-1	1250-1260		8.1			100	100	100	92	80	71	68	57	36	25.1	
GR-1	1440-1450		0.0			100	100	97	95	93	89	85	74	58	38.9	
GR-1	1460-1470		0.0			100	100	100	98	91	85	82	72	46	22.1	

Project Number : 97-2-646

Project : LANL Well Samples

Table No. : 1

SUMMARY OF LABORATORY TEST DATA

Test Hole	Depth (feet)	Unified Classification	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
				LL	PI	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
GR-1	1490-1500		14.9			100	100	100	100	98	96	95	88	61	30.7	
GR-1	1500-1510		19.4			100	100	100	98	95	93	92	82	58	32.9	
GR-1	1550-1560		14.7			100	100	100	100	100	100	99	89	56	27.0	
GR-1	1590-1600		15.3			100	100	100	100	100	99	93	58	37	27.4	
GR-1	1640-1650		18.8			100	100	100	97	93	88	84	63	38	23.7	
GR-1	1650-1660		16.4			100	100	100	99	94	89	86	67	42	26.6	
GR-1	1670-1680		19.8			100	100	100	99	97	96	94	85	60	37.3	
GR-1	1680-1690		14.7			100	100	100	99	96	92	90	81	55	32.8	

Project Number : 97-2-646

Project : LANL Well Samples

Table No. : 1con't

SUMMARY OF LAB ORATORY TEST DATA

Test Hole	Depth (feet)	Unified Classification	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
				LL	PI	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
GR-1	1710-1720		12.2			100	100	100	100	99	98	97	94	71	28.6	
GR-1	1730-1740		15.4			100	100	100	100	99	99	97	83	56	32.9	
GR-1	1760-1770		16.5			100	100	100	100	98	95	94	76	45	28.5	
GR-1	1770-1780		20.1			100	100	100	100	99	97	96	83	52	30.7	
GR-1	1800-1810		26.5			100	100	100	99	96	91	89	74	43	25.3	
GR-1	1840-1850		25.0			100	100	100	99	96	93	91	79	51	28.0	
GR-1	1870-1880		20.2			100	100	100	100	99	98	98	95	72	34.5	
GR-1	1880-1890		19.9			100	100	100	100	100	100	99	96	71	34.8	
GR-1	1920-1930		17.0			100	100	100	99	94	88	85	70	47	33.2	
GR-1	1930-1940		20.2			100	100	100	99	98	98	98	96	76	31.6	
GR-1	1960-1970		23.1			100	100	100	95	89	85	83	76	54	29.9	
GR-1	1980-1990		20.6			100	100	96	85	82	80	79	75	56	31.5	
GR-1	2000-2010		28.9			100	100	100	100	98	96	93	87	70	39.9	
GR-1	2030-2040		23.0			100	100	100	100	98	96	94	88	60	35.6	

Project Number : 97-2-646

Project : LANL Well Samples

Table No. : 1

JM : Vinyard & Associates

Appendix I-7

pumping test data, GR-1

GUAJE REPLACMENT WELL NO. 1
STEP-DRAWDOWN TEST - 7/27/98
starting water level: 550.73 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
07/27/98	10:10	0				start pump--begin step 1
07/27/98	10:11	1.35	607.06			
07/27/98		1.9	608.7			
07/27/98		3.32	594.3			
07/27/98		3.97	588.24			
07/27/98		4.58	585.8	199	5.67	
07/27/98		6.2	589.95			
07/27/98		7.37	591.21			
07/27/98		8.13	591.95	199	4.83	
07/27/98		8.85	592.08			
07/27/98		9.5	592.68			
07/27/98		10.17	592.35			
07/27/98	10:20	10.97	590.22			
07/27/98		11.83	589.52	199	5.13	
07/27/98		12.82	588.97			
07/27/98		14.13	588.93			
07/27/98		15	588.98	160	4.18	adjust Q up
07/27/98		15.7	589.25			
07/27/98		16.45	589.3			
07/27/98		17.62	590.02			
07/27/98		18.37	590.59			
07/27/98		19.2	591.24			
07/27/98		20.15	592.85			
07/27/98	10:31	21	595.01	221	4.99	
07/27/98		21.48	596.05			
07/27/98		23	597.32			
07/27/98		24	597.52			
07/27/98		25.33	598.14			
07/27/98		26.25	598.45			
07/27/98		27	599.42			
07/27/98		28	600.28			
07/27/98		29.08	601.17			
07/27/98	10:40	30	601.24			
07/27/98		32	602.82			
07/27/98		34	604.45	220	4.10	
07/27/98		36.25	604.9	219	4.04	
07/27/98		38	605.4			
07/27/98		40.75	605.72	225	4.09	
07/27/98		48.5	606.9			
07/27/98		50	607.4	206	3.64	2 3/8" on manometer (6"x8")
07/27/98		55	607.92			

GUAJE REPLACMENT WELL NO. 1
STEP-DRAWDOWN TEST - 7/27/98
starting water level: 550.73 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
07/27/98	11:10	60	608.71	222	3.83	
07/27/98		65	609.25			
07/27/98		70.75	610.17			
07/27/98		75.5	610.82			
07/27/98		80	611.14	230	3.81	
07/27/98		85	611.28	220	3.63	2 1/2" on manometer (6"x8")
07/27/98		90	611.5			
07/27/98		95.33	612.23			
07/27/98		99.75	612.3			
07/27/98		100	612.3			begin step 2 @ 11:50
07/27/98		100.5	616.73			
07/27/98		101.15	619.45			
07/27/98		101.8	621.1			
07/27/98	11:52	102.68	626.54			
07/27/98		103.42	629.92	298	3.76	
07/27/98		104.25	632.4			
07/27/98		105.08	633.86			
07/27/98		105.83	634.85			
07/27/98		106.67	635.9			
07/27/98		107.25	636.76			
07/27/98		107.92	637.1			
07/27/98		108.58	637.08			
07/27/98		109.27	637.66			
07/27/98	12:00	110.32	637.68			
07/27/98		111.22	638.45			
07/27/98		111.85	638.15			
07/27/98		113.22	639.15			
07/27/98		114	639.59	300	3.38	
07/27/98		115.22	639.33			
07/27/98		116.17	639.53			
07/27/98		117.58	640.14			
07/27/98		118.25	640.16			
07/27/98		119.17	640.33			
07/27/98		120.25	640.59			
07/27/98		121.25	640.74			
07/27/98	12:12	122.25	641.16			
07/27/98		123.08	641.21			
07/27/98		124.2	641.4			
07/27/98		125.17	641.82			
07/27/98		126.08	642.04			
07/27/98		127.33	643.68			

GUAJE REPLACMENT WELL NO. 1
STEP-DRAWDOWN TEST - 7/27/98
starting water level: 550.73 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
07/27/98		128.13	643.43			
07/27/98		129.23	644.4			
07/27/98		130.28	644.6	330	3.52	5 1/8" on manometer (6"x8")
07/27/98		136.2	647.06	301	3.12	
07/27/98		138	647.52			
07/27/98		140.5	647.65	346	3.57	5 1/4" on manometer (6"x8")
07/27/98	12:35	145.5	647.8	333	3.43	
07/27/98		150.75	647.93			4 7/8" on manometer (6"x8")
07/27/98		156.5	648.08	313	3.22	
07/27/98		161	648.3			
07/27/98		165	647.78	337	3.47	
07/27/98		171	648.65			
07/27/98		175.33	648.9			
07/27/98		180.33	647.65			4 3/4" on manometer (6"x8")
07/27/98		187	651.35			
07/27/98		189	651.68			
07/27/98		190.1	651.7	332	3.29	
07/27/98		191.5	651.59			4 7/8" on manometer (6"x8")
07/27/98		193.83	651.27			
07/27/98		197.17	651.12	335	3.34	4" on manometer (6"x8"),13:29:10
07/27/98	13:30	200	651.15			begin step 3 @ 13:30
07/27/98		200.97	657.4			
07/27/98		201.62	660.35			
07/27/98		202.57	662.73			
07/27/98		203.37	663.68			
07/27/98		204	664.24			
07/27/98		204.55	664.57			
07/27/98		205.27	664.78	407	3.57	
07/27/98		206.35	665.45			
07/27/98	13:37	207.37	666.06			
07/27/98		208.1	666.08			6 3/4" on manometer (6"x8")
07/27/98		209.57	666.98			
07/27/98		210.53	666.75			
07/27/98		211.52	667.3			
07/27/98		212.27	667.43			
07/27/98		213	667.81			
07/27/98		214.25	667.77			
07/27/98		215.2	668.1			
07/27/98	13:46	216.4	668			
07/27/98		217.33	668.08			
07/27/98		218.17	668.37	429	3.65	

GUAJE REPLACMENT WELL NO. 1
STEP-DRAWDOWN TEST - 7/27/98
starting water level: 550.73 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
07/27/98		219.33	668.57			
07/27/98		220.63	669.12			
07/27/98		224.17	669.18			
07/27/98		226.28	669.38			6 3/4" on manometer (6"x8")
07/27/98		227.83	669.44			
07/27/98		230	670.22			6 3/4" on manometer (6"x8")
07/27/98		232.58	670.2			
07/27/98	14:04	234.17	670.86			
07/27/98		235.88	669.84			
07/27/98		237.87	670.81			
07/27/98		240	671.1			
07/27/98		247	672.3			
07/27/98		250.53	672.07			
07/27/98		256.75	672.62	400	3.28	6 3/4" on manometer (6"x8")
07/27/98		263.42	673.13	400	3.27	
07/27/98		265.37	672.87			
07/27/98	14:40	270.57	673.6			
07/27/98		276.12	673.28			6 3/4" on manometer (6"x8")
07/27/98		280.37	673.58			
07/27/98		286.42	674.11			
07/27/98		290.5	673.71	395	3.21	6 3/4" on manometer (6"x8")
07/27/98		295.85	674.38			
07/27/98		299.68	674.7			
07/27/98	15:10	300	674.7			begin step 4 @ 15:10
07/27/98		300.88	682.5			
07/27/98		301.75	686.52			
07/27/98		302.26	688.65			
07/27/98		302.933	690.42			
07/27/98		303.65	691.71			
07/27/98		304.567	693.1	509	3.58	
07/27/98		305.383	693.8			
07/27/98		306.167	694.31			
07/27/98	15:17	307	694.78			
07/27/98		307.65	695.33			
07/27/98		308.517	695.7			
07/27/98		309.2	695.9			
07/27/98		309.85	695.1			
07/27/98		310.533	696.44			
07/27/98		311.083	696.5			
07/27/98		312.217	696.73			10" on manometer (6"x8")
07/27/98		313.317	697.34			

GUAJE REPLACMENT WELL NO. 1
STEP-DRAWDOWN TEST - 7/27/98
starting water level: 550.73 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
07/27/98		314.17	698.58			
07/27/98		315.367	697.78			
07/27/98		316.15	697.76			
07/27/98		317.217	697.83			
07/27/98		318.233	698.01			
07/27/98	15:29	319.85	698.45			
07/27/98		321.133	698.47			
07/27/98		322.267	698.65			
07/27/98		323.2	698.43			
07/27/98		324.517	698.58			
07/27/98		325.3	698.7			
07/27/98		326.567	699.03			
07/27/98		328.217	699.92			
07/27/98		329.133	699.78			
07/27/98		330.067	700			
07/27/98		332.133	699.96			
07/27/98		334.133	700.42			
07/27/98		335.967	700.52			
07/27/98		338.33	700.71			
07/27/98		340	700.65			10" on manometer (6"x8")
07/27/98		345.2	701.19			
07/27/98		351.75	702.02	491	3.25	
07/27/98		356.1	701.6			9 7/8" on manometer (6"x8")
07/27/98		359.883	701.8			9 3/4" on manometer (6"x8")
07/27/98		365.33	701.85			
07/27/98		371.25	702.2			9 3/4" on manometer (6"x8")
07/27/98		375.35	702.29			
07/27/98		380.6	702.57			
07/27/98	16:35	385.33	702.7			9 1/2" on manometer (6"x8")
07/27/98		389.783	702.35			
07/27/98		396.167	702.7			
07/27/98		399.367	702.9			
07/27/98	16:50	400				start recovery
07/27/98		401.78	562.1			
07/27/98		403.03	582			
07/27/98		403.767	586.9			
07/27/98		404.65	590			
07/27/98		405.42	591.4			
07/27/98		405.95	592.1			
07/27/98		406.45	592.27			
07/27/98		406.83	592.33			

GUAJE REPLACMENT WELL NO. 1
STEP-DRAWDOWN TEST - 7/27/98
starting water level: 550.73 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
07/27/98		407.27	592.58			
07/27/98		407.7	592.51			
07/27/98		408.08	592.41			
07/27/98		408.53	592.26			
07/27/98		409.08	591.78			
07/27/98		409.58	591.8			
07/27/98		410.25	591.13			
07/27/98		411.1	590.83			
07/27/98	17:02	412.07	590.24			
07/27/98		412.767	589.78			
07/27/98		413.5	589.2			
07/27/98		414.33	589.1			
07/27/98	17:05	415.083	588.45			
07/27/98		416	587.7			
07/27/98		417	587.2			
07/27/98		418	586.92			
07/27/98		419	585.2			
07/27/98		420	585.15			
07/27/98		421	585.29			
07/27/98		422.417	584.91			
07/27/98		423.33	584.43			
07/27/98	17:15	425	583.53			
07/27/98		426	583.53			
07/27/98		427	583.09			
07/27/98		428	582.5			
07/27/98		429	582.17			
07/27/98		430	581.78			
07/27/98		432	581.1			
07/27/98		434	580.59			
07/27/98		436.5	579.98			
07/27/98		438	579.34			
07/27/98		440	578.9			
07/27/98		445	577.54			
07/27/98		450	576.73			
07/27/98		455	575.65			
07/27/98	17:50	460	574.85			stop recovery

GUAJE REPLACMENT WELL NO. 1
CONSTANT-RATE TEST
starting water level: 551.90 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
07/21/98	12:23	0	553.8	551.9				pump on
07/21/98	12:25	2	620.9	619			6.1	discharge hazy
07/21/98		4	622.92	621.02			5.9	water to surface @ t=3
07/21/98		6	631.27	629.37			5.3	start sand test @ t=3.5
07/21/98		7	635.06	633.16			5.0	
07/21/98		9	637.57	635.67	6.25"	408	4.9	
07/21/98	12:33	10	639.16	637.26	6.25"	408	4.8	slight haze
07/21/98		12	641.48	639.58	6.25"	408	4.7	trace sand @ t=13
07/21/98		14	643.88	641.98	6.25"	408	4.5	
07/21/98		17	646.56	644.66	6.25"	408	4.4	
07/21/98		19	649.75	647.85	6.25"	408	4.3	slight haze
07/21/98		21	649.62	647.72	6.25"	408	4.3	trace sand
07/21/98		25	651	649.1	6.25"	408	4.2	
07/21/98	12:53	30	652.96	651.06	6.25"	408	4.1	
07/21/98		35	653.48	651.58	6.25"	408	4.1	
07/21/98	13:05	42	653.86	651.96	6.25"	408	4.1	
07/21/98		47	654.62	652.72	6.25"	408	4.0	
07/21/98		52	655.58	653.68	6.25"	408	4.0	
07/21/98		57	655.98	654.08	6.25"	408	4.0	
07/21/98		65	656.73	654.83	6.25"	408	4.0	
07/21/98		72	659.2	657.3	6.25"	408	3.9	
07/21/98		77	659.62	657.72	6.25"	408	3.9	
07/21/98		82	660.83	658.93	6.25"	408	3.8	sand = 0.08 cc
07/21/98	13:50	87	661.5	659.6	6.25"	408	3.8	
07/21/98		95	661.6	659.7	6.25"	408	3.8	
07/21/98		97	662.02	660.12	6.25"	408	3.8	T=90, k=191, pH=7.57
07/21/98		107	662.49	660.59	6.25"	408	3.8	T=89, k=176, pH=7.66
07/21/98		117	662.87	660.97	6.25"	408	3.7	
07/21/98		129	663.32	661.42	6.25"	408	3.7	
07/21/98		137	662.52	660.62	6.25"	408	3.8	adjust Q
07/21/98		151	665.65	663.75	6.25"	408	3.6	T=87, k=169
07/21/98	15:00	157	665.55	663.65	6.25"	408	3.7	
07/21/98		171	667.25	665.35	6.25"	408	3.6	T=87, k=170
07/21/98		180	668.43	666.53	6.25"	408	3.6	
07/21/98		191	668.64	666.74	6.25"	408	3.6	
07/21/98		200	669.53	667.63	6.25"	408	3.5	T=90, k=171
07/21/98	16:00	217	670.9	669	6.25"	408	3.5	
07/21/98		235	671.17	669.27	6.25"	408	3.5	
07/21/98		248	671.65	669.75	6.25"	408	3.5	T=91, k=171, sand = 0.15cc
07/21/98		264	671.15	669.25	6.25"	408	3.5	adjust Q
07/21/98	17:03	280	672.73	670.83	6.25"	408	3.4	
07/21/98		307	674.13	672.23	6.25"	408	3.4	
07/21/98		339	675.15	673.25	6.25"	408	3.4	
07/21/98		370	675.78	673.88	6.25"	408	3.3	
07/21/98		397	676.8	674.9	6.25"	408	3.3	T=90, k=177, pH=7.78
07/21/98		413	678.62	676.72	6.25"	408	3.3	
07/21/98		432	678.9	677	6.25"	408	3.3	
07/21/98		442	679.44	677.54	6.25"	408	3.2	
07/21/98		460	679.45	677.55	6.25"	408	3.2	
07/21/98		474	678.5	676.6	6.25"	408	3.3	
07/21/98		487	680.34	678.44	6.25"	408	3.2	
07/21/98	20:45	502	682.45	680.55	6.25"	408	3.2	
07/21/98		517	681.78	679.88	6.25"	408	3.2	sand = 0.2 cc
07/21/98		532	681.95	680.05	6.25"	408	3.2	

GUAJE REPLACMENT WELL NO. 1
CONSTANT-RATE TEST
starting water level: 551.90 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
07/21/98		547	683.65	681.75	6.25"	408	3.1	
07/21/98		562	684.28	682.38	6.25"	408	3.1	
07/21/98		577	684.39	682.49	6.25"	408	3.1	
07/21/98		592	684.14	682.24	6.25"	408	3.1	
07/21/98		607	684.85	682.95	6.25"	408	3.1	
07/21/98		622	685.14	683.24	6.25"	408	3.1	
07/21/98		637	686.15	684.25	6.25"	408	3.1	
07/21/98		656	686.16	684.26	6.25"	408	3.1	
07/21/98		667	686.74	684.84	6.25"	408	3.1	
07/21/98	23:45	682	686.92	685.02	6.25"	408	3.1	
07/22/98		697	687.35	685.45	6.25"	408	3.1	
07/22/98		712	687.07	685.17	6.25"	408	3.1	
07/22/98		727	687	685.1	6.25"	408	3.1	
07/22/98		742	687.62	685.72	6.25"	408	3.0	
07/22/98		757	687.35	685.45	6.25"	408	3.1	
07/22/98		772	687.79	685.89	6.25"	408	3.0	
07/22/98		787	688.05	686.15	6.25"	408	3.0	
07/22/98	1:45	802	688.84	686.94	6.25"	408	3.0	
07/22/98		817	688	686.1	6.25"	408	3.0	
07/22/98		832	689.04	687.14	6.25"	408	3.0	
07/22/98		847	689.43	687.53	6.25"	408	3.0	
07/22/98		862	689.55	687.65	6.25"	408	3.0	
07/22/98		877	689	687.1	6.25"	408	3.0	
07/22/98		892	688.84	686.94	6.25"	408	3.0	
07/22/98		907	688.81	686.91	6.25"	408	3.0	
07/22/98		922	689.75	687.85	6.25"	408	3.0	
07/22/98		937	688.54	686.64	6.25"	408	3.0	
07/22/98		952	688.95	687.05	6.25"	408	3.0	
07/22/98	4:30	967	689.11	687.21	6.25"	408	3.0	
07/22/98		982	690.95	689.05	6.25"	408	3.0	
07/22/98		997	689.35	687.45	6.25"	408	3.0	
07/22/98		1012	689.1	687.2	6.25"	408	3.0	
07/22/98		1029	689.2	687.3	6.25"	408	3.0	
07/22/98		1042	688.51	686.61	6.25"	408	3.0	
07/22/98		1057	688.7	686.8	6.25"	408	3.0	
07/22/98		1072	689.1	687.2	6.25"	408	3.0	
07/22/98		1087	690.25	688.35	6.25"	408	3.0	
07/22/98		1102	689.94	688.04	6.25"	408	3.0	
07/22/98	7:00	1117	689	687.1	6.25"	408	3.0	
07/22/98		1132	690.04	688.14	6.25"	408	3.0	T=89, k=193, pH=7.54
07/22/98		1149	691.03	689.13	6.25"	408	3.0	
07/22/98		1162	690.7	688.8	6.25"	408	3.0	
07/22/98		1177	690.55	688.65	6.25"	408	3.0	
07/22/98		1194	689.85	687.95	6.25"	408	3.0	
07/22/98		1207	686.94	685.04	6.25"	408	3.1	adjust Q
07/22/98		1237	688.63	686.73	6.25"	408	3.0	
07/22/98		1252	690.33	688.43	6.25"	408	3.0	
07/22/98		1267	689.25	687.35	6.25"	408	3.0	
07/22/98		1282	689.15	687.25	6.25"	408	3.0	
07/22/98		1297	688.78	686.88	6.25"	408	3.0	
07/22/98		1312	689.05	687.15	6.25"	408	3.0	T=90, k=191, pH=7.40
07/22/98	10:30	1327	689.07	687.17	6.25"	408	3.0	adjust Q
07/22/98		1357	691.33	689.43	6.25"	408	3.0	sand = 0.31 cc
07/22/98		1372	692.24	690.34	6.25"	408	2.9	turbidity = 5.4 NTU
07/22/98		1387	692.25	690.35	6.25"	408	2.9	

GUAJE REPLACMENT WELL NO. 1
CONSTANT-RATE TEST
starting water level: 551.90 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
07/22/98		1402	692.32	690.42	6.25"	408	2.9	
07/22/98		1417	692	690.1	6.25"	408	3.0	T=92, k=193, pH=7.31
07/22/98		1432	693.1	691.2	6.25"	408	2.9	adjust Q
07/22/98		1447	692.28	690.38	6.25"	408	2.9	
07/22/98		1464	691.8	689.9	6.25"	408	3.0	
07/22/98		1478	691.9	690	6.25"	408	3.0	
07/22/98		1492	691.67	689.77	6.25"	408	3.0	turbidity = 4.8 NTU
07/22/98		1514	691.42	689.52	6.25"	408	3.0	
07/22/98	13:48	1525	692.08	690.18	6.25"	408	3.0	
07/22/98		1552	692.84	690.94	6.25"	408	2.9	adjust Q
07/22/98		1567	691.31	689.41	6.25"	408	3.0	T=89, k=194, pH=7.37
07/22/98		1585	690.5	688.6	6.25"	408	3.0	
07/22/98		1597	689.72	687.82	6.25"	408	3.0	
07/22/98		1613	690.85	688.95	6.25"	408	3.0	
07/22/98		1627	691.05	689.15	6.25"	408	3.0	sand = 0.31 cc
07/22/98		1642	692.58	690.68	6.25"	408	2.9	
07/22/98		1657	691.72	689.82	6.25"	408	3.0	
07/22/98		1672	692.11	690.21	6.25"	408	2.9	
07/22/98		1687	692.51	690.61	6.25"	408	2.9	
07/22/98		1702	692.38	690.48	6.25"	408	2.9	
07/22/98		1719	691.76	689.86	6.25"	408	3.0	
07/22/98	17:15	1732	691.53	689.63	6.25"	408	3.0	
07/22/98		1749	691.38	689.48	6.25"	408	3.0	
07/22/98		1762	692.23	690.33	6.25"	408	2.9	T=89, k=204, pH=7.28
07/22/98		1777	692.61	690.71	6.25"	408	2.9	turbidity = 4.5 NTU
07/22/98		1792	693.2	691.3	6.25"	408	2.9	
07/22/98		1807	692.64	690.74	6.25"	408	2.9	
07/22/98		1824	692.9	691	6.25"	408	2.9	
07/22/98		1837	693.34	691.44	6.25"	408	2.9	
07/22/98		1853	693.51	691.61	6.25"	408	2.9	
07/22/98		1867	694.3	692.4	6.25"	408	2.9	
07/22/98		1882	692.5	690.6	6.25"	408	2.9	
07/22/98		1897	692.76	690.86	6.25"	408	2.9	
07/22/98		1912	693.51	691.61	6.25"	408	2.9	
07/22/98		1927	694.5	692.6	6.25"	408	2.9	T=89, k=196, pH=7.27
07/22/98		1942	694.34	692.44	6.25"	408	2.9	
07/22/98		1957	694.55	692.65	6.25"	408	2.9	
07/22/98		1972	695.1	693.2	6.25"	408	2.9	
07/22/98		2002	692.91	691.01	6.25"	408	2.9	
07/22/98		2017	692.87	690.97	6.25"	408	2.9	sand = 0.32 cc
07/22/98	22:15	2032	692	690.1	6.25"	408	3.0	turbidity = 4.1 NTU
07/22/98		2055	692.24	690.34	6.25"	408	2.9	
07/22/98		2063	694.8	692.9	6.25"	408	2.9	
07/22/98		2077	694.17	692.27	6.25"	408	2.9	
07/22/98		2092	694.18	692.28	6.25"	408	2.9	
07/22/98		2107	696	694.1	6.25"	408	2.9	
07/22/98		2122	695.4	693.5	6.25"	408	2.9	
07/23/98		2137	695.15	693.25	6.25"	408	2.9	
07/23/98		2152	695.09	693.19	6.25"	408	2.9	
07/23/98		2167	695	693.1	6.25"	408	2.9	
07/23/98		2182	694.54	692.64	6.25"	408	2.9	
07/23/98		2197	695.8	693.9	6.25"	408	2.9	
07/23/98		2212	696.3	694.4	6.25"	408	2.9	
07/23/98		2227	696.8	694.9	6.25"	408	2.9	
07/23/98	1:45	2242	697.32	695.42	6.25"	408	2.8	

GUAJE REPLACMENT WELL NO. 1
CONSTANT-RATE TEST
starting water level: 551.90 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
07/23/98		2257	697.56	695.66	6.25"	408	2.8	adjust Q
07/23/98		2272	697.41	695.51	6.25"	408	2.8	
07/23/98		2287	697.8	695.9	6.25"	408	2.8	
07/23/98		2302	697.15	695.25	6.25"	408	2.8	
07/23/98		2317	697.03	695.13	6.25"	408	2.8	
07/23/98		2332	696.66	694.76	6.25"	408	2.9	
07/23/98		2347	696	694.1	6.25"	408	2.9	
07/23/98		2362	695.9	694	6.25"	408	2.9	
07/23/98		2377	695.75	693.85	6.25"	408	2.9	
07/23/98		2392	696	694.1	6.25"	408	2.9	
07/23/98	4:30	2407	696.46	694.56	6.25"	408	2.9	
07/23/98		2422	697.07	695.17	6.25"	408	2.8	
07/23/98		2437	697.36	695.46	6.25"	408	2.8	
07/23/98		2452	697.56	695.66	6.25"	408	2.8	
07/23/98		2467	697.66	695.76	6.25"	408	2.8	
07/23/98		2482	697.81	695.91	6.25"	408	2.8	
07/23/98		2497	697.68	695.78	6.25"	408	2.8	
07/23/98		2512	696.8	694.9	6.25"	408	2.9	
07/23/98		2527	699.8	697.9	6.25"	408	2.8	adjust Q
07/23/98		2542	698.2	696.3	6.25"	408	2.8	
07/23/98		2557	698	696.1	6.25"	408	2.8	
07/23/98		2575	698.3	696.4	6.25"	408	2.8	T=90, k=194, pH=7.34
07/23/98	7:30	2587	698.37	696.47	6.25"	408	2.8	
07/23/98		2604	698.35	696.45	6.25"	408	2.8	
07/23/98		2617	698.61	696.71	6.25"	408	2.8	
07/23/98		2632	698.27	696.37	6.25"	408	2.8	
07/23/98		2649	697.78	695.88	6.25"	408	2.8	
07/23/98		2662	696.82	694.92	6.25"	408	2.9	
07/23/98		2677	696.34	694.44	6.25"	408	2.9	
07/23/98		2692	698.4	696.5	6.25"	408	2.8	sand = 0.33 cc
07/23/98		2709	698.42	696.52	6.25"	408	2.8	
07/23/98		2722	698.77	696.87	6.25"	408	2.8	turbidity = 3.3 NTU
07/23/98	10:15	2737	699.15	697.25	6.25"	408	2.8	
07/23/98		2752	698.58	696.68	6.25"	408	2.8	
07/23/98		2768	699.29	697.39	6.25"	408	2.8	
07/23/98		2782	698.96	697.06	6.25"	408	2.8	
07/23/98		2800	698.86	696.96	6.25"	408	2.8	T=91, k=186, pH=7.45
07/23/98		2812	698.09	696.19	6.25"	408	2.8	turbidity = 3.5 NTU
07/23/98		2827	697.87	695.97	6.25"	408	2.8	
07/23/98		2842	697.91	696.01	6.25"	408	2.8	
07/23/98		2857	697.9	696	6.25"	408	2.8	
07/23/98		2865	697.68	695.78	6.25"	408	2.8	
07/23/98	12:29	2871	697.52	695.62	6.25"	408	2.8	total sand = 0.34 cc

GUAJE REPLACMENT WELL NO. 1
CONSTANT-RATE TEST
starting water level: 551.90 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	t/t'	remarks
07/23/98	12:29	0				pump off
07/23/98	12:30	1	569.85	567.95	2872	
07/23/98	12:31	1.3	585.8	583.9	2209	
07/23/98		2.2	598.15	596.25	1306	
07/23/98		3.22	603	601.1	893	
07/23/98		4.04	605.85	603.95	712	
07/23/98		4.45	607.9	606	646	
07/23/98		5.21	609.1	607.2	552	
07/23/98		6.04	609.92	608.02	476	
07/23/98		6.42	610.15	608.25	448	
07/23/98		7.27	610.07	608.17	396	
07/23/98		8.12	610.07	608.17	355	
07/23/98		8.37	610.62	608.72	344	
07/23/98		9.15	610.36	608.46	315	
07/23/98		9.4	610.44	608.54	306	
07/23/98		10.07	610.14	608.24	286	
07/23/98		10.38	610.1	608.2	278	
07/23/98		11.06	609.9	608	261	
07/23/98		11.5	609.5	607.6	251	
07/23/98		12.25	609.24	607.34	235	
07/23/98		13	609	607.1	222	
07/23/98		13.3	608.77	606.87	217	
07/23/98	12:44	14	608.46	606.56	206	
07/23/98		14.3	607.7	605.8	202	
07/23/98		15	608.09	606.19	192	
07/23/98		15.3	607.86	605.96	189	
07/23/98		16	607.54	605.64	180	
07/23/98		16.4	607.43	605.53	176	
07/23/98		17	607.18	605.28	170	
07/23/98		17.3	606.98	605.08	167	
07/23/98		18	606.52	604.62	161	
07/23/98		18.35	606.4	604.5	157	
07/23/98		19	606.17	604.27	152	
07/23/98		20	605.68	603.78	145	
07/23/98		21	605.37	603.47	138	
07/23/98		22.2	604.49	602.59	130	
07/23/98		23	604.3	602.4	126	
07/23/98		24	603.69	601.79	121	
07/23/98		25	603.6	601.7	116	
07/23/98		26	603.18	601.28	111	
07/23/98		27	602.76	600.86	107	
07/23/98		28	602.56	600.66	104	
07/23/98		29	602.12	600.22	100	
07/23/98	13:03	30	601.85	599.95	97	
07/23/98	13:05	33	600.98	599.08	88	
07/23/98		35	600.42	598.52	83	
07/23/98		37	599.86	597.96	79	
07/23/98		38	598.58	596.68	77	
07/23/98		40	599.17	597.27	73	
07/23/98		45	597.98	596.08	65	
07/23/98		50	597.04	595.14	58	
07/23/98		55	596.15	594.25	53	
07/23/98	13:35	60	595.43	593.53	49	
07/23/98		65	594.66	592.76	45	
07/23/98		70	593.88	591.98	42	

GUAJE REPLACMENT WELL NO. 1
CONSTANT-RATE TEST
starting water level: 551.90 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	t/t'	remarks
07/23/98		75	593.17	591.27	39	
07/23/98		80	592.65	590.75	37	
07/23/98		85	592	590.1	35	
07/23/98		90	591.4	589.5	33	
07/23/98		95	591.3	589.4	31	
07/23/98		100	590.62	588.72	30	
07/23/98		105	590.14	588.24	28	
07/23/98		113	589.37	587.47	26	
07/23/98	14:30	120	587.38	585.48	25	
07/23/98	16:50	260	581.33	579.43	12	
07/24/98	9:00	1230	565.05	563.15	3	
07/27/98	10:00	5610	552.63	550.73	2	

1 day

3-4 days

max drawdown

60 / 93 3.

5610 min

540

210

180

24

60

120

180

696

551

145'

after 1 day recovery

563

551

12'

after 3-4 days

0

Appendix I-8

gyroscopic survey results, GR-1

****

>>>> Welenco, Inc.>>>>

DIRECTIONAL SURVEY

****

Date: 11-MAY-98

Company : LOS ALAMOS NATIONAL LAB.
Well No : GR-1
Field : GUAJE
State : NM
County: SANTA FE
Witnessed By: FUQUA
Rec. By: SHARPLESS
Location : LOS ALAMOS
Remarks : RUN #4 IN 16" ID CASING

****

Measured Depth, Feet	Inclination, Degrees True	Direction, Degrees	Course Deviation, Feet	True Vertical Depth, Feet	Closure Distance, Feet	Closure Bearing, Degrees True
0	0.0	202	0.00	0.00	0.00	0.0
10	0.0	166	0.00	10.00	0.00	166.0
20	0.0	167	0.00	20.00	0.00	166.0
30	0.0	172	0.00	30.00	0.00	168.0
40	0.0	173	0.00	40.00	0.00	169.0
50	0.0	194	0.00	50.00	0.00	169.0
60	0.0	211	0.00	60.00	0.00	169.0
70	0.0	178	0.00	70.00	0.00	169.0
80	0.0	201	0.00	80.00	0.00	169.0
90	0.0	187	0.00	90.00	0.00	169.0
100	0.0	189	0.00	100.00	0.00	169.0
110	0.0	191	0.00	110.00	0.00	169.0
120	0.0	198	0.00	120.00	0.00	169.0
130	0.0	182	0.00	130.00	0.00	169.0
140	0.0	194	0.00	140.00	0.00	169.0
150	0.0	200	0.00	150.00	0.00	169.0
160	0.0	220	0.00	160.00	0.00	169.0
170	0.0	191	0.00	170.00	0.00	169.0
180	0.0	210	0.00	180.00	0.00	169.0
190	0.0	200	0.00	190.00	0.00	169.0
200	0.0	200	0.00	200.00	0.00	169.0
210	0.0	200	0.00	210.00	0.00	169.0
220	0.0	203	0.00	220.00	0.00	169.0
230	0.0	200	0.00	230.00	0.00	169.0
240	0.0	185	0.00	240.00	0.00	169.0
250	0.0	199	0.00	250.00	0.00	169.0
260	0.0	198	0.00	260.00	0.00	169.0
270	0.0	192	0.00	270.00	0.00	169.0
280	0.0	195	0.00	280.00	0.00	169.0
290	0.0	200	0.00	290.00	0.00	169.0
300	0.0	189	0.00	300.00	0.00	169.0
310	0.0	183	0.00	310.00	0.00	169.0
320	0.0	189	0.00	320.00	0.00	169.0
330	0.0	198	0.00	330.00	0.00	174.7
340	0.0	204	0.00	340.00	0.01	178.6
350	0.0	196	0.00	350.00	0.01	178.6
360	0.0	190	0.00	360.00	0.01	178.6
370	0.0	210	0.00	370.00	0.01	189.1
380	0.0	210	0.00	380.00	0.01	195.8
390	0.0	204	0.00	390.00	0.01	196.8

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
400	0.0	217	0.00	400.00	0.01	196.8
410	0.0	125	0.00	410.00	0.01	196.8
420	0.0	165	0.00	420.00	0.01	196.8
430	0.0	186	0.00	430.00	0.01	196.8
440	0.0	198	0.00	440.00	0.01	196.8
450	0.0	181	0.00	450.00	0.01	196.8
460	0.0	202	0.00	460.00	0.01	196.8
470	0.0	205	0.00	470.00	0.01	196.8
480	0.0	194	0.00	480.00	0.01	196.8
490	0.0	195	0.00	490.00	0.01	196.6
500	0.0	202	0.00	500.00	0.02	196.4
510	0.0	190	0.00	510.00	0.02	196.4
520	0.0	192	0.00	520.00	0.02	196.4
530	0.0	200	0.00	530.00	0.02	196.4
540	0.0	204	0.00	540.00	0.02	196.4
550	0.0	170	0.00	550.00	0.02	196.4
560	0.0	205	0.00	560.00	0.02	196.4
570	0.0	209	0.00	570.00	0.02	196.4
580	0.0	207	0.00	580.00	0.02	197.0
590	0.0	204	0.00	590.00	0.02	198.1
600	0.0	214	0.00	600.00	0.02	198.6
610	0.0	213	0.00	610.00	0.02	198.6
620	0.0	205	0.00	620.00	0.02	198.6
630	0.0	200	0.00	630.00	0.02	198.6
640	0.0	203	0.00	640.00	0.02	198.6
650	0.0	219	0.00	650.00	0.02	198.6
660	0.0	207	0.00	660.00	0.02	198.6
670	0.0	207	0.00	670.00	0.02	198.6
680	0.0	219	0.00	680.00	0.02	198.6
690	0.0	206	0.00	690.00	0.02	198.6
700	0.0	212	0.00	700.00	0.02	198.6
710	0.0	200	0.00	710.00	0.02	198.6
720	0.0	206	0.00	720.00	0.02	198.6
730	0.0	200	0.00	730.00	0.02	198.6
740	0.0	201	0.00	740.00	0.02	198.6
750	0.0	205	0.00	750.00	0.02	198.6
760	0.0	199	0.00	760.00	0.02	198.6
770	0.0	203	0.00	770.00	0.02	198.6
780	0.0	205	0.00	780.00	0.02	198.6
790	0.0	210	0.00	790.00	0.02	198.6

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
800	0.0	204	0.00	800.00	0.02	198.6
810	0.0	206	0.00	810.00	0.02	198.6
820	0.0	206	0.00	820.00	0.02	198.6
830	0.0	208	0.00	830.00	0.02	198.6
840	0.0	204	0.00	840.00	0.02	198.6
850	0.0	204	0.00	850.00	0.02	198.6
860	0.0	200	0.00	860.00	0.02	198.6
870	0.0	208	0.00	870.00	0.02	198.6
880	0.0	208	0.00	880.00	0.02	199.7
890	0.0	206	0.00	890.00	0.03	200.5
900	0.0	206	0.00	900.00	0.03	200.5
910	0.0	206	0.00	910.00	0.03	200.5
920	0.0	207	0.00	920.00	0.03	200.5
930	0.0	207	0.00	930.00	0.03	200.5
940	0.0	201	0.00	940.00	0.03	200.5
950	0.0	205	0.00	950.00	0.03	200.5
960	0.0	175	0.00	960.00	0.03	200.5
970	0.0	178	0.00	970.00	0.03	198.5
980	0.0	194	0.00	980.00	0.03	196.7
990	0.0	198	0.00	990.00	0.03	196.8
1000	0.0	204	0.00	1000.00	0.03	196.9
1010	0.0	210	0.00	1010.00	0.03	196.9
1020	0.0	205	0.00	1020.00	0.03	196.9
1030	0.0	209	0.00	1030.00	0.03	196.9
1040	0.0	209	0.00	1040.00	0.03	196.9
1050	0.0	200	0.00	1050.00	0.03	196.9
1060	0.0	197	0.00	1060.00	0.03	196.9
1070	0.0	195	0.00	1070.00	0.03	196.9
1080	0.0	196	0.00	1080.00	0.03	196.9
1090	0.0	189	0.00	1090.00	0.04	196.5
1100	0.1	192	0.01	1100.00	0.04	195.7
1110	0.1	198	0.01	1110.00	0.05	195.6
1120	0.0	206	0.01	1120.00	0.06	196.3
1130	0.1	202	0.01	1130.00	0.07	197.1
1140	0.1	205	0.01	1140.00	0.08	197.9
1150	0.0	204	0.01	1150.00	0.08	198.5
1160	0.0	216	0.00	1160.00	0.08	198.6
1170	0.0	193	0.00	1170.00	0.08	198.6
1180	0.0	190	0.00	1180.00	0.08	198.6
1190	0.1	186	0.00	1190.00	0.09	198.0

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
1200	0.1	188	0.01	1200.00	0.10	196.5
1210	0.1	190	0.02	1210.00	0.12	195.3
1220	0.1	188	0.02	1220.00	0.14	194.6
1230	0.1	206	0.02	1230.00	0.15	194.8
1240	0.0	205	0.01	1240.00	0.16	195.4
1250	0.0	206	0.00	1250.00	0.17	195.5
1260	0.0	225	0.00	1260.00	0.17	195.5
1270	0.0	204	0.00	1270.00	0.17	195.5
1280	0.0	170	0.00	1280.00	0.17	195.2
1290	0.0	181	0.00	1290.00	0.17	194.6
1300	0.0	190	0.01	1300.00	0.18	194.4
1310	0.1	186	0.01	1310.00	0.19	194.1
1320	0.1	189	0.02	1320.00	0.20	193.6
1330	0.1	202	0.02	1330.00	0.22	193.6
1340	0.1	209	0.02	1340.00	0.23	194.6
1350	0.0	208	0.01	1350.00	0.25	195.4
1360	0.0	204	0.00	1360.00	0.25	195.5
1370	0.0	202	0.00	1370.00	0.25	195.5
1380	0.0	188	0.00	1380.00	0.25	195.5
1390	0.1	191	0.00	1390.00	0.26	195.5
1400	0.1	182	0.01	1400.00	0.27	194.9
1410	0.1	187	0.02	1410.00	0.29	194.2
1420	0.2	200	0.02	1420.00	0.31	194.2
1430	0.1	206	0.02	1430.00	0.33	194.6
1440	0.0	211	0.01	1440.00	0.34	194.8
1450	0.0	200	0.00	1450.00	0.34	194.8
1460	0.0	208	0.00	1460.00	0.34	194.8
1470	0.0	214	0.00	1470.00	0.34	194.8
1480	0.0	191	0.00	1480.00	0.34	194.8
1490	0.1	190	0.00	1490.00	0.34	194.7
1500	0.1	207	0.01	1500.00	0.36	195.0
1510	0.1	220	0.02	1510.00	0.37	195.9
1520	0.0	217	0.01	1520.00	0.38	196.4
1530	0.0	224	0.00	1530.00	0.38	196.4
1540	0.0	202	0.00	1540.00	0.38	196.4
1550	0.0	170	0.00	1550.00	0.38	196.4
1560	0.4	186	0.04	1560.00	0.42	195.5
1570	0.1	191	0.05	1570.00	0.46	194.6
1580	0.2	203	0.02	1580.00	0.49	194.8
1590	0.1	207	0.02	1590.00	0.51	195.1

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
1600	0.1	211	0.01	1600.00	0.52	195.5
1610	0.0	202	0.01	1610.00	0.53	195.8
1620	0.0	207	0.00	1620.00	0.53	195.8
1630	0.1	186	0.01	1630.00	0.54	195.6
1640	0.2	192	0.02	1640.00	0.56	195.4
1650	0.2	200	0.03	1650.00	0.59	195.5
1660	0.1	209	0.03	1660.00	0.62	195.8
1670	0.1	212	0.02	1670.00	0.64	196.3
1680	0.0	213	0.01	1680.00	0.65	196.5
1690	0.0	205	0.00	1690.00	0.65	196.5
1700	0.0	172	0.00	1700.00	0.65	196.5
1710	0.1	174	0.01	1710.00	0.66	196.3
1720	0.2	187	0.02	1720.00	0.68	195.9
1730	0.2	199	0.04	1730.00	0.72	195.7
1740	0.1	220	0.03	1740.00	0.75	196.2
1750	0.0	228	0.01	1750.00	0.76	196.5
1760	0.0	229	0.00	1760.00	0.76	196.5
1770	0.0	188	0.00	1770.00	0.76	196.5
1780	0.1	174	0.01	1780.00	0.76	196.2
1790	0.2	197	0.02	1790.00	0.79	196.0
1800	0.0	205	0.02	1800.00	0.81	196.1
1810	0.0	213	0.01	1810.00	0.81	196.1
1820	0.0	221	0.00	1820.00	0.81	196.2
1830	0.0	214	0.00	1830.00	0.81	196.2
1840	0.0	176	0.00	1840.00	0.81	196.2
1850	0.0	161	0.00	1850.00	0.81	196.2
1860	0.1	186	0.01	1860.00	0.82	196.1
1870	0.1	192	0.01	1870.00	0.83	196.0
1880	0.0	204	0.01	1880.00	0.84	196.0
1890	0.0	211	0.00	1890.00	0.84	196.0
1900	0.0	221	0.00	1900.00	0.84	196.1
1910	0.0	205	0.00	1910.00	0.84	196.1
1920	0.0	174	0.00	1920.00	0.84	196.1
1930	0.0	206	0.00	1930.00	0.84	196.1
1940	0.0	204	0.00	1940.00	0.85	196.1
1950	0.1	201	0.01	1950.00	0.85	196.1
1960	0.1	177	0.01	1960.00	0.87	195.9
1970	0.1	177	0.02	1970.00	0.88	195.5
1980	0.0	172	0.01	1980.00	0.89	195.4
1990	0.0	183	0.00	1990.00	0.89	195.4

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing

Equip.: L-23 Office: AZ Job No.: 30545

Calculation Method: Balanced Tangential

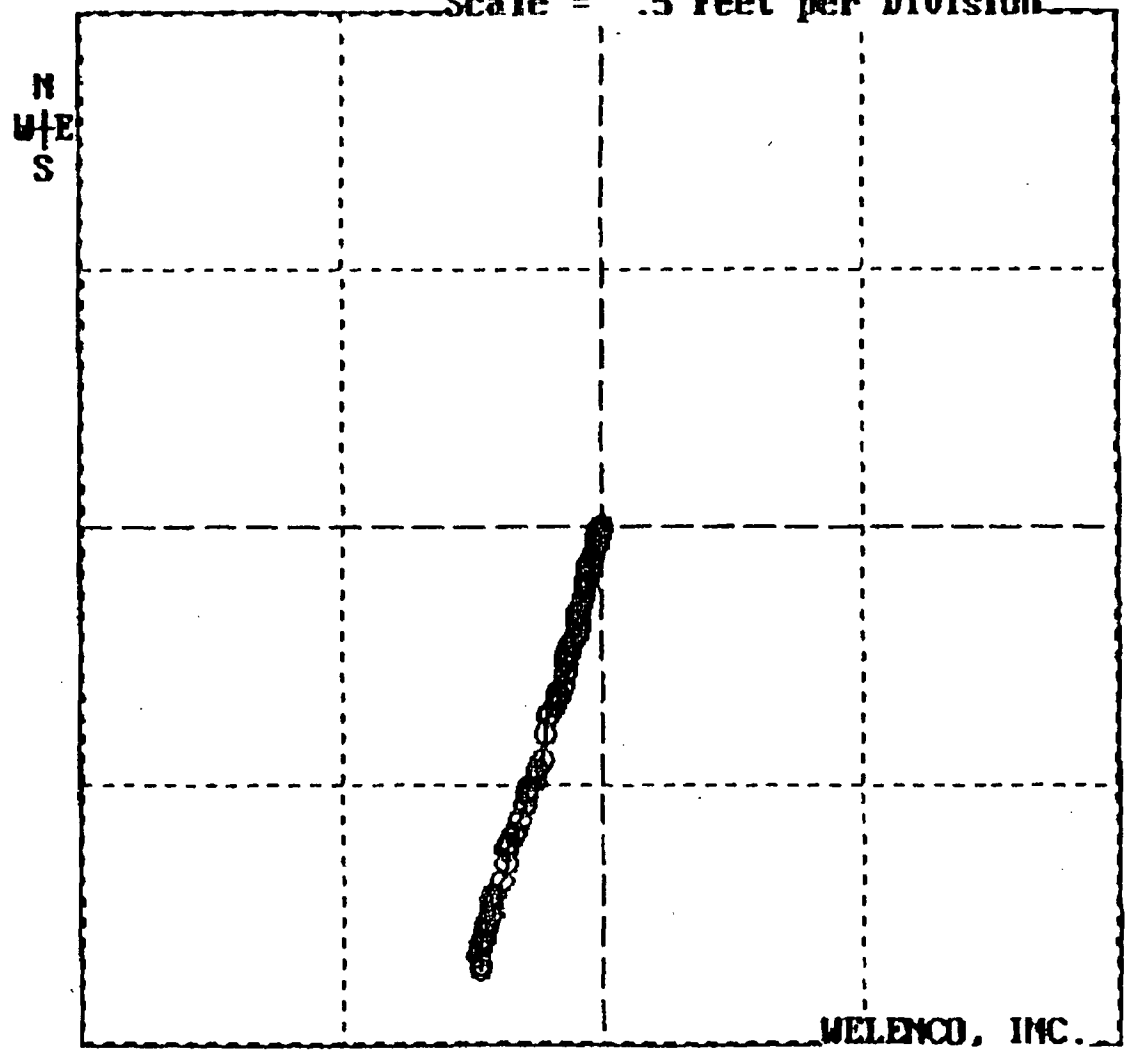
Company: LOS ALAMOS NATIONAL LAB.

Well #: GR-1

Date: 11-MAY-98

PLAN VIEW

Scale = .5 Feet per Division



WELENCO, INC.

CLOSURE

Distance: 0.89 FEET

Bearing: 195.4 DEGREES

T.V.D.: 1990.00 FEET

Calc. Method
Balanced Tangential

Company:
LOS ALAMOS NATIONAL LAB.
Well #:
GR-1

Date: 11-MAY-98

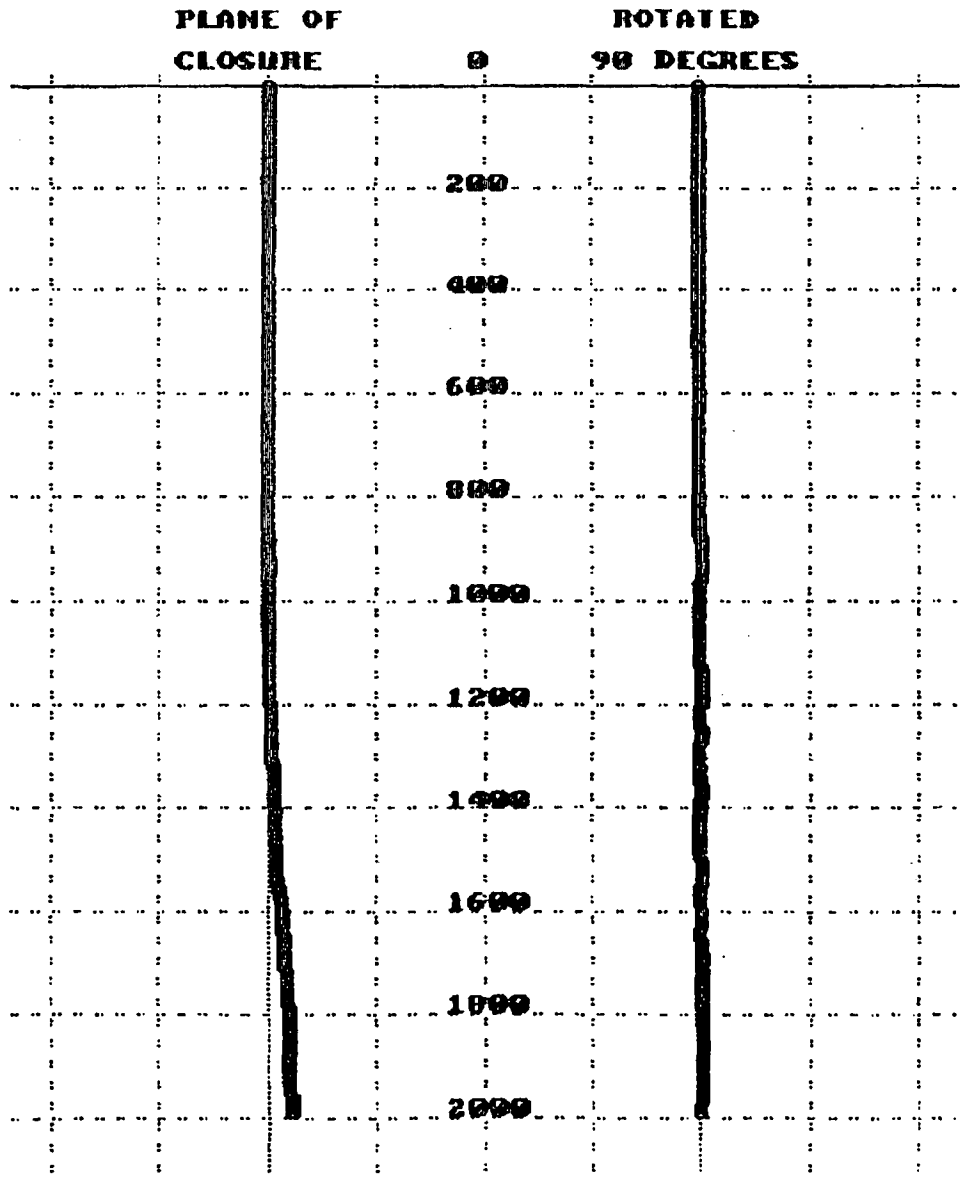
VERTICAL SECTION

Vert Scale = 200 Ft/Div
Horz Scale = 4 Ft/Div

CLOSURE

Distance: 0.89 FEET
Bearing: 195.4 DEGREES
T.V.D.: 1990.00 FEET

Calc. Method:
Balanced Tangential



Appendix II

(Guaje Replacement Well No. 2)

Appendix II-1

State Engineer Office Well Record, GR-2

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Los Alamos National Laboratory Owner's Well No. GR-2
Street or Post Office Address P.O. Box 1663
City and State Los Alamos, NM 87545

Well was drilled under Permit No. RG-486-S-3 and is located in the:

a. / ¼ SW ¼ SE ¼ NW ¼ of Section 4 Township 19N Range 7E N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Beylik Drilling, Inc. License No. WD-1105

Address 3702 B State Highway 528, Rio Rancho, NM 87124

Drilling Began 11/2/97 Completed 3/21/98 Type tools Reverse Rotary Size of hole 36/26 in.

Elevation of land surface or ——— at well is 6140 ? ft. Total depth of well 2000 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 318.4 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
			See Attached	1,200 GPM

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
28"	110.64	/	0	490	490	/	/	/
16 5/8" HSLA	65.08	/	+3	290	293	/	/	/
16 5/8" SS	66.60	/	290	565	275	/	/	/
16 5/8 SS	54.45	/	565	1980	1415	/	565	1415
16 5/8 SS	66.60	/	1980	2000	20	SE Head	/	/

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
0	490	36"	1023 sk gel	1833	Pressure Cement
			37 sk bent.		
			48,475# poz.		

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by:
_____
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad _____ FWL _____ FSL _____

File No. _____ Use _____ Location No. _____

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
			SEE ATTACHED

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

BEYLIK DRILLING, INC.

Kent M. Wartick

Driller

Kent M. Wartick

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

GEOLOGIC AND HYDROLOGIC LOG OF REPLACEMENT WELL GR 2
GUAJE CANYON

	Thickness	Depth
Alluvium Gravels, cobbles, and boulders: light brownish gray, rhyolite, latite, and dacite rock fragments, sub-rounded to rounded in a matrix of fine silty sand.	30	30
Puye Conglomerate Fanglomerate member; conglomerate; dark gray, rhyolite, latite, and dacite rock fragments, sub-rounded in a sand matrix of quartz, and rock fragments.	50	80
Totavi Lentil Conglomerate; dark gray, rhyolite and some quartzite rock fragments, sub-rounded to rounded in a quartz sand-gravel matrix.	30	110
Sand; very fine grained, light brown, quartz feldspar and mafic minerals, sub-rounded to rounded, well sorted; quartz, feldspar and mafic minerals are pitted, appears to be result of wind erosion, small light gray rhyolite rock fragments increase in lower 20ft.	40	150
Santa Fe Group Chaquehui Member; Conglomerate; light to dark gray, latite, rhyolite, quartzite and some schist rock fragments in a matrix of sand-size particles of quartz, feldspar, and rock fragments.	75	225
Sandy siltstone: gray, very fine sand particles of quartz, feldspar, and mafic minerals in a gray silt to clay matrix; inclusion of white clots of clay that may be weathered pumice form 250 to 270ft.	45	270
Sandy siltstone: light gray, mostly fine-grained quartz, feldspar and mafic minerals in a clay to silt matrix; few clots of white clay.	130	400
Sandstone; very light gray, made up of fine-grained quartz, feldspar and matic minerals; a few small rock fragments, some clots of white clay.	40	440
Siltstone; light red, fine-grained quartz, feldspar and mafic minerals; a few clots of white clay in a silt to clay matrix	30	470
Siltstone; light gray, fine-grained quartz, feldspar and mafic minerals; a few rock fragments of rhyolite and clots of white clay; water bearing 498 to 510ft.	40	510
Siltstone; reddish gray, fine-grained quartz, feldspar, and mafic minerals in a matrix of silt and clay; water bearing 510 to 512 ft: 518 to 520	30	540
Conglomerate; gray, latite, dacite, rhyolite and quartzite in a matrix of quartz, feldspar and rock fragments; some clay.	20	560
Siltstone; light tan, very fine-grained quartzs and feldspar in silt to clay matrix: a few rock fragments; water bearing 578 to 580ft.	20	580
Siltstone; white, very fine-grained quartz and feldspar, some mafic minerals in silt to clay matrix; water bearing 590 to 600 ft.	20	600

Silty sandstone; tan to light gray, quartz, feldspar, mafic minerals and some small rock fragments in a fine sand matrix; water bearing 600 to 620ft.	20	620
Siltstone; light gray, fine-grained quartz, feldspar, and some mafic minerals and small rock fragments in a light gray silt to clay matrix; a few small clots of white clay; water bearing 620 to 630ft.; 634 to 638 ft; 652 to 656 ft; 660 to 682 ft; 685 to 696 ft; 698 to 720 ft; 722 to 738 ft; 738 to 742 ft; 742 to 748 ft;	130	750
Silty Sandstone; light pinkish gray, quartz, feldspar, and mafic minerals in a silt to clay matrix; water bearing 772 to 774ft, 778 to 780ft.	70	820
Silty sandstone; gray, quartz, feldspar, and mafic minerals in a silt to clay matrix; water bearing 830 to 840ft;	20	840
Silty sandstone; dark gray, quartz, feldspar and mafic minerals in a silt to clay matrix; a few clots of white clay; water bearing 840 to 858ft.	20	860
Silty sandstone; light pinkish gray, quartz, feldspar, and mafic minerals in a silt to clay matrix; a few clots of white clay; water bearing 874 to 888ft; 890 to 896ft.	60	920
Silty Sandstone; light brownish gray, quartz, feldspar, and mafic minerals in a silt to clay matrix.	20	940
Silty Sandstone; light gray, quartz, feldspar and mafic minerals in a silt to clay matrix; water bearing 952 to 958ft.	25	965
Basalt; dark gray, vesicular to dense; water bearing 974 to 986ft; 988 to 989ft; 992 to 996ft; 1,014 to 1,022ft.	65	1,030
Interflow breccia; light pinkish gray, mostly mudstone with a few small fragments of basalt; water bearing 1,034 to 1038ft.	10	1,040
Basalt, dark gray, vasicular to dense; water bearing 1,050 to 1056ft.	30	1,070
Tesuque Formation; Claystone or Siltstone; brick red, quartz crystals and crystal fragments, arkosic.	10	1,080
Siltstone; yellowish gray, quartz crystals and crystal fragments, arkosic, in a gray to greenish slit to clay matrix	20	1,100
Siltstone; light pink, quartz crystals and crystal fragments, arkosic, some mafic mineral Water bearing 1,132 to 1,138ft.	60	1,160
Claystone; Medium gray, arkosic, a few clots of white clay; water bearing 1,176 to 1,1784.	20	1,180
Siltstone; light gray, arkosic, water bearing 1,184 to 1,186ft; 1,192 to 1,206ft.	20	1,200
Claystone; very light gray, arkosic, a few clots of white clay.	60	1,260
Siltstone; light pinkish gray, arkosic; water bearing 1,296 to 1,300ft.	40	1,300
Siltstone; light gray, arkosic; water bearing 1,300 to 1,312ft; 1,318 to 1,340ft.	46	1,340
Siltstone; pinkish gray, arkosic; water bearing 1,340 to 1,344ft; 1,394 to 1,400ft.	100	1,440
Siltstone; light gray, arkosic; water bearing 1,400 to 1,412ft.	90	1,530
Siltstone; light pinkish gray, arkosic; water bearing 1,558 to 1,562ft.	50	1,580

Claystone; light gray, arkosic	40	1,620
Silty Sandstone; light gray, arkosic, a few dark gray rock fragments; water bearing 1,620 to 1,626ft.	30	1,650
Siltstone, almost as claystone; greenish gray, arkosic; water bearing 1,667 to 1,676; 1680 to 1,690ft.	50	1,700
Siltstone, light pinkish gray, arkosic.	30	1,730
Claystone; light pinkish gray, arkosic, water bearing 1,784 to 1,794ft; 1,804 to 1,806	130	1,860
Claystone; light pinkish gray, clots of white clay, arkosic.	130	1,990
Claystone; light red to light pinkish gray, arkosic.	54	2,044
Note: Interpretation of Water Bearing zones based on Microlog; Total depth drilled 2,044ft. Ceased to 484 ft when geophysical logs were run.		

Appendix II-2

drilling fluid test results, GR-2 pilot hole

Drilling Fluid Properties for GR-2 – Pilot Hole

date	time	depth, ft	viscosity, sec/qt	weight, lb/gal	filtrate, cm^3/30 min.	pH	activity
11/19/97	13:25	557	30	8.4	32.8	9.0	drilling
11/20/97	9:45	659	32	8.6	12.8	9.0	TOH; bit
11/21/97	11:15	766	30	8.5	14.4	9.0	TOH; Totco
11/22/97	12:45	983	35	8.7	8.0	9.0	drilling
11/23/97	14:20	1,008	35	8.7	8.0	9.0	drilling
11/24/97	11:15	1,064	34	8.6	9.6	9.0	TOH; bit
11/25/97	14:25	1,287	33	8.7	9.6	9.0	drilling
11/26/97	11:20	1,485	33	8.7	8.0	8.0	drilling
11/28/97	11:25	1,792	31	8.8	8.0	8.0	drilling
11/29/97	10:50	1,943	31	8.8	10.4	8.0	drilling
11/30/97	9:40	2,040 TD	30	8.6	11.2	8.0	logging

ft feet
sec/qt seconds per quart
lb/gal pounds per gallon
cm^3/30 min cubic centimeters per 30 minutes

Appendix II-3

deviation survey results, GR-2 pilot hole

Deviation survey results, LANL Guaje Replacement Well No. 2
(from Totco surveys in pilot hole)

depth, feet	deviation, degrees
60	0.125
120	0.05
180	0.15
240	0.125
300	0.1
360	0.1
420	0.1
480	0.15
500	0.18
580	0.125
640	0.0628
700	0.0625
760	0.125
820	0.0
883	0.0
1,060	0.031
1,120	0.0625
1,180	0.108
1,240	0.0625
1,300	0.0625
1,360	0.0625
1,420	0.0625
1,540	0.125
1,600	0.0625
1,660	0.0625
1,720	0.05
1,780	0.175
1,840	0.0
1,900	0.25
1,960	0.0625

Appendix II-4

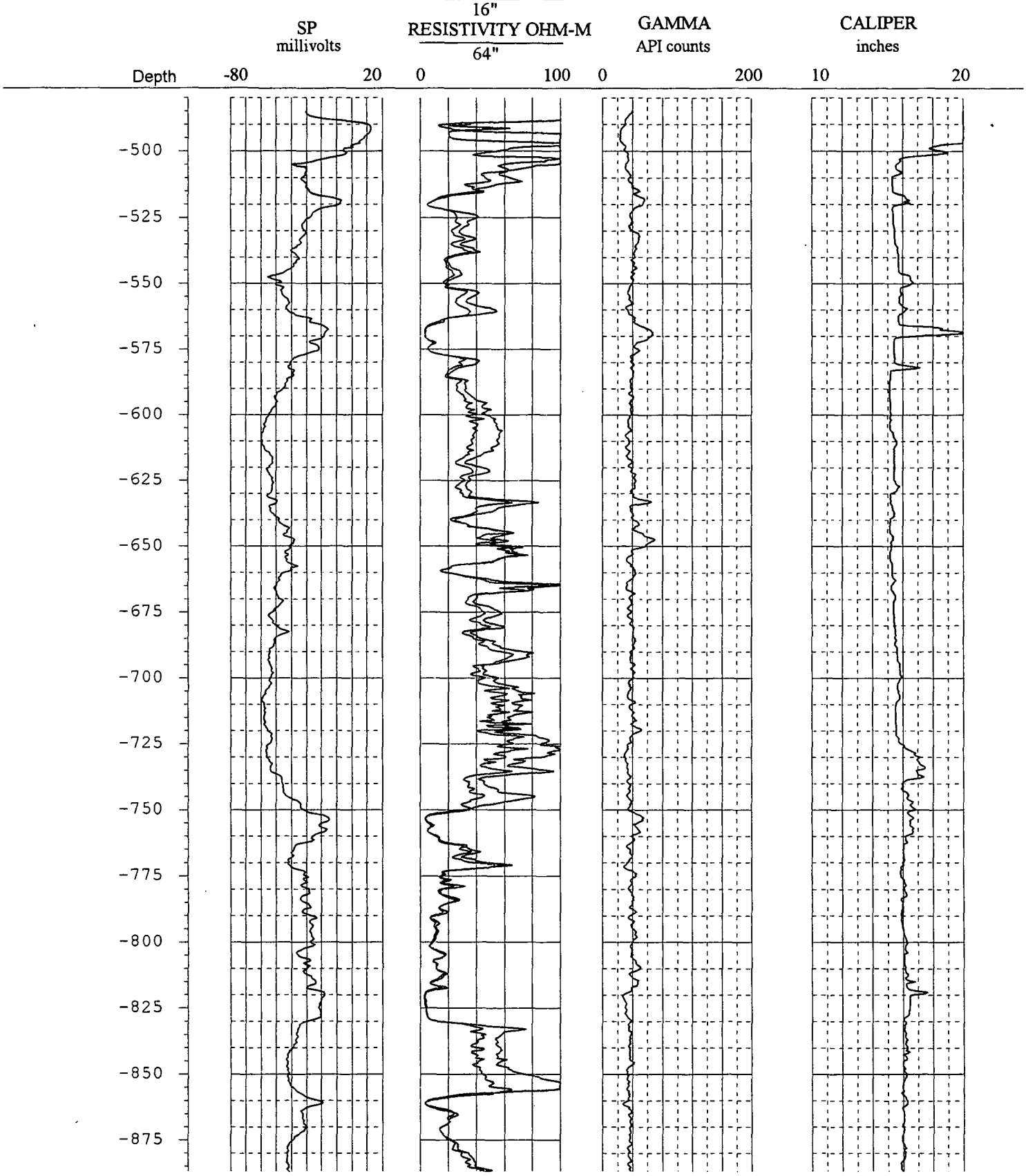
plots of geophysical log data, GR-2 pilot hole

JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-2

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Schlumberger
Casing: 28" to 483 ft
Bit Size: 17.5"
Date: November 29, 1997

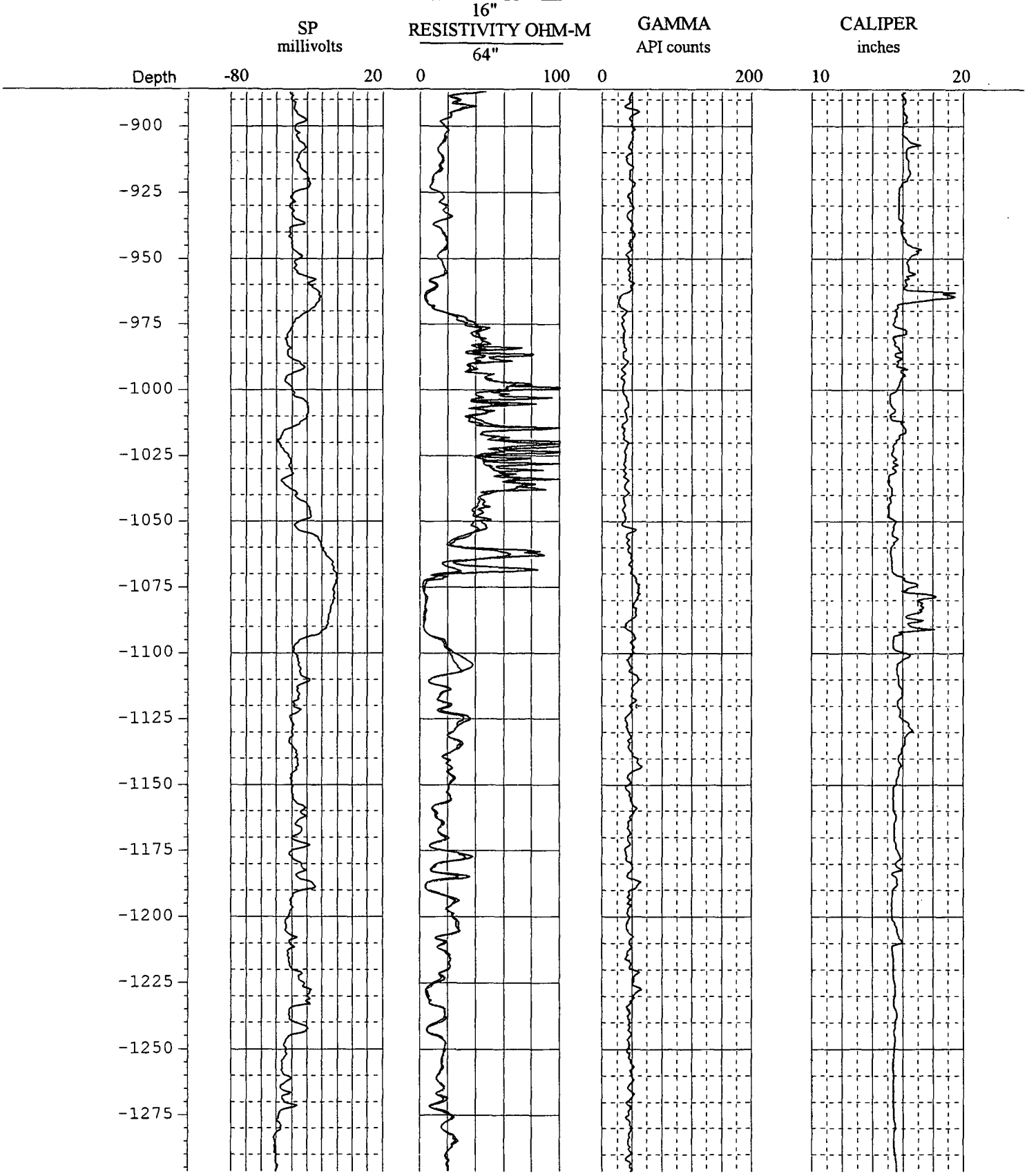


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-2

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Schlumberger
Casing: 28" to 483 ft
Bit Size: 17.5"
Date: November 29, 1997

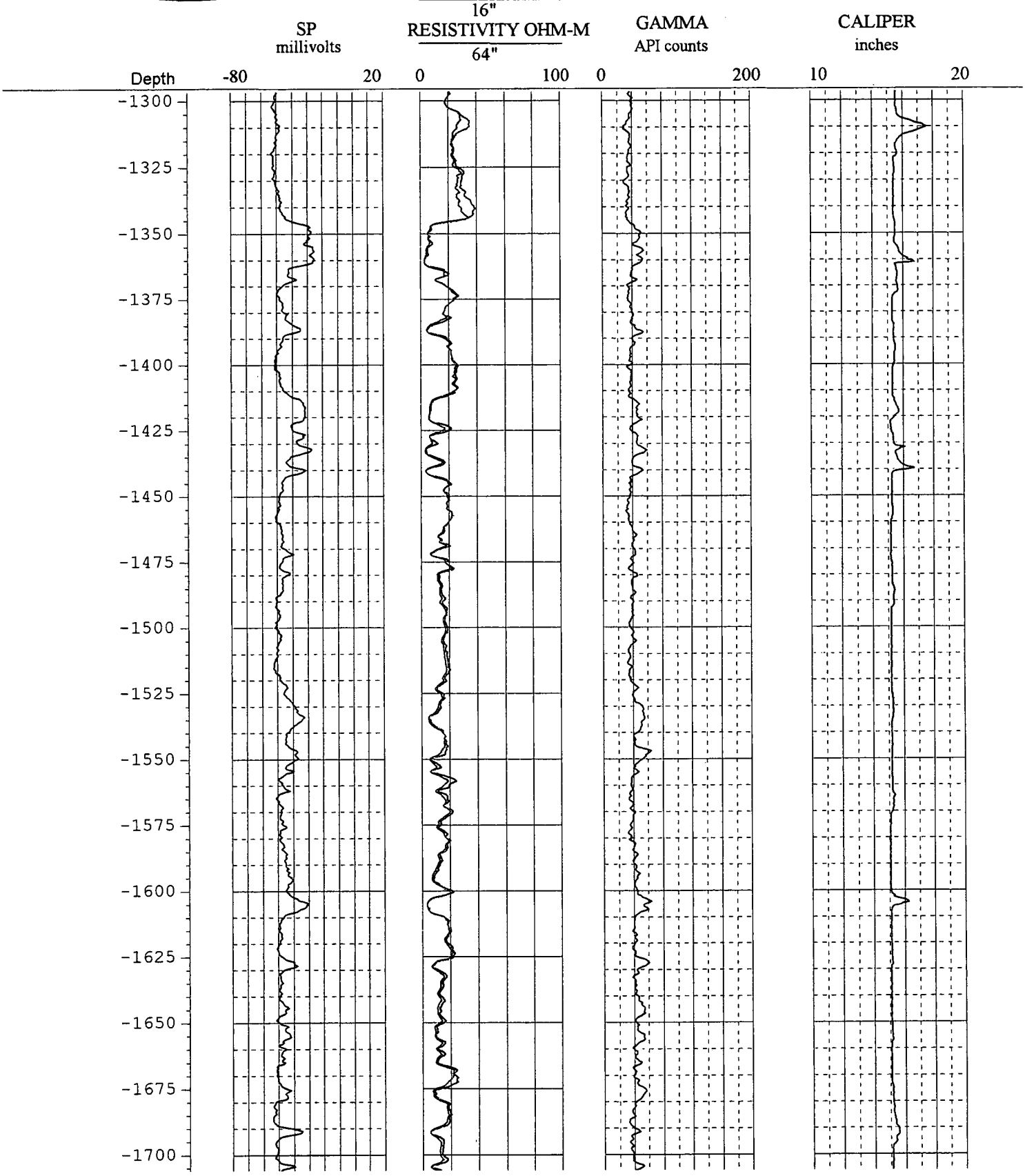


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-2

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Schlumberger
Casing: 28" to 483 ft
Bit Size: 17.5"
Date: November 29, 1997

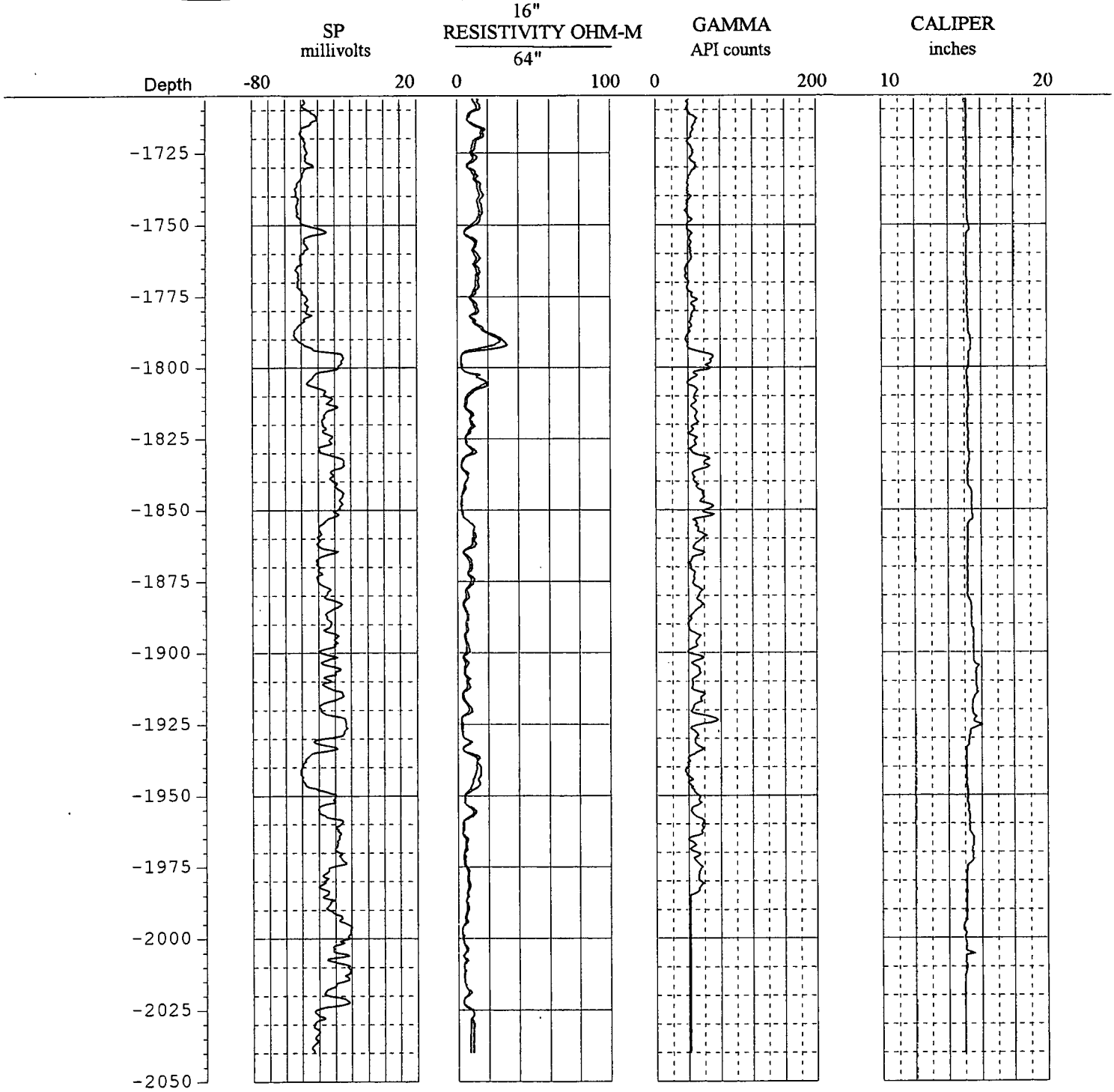


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-2

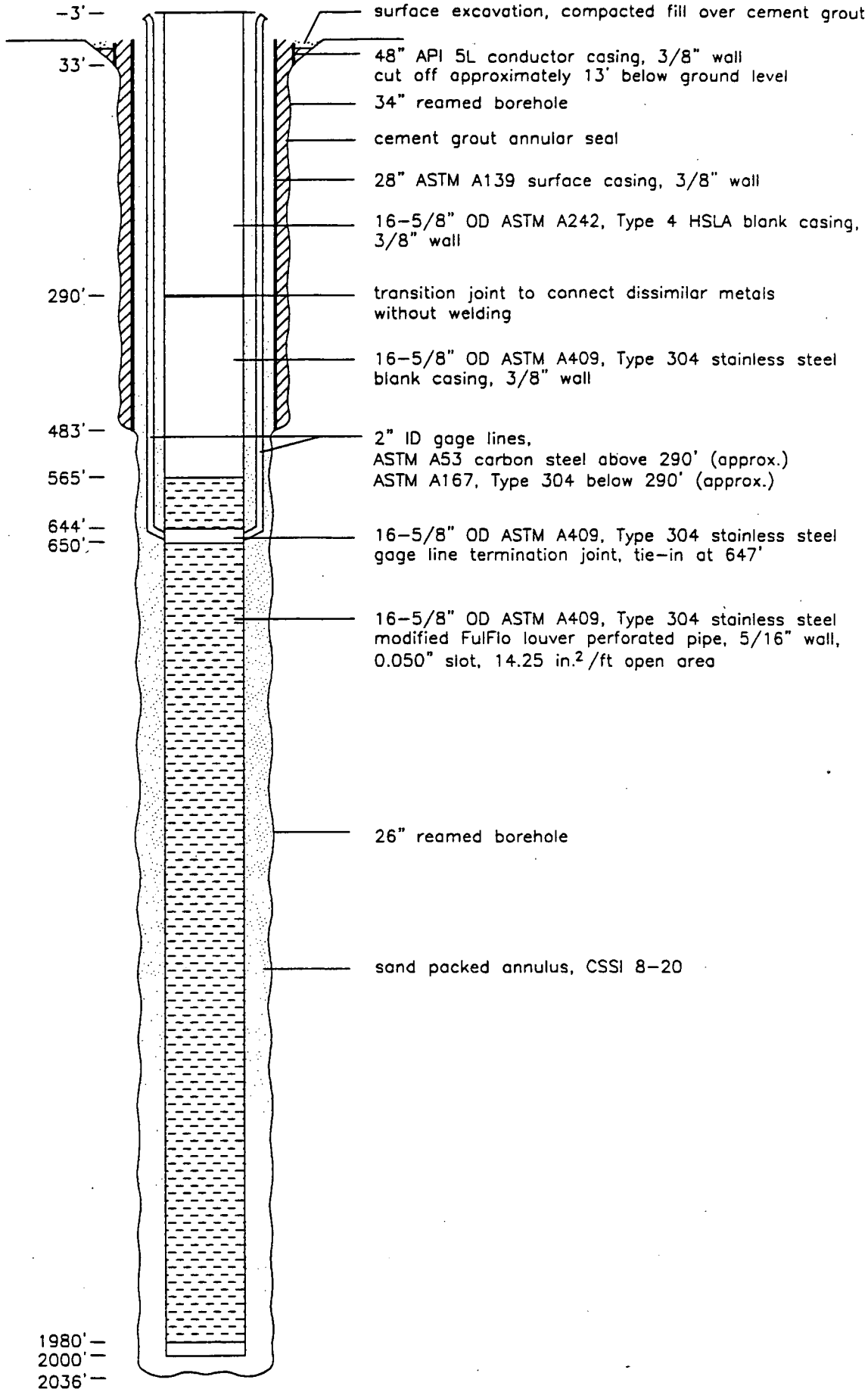
Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Schlumberger
Casing: 28" to 483 ft
Bit Size: 17.5"
Date: November 29, 1997



Appendix II-5

well completion diagram, GR-2



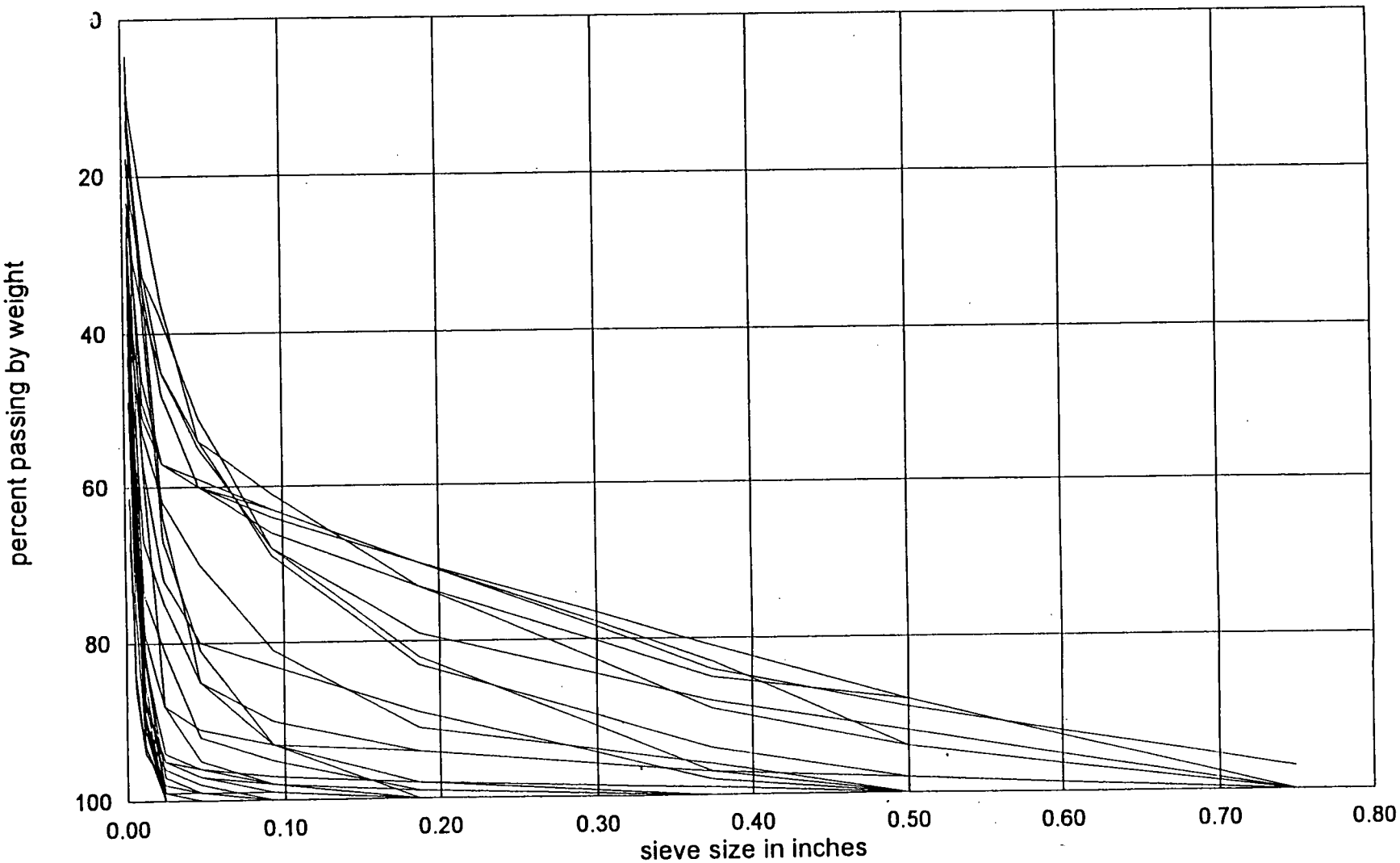
Well completion diagram, GR-2

JOHN SHOMAKER & ASSOCIATES, INC.

Appendix II-6

plot of sieve analysis results, GR-2

Sieve Analysis Results, Guaje Replacement Well No. 2



Dec. 21 '97 05:25PM P4
PHONE NO. : 5057979749
FROM : Vinyard & Associates

B . B331
(. C331

SUMMARY OF LA ORATORY TEST DATA

Test Hole	Depth (feet)	Unified Classification	Natural Dry Density (pcf)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
				LL	PI	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
GR-2	950-960					100	100	100	100	100	100	100	89	50	26.7	
GR-2	1200-1210					100	100	99	98	97	96	95	87	52	29.0	
GR-2	1210-1220					100	100	100	100	100	99	93	91	86	61.3	
GR-2	1280-1290					100	100	100	100	100	100	100	91	58	36.4	
GR-2	1290-1300					100	100	100	100	100	100	99	92	61	36.6	
GR-2	1320-1330					100	100	100	100	99	99	98	94	84	67.1	
GR-2	1370-1380					100	100	100	100	98	96	84	82	36	4.7	← CALL 4.7?
GR-2	1460-1470					100	100	100	100	100	99	99	93	76	48.8	
GR-2	1470-1480					100	100	100	100	100	99	99	91	70	43.0	
GR-2	1480-1490					100	100	100	99	98	97	95	90	66	36.4	
GR-2	1490-1500					100	100	100	100	99	97	95	87	64	40.3	

PRELIMINARY

Project Number : 97-2-646
Project : Los Alamos Well GR-2

Table No. : 1

SUMMARY OF LABORA ORY TEST DATA

th (feet)	Unified Classification	Natural Dry Density (pcf)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
			LL	PI	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
50-1560					100	100	96	91	81	70	62	53	43	27.9	
10-1620					100	100	100	100	100	98	96	91	65	40.2	
50-1660					100	100	100	98	93	81	67	56	39	25.6	
70-1680					100	100	100	100	93	85	75	67	48	33.1	
70-1780					100	100	100	99	98	95	88	79	61	37.2	
190-1900					100	100	100	99	98	97	95	88	67	39.8	

PRELIMINARY

ect Number : 97-2-646

ect : Las Alamos Well GR-2

Table No. : 1

V

Vinyard & Associates, Inc.

8916-A Adams, NE
Albuquerque, New Mexico 87113
(505) 797-9743

A

Geotechnical Engineering * Materials Testing * Environmental Engineering

December 1, 1997

Beylik Drilling Co.
3702-B State Highway 528
Rio Rancho, NM 87124

Attn: Mr. Kent Wartick

Project: Los Alamos Well - Samples
V & A Project No. 97-2-646

Gentlemen:

Attached are copies of the Sieve Analysis Test Results for the subject project.

Should you have any questions regarding this data, please do not hesitate to call.

Sincerely,

PRELIMINARY

Martin D. Vinyard, P.E.
Vinyard & Associates, Inc.

Attachment: Data Sheets (2)

cc: Addressee: (1)

ms

Appendix II-7

pumping test data, GR-2

GUAJE REPLACEMENT WELL NO. 2

STEP-DRAWDOWN TEST - 3/4/98

starting water level: 342.83 ft bgl

water level for specific capacity calculations: 322.74 ft bgl (prior to constant-rate test)

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
	9:06	pre-pump	342.83			start pump
03/04/98	9:07	1	366.68			
03/04/98	9:08	2	357.75			adjust engine rpm
03/04/98	9:09	3	361.27	408	10.39	
03/04/98	9:10	4	362.99	433	10.56	water clearing
03/04/98	9:11	5	363.73			
03/04/98	9:12	6	364.34	415	9.80	spinner survey by Welenco
03/04/98	9:13	7	363.96	400	9.53	
03/04/98	9:14	8	364.49			
03/04/98	9:15	9	364.34			
03/04/98	9:16	10	364.19			
03/04/98	9:18	12	365.28	421	9.73	start sand test
03/04/98	9:20	14	364.76	415	9.71	
03/04/98	9:22	16	366.06	415	9.42	
03/04/98	9:24	18	365.31	415	9.58	
03/04/98	9:26	20	366.67	415	9.29	
03/04/98	9:31	25	366.19	415	9.39	
03/04/98	9:36	30	366.59	415	9.31	
03/04/98	9:41	35	366.78	415	9.27	
03/04/98	9:46	40	367.42	415	9.14	
03/04/98	9:51	45	367.75	415	9.07	
03/04/98	9:56	50	367.53	415	9.11	T=85, k=195, pH=8.3
03/04/98	10:01	55	367.85	415	9.05	
03/04/98	10:06	60	367.46	415	9.13	
03/04/98	10:11	65	367.81	415	9.06	
03/04/98	10:16	70	367.69	415	9.08	
03/04/98	10:21	75	368.53	415	8.92	.02ml sand, 0.2 ppm
03/04/98	10:26	80	368.30	415	8.96	
03/04/98	10:31	85	367.95	415	9.03	
03/04/98	10:36	90	368.00	415	9.02	
03/04/98	10:41	95	368.42	415	8.94	T=83, k=185, pH=8.4
03/04/98	10:46	100	368.52	415	8.92	
03/04/98	10:47	101	376.84			increase Q, step 2
03/04/98	10:48	102	377.28			
03/04/98	10:49	103	378.01	578	10.32	1,200 rpm
03/04/98	10:50	104	377.87	578	10.35	
03/04/98	10:51	105	378.22			adjust flow rate up
03/04/98	10:52	106	378.66	599	10.57	
03/04/98	10:53	107	378.23			
03/04/98	10:54	108	379.60			

GUAJE REPLACEMENT WELL NO. 2

STEP-DRAWDOWN TEST - 3/4/98

starting water level: 342.83 ft bgl

water level for specific capacity calculations: 322.74 ft bgl (prior to constant-rate test)

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
03/04/98	10:55	109	379.76			T=84, k=178, pH=8.4
03/04/98	10:56	110	380.08			
03/04/98	10:58	112	380.01			
03/04/98	11:00	114	380.50	599	10.24	
03/04/98	11:02	116	380.46			
03/04/98	11:04	118	381.38			
03/04/98	11:06	120	380.94	594	10.08	
03/04/98	11:11	125	381.14	594	10.04	T=84, k=185, pH=8.4
03/04/98	11:16	130	381.17	589	9.95	
03/04/98	11:21	135	381.08	589	9.97	
03/04/98	11:26	140	381.54	589	9.89	
03/04/98	11:31	145	382.18	589	9.79	
03/04/98	11:36	150	381.23	589	9.95	
03/04/98	11:41	155	382.51	589	9.73	
03/04/98	11:46	160	382.21	589	9.78	
03/04/98	11:51	165	382.50	589	9.74	
03/04/98	11:56	170	382.22	589	9.78	
03/04/98	12:01	175	382.53	589	9.73	
03/04/98	12:06	180	382.34	589	9.76	
03/04/98	12:11	185	382.56	589	9.73	
03/04/98	12:16	190	381.99	589	9.82	
03/04/98	12:21	195	382.93	589	9.67	.02ml sand, trace
03/04/98	12:26	200	384.78	589	9.38	
03/04/98	12:27	201	388.72	798	11.96	increase Q, step 3
03/04/98	12:28	202	392.78	798	11.27	
03/04/98	12:29	203	393.61	798	11.14	
03/04/98	12:30	204	394.33	798	11.03	
03/04/98	12:31	205	393.94	798	11.09	
03/04/98	12:32	206	394.75	798	10.97	
03/04/98	12:33	207	395.11	798	10.92	
03/04/98	12:34	208	395.50	798	10.86	
03/04/98	12:35	209	395.60	798	10.84	
03/04/98	12:36	210	395.56	798	10.85	
03/04/98	12:38	212	395.53	798	10.85	
03/04/98	12:40	214	395.79	798	10.81	
03/04/98	12:42	216	396.21	798	10.75	
03/04/98	12:44	218	396.11	798	10.77	
03/04/98	12:46	220	396.48	798	10.71	
03/04/98	12:51	225	396.33	798	10.74	
03/04/98	12:56	230	396.99	798	10.64	

GUAJE REPLACEMENT WELL NO. 2

STEP-DRAWDOWN TEST - 3/4/98

starting water level: 342.83 ft bgl

water level for specific capacity calculations: 322.74 ft bgl (prior to constant-rate test)

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
03/04/98	13:01	235	397.35	798	10.59	T=86, k=177, pH=8.4
03/04/98	13:06	240	397.12	798	10.62	
03/04/98	13:11	245	397.61	798	10.55	
03/04/98	13:16	250	398.19	798	10.47	
03/04/98	13:21	255	397.67	798	10.55	
03/04/98	13:26	260	398.18	798	10.48	
03/04/98	13:31	265	398.44	798	10.44	
03/04/98	13:36	270	398.68	798	10.41	
03/04/98	13:41	275	398.64	798	10.41	
03/04/98	13:46	280	398.77	798	10.39	
03/04/98	13:51	285	398.57	798	10.42	
03/04/98	13:56	290	398.90	798	10.38	
03/04/98	14:01	295	399.33	798	10.32	trace sand
03/04/98	14:06	300	399.27	798	10.33	
03/04/98	14:07	301	402.96	1007	12.44	increase Q, step 4
03/04/98	14:08	302	407.64	1007	11.76	1,500 rpm
03/04/98	14:09	303	410.04	1007	11.44	
03/04/98	14:10	304	412.43	1007	11.14	
03/04/98	14:11	305	412.09	1007	11.18	
03/04/98	14:12	306	412.90	1007	11.08	
03/04/98	14:13	307	412.92	1007	11.08	
03/04/98	14:14	308	412.70	1007	11.10	
03/04/98	14:15	309	413.09	1007	11.05	
03/04/98	14:16	310	413.21	1007	11.04	
03/04/98	14:18	312	413.37	1007	11.02	
03/04/98	14:20	314	413.79	1007	10.97	
03/04/98	14:22	316	414.39	1007	10.90	
03/04/98	14:24	318	414.64	1007	10.87	
03/04/98	14:26	320	415.13	1007	10.81	
03/04/98	14:31	325	415.69	1007	10.75	
03/04/98	14:36	330	415.50	1007	10.77	
03/04/98	14:41	335	415.55	1007	10.76	
03/04/98	14:46	340	416.28	1007	10.68	
03/04/98	14:51	345	416.95	1007	10.61	
03/04/98	14:56	350	417.22	1007	10.58	
03/04/98	15:01	355	417.18	1007	10.58	T=88, k=190, pH=8.4
03/04/98	15:06	360	417.33	1007	10.56	
03/04/98	15:11	365	418.37	1007	10.45	
03/04/98	15:16	370	418.34	1007	10.45	
03/04/98	15:21	375	418.09	1007	10.48	

GUAJE REPLACEMENT WELL NO. 2

STEP-DRAWDOWN TEST - 3/4/98

starting water level: 342.83 ft bgl

water level for specific capacity calculations: 322.74 ft bgl (prior to constant-rate test)

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
03/04/98	15:26	380	418.21	1007	10.47	
03/04/98	15:31	385	418.74	1007	10.41	
03/04/98	15:36	390	418.67	1007	10.42	
03/04/98	15:41	395	418.87	1007	10.40	
03/04/98	15:46	400	419.28	1007	10.35	
03/04/98	15:47	401	421.38	1110	11.17	increase Q, step 5
03/04/98	15:48	402	427.74	1110	10.50	
03/04/98	15:49	403	429.76	1110	10.30	
03/04/98	15:50	404	429.53	1110	10.32	
03/04/98	15:51	405	429.17	1110	10.36	
03/04/98	15:52	406	427.19	1110	10.55	
03/04/98	15:53	407	425.96	1110	10.68	
03/04/98	15:54	408	424.94	1110	10.78	
03/04/98	15:55	409	424.85	1110	10.79	
03/04/98	15:56	410	423.70	1110	10.91	T=88, k=189, pH=8.4
03/04/98	15:58	412	425.83	1110	10.69	
03/04/98	16:00	414	426.73	1110	10.60	
03/04/98	16:02	416	426.50	1110	10.62	
03/04/98	16:04	418	426.70	1110	10.60	
03/04/98	16:06	420	426.15	1110	10.66	
03/04/98	16:11	425	426.80	1110	10.59	
03/04/98	16:16	430	427.52	1110	10.52	
03/04/98	16:21	435	427.67	1110	10.50	
03/04/98	16:26	440	428.24	1110	10.45	trace sand
03/04/98	16:31	445	427.70	1110	10.50	
03/04/98	16:36	450	427.74	1110	10.50	
03/04/98	16:41	455	427.90	1110	10.48	
03/04/98	16:46	460	428.74	1110	10.40	
03/04/98	16:51	465	429.14	1110	10.36	
03/04/98	16:56	470	429.04	1110	10.37	
03/04/98	17:01	475	428.95	1110	10.38	
03/04/98	17:06	480	429.20	1110	10.35	T=88, k=188, pH=8.3
03/04/98	17:11	485	429.31	1110	10.34	
03/04/98	17:16	490	429.56	1110	10.32	
03/04/98	17:21	495	431.10	1110	10.17	
03/04/98	17:26	500	429.93	1110	10.28	
03/04/98	17:31	505	430.09	1110	10.27	
03/04/98	17:36	510	429.99	1110	10.28	
03/04/98	17:41	515	430.77	1110	10.20	
03/04/98	17:46	520	431.15	1110	10.17	

GUAJE REPLACEMENT WELL NO. 2

STEP-DRAWDOWN TEST - 3/4/98

starting water level: 342.83 ft bgl

water level for specific capacity calculations: 322.74 ft bgl (prior to constant-rate test)

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
03/04/98	17:48	522	431.31	1110	10.16	pump off
03/04/98	17:49	523	359.80			start recovery
03/04/98	17:50	524	362.79			435,000 gal pumped
03/04/98	17:51	525	368.65			
03/04/98	17:52	526	368.52			
03/04/98	17:53	527	367.80			
03/04/98	17:54	528	367.04			
03/04/98	17:55	529	366.35			
03/04/98	17:56	530	365.71			
03/04/98	17:57	531	365.16			
03/04/98	17:58	532	364.67			
03/04/98	17:59	533	364.20			
03/04/98	18:00	534	363.79			
03/04/98	18:01	535	363.39			
03/04/98	18:02	536	363.05			
03/04/98	18:03	537	362.71			
03/04/98	18:04	538	362.41			
03/04/98	18:05	539	362.12			
03/04/98	18:06	540	361.84			
03/04/98	18:07	541	361.58			
03/04/98	18:08	542	361.35			
03/04/98	18:10	544	360.90			
03/04/98	18:12	546	360.51			
03/04/98	18:14	548	360.14			
03/04/98	18:16	550	359.82			
03/04/98	18:21	555	359.09			
03/04/98	18:26	560	358.50			
03/04/98	18:31	565	357.99			
03/04/98	18:36	570	357.54			
03/04/98	18:41	575	357.15			
03/04/98	18:46	580	356.79			
03/04/98	18:51	585	356.46			
03/04/98	18:56	590	356.17			
03/04/98	19:01	595	355.91			
03/04/98	19:06	600	355.63			
03/04/98	19:16	610	355.17			
03/04/98	19:26	620	354.75			
03/04/98	19:36	630	354.37			
03/04/98	19:46	640	354.02			
03/04/98	19:56	650	353.69			

GUAJE REPLACEMENT WELL NO. 2

STEP-DRAWDOWN TEST - 3/4/98

starting water level: 342.83 ft bgl

water level for specific capacity calculations: 322.74 ft bgl (prior to constant-rate test)

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
03/04/98	20:06	660	353.42			
03/04/98	20:16	670	353.13			
03/04/98	20:26	680	352.88			
03/04/98	20:36	690	352.62			
03/04/98	20:46	700	352.39			
03/04/98	21:16	730	351.74			
03/04/98	21:46	760	351.17			
03/04/98	22:16	790	350.65			
03/04/98	22:46	820	350.19			
03/04/98	23:16	850	349.75			
03/04/98	23:46	880	349.36			
03/05/98	0:16	910	348.98			
03/05/98	0:46	940	348.62			
03/05/98	1:16	970	348.29			
03/05/98	1:46	1000	347.97			
03/05/98	3:26	1100	347.01			
03/05/98	5:06	1200	346.16			
03/05/98	6:46	1300	345.41			
03/05/98	8:26	1400	344.70			
03/05/98	10:06	1500	344.04			
03/05/98	11:46	1600	343.41			
03/05/98	13:26	1700	342.81			
03/05/98	14:30	1764	342.46			end of recovery

GUAJE REPLACMENT WELL NO. 2
CONSTANT-RATE TEST
starting water level: 322.74 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
02/28/98	15:02	0						pump on
02/28/98		1	339.7	338.5			57.2	
02/28/98		2	330.73	329.53				Q unsteady, adj pump driver
02/28/98		2.75	330.72	329.52				
02/28/98		3.5	330.8	329.6				water to surface @ t=4
02/28/98		5	349.4	348.2	33.5"	901	35.4	
02/28/98		5.75	357.5	356.3	33.5"	901	26.8	
02/28/98		7.75	372.45	371.25	33.5"	901	18.6	adj driver rpm
02/28/98		8.5	372.56	371.36	33.5"	901	18.5	adj Q w/ gate valve
02/28/98		9.5	371.65	370.45	33.5"	901	18.9	
02/28/98		10.5	373.04	371.84	33.5"	901	18.4	
02/28/98		11	373.17	371.97	33.5"	901	18.3	
02/28/98	15:14	12	375.2	374	33.5"	901	17.6	
02/28/98		14.5	377.2	376	33.5"	901	16.9	
02/28/98		27	378.5	377.3	33.5"	901	16.5	
02/28/98		27.5	379.65	378.45	33.5"	901	16.2	
02/28/98		28.25	379.77	378.57	33.5"	901	16.1	
02/28/98		31.5	380.23	379.03	33.5"	901	16.0	
02/28/98		32.75	380.43	379.23	33.5"	901	15.9	no sand
02/28/98		35	380.99	379.79	33.5"	901	15.8	
02/28/98	15:42	40	382.25	381.05	33.5"	901	15.5	no sand
02/28/98		45	382.5	381.3	33.5"	901	15.4	T=87, k=210, pH=8.48
02/28/98		51	383.32	382.12	33.5"	901	15.2	
02/28/98		55	383.7	382.5	33.5"	901	15.1	
02/28/98	16:02	60	384.3	383.1	33.5"	901	14.9	T=86, k=187, pH=8.48
02/28/98		70	385.01	383.81	33.5"	901	14.8	
02/28/98		80	385.7	384.5	33.5"	901	14.6	
02/28/98		90	386.2	385	33.5"	901	14.5	
02/28/98		100	386.93	385.73	33.5"	901	14.3	0.02 ml sand, 0.1 ppm
02/28/98		115	387.82	386.62	33.5"	901	14.1	
02/28/98		117	387.95	386.75	33.5"	901	14.1	
02/28/98		130	388.6	387.4	33.5"	901	13.9	
02/28/98		145	389.17	387.97	33.5"	901	13.8	
02/28/98		160	389.65	388.45	33.5"	901	13.7	
02/28/98		170	390.55	389.35	33.5"	901	13.5	
02/28/98		190	392.25	391.05	33.5"	901	13.2	T=87, k=218, pH=8.59
02/28/98		206	393	391.8	33.5"	901	13.0	0.02 ml sand, 0.05 ppm
02/28/98	18:42	220	391.92	390.72	33.5"	901	13.3	
02/28/98		235	393.28	392.08	33.5"	901	13.0	T=87, k=212, pH=8.58
02/28/98		265	393.08	391.88	33.5"	901	13.0	0.04 ppm sand
02/28/98		308	395.6	394.4	33.5"	901	12.6	
02/28/98		329	395.94	394.74	33.5"	901	12.5	
02/28/98		358	396.61	395.41	33.5"	901	12.4	
02/28/98		388	398.34	397.14	33.5"	901	12.1	
02/28/98		418	398.1	396.9	33.5"	901	12.1	
02/28/98		448	398.81	397.61	33.5"	901	12.0	
02/28/98		478	400.19	398.99	33.5"	901	11.8	
02/28/98		538	398.73	396.88	33.5"	901	12.2	new mp, gl=mp-1.85'
03/01/98		578	399.56	397.71	33.5"	901	12.0	
03/01/98	01:00	598	400.01	398.16	33.5"	901	11.9	adjust Q
03/01/98		628	400.12	398.27	33.5"	901	11.9	
03/01/98		658	402.38	400.53	33.5"	901	11.6	
03/01/98		723	402.48	400.63	33.5"	901	11.6	
03/01/98		893	407.5	405.65	33.5"	901	10.9	
03/01/98	06:30	928	406.92	405.07	33.5"	901	10.9	

GUAJE REPLACMENT WELL NO. 2
CONSTANT-RATE TEST
starting water level: 322.74 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
03/01/98	07:00	958	407.5	405.65	33.5"	901	10.9	
03/01/98		994	407.63	405.78	33.5"	901	10.9	
03/01/98		1003	407.74	405.89	33.5"	901	10.8	adj. Q w/ gate valve
03/01/98		1018	407.9	406.05	33.5"	901	10.8	
03/01/98		1033	408.15	406.3	33.5"	901	10.8	
03/01/98		1048	408.52	406.67	33.5"	901	10.7	
03/01/98		1063	408.41	406.56	33.5"	901	10.7	
03/01/98	09:00	1078	408.78	406.93	33.5"	901	10.7	
03/01/98		1093	408.95	407.1	33.5"	901	10.7	adj. Q w/ gate valve
03/01/98		1110	410.02	408.17	33.5"	901	10.5	
03/01/98		1125	410.13	408.28	33.5"	901	10.5	
03/01/98		1140	410.14	408.29	33.5"	901	10.5	
03/01/98		1157	410.61	408.76	33.5"	901	10.5	
03/01/98		1175	410.47	408.62	33.5"	901	10.5	adj. Q w/ gate valve
03/01/98		1197	411.33	409.48	33.5"	901	10.4	
03/01/98	11:16	1214	411.07	409.22	33.5"	901	10.4	
03/01/98		1228	411.99	410.14	33.5"	901	10.3	
03/01/98		1243	412.14	410.29	33.5"	901	10.3	
03/01/98		1258	412.37	410.52	33.5"	901	10.3	
03/01/98		1273	412.45	410.6	33.5"	901	10.3	
03/01/98		1288	412.68	410.83	33.5"	901	10.2	
03/01/98	12:50	1303	412.67	410.82	33.5"	901	10.2	
03/01/98		1318	413.25	411.4	33.5"	901	10.2	T=87, k=196, pH=8.32
03/01/98		1338	413.7	411.85	33.5"	901	10.1	0.03 ml sand, 0.01 ppm
03/01/98		1343	413.8	411.95	33.5"	901	10.1	adj. Q w/ gate valve
03/01/98		1358	413.94	412.09	33.5"	901	10.1	
03/01/98	14:00	1378	414.18	412.33	33.5"	901	10.1	
03/01/98	14:15	1393	414.46	412.61	33.5"	901	10.0	
03/01/98		1408	414.88	413.03	33.5"	901	10.0	T=88, k=196, pH=8.31
03/01/98		1423	415.13	413.28	33.5"	901	10.0	0.03 ml sand, 0.01 ppm
03/01/98		1438	415.31	413.46	33.5"	901	9.9	
03/01/98		1453	415.45	413.6	33.5"	901	9.9	
03/01/98		1468	415.76	413.91	33.5"	901	9.9	
03/01/98		1483	415.93	414.08	33.5"	901	9.9	
03/01/98		1498	416.18	414.33	33.5"	901	9.8	
03/01/98		1513	416.45	414.6	33.5"	901	9.8	
03/01/98		1528	416.54	414.69	33.5"	901	9.8	T=88, k=233, pH=8.33
03/01/98	16:45	1543	416.76	414.91	33.5"	901	9.8	0.04 ml sand, 0.01 ppm
03/01/98		1558	416.94	415.09	33.5"	901	9.8	
03/01/98		1573	417.16	415.31	33.5"	901	9.7	
03/01/98		1588	417.36	415.51	33.5"	901	9.7	
03/01/98		1603	417.45	415.6	33.5"	901	9.7	
03/01/98		1618	417.74	415.89	33.5"	901	9.7	
03/01/98		1633	417.85	416	33.5"	901	9.7	
03/01/98		1648	418.13	416.28	33.5"	901	9.6	
03/01/98		1663	418.19	416.34	33.5"	901	9.6	T=87, k=240, pH=8.32
03/01/98	19:00	1678	418.32	416.47	33.5"	901	9.6	0.04 ml sand, 0.01 ppm
03/01/98		1693	418.58	416.73	33.5"	901	9.6	
03/01/98		1708	418.63	416.78	33.5"	901	9.6	
03/01/98		1738	419.83	417.98	33.5"	901	9.5	
03/01/98		1828	419.65	417.8	33.5"	901	9.5	
03/01/98		1858	420.33	418.48	33.5"	901	9.4	
03/01/98	22:30	1888	420.37	418.52	33.5"	901	9.4	
03/01/98	23:00	1918	421.02	419.17	33.5"	901	9.3	
03/01/98	23:30	1948	421.32	419.47	33.5"	901	9.3	
03/01/98		1978	421.83	419.98	33.5"	901	9.3	

GUAJE REPLACMENT WELL NO. 2
CONSTANT-RATE TEST
starting water level: 322.74 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
03/02/98	01:30	2008	421.83	419.98	33.5"	901	9.3	
03/02/98		2038	422.34	420.49	33.5"	901	9.2	
03/02/98		2068	422.56	420.71	33.5"	901	9.2	T=85, k=259, pH=8.3
03/02/98		2098	422.96	421.11	33.5"	901	9.2	
03/02/98		2128	423.31	421.46	33.5"	901	9.1	
03/02/98		2158	423.54	421.69	33.5"	901	9.1	
03/02/98		2188	424.01	422.16	33.5"	901	9.1	
03/02/98		2218	424.68	422.83	33.5"	901	9.0	
03/02/98		2248	424.64	422.79	33.5"	901	9.0	
03/02/98		2278	424.85	423	33.5"	901	9.0	
03/02/98		2308	424.95	423.1	33.5"	901	9.0	
03/02/98		2338	425.64	423.79	33.5"	901	8.9	
03/02/98		2368	425.75	423.9	33.5"	901	8.9	
03/02/98		2398	426.03	424.18	33.5"	901	8.9	
03/02/98		2428	427.02	425.17	33.5"	901	8.8	adj. Q w/ gate valve
03/02/98	08:00	2458	427.35	425.5	33.5"	901	8.8	
03/02/98		2488	427.64	425.79	33.5"	901	8.7	
03/02/98		2518	427.83	425.98	33.5"	901	8.7	
03/02/98		2548	428.05	426.2	33.5"	901	8.7	
03/02/98		2578	428.48	426.63	33.5"	901	8.7	
03/02/98		2608	428.65	426.8	33.5"	901	8.7	
03/02/98		2638	428.8	426.95	33.5"	901	8.6	
03/02/98		2668	428.97	427.12	33.5"	901	8.6	T=84, k=185, pH=8.37
03/02/98	12:00	2698	429.17	427.32	33.5"	901	8.6	
03/02/98		2728	429.17	427.32	33.5"	901	8.6	adj. Q w/ gate valve
03/02/98		2758	429.81	427.96	33.5"	901	8.6	
03/02/98		2788	430.8	428.95	33.5"	901	8.5	adj. Q w/ gate valve
03/02/98		2818	431.04	429.19	33.5"	901	8.5	
03/02/98		2826	431.08	429.23	33.5"	901	8.5	LANL coll. bact. samp no. 2, first samp failed
03/02/98		2848	431.34	429.49	33.5"	901	8.4	
03/02/98		2878	431.61	429.76	33.5"	901	8.4	
03/02/98	15:04	2882	431.52	429.67	33.5"	901	8.4	0.06 ml sand, 0.01 ppm

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	t/t'	remarks
03/02/98	15:05	0				pump off
03/02/98	15:05	0.5	375.55	374.35	5765	
03/02/98		1	368	366.8	2883	
03/02/98	15:06	1.5	368.56	367.36	1922	
03/02/98		2	376.61	375.41	1442	
03/02/98		2.75	380.77	379.57	1049	
03/02/98		3.33	381.11	379.91	866	
03/02/98		3.75	381.21	380.01	770	
03/02/98		4.5	381.06	379.86	641	
03/02/98		5	380.55	379.35	577	
03/02/98	15:10	5.75	380.26	379.06	502	
03/02/98	15:12	7	379.77	378.57	413	
03/02/98		8.25	380.33	379.13	350	
03/02/98		9	379.87	378.67	321	
03/02/98		11	379.58	378.38	263	
03/02/98		13.5	378.66	377.46	214	
03/02/98	15:20	15	378.06	376.86	193	
03/02/98		18	377.48	376.28	161	
03/02/98		19	377.15	375.95	153	
03/02/98		22.5	376.52	375.32	129	

GUAJE REPLACMENT WELL NO. 2
CONSTANT-RATE TEST
starting water level: 322.74 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	t/t'	remarks
03/02/98	15:30	25	375.95	374.75	116	
03/02/98		27	375.65	374.45	108	
03/02/98		28.75	375.4	374.2	101	
03/02/98		30	375.3	374.1	97	
03/02/98		38.25	374.34	373.14	76	
03/02/98		39.25	374.26	373.06	74	
03/02/98		40.75	374	372.8	72	
03/02/98		43.75	373.89	372.69	67	
03/02/98		48	373.35	372.15	61	
03/02/98		52	372.98	371.78	56	
03/02/98	16:00	56	372.72	371.52	52	
03/02/98		65	372.19	370.99	45	
03/02/98		75	371.64	370.44	39	
03/02/98		85	370.98	369.78	35	
03/02/98		95	370.53	369.33	31	
03/02/98		108	369.95	368.75	28	
03/02/98		115	369.61	368.41	26	
03/02/98		130	368.99	367.79	23	
03/02/98		145	368.49	367.29	21	
03/02/98		160	367.95	366.75	19	
03/02/98		175	367.48	366.28	17	
03/02/98		190	366.97	365.77	16	
03/02/98		205	366.62	365.42	15	
03/02/98		220	366.13	364.93	14	
03/02/98		235	365.2	364	13	
03/02/98		265	365.1	363.9	12	
03/02/98	20:00	295	364.2	363	11	
03/02/98		325	363.6	362.4	10	
03/02/98		355	363	361.8	9	
03/02/98		385	362.4	361.2	8	
03/02/98		415	362.05	360.85	8	
03/02/98		445	361.2	360	7	
03/02/98		475	360.6	359.4	7	
03/02/98	23:30	505	360.15	358.95	7	
03/03/98	00:00	535	359.8	358.6	6	
03/03/98		565	359.2	358	6	
03/03/98		595	358.8	357.6	6	
03/03/98		625	358.3	357.1	6	
03/03/98		995	353.75	352.55	4	
03/03/98		1015	353.48	352.28	4	
03/03/98		1045	353.2	352	4	
03/03/98		1075	352.87	351.67	4	
03/03/98		1105	352.55	351.35	4	
03/03/98	10:00	1135	352.27	351.07	4	
03/03/98	10:20	1155	351.8	350.6	3	
03/03/98		1240	351.02	349.82	3	
03/03/98		1285	350.55	349.35	3	
03/03/98		1330	350.23	349.03	3	
03/03/98	15:45	1480	348.96	347.76	3	
03/03/98	16:45	1540	348.46	347.26	3	

Appendix II-8

gyroscopic survey results, GR-2

****

>>>> Welenco, Inc.>>>>

DIRECTIONAL SURVEY

****

Date: 3-7-1998

Company : BEYLIK DRILLING, INC.
Well No : GR-2 (GUAJE REPLACEMENT WELL)
Field : LOS ALAMOS NATIONAL LAB
State : N.M. County: LOS ALAMOS
Witnessed By: MALUSA Rec. By: CHRISTY
Location :
Remarks : GYRO TOOL # 2536

****

Measured Depth, Feet	Inclination, Degrees True	Direction, Degrees	Course Deviation, Feet	True Vertical Depth, Feet	Closure Distance, Feet	Closure Bearing, Degrees True
0	0.0	316	0.00	0.00	0.00	0.0
10	0.0	274	0.00	10.00	0.00	0.0
20	0.0	236	0.00	20.00	0.00	0.0
30	0.0	172	0.00	30.00	0.00	0.0
40	0.0	293	0.00	40.00	0.00	0.0
50	0.0	213	0.00	50.00	0.00	0.0
60	0.0	287	0.00	60.00	0.00	0.0
70	0.0	259	0.00	70.00	0.00	0.0
80	0.0	218	0.00	80.00	0.00	0.0
90	0.0	220	0.00	90.00	0.00	0.0
100	0.0	133	0.00	100.00	0.00	0.0
110	0.0	249	0.00	110.00	0.00	0.0
120	0.0	290	0.00	120.00	0.00	0.0
130	0.0	233	0.00	130.00	0.00	0.0
140	0.0	291	0.00	140.00	0.00	0.0
150	0.0	191	0.00	150.00	0.00	0.0
160	0.0	44	0.00	160.00	0.00	0.0
170	0.0	3	0.00	170.00	0.00	0.0
180	0.0	187	0.00	180.00	0.00	0.0
190	0.0	191	0.00	190.00	0.00	0.0
200	0.0	20	0.00	200.00	0.00	0.0
210	0.0	125	0.00	210.00	0.00	0.0
220	0.0	9	0.00	220.00	0.00	0.0
230	0.0	151	0.00	230.00	0.00	0.0
240	0.0	281	0.00	240.00	0.00	0.0
250	0.0	299	0.00	250.00	0.00	0.0
260	0.0	262	0.00	260.00	0.00	0.0
270	0.0	265	0.00	270.00	0.00	0.0
280	0.0	264	0.00	280.00	0.00	0.0
290	0.0	309	0.00	290.00	0.00	0.0
300	0.0	320	0.00	300.00	0.00	0.0
310	0.0	249	0.00	310 00	0.00	0.0
320	0.0	265	0.00	320.00	0.00	0.0
330	0.0	2	0.00	330.00	0.00	0.0
340	0.0	186	0.00	340.00	0.00	0.0
350	0.0	192	0.00	350.00	0.00	0.0
360	0.0	258	0.00	360.00	0.00	0.0
370	0.0	270	0.00	370.00	0.00	0.0
380	0.0	297	0.00	380.00	0.00	0.0
390	0.0	243	0.00	390.00	0.00	0.0

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
400	0.0	246	0.00	400.00	0.00	0.0
410	0.1	270	0.01	410.00	0.01	270.0
420	0.0	248	0.01	420.00	0.02	270.0
430	0.0	260	0.00	430.00	0.02	270.0
440	0.1	244	0.01	440.00	0.03	261.4
450	0.1	240	0.02	450.00	0.04	253.6
460	0.0	228	0.01	460.00	0.05	251.3
470	0.0	211	0.00	470.00	0.05	251.3
480	0.0	240	0.00	480.00	0.05	251.3
490	0.0	230	0.00	490.00	0.05	251.3
500	0.0	240	0.00	500.00	0.05	251.3
510	0.0	232	0.00	510.00	0.05	251.3
520	0.0	238	0.00	520.00	0.05	251.3
530	0.0	212	0.00	530.00	0.05	251.3
540	0.0	207	0.00	540.00	0.05	251.3
550	0.0	201	0.00	550.00	0.05	251.3
560	0.0	229	0.00	560.00	0.05	251.3
570	0.0	242	0.00	570.00	0.05	251.3
580	0.0	197	0.00	580.00	0.05	251.3
590	0.0	232	0.00	590.00	0.05	251.3
600	0.0	234	0.00	600.00	0.05	251.3
610	0.0	237	0.00	610.00	0.05	251.3
620	0.0	243	0.00	620.00	0.05	251.3
630	0.0	190	0.00	630.00	0.05	251.3
640	0.0	208	0.00	640.00	0.05	251.3
650	0.0	213	0.00	650.00	0.05	251.3
660	0.0	194	0.00	660.00	0.05	251.3
670	0.0	207	0.00	670.00	0.05	251.3
680	0.0	206	0.00	680.00	0.05	251.3
690	0.0	207	0.00	690.00	0.05	251.3
700	0.0	226	0.00	700.00	0.05	251.3
710	0.0	237	0.00	710.00	0.05	251.3
720	0.0	198	0.00	720.00	0.05	251.3
730	0.0	201	0.00	730.00	0.05	251.3
740	0.0	222	0.00	740.00	0.05	251.3
750	0.0	230	0.00	750.00	0.05	251.3
760	0.0	207	0.00	760.00	0.05	251.3
770	0.0	205	0.00	770.00	0.05	251.3
780	0.0	214	0.00	780.00	0.05	251.3
790	0.0	198	0.00	790.00	0.05	251.3

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
800	0.0	209	0.00	800.00	0.05	251.3
810	0.0	243	0.00	810.00	0.05	251.3
820	0.0	208	0.00	820.00	0.05	251.3
830	0.0	201	0.00	830.00	0.05	251.3
840	0.0	205	0.00	840.00	0.05	251.3
850	0.0	190	0.00	850.00	0.05	251.3
860	0.0	197	0.00	860.00	0.05	251.3
870	0.0	203	0.00	870.00	0.05	251.3
880	0.0	219	0.00	880.00	0.05	251.3
890	0.0	198	0.00	890.00	0.05	251.3
900	0.0	199	0.00	900.00	0.05	251.3
910	0.0	195	0.00	910.00	0.05	251.3
920	0.0	216	0.00	920.00	0.05	251.3
930	0.0	246	0.00	930.00	0.05	251.3
940	0.0	230	0.00	940.00	0.05	251.3
950	0.0	207	0.00	950.00	0.05	251.3
960	0.0	243	0.00	960.00	0.05	251.3
970	0.0	249	0.00	970.00	0.05	251.3
980	0.0	224	0.00	980.00	0.05	251.3
990	0.0	242	0.00	990.00	0.05	251.3
1000	0.0	230	0.00	1000.00	0.05	251.3
1010	0.0	242	0.00	1010.00	0.05	251.3
1020	0.0	231	0.00	1020.00	0.05	251.3
1030	0.0	211	0.00	1030.00	0.05	251.3
1040	0.0	186	0.00	1040.00	0.05	251.3
1050	0.0	226	0.00	1050.00	0.05	251.3
1060	0.0	222	0.00	1060.00	0.05	251.3
1070	0.0	219	0.00	1070.00	0.05	251.3
1080	0.0	228	0.00	1080.00	0.05	251.3
1090	0.0	211	0.00	1090.00	0.05	251.3
1100	0.0	241	0.00	1100.00	0.05	251.3
1110	0.0	194	0.00	1110.00	0.05	251.3
1120	0.0	182	0.00	1120.00	0.05	251.3
1130	0.0	173	0.00	1130.00	0.05	251.3
1140	0.0	175	0.00	1140.00	0.05	251.3
1150	0.0	180	0.00	1150.00	0.05	251.3
1160	0.0	208	0.00	1160.00	0.05	251.3
1170	0.0	183	0.00	1170.00	0.05	251.3
1180	0.0	203	0.00	1180.00	0.05	251.3
1190	0.0	260	0.00	1190.00	0.05	251.3

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
1200	0.0	234	0.00	1200.00	0.05	251.3
1210	0.0	224	0.00	1210.00	0.05	251.3
1220	0.0	225	0.00	1220.00	0.05	251.3
1230	0.0	207	0.00	1230.00	0.05	251.3
1240	0.0	232	0.00	1240.00	0.05	251.3
1250	0.0	187	0.00	1250.00	0.05	251.3
1260	0.0	183	0.00	1260.00	0.05	251.3
1270	0.0	187	0.00	1270.00	0.05	251.3
1280	0.0	219	0.00	1280.00	0.05	251.3
1290	0.0	207	0.00	1290.00	0.05	251.3
1300	0.0	240	0.00	1300.00	0.05	251.3
1310	0.0	213	0.00	1310.00	0.05	251.3
1320	0.0	225	0.00	1320.00	0.05	251.3
1330	0.0	265	0.00	1330.00	0.05	251.3
1340	0.0	223	0.00	1340.00	0.05	251.3
1350	0.0	201	0.00	1350.00	0.05	251.3
1360	0.0	206	0.00	1360.00	0.05	251.3
1370	0.0	204	0.00	1370.00	0.05	251.3
1380	0.0	187	0.00	1380.00	0.05	251.3
1390	0.0	201	0.00	1390.00	0.05	251.3
1400	0.0	249	0.00	1400.00	0.05	251.3
1410	0.0	220	0.00	1410.00	0.05	251.3
1420	0.0	203	0.00	1420.00	0.05	251.3
1430	0.0	194	0.00	1430.00	0.05	251.3
1440	0.0	189	0.00	1440.00	0.05	251.3
1450	0.0	196	0.00	1450.00	0.05	251.3
1460	0.1	219	0.01	1460.00	0.06	246.7
1470	0.0	212	0.01	1470.00	0.07	243.2
1480	0.1	185	0.01	1480.00	0.07	237.2
1490	0.0	199	0.01	1490.00	0.08	232.1
1500	0.0	173	0.00	1500.00	0.08	232.1
1510	0.0	161	0.00	1510.00	0.08	232.1
1520	0.0	197	0.00	1520.00	0.08	232.1
1530	0.0	180	0.00	1530.00	0.08	232.1
1540	0.0	220	0.00	1540.00	0.08	232.1
1550	0.0	257	0.00	1550.00	0.08	232.1
1560	0.0	246	0.00	1560.00	0.08	232.1
1570	0.1	208	0.01	1570.00	0.09	229.7
1580	0.0	212	0.01	1580.00	0.09	227.7
1590	0.0	234	0.00	1590.00	0.09	227.7

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
1600	0.0	199	0.00	1600.00	0.09	227.7
1610	0.0	218	0.00	1610.00	0.09	227.7
1620	0.1	176	0.01	1620.00	0.10	223.7
1630	0.1	199	0.02	1630.00	0.11	218.6
1640	0.0	191	0.01	1640.00	0.12	217.2
1650	0.0	198	0.00	1650.00	0.12	217.2
1660	0.0	186	0.00	1660.00	0.12	217.2
1670	0.0	214	0.00	1670.00	0.12	217.2
1680	0.0	224	0.00	1680.00	0.12	217.2
1690	0.0	200	0.00	1690.00	0.12	217.2
1700	0.0	184	0.00	1700.00	0.12	217.2
1710	0.0	236	0.00	1710.00	0.12	217.2
1720	0.0	245	0.00	1720.00	0.12	217.2
1730	0.0	222	0.00	1730.00	0.12	217.2
1740	0.0	223	0.00	1740.00	0.12	217.2
1750	0.0	180	0.00	1750.00	0.12	217.2
1760	0.0	227	0.00	1760.00	0.12	217.2
1770	0.0	237	0.00	1770.00	0.12	217.2
1780	0.0	246	0.00	1780.00	0.12	217.2
1790	0.1	225	0.01	1790.00	0.13	217.7
1800	0.1	220	0.02	1800.00	0.15	218.3
1810	0.0	203	0.01	1810.00	0.16	218.4
1820	0.1	246	0.01	1820.00	0.16	219.8
1830	0.1	222	0.02	1830.00	0.18	221.1
1840	0.2	204	0.03	1840.00	0.21	219.7
1850	0.1	192	0.03	1850.00	0.23	217.6
1860	0.1	228	0.02	1860.00	0.25	217.1
1870	0.2	222	0.03	1870.00	0.27	217.7
1880	0.2	216	0.03	1880.00	0.31	217.9
1890	0.2	195	0.03	1890.00	0.34	216.6
1900	0.2	178	0.03	1900.00	0.37	214.0
1910	0.2	207	0.03	1910.00	0.40	212.2
1920	0.2	212	0.03	1920.00	0.44	212.0
1930	0.2	198	0.03	1930.00	0.47	211.5
1940	0.2	188	0.03	1940.00	0.51	210.2
1950	0.3	201	0.04	1950.00	0.55	209.1
1960	0.3	201	0.05	1960.00	0.60	208.4
1970	0.3	199	0.05	1970.00	0.65	207.7
1980	0.3	198	0.05	1980.00	0.70	207.0
1985	0.2	215	0.02	1985.00	0.72	207.0

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing

Equip.: L-11 Office: AZ Job No.: 30572

Calculation Method: Balanced Tangential

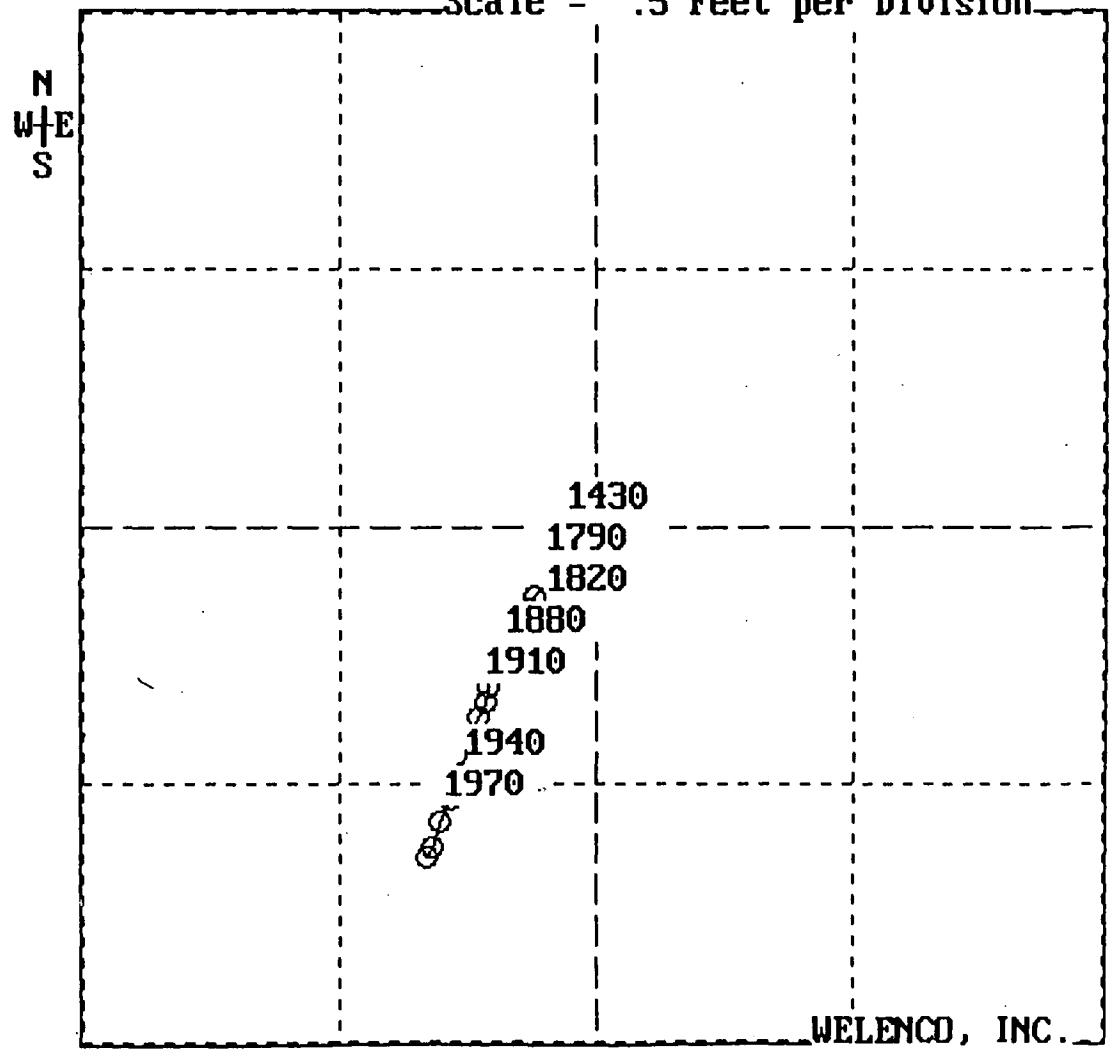
Company: BEYLIK DRILLING, INC.

Well #: GR-2 (GUAJE REPLACEMENT WELL)

Date: 3-7-1998

PLAN VIEW

Scale = .5 Feet per Division



CLOSURE

Distance: 0.72 FEET

Bearing: 207.0 DEGREES

T.V.D.: 1985.00 FEET

Calc. Method
Balanced Tangential

Company:
BEYLIK DRILLING, INC.
Well #:
GR-2 (GUAJE REPLACEMENT WELL)

Date: 3-7-1998

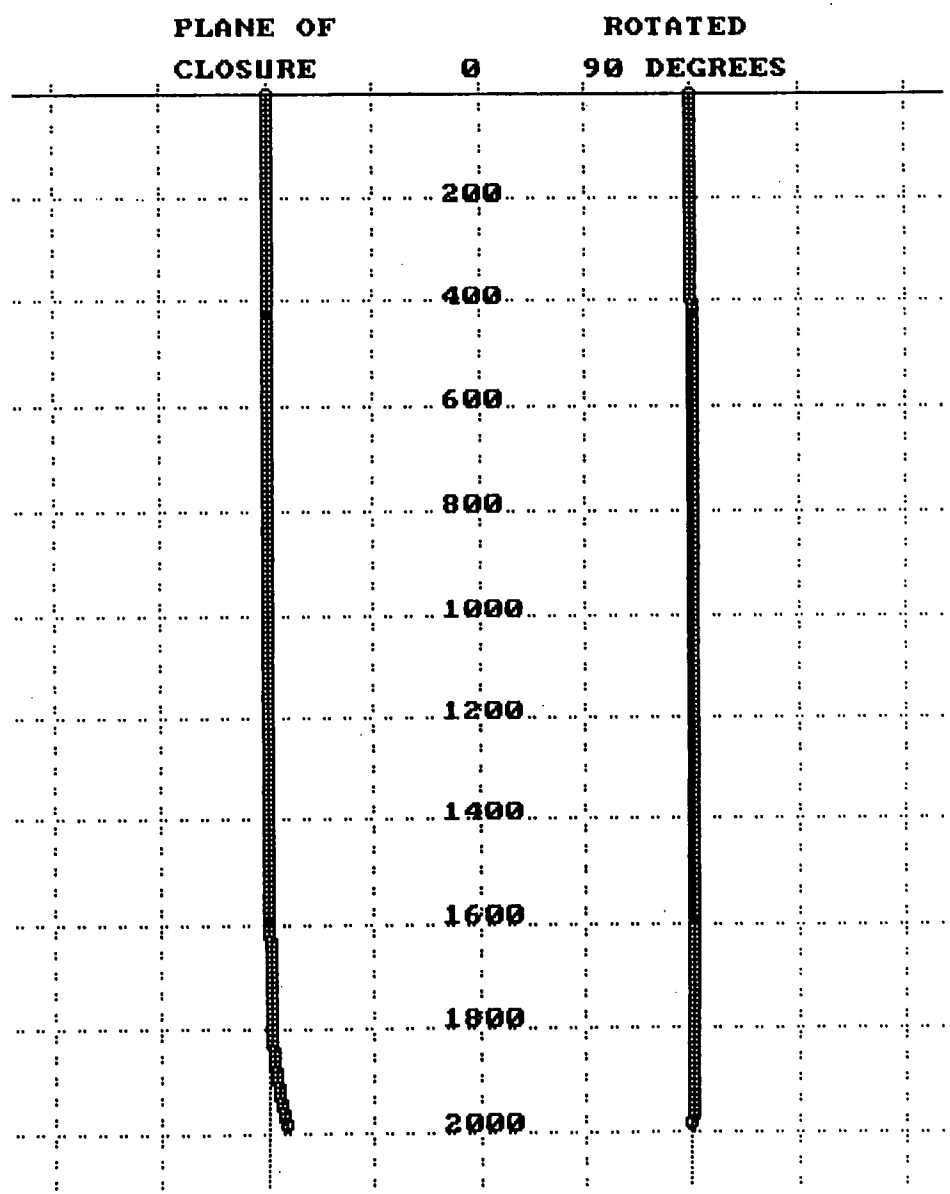
VERTICAL SECTION

Vert Scale = 200 Ft/Div
Horz Scale = 4 Ft/Div

CLOSURE

Distance: 0.72 FEET
Bearing: 207.0 DEGREES
T.V.D.: 1985.00 FEET

Calc. Method:
Balanced Tangential



Appendix III

(Guaje Replacement Well No. 3)

Appendix III-1

State Engineer Office Well Record, GR-3

Revised June 1972

STATE ENGINEER OFFICE
WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Los Alamos National Laboratory Owner's Well No. GR-3
Street or Post Office Address P.O. Box 1663
City and State Los Alamos, NM 87545

Well was drilled under Permit No. RG-486-S-2 and is located in the:

a. ____ ¼ NW ¼ SE ¼ NE ¼ of Section 5 Township 19N Range 7 E N.M.P.M.

b. Tract No. - of Map No. - of the -

c. Lot No. - of Block No. - of the -
Subdivision, recorded in - County.

d. X= - feet, Y= - feet, N.M. Coordinate System - Zone in the - Grant.

(B) Drilling Contractor Beylik Drilling, Inc. License No. WD-1105

Address 3702 B State Highway 528, Rio Rancho, NM 87124

Drilling Began 11/13/97 Completed 5/9/98 Type tools Reverse Rotary Size of hole 36/26 in.

Elevation of land surface or - at well is 6212 ft. Total depth of well 2000 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 400 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
515	2000	1485	See Attached	1,200

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
28"	110.64	-	0	515	515	-	-	-
16 5/8"LC	65.08	-	+3	315	318	-	-	-
16 5/8"SS	66.06	-	315	590	275	-	-	-
16 5/8"SS	54.54	-	590	1980	1390	-	590	1980
16 5/8"SS	66.06	-	1980	2000	20	SE HEAD	-	-

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
0	515	36"	1040 Sack Cement	1740	Pressure Cement with
			48,300 # Pozmix		Halliburton.
			2352 # Bentonite		
			38 sk cc		

Section 5. PLUGGING RECORD

Plugging Contractor
Address
Plugging Method
Date Well Plugged
Plugging approved by:

State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad FWL FSL

File No. Use Location No.

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
			SEE ATTACHED

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

BEYLIK DRILLING, INC.

Kent M. Wartick

Driller

Kent M. Wartick / Division Manager

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

GEOLOGIC AND HYDROLOGIC LOG OF REPLACEMENT WELL GR-3, GUAJE CANYON

	Thickness	Depth
Alluvium; gravels, cobbles, and boulders, light brown, rhyolite, latite, and dacite, sub-rounded in a matrix of rock fragments, silt and sand.	20	20
Puye Conglomerate Fanglomerate Member; conglomerate, light gray to dark gray, rhyolite, latite and dacite, angular to sub-rounded.	40	60
Totavi Lentil Conglomerate; light gray to dark gray, rounded latite, rhyolite, and quartzite in a matrix of quartz and feldspar crystals and crystal fragments. Fine sand from 130 to 140ft, mostly quartz, feldspar, and some mafic minerals and fine rock fragments, sub-rounded to rounded, appear pitted, may be due to sorting by wind erosion.	80	140
Santa Fe Group Chaquehui Formation Conglomerate; light to dark gray, generally sub-rounded latite, rhyolite, and quartzite with a few granite-like rock fragments in a matrix of sand size quartz and feldspar crystals, crystal fragments and a few rock fragments; interbedded with lenses of sand-size material.	150	290
Sandy siltstone; light pinkish red, arkosic.	10	300
Sandy siltstone; tan to light gray, arkosic, a few clots of white clay, some larger rock fragments in occasional section, rock fragments sub-rounded.	150	450
Basalts and interbedded siltstone: basalt gray, dense; siltstones light tan, arkosic, with clots of white clay.	40	490
Sandstone; light tan, fine grained arkosic.	20	510
Silty sandstone; light gray, arkosic, some clots of white clay and occasional rock fragment. Water Bearing 552 to 580ft; 584 to 594ft.	80	590
Siltstone: light gray arkosic. Water Bearing 600 to 610ft; 628 to 642ft	70	660
Siltstone; light pinkish gray, arkosic. Water bearing 680 to 684ft; 690 to 698ft, 700 to 728ft; 730 to 742ft; 748 to 736ft; 760 to 764ft; 772 to 804ft; 812 to 818ft; 822 to 830ft.	170	830
Siltstone; light red, arkosic with a few gray basalt fragments. Water bearing from 830 to 836ft.	10	840
Siltstone; gray, arkosic with a few clots of white clay and basalt fragments.	10	850
Basalt; dark gray, dense, may include intertlow breccia containing silt or claystone. Water Bearing 864 to 876ft, 884 to 890ft.	40	890
Claystone; light red, arkosic, clots of white clay.	10	900
Basalt breccia: gray with light red siltstone arkosic.	10	910
Silty sandstone; light red arkosic.	10	920

Silty sandstone; light red to tan, fine sand from 970 to 980ft. Water Bearing 958 to 970ft; 972 to 978ft.	60	980
Silty sandstone; light pinkish red, arkosic, a few clots of white clay.	40	1,020
Silty sandstone; light brown; some clay, arkosic.	10	1,030
Basalt; dark gray, dense, may include some interflow breccias and sandstone. Water Bearing 1,054 to 1,078ft 1,080 to 1,084ft.	60	1,090
Sandstone; light red, a few fragments of gray basalt.	10	1,100
Sandy siltstone; light pinkish tan, arkosic, a few rock fragments of basalt. Water Bearing 1,134 to 1,042ft.	50	1,150
Siltstone to claystone; purplish gray, arkosic.	10	1,160
Basalt, light to dark gray, dense; light gray basalt with phenocrysts of white feldspar 1,180 to 1190ft.	40	1,200
Tesuque Formation; Silty sandstone; light tan, arkosic with clots of white clay. Water Bearing 1,225 to 1,248ft.	50	1,250
Silty sandstone; light red arkosic. Water Bearing 1,260 to 1,264ft.	20	1,270
Silty sandstone; light tan, arkosic; small rock fragments of gray basalt, dense sub-rounded from 1,270 to 1,420ft and 1,700 to 1,750ft. Water Bearing 1,282 to 1,286ft; 1,300 to 1,310ft; 1,314 to 1,328ft; 1,348ft to 1,350ft; 1,382 to 1,390ft; 1,408 to 1,434ft, 1,464 to 1,490ft.	480	1,750
Basalt; dark gray, interflow sand and gravels, sub-rounded. Water bearing, 1754 to 1,756ft.	30	1,780
Claystone and siltstone; occasional thin lenses of silty sandstone, light tan, arkosic.	230	2,010
Note: Interpretation of water bearing zones based on resistively logs. Total depth drilled 2,010ft. Cased to 515ft when geophysical logs were run.		

Appendix III-2

drilling fluid test results, GR-3 pilot hole

Drilling Fluid Properties for GR-3 – Pilot Hole

date	time	depth, ft	viscosity, sec/qt	weight, lb/gal	filtrate, cm^3/30 min.	pH	activity
11/28/97	11:50	563	42	8.8	8.0	11.0	drilling
11/29/97	10:15	708	38	8.8	7.2	10.0	drilling
11/30/97	9:05	854	35	8.7	8.0	9.0	drilling
12/1/97	14:10	1,000	32	8.8	8.8	8.0	TOH; log
12/4/97	10:10	1,270	32	8.8	8.8	8.0	drilling
12/6/97	11:10	1,492	31	8.8	10.4	8.0	drilling
12/7/97	13:40	1,570	30	8.8	11.2	7.0	drilling
12/8/97	11:00	1,728	29	8.7	11.2	7.0	TOH; bit
12/9/97	10:45	1,842	31	8.8	11.2	7.0	repairs
12/10/97	11:10	1,952	31	8.7	8.0	7.0	drilling
12/11/97	11:15	1,953	31	8.9	8.8	7.0	drilling
12/12/97	11:10	2,017	32	8.8	12.0	7.0	fishing

ft feet
sec/qt seconds per quart
lb/gal pounds per gallon
cm^3/30 min cubic centimeters per 30 minutes

Appendix III-3

deviation survey results, GR-3 pilot hole

Deviation survey results, LANL Guaje Replacement Well No. 3
(from Totco surveys in pilot hole)

depth, feet	deviation, degrees
120	
180	<0.25
240	0.125
300	0.0
360	0.125
420	0.0625
480	0.0625
540	0.0
600	0.0
660	0.0
720	0.0
780	0.0625
840	0.0
900	0.0625
960	0.125
1,020	0.0625
1,080	0.0625
1,140	0.0625
1,200	0.125
1,265	<0.0625
1,325	0.125
1,380	0.0625
1,425	0.125
1,484	0.0625
1,540	0.0625
1,600	0.1875
1,660	0.0
1,720	0.125
1,780	0.0625
1,840	0.125
1,900	0.125
1,960	0.0625

Appendix III-4

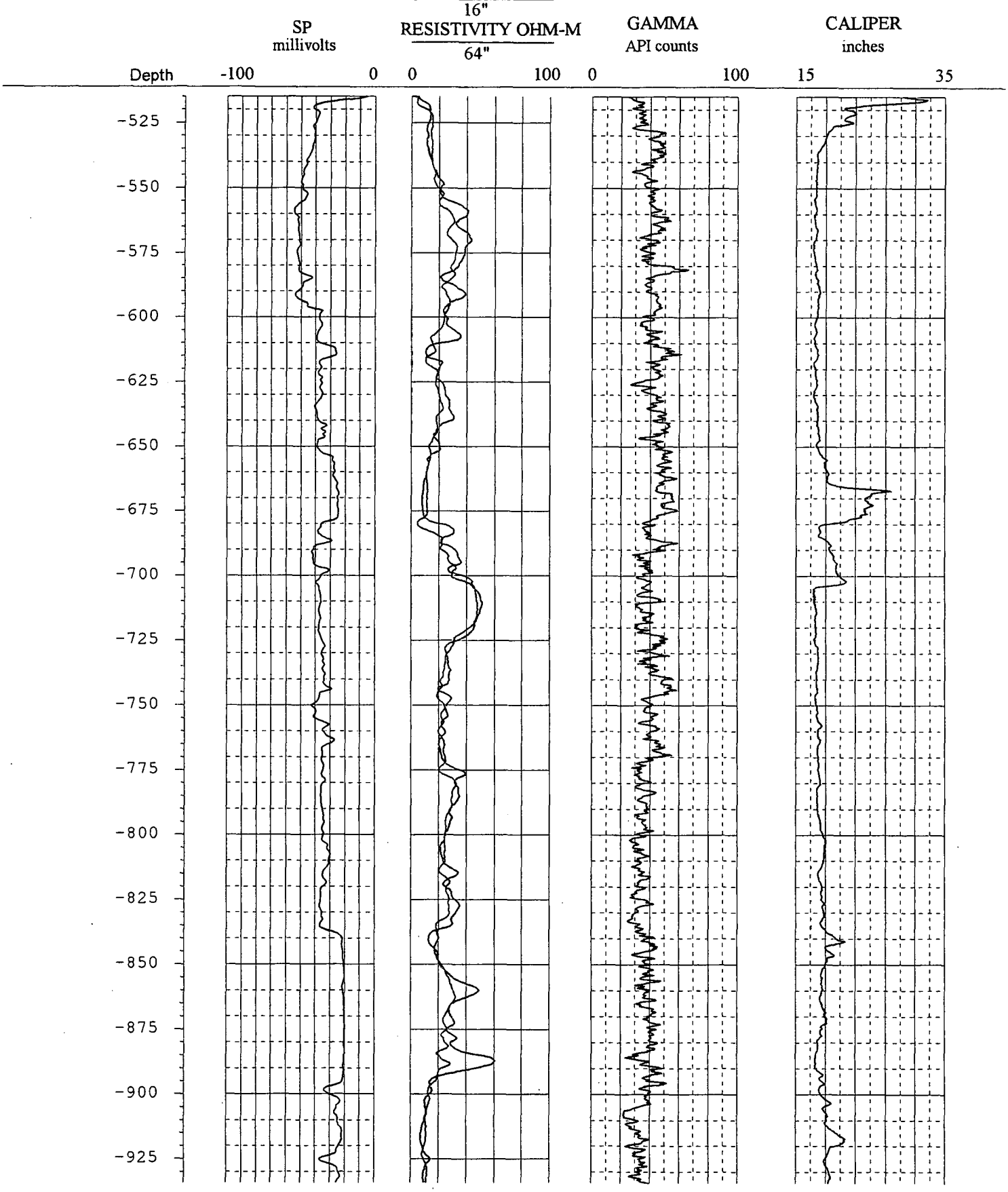
plots of geophysical log data, GR-3 pilot hole

JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-3

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: SW Geoph. Serv
Casing: 28" to 515 ft
Bit Size: 17.5"
Date: December 13, 1997

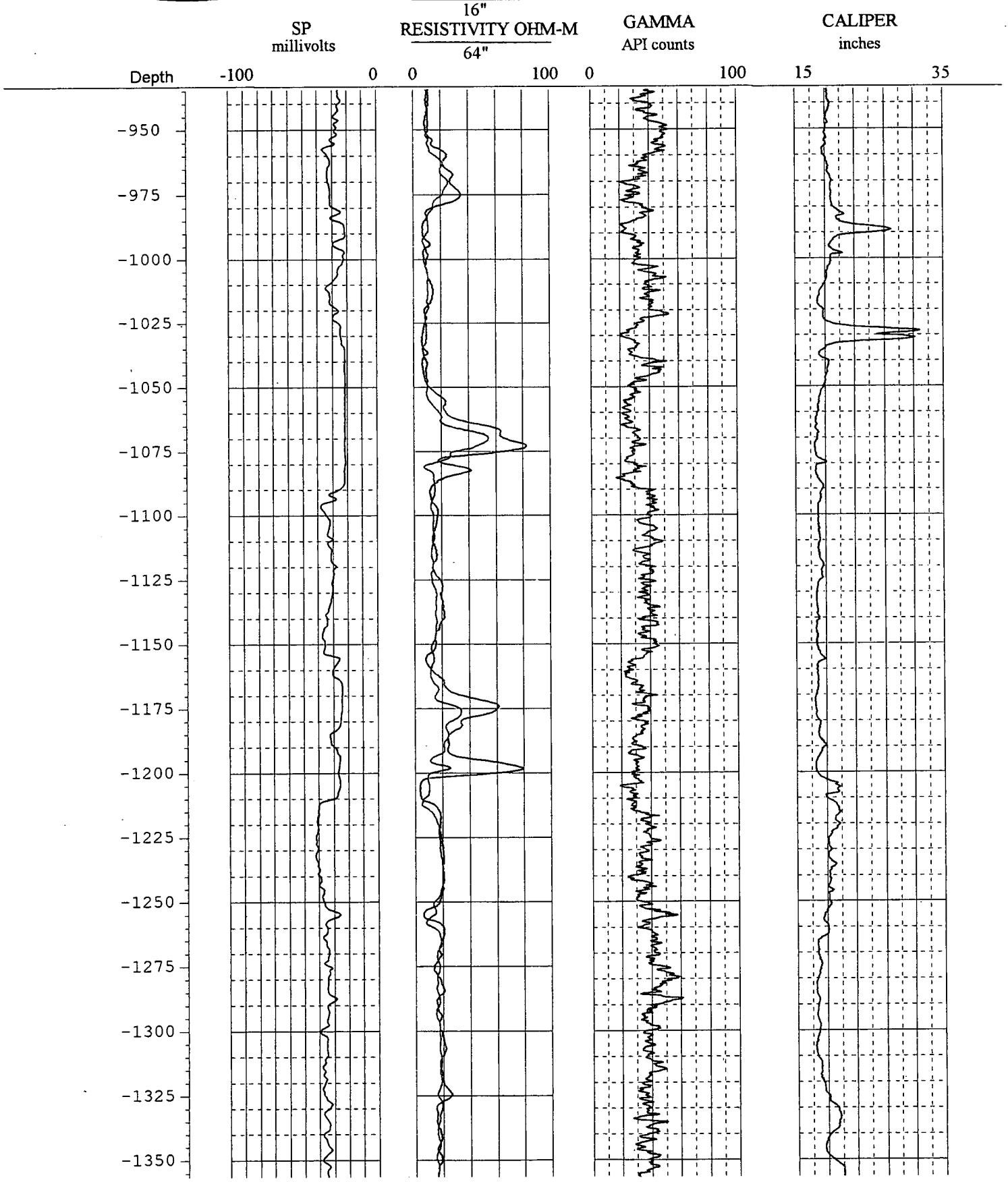


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-3

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: SW Geoph. Serv
Casing: 28" to 515 ft
Bit Size: 17.5"
Date: December 13, 1997

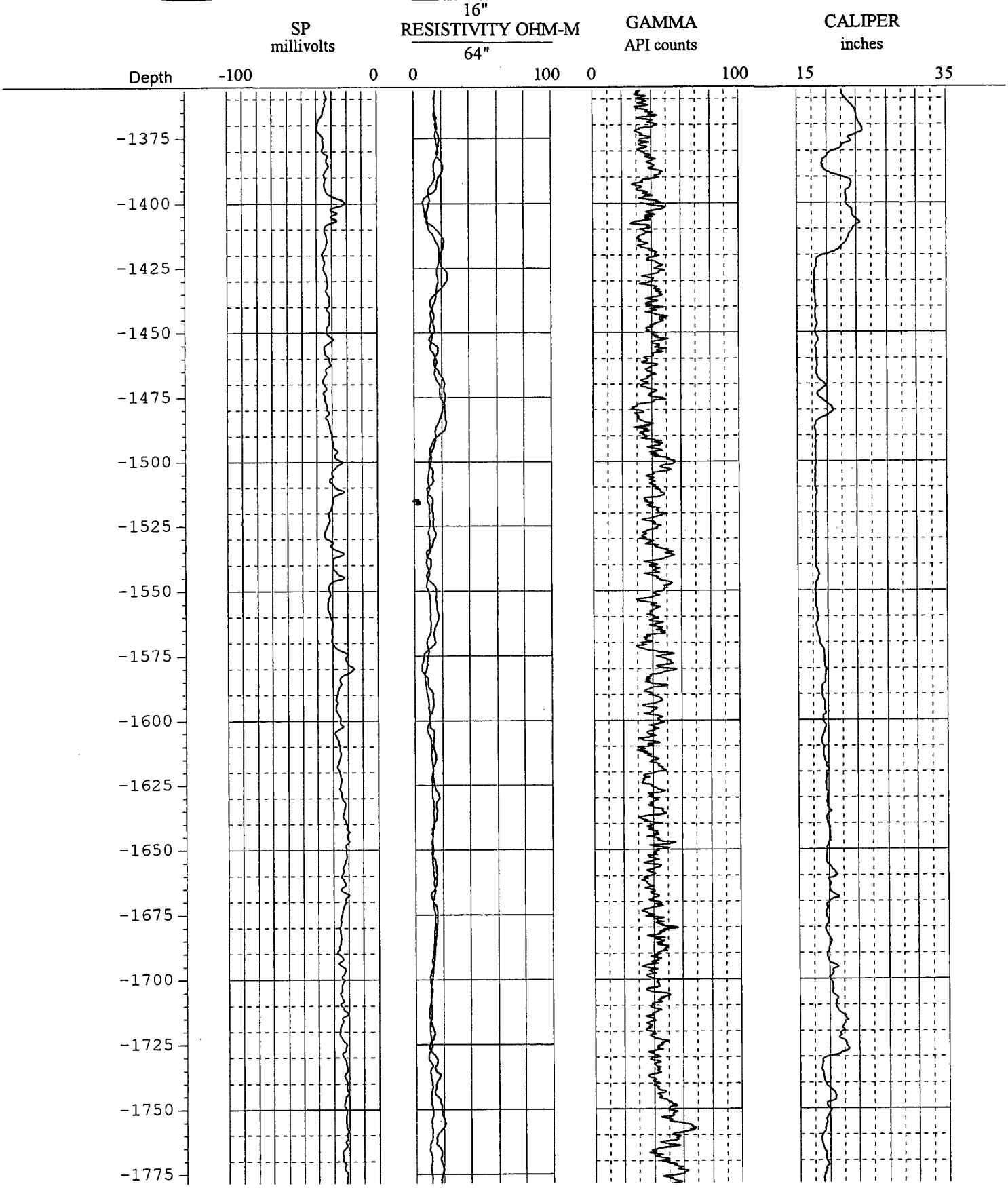


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-3

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: SW Geoph. Serv
Casing: 28" to 515 ft
Bit Size: 17.5"
Date: December 13, 1997

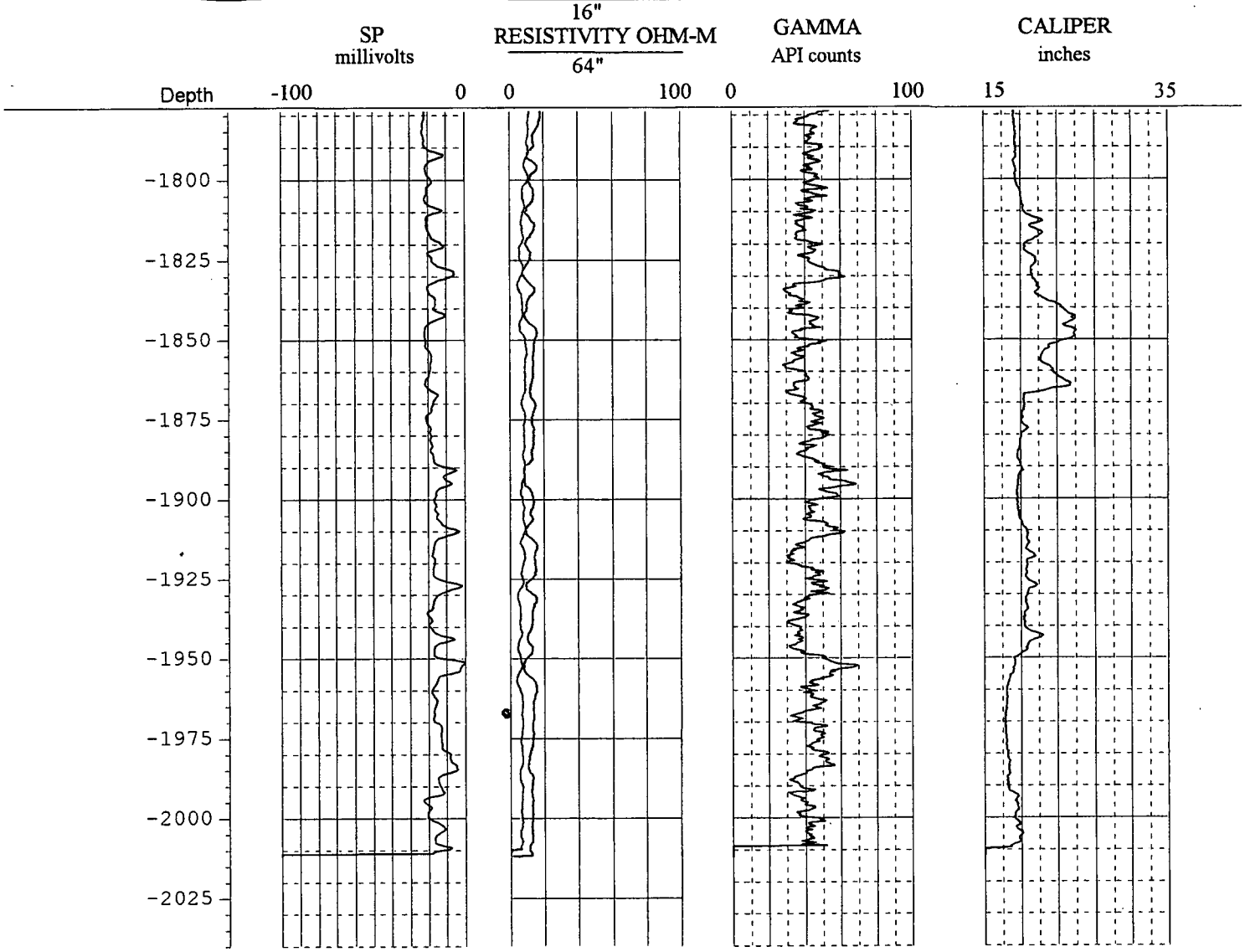


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-3

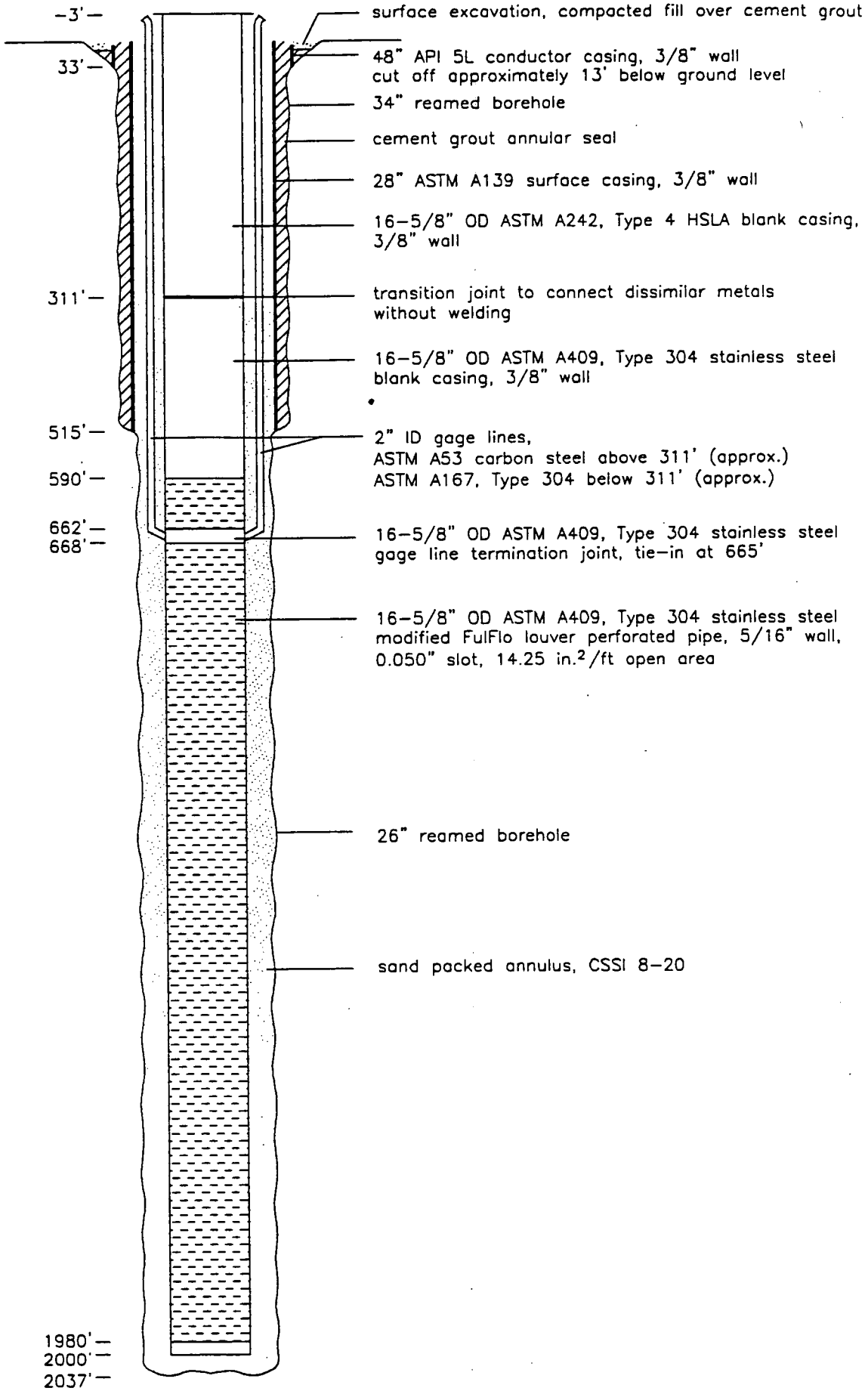
Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: SW Geoph. Serv
Casing: 28" to 515 ft
Bit Size: 17.5"
Date: December 13, 1997



Appendix III-5

well completion diagram, GR-3



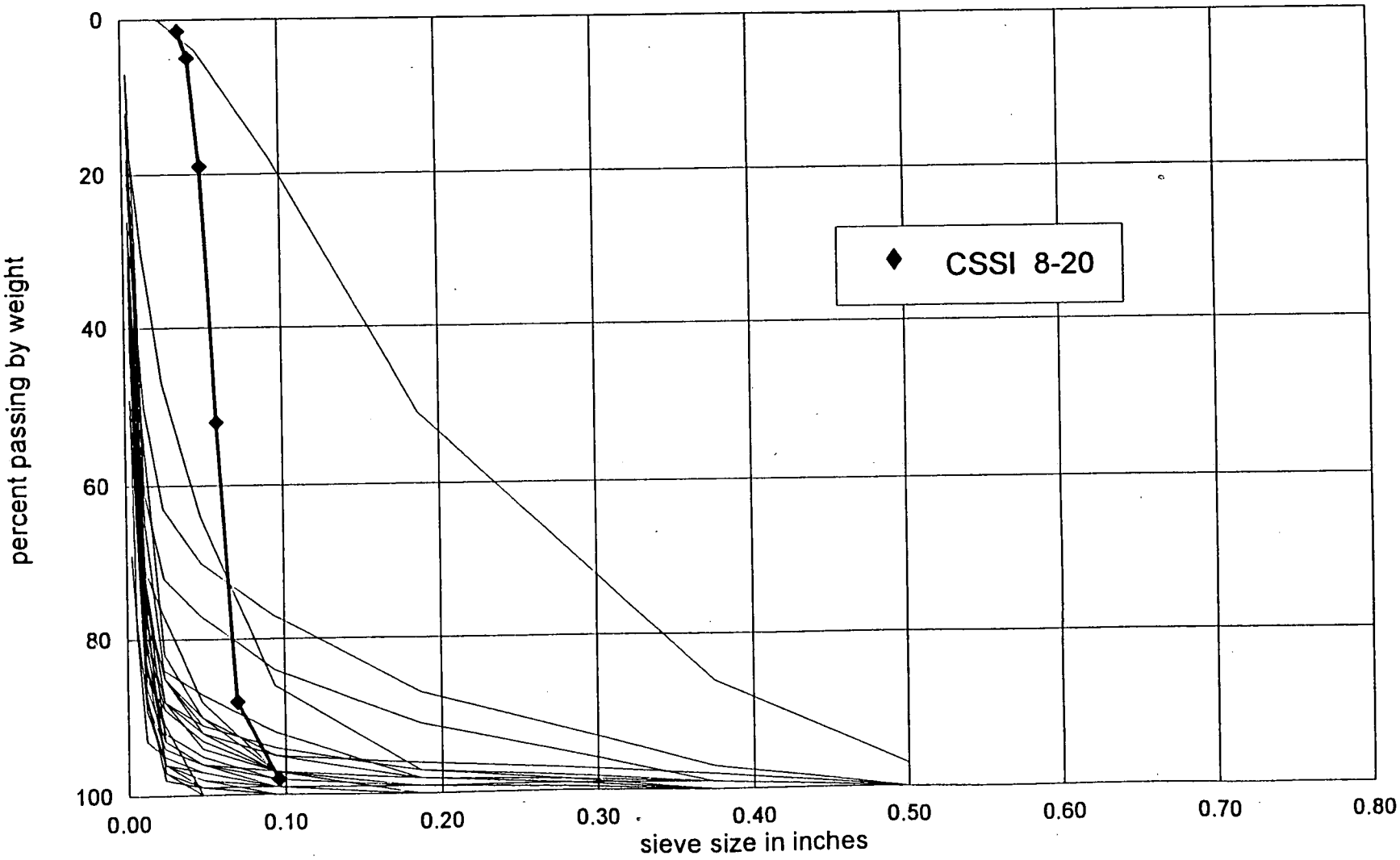
Well completion diagram, GR-3

JOHN SHOMAKER & ASSOCIATES, INC.

Appendix III-6

plot of sieve analysis results, GR-3

Sieve Analysis Results, Guaje Replacement Well No. 3



SUMMARY OF LA ORATORY TEST DATA

Test Hole	Depth (feet)	Unified Classification	Natural Dry Density (pcf)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
				LL	PI	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
GR-3	1000-1010					100	100	100	100	99	99	97	75	35	18.4	
GR-3	1020-1030					100	100	100	100	100	99	98	87	56	31.9	
GR-3	1090-1100					100	100	100	99	97	94	89	69	40	20.4	
GR-3	1110-1120					100	100	100	100	97	94	88	72	46	27.6	
GR-3	1120-1130					100	100	99	99	98	96	93	72	37	19.1	
GR-3	1130-1170					100	100	99	98	97	96	93	73	33	13.2	
GR-3	1200-1210					100	100	99	99	98	96	94	88	76	68.7	
GR-3	1220-1230					100	100	100	99	98	95	92	81	62	51.0	
GR-3	1240-1250					100	100	100	98	95	90	85	75	50	35.9	
GR-3	1280-1290					100	100	100	100	100	98	96	88	65	49.0	
GR-3	1310-1320					100	100	98	96	95	92	85	65	43	28.4	
GR-3	1350-1360					100	100	100	99	97	93	89	80	50	32.5	
GR-3	1370-1380					100	100	99	99	98	95	92	83	55	32.9	
GR-3	1420-1430					100	100	99	91	84	77	72	61	23	6.5	
GR-3	1450-1470					100	100	100	100	97	92	88	73	45	35.2	
GR-3	1470-1480					100	100	100	99	97	88	77	71	45	32.4	
GR-3	1490-1500					100	100	100	100	100	99	96	89	52	35.5	
GR-3	1510-1530					100	100	99	97	94	91	88	79	56	38.4	
GR-3	1540-1550					100	100	100	100	99	96	93	86	59	41.5	

Project Number : 97-2-646

Project : Los Alamos Well GR-3

Table No. : 1

SUMMARY OF LABORATORY TEST DATA

Test Hole	Depth (feet)	Unified Classification	Natural Dry Density (pcf)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
				LL	PI	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
GR-3	1590-1600					100	100	100	100	99	97	95	93	79	49.1	
GR-3	1610-1630					100	100	100	99	97	93	89	85	65	37.7	
GR-3	1630-1650					100	100	100	97	86	64	47	31	20	15.3	
GR-3	1650-1670					100	100	100	98	92	87	84	78	59	37.4	
GR-3	1690-1700					100	100	100	100	99	98	96	83	50	26.0	

Project Number : 97-2-646

Project : Los Alamos Well GR-3

Dec. 18 1997 11:31AM
PHONE NO. : 5057979749
Vingard & Associates

SUMMARY OF LABORATORY TEST DATA

Test Hole	Depth (feet)	Unified Classification	Natural Dry Density (pcf)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
				LL	PI	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
GR-3	1710-1720					100	100	100	100	98	93	87	79	48	15.9	
GR-3	1720-1730					100	100	98	98	96	92	84	74	55	34.7	
GR-3	1760-1770					100	100	100	95	98	44	14	10	5	2.5	
GR-3	1790-1800					100	100	94	89	78	63	51	46	36	15.5	
GR-3	1880-1890					100	100	100	98	94	85	75	69	32	27.4	
GR-3	1910-1920					100	100	99	95	88	80	76	68	48	26.9	
GR-3	1930-1940					100	100	100	99	99	97	97	95	73	38.9	
GR-3	1940-1950					100	100	100	100	99	99	97	84	60	37.6	

Project Number : 97-2-646

Project : Los Alamos Well GR-3

Table No. : 1

V

Vinyard & Associates, Inc.

4415 D Hawkins, NE
Albuquerque, New Mexico 87109
(505) 345-1937

A

Geotechnical Engineering * Materials Testing * Environmental Engineering

December 13, 1997

Beylik Drilling Co.
3702-B State Highway 528
Rio Rancho, NM 87124

Attn: Mr. Kent Wartick

Project: Los Alamos Well - Samples
V & A Project No. 97-2-646

Gentlemen:

Attached are copies of the Sieve Analysis Test Results for the subject project.

Should you have any questions regarding this data, please do not hesitate to call.

Sincerely,

Martin D. Vinyard, P.E.
Vinyard & Associates, Inc.

Attachment: Data Sheets (1)

cc: Addressee: (1)

rka

Appendix III-7

pumping test data, GR-3

GUAJE REPLACEMENT WELL NO. 3
STEP-DRAWDOWN TEST - 5/2/98
starting water level: 407.63 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
05/02/98	12:32	pre-pump	407.63			
05/02/98	12:35					start pump
05/02/98	12:36	1.35	443.63		16.67	
05/02/98		2.8	455.18		12.62	
05/02/98		3.87	458.03		11.90	
05/02/98		4.58	458.68	600	11.75	
05/02/98		5.5	460.31	600	11.39	
05/02/98		6.25	461.03	600	11.24	
05/02/98		7.83	462.49	600	10.94	
05/02/98		8.5	463.11	600	10.81	
05/02/98		10	464.36	600	10.58	
05/02/98		11.33	464.83	600	10.49	
05/02/98		12.5	465.43	600	10.38	
05/02/98	12:48	13.08	465.88	600	10.30	
05/02/98		14.75	467.47	600	10.03	
05/02/98		0.67222	468.28	600	9.89	
05/02/98		0.71319	468.48	600	9.86	
05/02/98		18.13	467.35	600	10.05	
05/02/98		19.5	469.23	600	9.74	
05/02/98		21.17	469.38	600	9.72	
05/02/98		22.25	469.73	600	9.66	
05/02/98		24.75	470.58	600	9.53	
05/02/98		26.43	469.15	600	9.75	
05/02/98	13:03	28	470.23	600	9.58	
05/02/98		31.73	471.73	600	9.36	
05/02/98		35.33	472.29	600	9.28	
05/02/98		41.83	470.43	600	9.55	
05/02/98		42	472	600	9.32	
05/02/98		43	472.81	600	9.21	
05/02/98		45	471.73	600	9.36	
05/02/98		47	473.78	600	9.07	
05/02/98		48.5	473.18	600	9.15	
05/02/98		50	474.23	600	9.01	
05/02/98	13:35	60	474.03	600	9.04	
05/02/98		65	474.47	600	8.98	
05/02/98		71	474.86	600	8.92	
05/02/98		75	475.03	600	8.90	
05/02/98		80	473.53	600	9.10	

GUAJE REPLACMENT WELL NO. 3
STEP DRAWDOWN TEST - 5/2/98
starting water level: 407.63 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
05/02/98		82	475.3	600	8.87	
05/02/98		85	475.36	600	8.86	
05/02/98		90	475.53	600	8.84	
05/02/98	14:10	95	475.85	600	8.80	
05/02/98		100	475.98	600	8.78	start step 2
05/02/98		101	480.88	700	9.56	
05/02/98		101.75	483.98	700	9.17	
05/02/98		102.75	484.28	700	9.13	
05/02/98		104	484.81	700	9.07	
05/02/98		104.75	485.05	700	9.04	
05/02/98		105.58	485.29	700	9.01	
05/02/98		107.25	485.61	700	8.98	
05/02/98		108.25	485.88	700	8.95	
05/02/98		109.25	485.97	700	8.94	
05/02/98		111	486.43	700	8.88	
05/02/98		112.25	486.08	700	8.92	
05/02/98	14:28	113.25	486.33	700	8.89	
05/02/98		114	485.83	700	8.95	
05/02/98		116	486.7	700	8.85	
05/02/98		117.83	486.53	700	8.87	
05/02/98		121.5	486.98	700	8.82	
05/02/98		125	487.38	700	8.78	
05/02/98		129	487.51	700	8.76	
05/02/98		135	487.68	700	8.74	
05/02/98	14:55	140	487.93	700	8.72	
05/02/98		145	488.28	700	8.68	
05/02/98		150	488.63	700	8.64	
05/02/98		156	488.81	700	8.62	
05/02/98		160	489.11	700	8.59	
05/02/98		167	489.46	700	8.55	
05/02/98		170	489.41	700	8.56	
05/02/98		175	489.68	700	8.53	
05/02/98		181	489.8	700	8.52	
05/02/98		185	489.78	700	8.52	
05/02/98		187	489.88	700	8.51	
05/02/98		191	490.05	700	8.49	
05/02/98		195	489.88	700	8.51	
05/02/98		200	489.93	700	8.51	

GUAJE REPLACMENT WELL NO. 3
STEP DRAWDOWN TEST - 5/2/98
starting water level: 407.63 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
05/02/98		205	489.98	700	8.50	
05/02/98	16:09	214.75	489.83	700	8.52	@ 16:10 start step 3
05/02/98		216.58	497.45	800	8.91	
05/02/98		217.25	497.68	800	8.88	
05/02/98		218.5	498.93	800	8.76	
05/02/98		219.75	499.55	800	8.70	
05/02/98		221.25	499.81	800	8.68	
05/02/98		222.5	499.98	800	8.66	
05/02/98		225.5	500.31	800	8.63	
05/02/98		234	500.23	800	8.64	
05/02/98		235	500.18	800	8.64	
05/02/98		239.75	500.38	800	8.63	
05/02/98		244.5	500.58	800	8.61	
05/02/98	16:47	252	500.81	800	8.59	
05/02/98		260	500.58	800	8.61	
05/02/98		265	501.11	800	8.56	
05/02/98		273.5	501.88	800	8.49	
05/02/98		278	501.83	800	8.49	
05/02/98		284	502.08	800	8.47	
05/02/98		295	502.73	800	8.41	
05/02/98		300	503.18	800	8.37	
05/02/98		306	503.48	800	8.35	
05/02/98		310	503.68	800	8.33	
05/02/98		315	503.93	800	8.31	
05/02/98		320	503.98	800	8.30	
05/02/98		325	504.62	800	8.25	
05/02/98	18:04	329	505.01	800	8.22	@ 18:05 start step 4
05/02/98		331.15	510.23			
05/02/98		332.5	512.08			
05/02/98		332.83	512.66	900	8.57	
05/02/98		333.17	513.13	900	8.53	
05/02/98		333.75	513.23	900	8.52	
05/02/98		335	513.48	900	8.50	
05/02/98		336	513.73	900	8.48	
05/02/98		337	513.78	900	8.48	
05/02/98		338.5	513.68	900	8.49	
05/02/98		339	513.98	900	8.46	
05/02/98		340.33	514.08	900	8.45	

GUAJE REPLACMENT WELL NO. 3
STEP DRAWDOWN TEST - 5/2/98
starting water level: 407.63 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
05/02/98	18:16	341	514.28	900	8.44	
05/02/98		343	514.53	900	8.42	
05/02/98		344	514.58	900	8.42	
05/02/98		345	514.8	900	8.40	
05/02/98		346	514.81	900	8.40	
05/02/98		347	514.86	900	8.39	
05/02/98		348	514.92	900	8.39	
05/02/98		349	514.98	900	8.38	
05/02/98		350	515.18	900	8.37	
05/02/98	18:28	353	515.38	900	8.35	
05/02/98		356	515.55	900	8.34	
05/02/98		358.75	515.78	900	8.32	
05/02/98		360	515.83	900	8.32	
05/02/98		368	516.13	900	8.29	
05/02/98		371	516.23	900	8.29	
05/02/98		375	516.38	900	8.28	
05/02/98		380	516.46	900	8.27	
05/02/98		385	516.83	900	8.24	
05/02/98		390	516.71	900	8.25	
05/02/98	19:10	395	516.75	900	8.25	
05/02/98		401	516.94	900	8.23	
05/02/98		407	517.08	900	8.22	
05/02/98		418	517.36	900	8.20	
05/02/98		424	517.55	900	8.1878	
05/02/98		431	517.85	900	8.1655	
05/02/98		435	516.73	900	8.2493	
05/02/98		436	516.78	900	8.2455	
05/02/98		437	517.83	900	8.167	
05/02/98		440	518.08	900	8.1485	
05/02/98	19:59	444	518.1	900	8.147	@ 20:00 start step 5
05/02/98		445.67	522.44	975	8.4923	
05/02/98		446.5	524.83	975	8.3191	
05/02/98		447.5	524.93	975	8.312	
05/02/98		448.5	525.25	975	8.2894	
05/02/98		449.5	525.63	975	8.2627	
05/02/98		450.5	525.73	975	8.2557	
05/02/98		451.67	525.93	975	8.2418	
05/02/98		453	525.83	975	8.2487	

GUAJE REPLACMENT WELL NO. 3
STEP DRAWDOWN TEST - 5/2/98
starting water level: 407.63 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
05/02/98		454	526.09	975	8.2306	
05/02/98		455	526.13	975	8.2278	
05/02/98		457	526.25	975	8.2195	
05/02/98	20:13	458	526.31	975	8.2154	
05/02/98		459	526.41	975	8.2085	
05/02/98		460	526.48	975	8.2036	
05/02/98		461	526.75	975	8.185	
05/02/98		462	527.36	975	8.1433	
05/02/98		463	527.81	975	8.1128	
05/02/98		464.5	527.85	975	8.1101	
05/02/98		467	527.73	975	8.1182	
05/02/98		469	527.83	975	8.1115	
05/02/98		471	527.85	975	8.1101	
05/02/98	20:28	473	527.81	975	8.1128	
05/02/98		475	527.58	975	8.1284	
05/02/98		477	527.52	975	8.1325	
05/02/98		480.5	527.65	975	8.1236	
05/02/98		485	527.78	975	8.1149	
05/02/98		490	527.95	975	8.1034	
05/02/98		496	528.2	975	8.0866	
05/02/98		502	528.27	975	8.0819	
05/02/98		505	528.53	975	8.0645	
05/02/98		512	528.73	975	8.0512	
05/02/98		515	528.85	975	8.0432	
05/02/98		520	528.72	975	8.0519	
05/02/98		525	529.01	975	8.0326	
05/02/98	21:25	530	528.96	975	8.0359	
05/02/98		535	529.48	975	8.0016	
05/02/98		540	529.62	975	7.9925	
05/02/98		545	529.8	975	7.9807	
05/02/98		550	529.58	975	7.9951	
05/02/98		555	529.61	975	7.9931	
05/02/98	21:54	559	529.73	975	7.9853	
05/02/98	21:55	560				stop pump
05/02/98	21:56	561	432.03			start recovery
05/02/98	21:57	562	443.53			
05/02/98	21:58	563	446.28			
05/02/98	21:59	563.75	444.63			

GUAJE REPLACMENT WELL NO. 3
STEP DRAWDOWN TEST - 5/2/98
starting water level: 407.63 ft bgl

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
05/02/98	22:00	566	445.67			
05/02/98		567	444.23			
05/02/98		568	443.62			
05/02/98		569	442.83			
05/02/98		570	442.08			
05/02/98	22:06	571	441.31			
05/02/98	22:07	572	439.38			
05/02/98		574	438.93			
05/02/98		576	438.28			
05/02/98		577	437.82			
05/02/98		579	437.43			
05/02/98	22:15	580	437.2			
05/02/98		581	436.83			
05/02/98		582	436.23			
05/02/98		583	435.93			
05/02/98		584	435.63			
05/02/98		585	435.44			
05/02/98		587	434.91			
05/02/98		589	434.68			
05/02/98		591	434.35			
05/02/98	22:28	593	433.91			
05/02/98		595	433.48			
05/02/98	22:35	600	432.53			
05/02/98		605	431.86			
05/02/98		613	430.83			
05/02/98		615	430.53			
05/02/98		621	429.78			
05/02/98	23:00	625	429.46			
05/02/98		630	429			
05/02/98	23:10	640	428.61			
05/03/98	07:20	1110	414.71			
05/03/98	11:02	1382	412.86			
05/03/98	13:02	1452	412.11			
05/03/98	15:02	1572	411.5			
05/03/98	17:04	1694	411.01			end of recovery

GUAJE REPLACMENT WELL NO. 3
CONSTANT-RATE TEST
starting water level: 396.77 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
04/28/98	16:15	0	400.34	396.77				pump on
04/28/98		0.75	452.28	448.71			15.4	water to surface, t = 1.1
04/28/98		1.5	460.55	456.98			13.3	water hazy
04/28/98		2	467.94	464.37			11.8	
04/28/98		3	472.98	469.41			11.0	water clear
04/28/98		4	475.57	472	25.5"	800	10.6	
04/28/98		5	477.56	473.99	25.5"	800	10.4	
04/28/98		6.25	478.95	475.38	25.5"	800	10.2	
04/28/98		7.25	479.96	476.39	25.5"	800	10.0	adjust Q
04/28/98		8.25	479.95	476.38	25.5"	800	10.0	
04/28/98		9.25	480.08	476.51	25.5"	800	10.0	
04/28/98		10.5	483.03	479.46	25.5"	800	9.7	adjust Q
04/28/98		12	484.12	480.55	25.5"	800	9.5	
04/28/98		14	485.16	481.59	25.5"	800	9.4	
04/28/98		16	486.2	482.63	25.5"	800	9.3	1.65 ppm silt, t=15
04/28/98		18	487.25	483.68	25.5"	800	9.2	dirty/clearing
04/28/98	16:37	22	488.32	484.75	25.5"	800	9.1	discharge clear
04/28/98		25	489.1	485.53	25.5"	800	9.0	discharge clear
04/28/98		30.25	490.38	486.81	25.5"	800	8.9	0.05 ml silt
04/28/98		37	491.37	487.8	25.5"	800	8.8	clear
04/28/98		40	491.78	488.21	25.5"	800	8.7	
04/28/98		50.5	493.28	489.71	25.5"	800	8.6	clear
04/28/98		60	492.87	489.3	25.5"	800	8.6	0.42 ppm silt, t=63
04/28/98		80	496.1	492.53	25.5"	800	8.4	adjust Q
04/28/98		105	497.8	494.23	25.5"	800	8.2	adjust Q
04/28/98		150	500.1	496.53	25.5"	800	8.0	0.35 ppm sand/silt, t=150
04/28/98		206	501.6	498.03	25.5"	800	7.9	
04/28/98		225	503	499.43	25.5"	800	7.8	
04/28/98		255	503.6	500.03	25.5"	800	7.7	
04/28/98	21:00	285	504.2	500.63	25.5"	800	7.7	
04/28/98		315	505.6	502.03	25.5"	800	7.6	
04/28/98		345	505.9	502.33	25.5"	800	7.6	
04/28/98		369	506.83	503.26	25.5"	800	7.5	
04/28/98		405	507.5	503.93	25.5"	800	7.5	
04/28/98	23:30	435	508	504.43	25.5"	800	7.4	
04/29/98	0:00	465	508.7	505.13	25.5"	800	7.4	
04/29/98		495	509	505.43	25.5"	800	7.4	
04/29/98		525	509.4	505.83	25.5"	800	7.3	
04/29/98		555	509.8	506.23	25.5"	800	7.3	
04/29/98		585	510.2	506.63	25.5"	800	7.3	
04/29/98	2:13	598	510.2	506.63	25.5"	800	7.3	0.11 ml sand/silt
04/29/98		615	510.3	506.73	25.5"	800	7.3	
04/29/98		645	510.5	506.93	25.5"	800	7.3	
04/29/98		675	510.9	507.33	25.5"	800	7.2	
04/29/98		705	511.4	507.83	25.5"	800	7.2	
04/29/98		735	512	508.43	25.5"	800	7.2	
04/29/98		765	512.3	508.73	25.5"	800	7.1	
04/29/98		795	512.2	508.63	25.5"	800	7.2	
04/29/98		825	511.18	507.61	25.5"	800	7.2	k=190, pH=8.37
04/29/98	7:00	885	511.65	508.08	25.5"	800	7.2	
04/29/98		915	511.5	507.93	25.5"	800	7.2	
04/29/98		926	513.13	509.56	25.5"	800	7.1	0.11 ml sand/silt
04/29/98		958	511.97	508.4	25.5"	800	7.2	
04/29/98		975	512.2	508.63	25.5"	800	7.2	

GUAJE REPLACMENT WELL NO. 3
CONSTANT-RATE TEST
starting water level: 396.77 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
04/29/98		1005	512.25	508.68	25.5"	800	7.1	
04/29/98		1035	512.35	508.78	25.5"	800	7.1	
04/29/98		1065	512.4	508.83	25.5"	800	7.1	
04/29/98		1095	512.5	508.93	25.5"	800	7.1	
04/29/98		1125	512.8	509.23	25.5"	800	7.1	
04/29/98		1155	512.85	509.28	25.5"	800	7.1	
04/29/98		1185	513.1	509.53	25.5"	800	7.1	
04/29/98		1215	513.3	509.73	25.5"	800	7.1	
04/29/98	13:00	1245	513.35	509.78	25.5"	800	7.1	
04/29/98		1275	513.9	510.33	25.5"	800	7.0	
04/29/98		1305	514	510.43	25.5"	800	7.0	
04/29/98		1335	514.45	510.88	25.5"	800	7.0	
04/29/98		1365	514.7	511.13	25.5"	800	7.0	
04/29/98		1395	514.65	511.08	25.5"	800	7.0	
04/29/98		1425	514.65	511.08	25.5"	800	7.0	
04/29/98		1485	515.1	511.53	25.5"	800	7.0	
04/29/98		1515	515.15	511.58	25.5"	800	7.0	0.11 ml sand/silt
04/29/98	18:00	1545	516.3	512.73	25.5"	800	6.9	
04/29/98		1575	516.1	512.53	25.5"	800	6.9	
04/29/98		1605	516.7	513.13	25.5"	800	6.9	T=82, k=193, pH=8.49
04/29/98		1635	516.5	512.93	25.5"	800	6.9	
04/29/98		1665	516.62	513.05	25.5"	800	6.9	
04/29/98		1695	516.6	513.03	25.5"	800	6.9	
04/29/98		1725	517.3	513.73	25.5"	800	6.8	
04/29/98		1785	517.6	514.03	25.5"	800	6.8	
04/29/98		1815	517.5	513.93	25.5"	800	6.8	
04/29/98		1845	517.5	513.93	25.5"	800	6.8	
04/29/98	23:30	1875	517.5	513.93	25.5"	800	6.8	
04/30/98	0:00	1905	517.7	514.13	25.5"	800	6.8	
04/30/98	0:30	1935	517.7	514.13	25.5"	800	6.8	
04/30/98		1965	518.25	514.68	25.5"	800	6.8	
04/30/98		1985	518.45	514.88	25.5"	800	6.8	
04/30/98		1995	518.1	514.53	25.5"	800	6.8	
04/30/98		2025	518.6	515.03	25.5"	800	6.8	
04/30/98		2055	518.5	514.93	25.5"	800	6.8	
04/30/98		2085	518.3	514.73	25.5"	800	6.8	
04/30/98		2115	518.2	514.63	25.5"	800	6.8	
04/30/98		2145	518.25	514.68	25.5"	800	6.8	
04/30/98		2175	518.2	514.63	25.5"	800	6.8	
04/30/98		2205	518.25	514.68	25.5"	800	6.8	
04/30/98		2235	518.25	514.68	25.5"	800	6.8	
04/30/98		2265	519.2	515.63	25.5"	800	6.7	
04/30/98	6:30	2295	519.85	516.28	25.5"	800	6.7	
04/30/98		2325	520	516.43	25.5"	800	6.7	
04/30/98		2355	519.95	516.38	25.5"	800	6.7	T=82, k=204, pH=8.41
04/30/98		2385	519.95	516.38	25.5"	800	6.7	0.11 ml sand/silt
04/30/98		2415	520.2	516.63	25.5"	800	6.7	
04/30/98		2445	520.1	516.53	25.5"	800	6.7	
04/30/98		2475	520.2	516.63	25.5"	800	6.7	
04/30/98		2505	520.6	517.03	25.5"	800	6.7	
04/30/98		2535	520.75	517.18	25.5"	800	6.6	
04/30/98		2565	520.85	517.28	25.5"	800	6.6	
04/30/98	11:30	2595	520.75	517.18	25.5"	800	6.6	
04/30/98		2625	520.9	517.33	25.5"	800	6.6	T=83, k=210, pH=8.2
04/30/98		2655	520.95	517.38	25.5"	800	6.6	0.11 ml sand/silt

GUAJE REPLACMENT WELL NO. 3
CONSTANT-RATE TEST
starting water level: 396.77 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
04/30/98		2685	520.95	517.38	25.5"	800	6.6	
04/30/98		2715	521.1	517.53	25.5"	800	6.6	
04/30/98		2745	521.3	517.73	25.5"	800	6.6	
04/30/98		2775	521.35	517.78	25.5"	800	6.6	
04/30/98		2805	521	517.43	25.5"	800	6.6	
04/30/98		2835	520.9	517.33	25.5"	800	6.6	
04/30/98		2865	520.93	517.36	25.5"	800	6.6	
04/30/98		2895	520.95	517.38	25.5"	800	6.6	
04/30/98		2908	520.65	517.08	25.5"	800	6.6	
04/30/98	16:44	2909	521.9	518.33	25.5"	800	6.6	total sand/silt 0.11 ml

GUAJE REPLACMENT WELL NO. 3
CONSTANT-RATE TEST
starting water level: 396.77 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	t/t'	remarks
04/30/98	16:45	0				pump off
04/30/98	16:46	2	433.6	430.03	1591	
04/30/98		2.5	446.12	442.55	1165	
04/30/98		3.1	450.5	446.93	946	
04/30/98		3.63	451.65	448.08	803	
04/30/98		4.25	452.05	448.48	686	
04/30/98		4.75	451.9	448.33	614	
04/30/98		5.50	451.5	447.93	530	
04/30/98		6.00	451.15	447.58	486	
04/30/98		6.50	450.8	447.23	449	
04/30/98		7.00	450.5	446.93	417	
04/30/98		7.50	450.12	446.55	389	
04/30/98		8.00	449.77	446.2	365	
04/30/98		8.50	448.5	444.93	343	
04/30/98		9.0	448.28	444.71	324	
04/30/98		9.50	448.42	444.85	307	
04/30/98		10.50	448.4	444.83	278	
04/30/98	16:56	11.00	448.2	444.63	266	
04/30/98		12.0	447.7	444.13	244	
04/30/98		13.00	447.2	443.63	225	
04/30/98		14	446.82	443.25	209	
04/30/98		15.0	446.35	442.78	195	
04/30/98		16	446	442.43	183	
04/30/98		17.0	445.65	442.08	172	
04/30/98		18	445.35	441.78	163	
04/30/98		19.0	445.05	441.48	154	
04/30/98		20	444.78	441.21	147	
04/30/98		21.0	444.48	440.91	140	
04/30/98		22	444.2	440.63	133	
04/30/98		23.0	443.94	440.37	128	
04/30/98		24	443.75	440.18	122	
04/30/98		25.00	443.52	439.95	117	
04/30/98		26	443.27	439.7	113	
04/30/98	17:12	27	443.07	439.5	109	
04/30/98		28	442.85	439.28	105	
04/30/98		29.0	442.65	439.08	101	
04/30/98		30	442.47	438.9	98	
04/30/98		31	442.25	438.68	95	
04/30/98		35	441.55	437.98	84	
04/30/98		40	440.2	436.63	74	
04/30/98		45	440.12	436.55	66	
04/30/98		50	439.4	435.83	59	
04/30/98		55	438.95	435.38	54	
04/30/98		60	438.42	434.85	50	
04/30/98		65	437.95	434.38	46	
04/30/98		70	437.45	433.88	43	
04/30/98		75	436.96	433.39	40	
04/30/98		80	436.48	432.91	37	
04/30/98		85	436.08	432.51	35	
04/30/98	18:15	90	435.72	432.15	33	
04/30/98		105	434.5	430.93	29	
04/30/98		135	432.7	429.13	23	
04/30/98		165	431.35	427.78	19	
04/30/98		195	429.87	426.3	16	
04/30/98		225	428.9	425.33	14	

GUAJE REPLACMENT WELL NO. 3
CONSTANT-RATE TEST
starting water level: 396.77 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	t/t'	remarks
04/30/98		255	427.9	424.33	12	
04/30/98		285	426.7	423.13	11	
04/30/98		315	426	422.43	10	
04/30/98		345	425.37	421.8	9	
04/30/98		375	424.65	421.08	9	
04/30/98	23:30	405	424.3	420.73	8	
05/01/98	0:00	435	423.52	419.95	8	
05/01/98		465	423.1	419.53	7	
05/01/98		495	422.4	418.83	7	
05/01/98		525	422	418.43	7	
05/01/98		555	421.65	418.08	6	
05/01/98		585	421.3	417.73	6	

Appendix III-8

gyroscopic survey results, GR-3

****

>>>> Welenco, Inc.>>>>
DIRECTIONAL SURVEY

****

Date: 11-MAY-98

Company : LOS ALAMOS NATIONAL LAB
Well No : GR-3
Field : GUAJE
State : NM
County: SANTA FE
Witnessed By: FUQUA
Rec. By: SHARPLESS
Location : LOS ALAMOS
Remarks : RUN #4 IN 16" ID CASING

****

Measured Depth, Feet	Incli-nation, Degrees True	Direc-tion, Degrees	Course Deviation, Feet	True Vertical Depth, Feet	Closure Distance, Feet	Closure Bearing, Degrees True
0	0.0	182	0.00	0.00	0.00	0.0
10	0.0	207	0.00	10.00	0.00	0.0
20	0.0	285	0.00	20.00	0.00	285.0
30	0.0	233	0.00	30.00	0.00	285.0
40	0.0	226	0.00	40.00	0.00	285.0
50	0.0	253	0.00	50.00	0.00	285.0
60	0.0	226	0.00	60.00	0.00	285.0
70	0.0	196	0.00	70.00	0.00	285.0
80	0.0	214	0.00	80.00	0.00	285.0
90	0.0	205	0.00	90.00	0.00	285.0
100	0.0	215	0.00	100.00	0.00	285.0
110	0.0	230	0.00	110.00	0.00	285.0
120	0.0	259	0.00	120.00	0.00	285.0
130	0.0	216	0.00	130.00	0.00	285.0
140	0.0	215	0.00	140.00	0.00	285.0
150	0.0	220	0.00	150.00	0.00	285.0
160	0.0	221	0.00	160.00	0.00	285.0
170	0.0	226	0.00	170.00	0.00	285.0
180	0.0	241	0.00	180.00	0.00	285.0
190	0.0	221	0.00	190.00	0.00	285.0
200	0.0	198	0.00	200.00	0.00	285.0
210	0.0	211	0.00	210.00	0.00	285.0
220	0.0	214	0.00	220.00	0.00	285.0
230	0.0	217	0.00	230.00	0.01	256.5
240	0.0	210	0.00	240.00	0.01	243.3
250	0.0	225	0.00	250.00	0.01	243.3
260	0.0	226	0.00	260.00	0.01	240.0
270	0.0	213	0.00	270.00	0.01	237.7
280	0.0	214	0.00	280.00	0.01	237.7
290	0.0	221	0.00	290.00	0.01	237.7
300	0.0	220	0.00	300.00	0.01	237.7
310	0.0	230	0.00	310.00	0.01	237.7
320	0.0	208	0.00	320.00	0.01	233.7
330	0.0	189	0.00	330.00	0.01	230.5
340	0.0	205	0.00	340.00	0.01	230.5
350	0.0	206	0.00	350.00	0.01	230.5
360	0.0	190	0.00	360.00	0.01	230.5
370	0.0	222	0.00	370.00	0.02	229.6
380	0.0	192	0.00	380.00	0.02	228.8
390	0.0	207	0.00	390.00	0.02	226.9

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
400	0.0	204	0.00	400.00	0.02	222.8
410	0.0	199	0.01	410.00	0.03	218.3
420	0.0	200	0.00	420.00	0.03	215.9
430	0.0	178	0.00	430.00	0.03	215.5
440	0.0	185	0.00	440.00	0.03	215.5
450	0.0	202	0.00	450.00	0.04	214.5
460	0.0	194	0.00	460.00	0.04	213.7
470	0.0	211	0.00	470.00	0.04	213.7
480	0.0	182	0.00	480.00	0.04	213.0
490	0.0	201	0.00	490.00	0.04	211.5
500	0.0	192	0.00	500.00	0.05	210.7
510	0.0	194	0.00	510.00	0.05	209.8
520	0.0	185	0.01	520.00	0.05	207.9
530	0.0	196	0.00	530.00	0.06	206.7
540	0.0	179	0.00	540.00	0.06	206.6
550	0.0	198	0.00	550.00	0.06	206.6
560	0.0	187	0.00	560.00	0.06	205.5
570	0.0	205	0.00	570.00	0.07	204.5
580	0.0	186	0.00	580.00	0.07	204.1
590	0.0	186	0.00	590.00	0.07	203.2
600	0.0	204	0.00	600.00	0.07	202.8
610	0.0	207	0.00	610.00	0.07	202.8
620	0.0	208	0.00	620.00	0.07	202.8
630	0.0	206	0.00	630.00	0.07	202.8
640	0.0	202	0.00	640.00	0.07	202.8
650	0.0	197	0.00	650.00	0.07	202.8
660	0.0	198	0.00	660.00	0.07	202.8
670	0.0	198	0.00	670.00	0.07	202.8
680	0.0	202	0.00	680.00	0.07	202.7
690	0.0	200	0.00	690.00	0.08	202.7
700	0.0	187	0.00	700.00	0.08	202.7
710	0.0	207	0.00	710.00	0.08	202.7
720	0.0	202	0.00	720.00	0.08	202.7
730	0.0	202	0.00	730.00	0.08	202.7
740	0.0	196	0.00	740.00	0.08	202.7
750	0.0	208	0.00	750.00	0.08	202.7
770	0.0	202	0.00	770.00	0.08	202.7
780	0.0	201	0.00	780.00	0.08	202.7
790	0.0	207	0.00	790.00	0.08	202.7
800	0.0	209	0.00	800.00	0.08	202.7

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
810	0.0	201	0.00	810.00	0.08	202.7
820	0.0	201	0.00	820.00	0.08	202.7
830	0.0	204	0.00	830.00	0.08	202.8
840	0.0	203	0.00	840.00	0.09	202.8
850	0.0	195	0.00	850.00	0.09	202.5
860	0.0	198	0.01	860.00	0.09	202.2
870	0.0	191	0.00	870.00	0.10	201.8
880	0.0	193	0.00	880.00	0.10	201.4
890	0.0	196	0.00	890.00	0.11	201.2
900	0.0	188	0.00	900.00	0.11	200.9
910	0.0	197	0.00	910.00	0.11	200.6
920	0.0	202	0.00	920.00	0.11	200.6
930	0.0	178	0.00	930.00	0.11	200.6
940	0.0	193	0.00	940.00	0.11	200.6
950	0.0	181	0.00	950.00	0.11	200.6
960	0.0	185	0.00	960.00	0.11	200.4
970	0.0	193	0.00	970.00	0.11	200.1
980	0.0	204	0.00	980.00	0.12	200.2
990	0.0	199	0.00	990.00	0.12	200.3
1000	0.0	187	0.00	1000.00	0.12	200.2
1010	0.0	195	0.00	1010.00	0.12	200.1
1020	0.0	198	0.00	1020.00	0.12	200.1
1030	0.0	190	0.00	1030.00	0.12	199.9
1040	0.0	198	0.01	1040.00	0.13	199.7
1050	0.0	198	0.00	1050.00	0.13	199.6
1060	0.0	185	0.00	1060.00	0.13	199.3
1070	0.0	196	0.00	1070.00	0.14	199.1
1080	0.0	195	0.00	1080.00	0.14	199.1
1090	0.0	200	0.00	1090.00	0.14	199.1
1100	0.0	202	0.00	1100.00	0.14	199.1
1110	0.0	195	0.00	1110.00	0.14	199.1
1120	0.0	191	0.00	1120.00	0.14	199.0
1130	0.0	183	0.00	1130.00	0.14	199.0
1140	0.0	198	0.00	1140.00	0.14	199.0
1150	0.0	195	0.00	1150.00	0.14	199.0
1160	0.0	195	0.00	1160.00	0.14	199.0
1170	0.0	199	0.00	1170.00	0.15	198.9
1180	0.0	183	0.00	1180.00	0.15	198.9
1190	0.0	182	0.00	1190.00	0.15	198.8
1200	0.0	202	0.00	1200.00	0.15	198.8

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
1210	0.0	197	0.00	1210.00	0.15	198.8
1220	0.0	210	0.00	1220.00	0.16	198.7
1230	0.0	208	0.00	1230.00	0.16	198.9
1240	0.0	198	0.00	1240.00	0.16	199.0
1250	0.0	198	0.00	1250.00	0.16	199.0
1260	0.0	196	0.00	1260.00	0.16	199.0
1270	0.0	180	0.00	1270.00	0.17	198.8
1280	0.0	195	0.00	1280.00	0.17	198.8
1290	0.0	203	0.00	1290.00	0.17	198.8
1300	0.0	188	0.01	1300.00	0.18	198.8
1310	0.0	206	0.00	1310.00	0.18	198.7
1320	0.0	190	0.00	1320.00	0.18	198.8
1330	0.0	192	0.00	1330.00	0.18	198.7
1340	0.0	177	0.00	1340.00	0.19	198.4
1350	0.0	196	0.00	1350.00	0.19	198.1
1360	0.0	185	0.00	1360.00	0.19	198.0
1370	0.0	200	0.00	1370.00	0.19	197.9
1380	0.0	198	0.00	1380.00	0.19	197.9
1390	0.0	184	0.00	1390.00	0.20	197.8
1400	0.0	192	0.00	1400.00	0.20	197.7
1410	0.0	194	0.00	1410.00	0.20	197.7
1420	0.0	194	0.00	1420.00	0.20	197.6
1430	0.0	198	0.00	1430.00	0.20	197.6
1440	0.0	198	0.00	1440.00	0.21	197.6
1450	0.0	196	0.01	1450.00	0.21	197.6
1460	0.0	210	0.01	1460.00	0.22	197.7
1470	0.0	196	0.00	1470.00	0.22	197.7
1480	0.0	198	0.00	1480.00	0.23	197.7
1490	0.0	202	0.00	1490.00	0.23	197.7
1500	0.0	200	0.00	1500.00	0.23	197.7
1510	0.0	198	0.00	1510.00	0.23	197.8
1520	0.0	195	0.01	1520.00	0.24	197.7
1530	0.0	182	0.00	1530.00	0.24	197.7
1540	0.0	197	0.00	1540.00	0.24	197.7
1550	0.0	199	0.00	1550.00	0.25	197.7
1560	0.0	202	0.00	1560.00	0.25	197.7
1570	0.0	200	0.00	1570.00	0.25	197.7
1580	0.0	192	0.00	1580.00	0.25	197.7
1590	0.0	181	0.00	1590.00	0.25	197.7
1600	0.0	187	0.00	1600.00	0.26	197.6

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
1610	0.0	195	0.01	1610.00	0.26	197.5
1620	0.0	203	0.01	1620.00	0.27	197.5
1630	0.0	199	0.01	1630.00	0.27	197.6
1640	0.0	202	0.00	1640.00	0.28	197.7
1650	0.0	202	0.00	1650.00	0.28	197.7
1660	0.0	195	0.00	1660.00	0.28	197.7
1670	0.0	187	0.00	1670.00	0.28	197.7
1680	0.0	195	0.00	1680.00	0.29	197.6
1690	0.0	193	0.00	1690.00	0.29	197.6
1700	0.0	202	0.00	1700.00	0.29	197.6
1710	0.0	199	0.01	1710.00	0.30	197.7
1720	0.0	194	0.00	1720.00	0.30	197.7
1730	0.0	199	0.00	1730.00	0.30	197.7
1740	0.0	206	0.00	1740.00	0.31	197.8
1750	0.0	193	0.01	1750.00	0.31	197.8
1760	0.0	184	0.01	1760.00	0.32	197.6
1770	0.0	187	0.00	1770.00	0.32	197.4
1780	0.0	184	0.00	1780.00	0.32	197.4
1790	0.0	181	0.00	1790.00	0.33	197.3
1800	0.0	191	0.00	1800.00	0.33	197.2
1810	0.0	195	0.00	1810.00	0.33	197.2
1820	0.0	208	0.00	1820.00	0.33	197.2
1830	0.0	209	0.00	1830.00	0.33	197.2
1840	0.0	203	0.00	1840.00	0.33	197.2
1850	0.0	192	0.00	1850.00	0.33	197.2
1860	0.0	189	0.00	1860.00	0.33	197.2
1870	0.0	193	0.00	1870.00	0.33	197.2
1880	0.0	196	0.00	1880.00	0.33	197.2
1890	0.0	203	0.00	1890.00	0.33	197.2
1900	0.0	189	0.00	1900.00	0.33	197.2
1910	0.0	193	0.00	1910.00	0.33	197.2
1920	0.0	196	0.00	1920.00	0.33	197.2
1930	0.0	207	0.00	1930.00	0.33	197.2
1940	0.0	198	0.00	1940.00	0.33	197.2
1950	0.0	194	0.00	1950.00	0.33	197.2
1960	0.0	193	0.00	1960.00	0.33	197.2
1970	0.0	200	0.00	1970.00	0.33	197.2
1980	0.0	188	0.00	1980.00	0.33	197.2

****

Equip.: L-23 Office: AZ Job No.: 30544

Calculation Method: Balanced Tangential

****

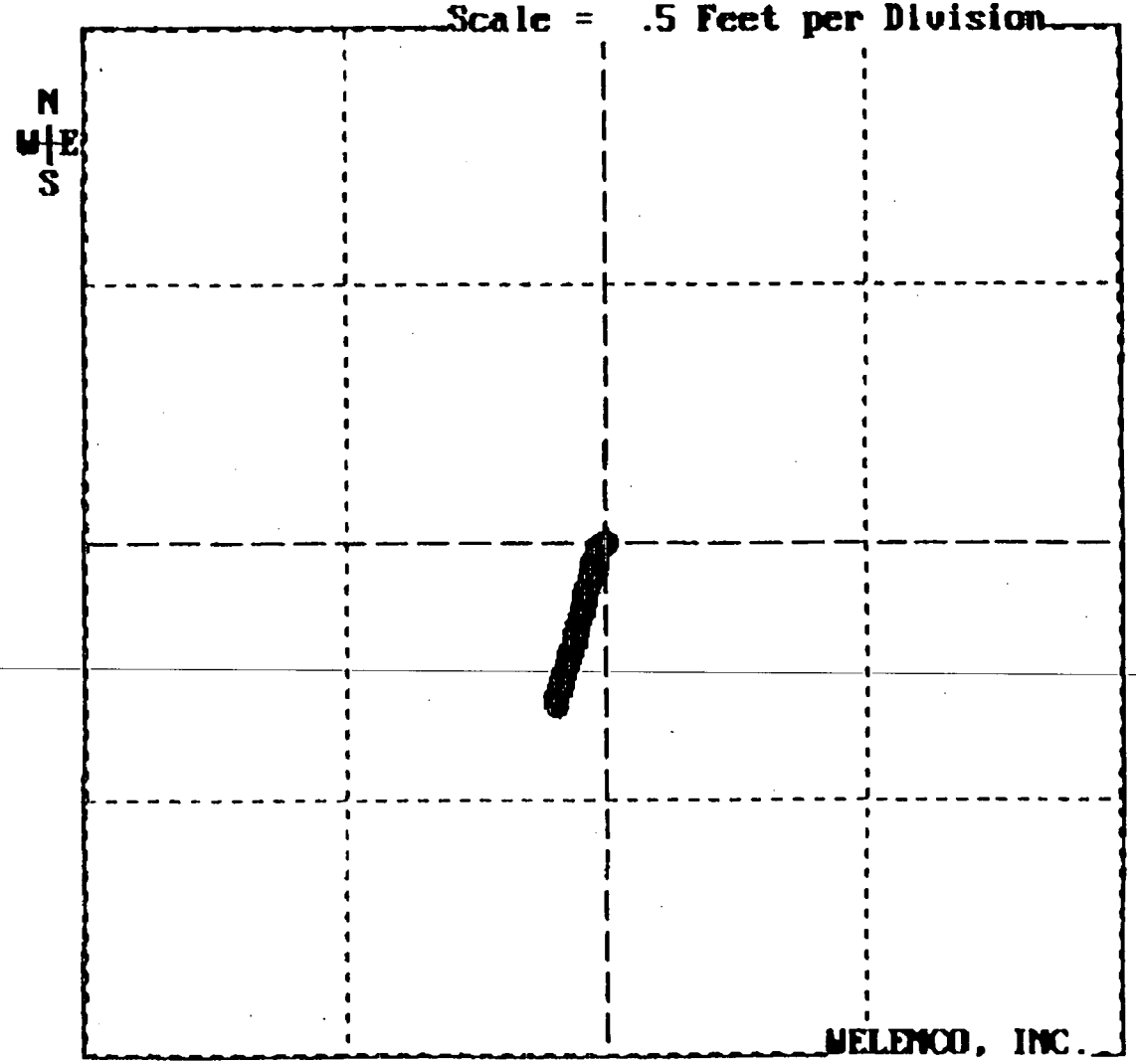
Company: LOS ALAMOS NATIONAL LAB

Well #: GR-3

Date: 11-MAY-98

PLAN VIEW

Scale = .5 Feet per Division



CLOSURE

Distance: 0.33 FEET

Bearing: 197.2 DEGREES

T.V.D.: 1900.00 FEET

Calc. Method
Balanced Tangential

Company:
LOS ALAMOS NATIONAL LAB
Well #:
GR-3

Date: 11-MAY-98

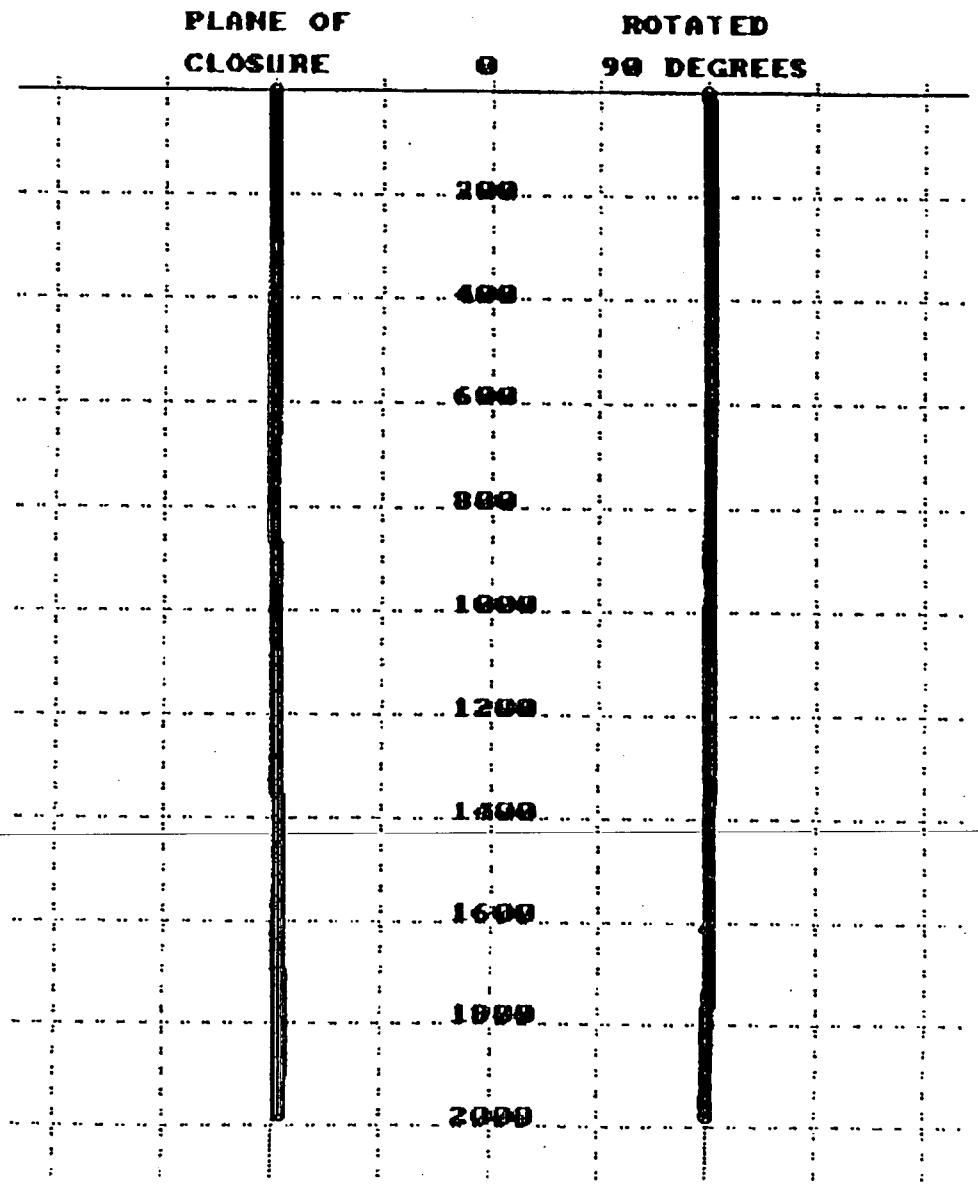
VERTICAL SECTION

Vert Scale = 200 Ft/Div
Horz Scale = 4 Ft/Div

CLOSURE

Distance: 0.33 FEET
Bearing: 197.2 DEGREES
T.V.D.: 1980.00 FEET

Calc. Method:
Balanced Tangential



Appendix IV

(Guaje Replacement Well No. 4)

Appendix IV-1

State Engineer Office Well Record, GR-4

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Los Alamos National Laboratory Owner's Well No. GR-4
Street or Post Office Address P.O. Box 1663
City and State Los Alamos, NM 87545

Well was drilled under Permit No. RG-486-5 and is located in the:

a. ____ ¼ SW ¼ NE ¼ NW ¼ of Section 5 Township 19N Range 7E N.M.P.M.

b. Tract No. - of Map No. - of the -

c. Lot No. - of Block No. - of the -
Subdivision, recorded in - County.

d. X= - feet, Y= - feet, N.M. Coordinate System - Zone in the - Grant.

(B) Drilling Contractor Beylik Drilling, Inc. License No. WD-1105

Address 3702 B State Highway 528, Rio Rancho, NM 87124

Drilling Began 1/8/98 Completed 5/18/98 Type tools Reverse Rotary Size of hole 36/26 in.

Elevation of land surface or - at well is 6299 ft. Total depth of well 2000 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 472 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
580	2000	1420	SEE ATTACHED	1,200

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
28"	110.64	-	0	580	580	-	-	-
16 5/8"LC	65.08	-	+3	380	383	-	-	-
16 5/8"SS	66.06	-	380	655	275	-	-	-
16 5/8"SS	54.54	-	655	1980	1325	-	655	1980
16 5/8"SS	66.06	-	1980	2000	20	SE HEAD	-	-

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
0	500	36"	115 sk cement	2009	Pressure Cement with
			55,200# Pozmix		Halliburton
			27 sk bentonite		
			43 sk CC		

Section 5. PLUGGING RECORD

Plugging Contractor
Address
Plugging Method
Date Well Plugged
Plugging approved by:

State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad FWL FSL

File No. Use Location No.

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
			SEE ATTACHED

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

BEYLIK DRILLING, INC

Kent M Wartick

Driller

Kent M. Wartick/Division Manager

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Guaje Replacement Well No. 4
Summarized Sample Description

depth, ft	thickness, ft	description
0-20	20	Alluvium, sand, gravel, cobbles, unconsolidated, poorly sorted, volcanic.
20-23	3	Tuff bed, welded ash fall, buff, pumaceous.
23-100	77	Gravelly sand, conglomeritic, silty, poorly to moderately well-cemented, subangular.
100-180	80	Sand, fine to medium grained, poorly sorted, subangular to subrounded, volcanic fragments, tuff, rhyolite, basalt; minor gravel-size fragments.
180-250	70	Gravelly sand, silty, subangular to subrounded, poorly sorted, rhyolitic.
250-340	90	Sand, very-fine to medium grained, subrounded to rounded, arkosic, quartz.
340-420	80	Sand, silty, very-fine to medium grained, subrounded to well-rounded; minor gravel; quartz, volcanic fragments, basalt, rhyolite.
420-480	60	Gravelly sand, subangular to subrounded, moderately cemented, silty, quartz, siliceous volcanics.
480-540	60	Sand, silty, subrounded, poorly sorted, moderately well-cemented as sandstone, quartz, siliceous volcanics.
540-580	40	Sandstone, clayey, very-fine to medium grained sand, pinkish- tan, quartz, minor volcanic fragments.
580-610	30	Basalt, vesicular, black; clay interbeds, brown.
610-740	130	Clayey sandstone, tan, very-fine to medium grained, subrounded, quartz, feldspar; pebbles, subrounded volcanic fragments.
740-964	224	Clay, sandy, orange-tan, very-fine grained, subrounded to rounded, quartz, silty, tan. (No sample 920-940)
964-1046	82	Basalt, dark gray, massive.
1046-1050	4	Clayey sand, reddish-orange, very-fine to fine grained, subrounded, quartz.
1050-1095	45	Basalt, dark gray, fractured, brecciated in upper 10 feet, lower section is massive.
1095-1180	85	Clayey sand, pinkish-tan, soft, plastic, very-fine grained, subangular to subrounded.
1180-1188	8	Basalt, weathered, 25% gone to clay, green and red-brown.
1188-1200	12	Clay, sandy, red-brown, soft.
1200-1280	80	Basalt, dark gray, hard, red-clay stringers in flows.
1280-1600	320	Silty sand, tan-brown, very-fine to fine grained, clayey. (No sample 1570-1580)
1600-1640	40	Clayey, silty sand, tan-brown; minor gravel, quartz.
1640-1900	260	Silty sand, tan, very-fine to fine grained, subrounded to rounded, quartz, volcanic fragments; minor gravel.
1900-2028	128	Clayey sand, silty, tan-brown, very-fine grained, subrounded, quartz.

Appendix IV-2

drilling fluid test results, GR-4 pilot hole

Drilling Fluid Properties for GR-4 – Pilot Hole

date	time	depth, ft	viscosity, sec/qt	weight, lb/gal	filtrate, cm^3/30 min.	pH	activity
1/26/98	11:00	665	32	8.9	20.0	9.5	drilling
1/27/98	10:00	740	37	8.9	9.6	9.0	drilling
1/29/98	10:00	925	34	8.9	9.6	8.5	drilling
1/30/98	12:00	990	34	8.9	12.0	8.5	drilling
2/1/98	10:00	1,028	34	8.9	8.0	8.5	drilling
2/2/98	7:00	1,080	34	8.9	9.0	8.5	drilling
2/3/98	13:30	1,188	30	9.0	8.8	8.0	repairs
2/4/98	13:00	1,222	32	9.0	8.8		drilling
2/5/98	12:00	1,282	32	9.0	9.6	7.5	drilling
2/6/98	10:45	1,401	33	9.1	8.0		drilling
2/7/98	11:15	1,518	31	8.9+	9.6	8.0	fishing
2/8/98	13:15	1,544	32	9.0	11.2	8.0	drilling
2/9/98	12:30	1,570	31	8.9	10.4	8.0	TOH; bit
2/10/98	10:50	1,688	31	8.9	9.6	8.0	totco survey
2/11/98	11:00	1,904	29	9.0	9.6	8.0	drilling

ft feet
sec/qt seconds per quart
lb/gal pounds per gallon
cm^3/30 min cubic centimeters per 30 minutes

Appendix IV-3

deviation survey results, GR-4 pilot hole

Deviation survey results, LANL Guaje Replacement Well No. 4
(from Totco surveys in pilot hole)

depth, feet	deviation, degrees
60	0.125
96	0.1875
120	0.125
185	0.125
245	0.0625
300	0.125
360	0.125
426	0.0
480	0.0625
540	0.125
666	0.125
726	0.25
760	0.25
780	0.125
846	0.125
900	0.1875
1,020	0.24
1,160	0.1875
1,180	0.1875
1,240	0.1875
1,300	0.1875
1,360	0.125
1,400	0.1875
1,469	0.1875
1,520	0.25
1,568	0.1875
1,628	0.125
1,688	0.25
1,740	0.125
1,800	<0.125
1,928	0.125
1,988	0.5

Appendix IV-4

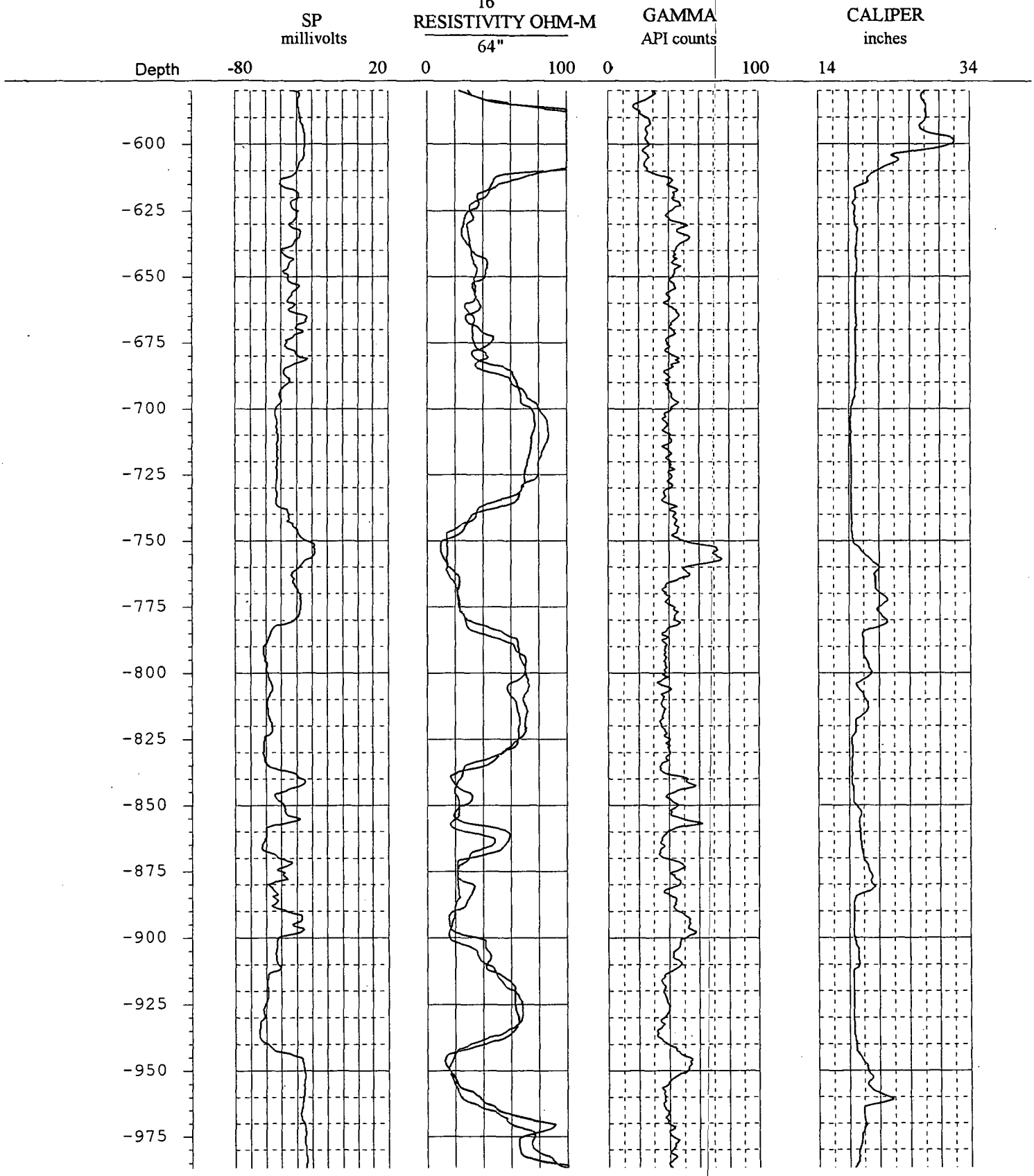
plots of geophysical log data, GR-4 pilot hole

JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-4

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Welenco
Casing: 28" to 580 ft
Bit Size: 17.5"
Date: Febuary 12, 1998

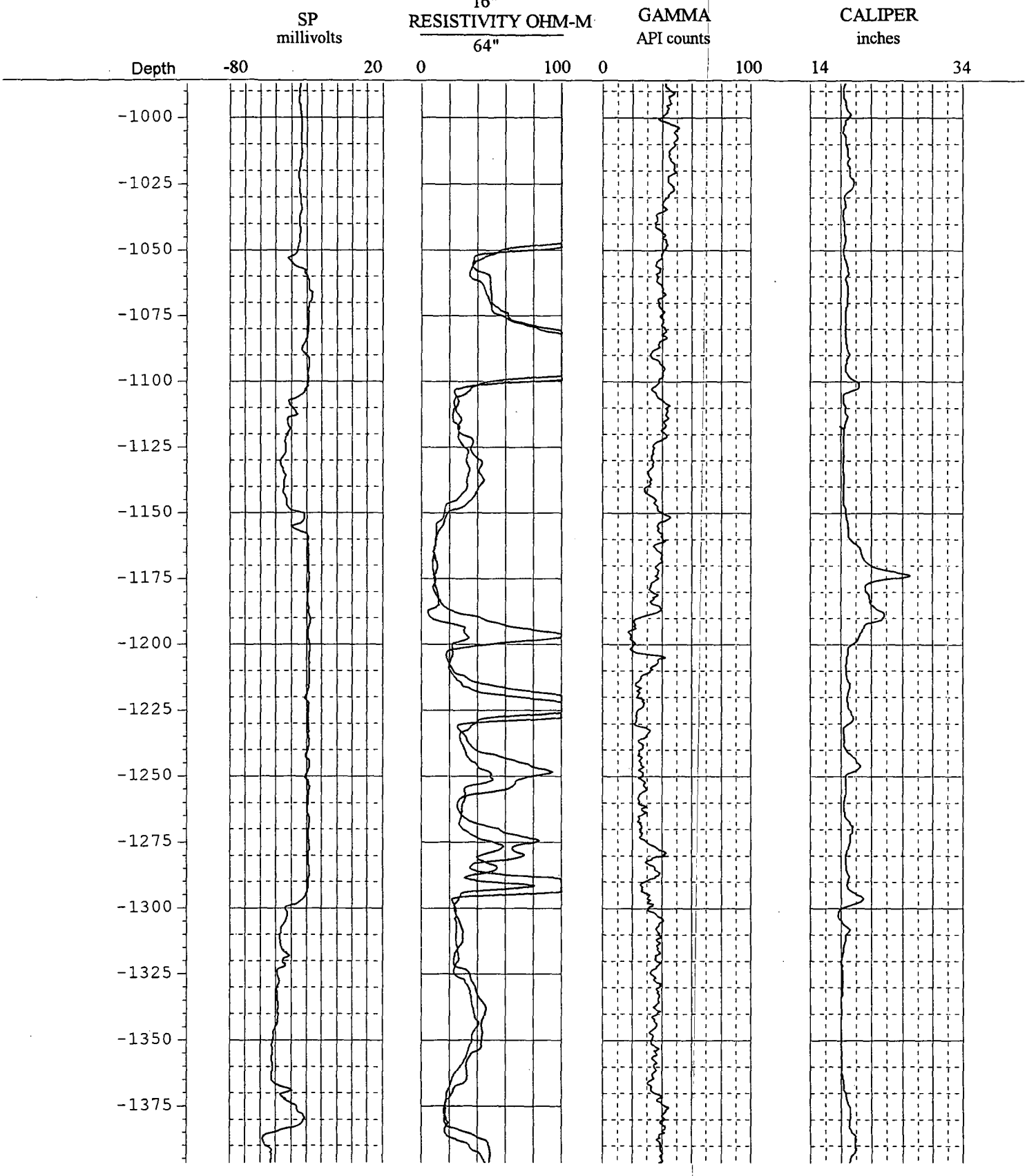


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-4

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Welenco
Casing: 28" to 580 ft
Bit Size: 17.5"
Date: Febuary 12, 1998

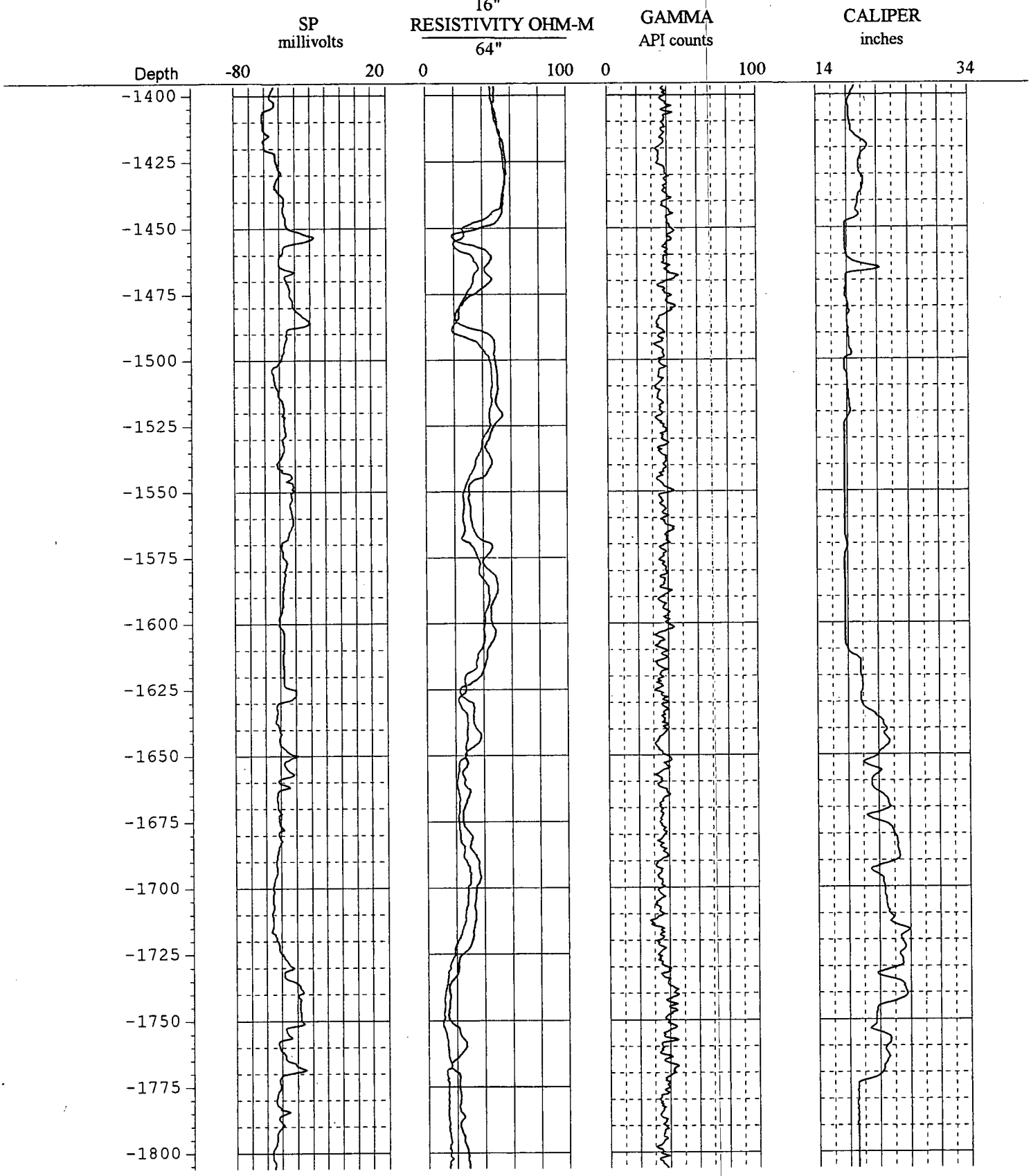


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-4

Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Welenco
Casing: 28" to 580 ft
Bit Size: 17.5"
Date: Febuary 12, 1998

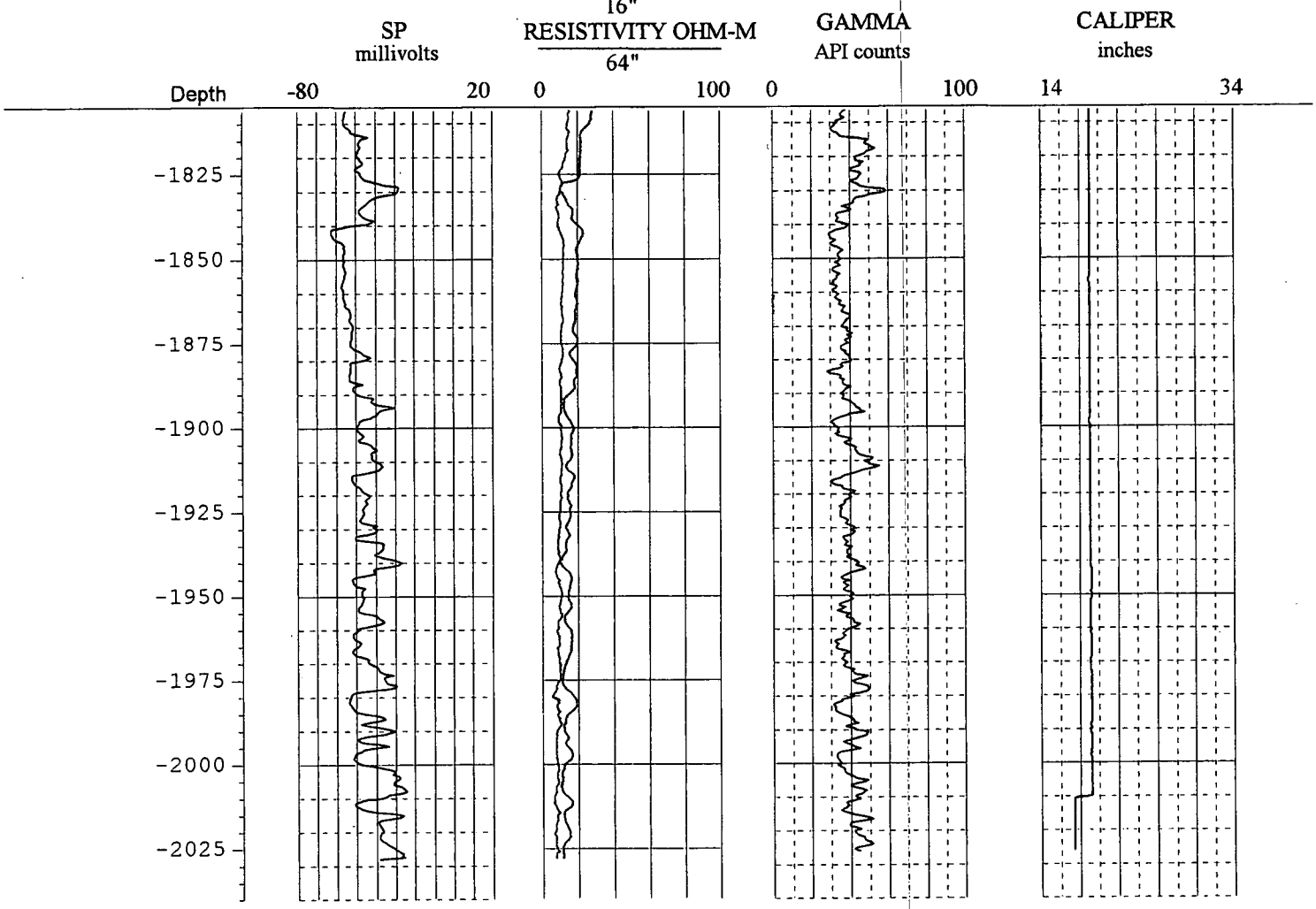


JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE D
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505)345-9920

Los Alamos National Labs GR-4

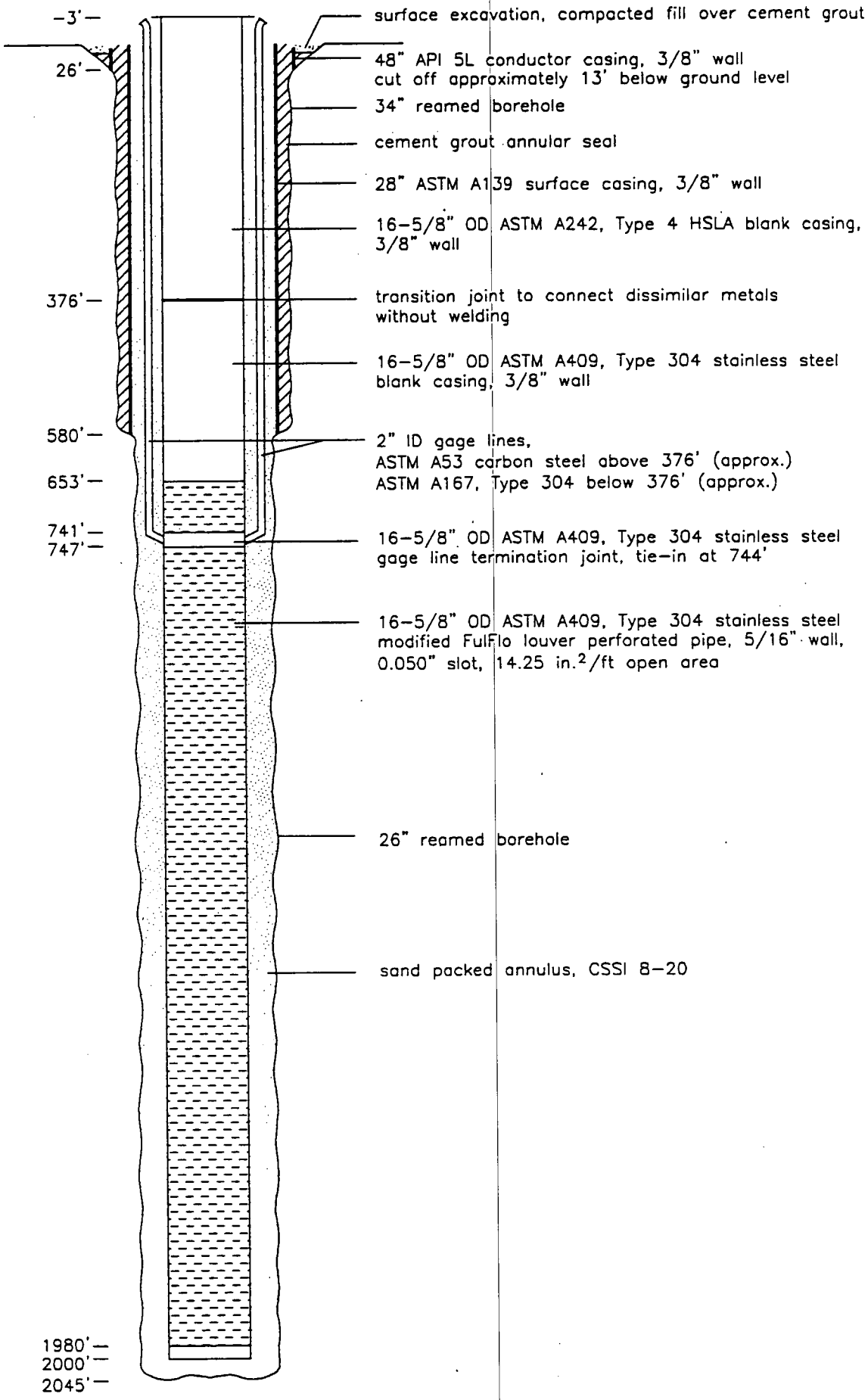
Hydrogeologist: JSAI
Contractor: Beylik Drilling
Drilling Method: Reverse Rotary

Logging Contractor: Welenco
Casing: 28" to 580 ft
Bit Size: 17.5"
Date: Febuary 12, 1998



Appendix IV-5

well completion diagram, GR-4



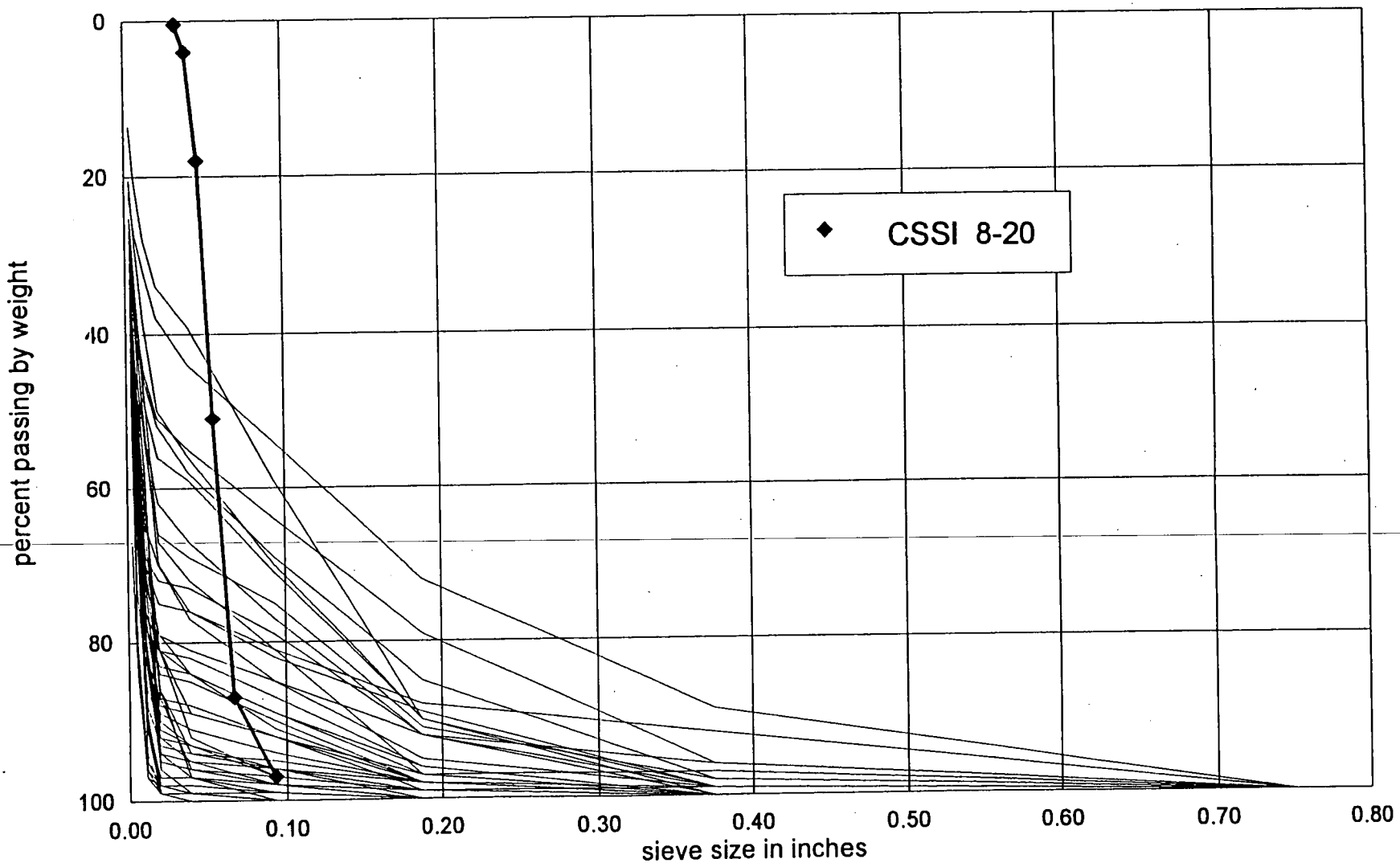
Well completion diagram, GR-4

JOHN SHOMAKER & ASSOCIATES, INC.

Appendix IV-6

plot of sieve analysis results, GR-4

Sieve Analysis Results, Guaje Replacment Well No. 4



SUMMARY OF LABORATORY TEST DATA

Depth (feet) GR-4	Unified Classification	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
			LL	PI	1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
610-620					100	100	99	90	70	56	50	39	28	20.5	
630-640					100	100	100	99	97	93	90	86	73	36.3	
650-660					100	100	100	98	91	84	79	72	60	33.5	
670-680					100	100	99	99	97	92	81	63	45	31.1	
700-710					100	100	98	91	75	69	66	54	36	26.9	
730-740					100	100	100	97	81	72	67	48	33	25.4	
760-770					100	100	100	100	98	95	92	84	59	35.0	
780-790					100	100	100	99	96	93	90	73	51	37.7	
800-810					100	100	100	100	100	100	99	94	65	43.6	
820-830					100	100	100	100	99	97	94	72	48	32.9	
840-850					100	100	100	100	100	97	86	71	47	34.3	
870-880					100	100	100	100	100	99	99	96	80	45.7	
890-900					100	100	99	95	85	77	70	52	38	29.1	
900-910					100	100	100	100	100	99	99	90	52	34.5	
940-950					100	100	98	85	69	58	52	46	39	28.2	
950-960					100	100	96	79	64	55	51	45	37	30.2	
1040-1050					100	100	100	98	95	94	93	88	59	34.9	
1110-1120					100	100	100	99	97	96	87	60	39	27.3	
1130-1140					100	100	100	99	96	94	86	66	44	32.1	

ject Number : 97-2-646

ject : Los Alamos Well Samples

Table No. : 1

SUMMARY OF LABOR/ TORY TEST DATA

Depth (feet) GR-4	Unified Classification	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
			LL	PI	1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
1160-1170					100	100	100	100	99	99	96	58	45	30.9	
1190-1200					100	100	99	89	82	76	70	65	58	40.0	
1250-1260					100	100	89	72	54	44	38	32	27	22.2	
1290-1300					100	100	100	99	96	95	94	82	53	35.1	
1310-1320					100	100	100	99	96	95	94	81	58	36.7	
1330-1340					100	100	100	99	96	93	91	77	54	34.3	
1350-1360					100	100	100	100	99	98	98	95	59	42.8	
1380-1390					100	100	100	100	98	97	97	90	57	41.9	
1400-1410					100	100	100	100	99	98	98	89	57	41.7	
1430-1440					100	100	100	100	99	98	98	90	62	44.1	
1460-1470					100	100	100	100	96	93	92	80	60	45.2	
1480-1490					100	100	100	98	90	85	84	76	58	37.4	

ject Number : 97-2-646

ject : Los Alamos Well Samples

Table No. : 1con't

SUMMARY OF LABORA_ORY TEST DATA

epth (feet) GR-4	Unified Classification	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
			LL	PI	1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
510-1520					100	100	100	98	92	89	88	77	48	38.2	
1530-1540					100	100	100	99	92	88	87	82	60	45.2	
1560-1570					100	100	99	98	96	95	94	83	58	44.0	
1590-1600					100	100	100	92	85	81	79	70	46	31.5	
1600-1610					100	100	100	90	71	59	56	49	34	25.3	
1630-1640					100	100	100	97	92	89	81	79	60	44.2	
1640-1650					100	100	100	96	87	82	81	71	46	31.3	
1670-1680					100	100	97	97	89	84	83	78	52	35.0	
1700-1710					100	100	100	100	99	99	98	96	80	46.6	
1720-1730					100	100	100	100	100	100	99	97	84	67.4	
1750-1760					100	100	100	98	94	91	89	82	63	45.8	
1780-1790					100	100	100	90	59	39	34	28	20	13.5	
1820-1830					100	100	99	92	79	73	72	69	56	37.7	
1830-1840					100	100	92	88	81	76	75	70	51	35.0	
1840-1850					100	100	100	96	89	84	81	76	50	39.4	
1870-1880					100	100	86	92	77	67	62	53	44	31.0	

oject Number : 97-2-646

Table No. : 1

SUMMARY OF LABORATORY TEST DATA

th (feet) 3R-4	Unified Classification	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
			LL	PI	1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
20-1930					100	100	100	100	100	100	99	91	62	42.7	
940-1950					100	100	99	99	98	96	95	83	54	38.1	
950-1960					100	100	100	100	99	99	98	97	81	48.7	

Table No. : 1 con't

Appendix IV-7

pumping test data, GR-4

GUAJE REPLACMENT WELL NO. 4
STEP-DRAWDOWN TEST - 4/11/98
starting water level: 452.60 ft bgl (pre-development)

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
04/11/98	12:00	pump on	471.7			pump on, step 1
04/11/98	12:01	1	512.4			water to surface @ t=1.25
04/11/98	12:02	2	523.68	556	7.82	cloudy, start sand tester
04/11/98	12:03	3	518.39	500	7.60	
04/11/98	12:04	4	517.25	500	7.73	disch clear
04/11/98	12:05	5	517.18	500	7.74	
04/11/98	12:06	6	518.98	500	7.53	Welenco on site, spinner logs
04/11/98	12:07	7	519.28	500	7.50	2 static runs and one run on
04/11/98		8	519.48	500	7.48	each step
04/11/98		9.5	519.85	500	7.43	
04/11/98		11	519.95	500	7.42	S. McLin data logger @ 1 min.
04/11/98		12	520.01	500	7.42	
04/11/98	12:13	13	520.23	500	7.39	adj. Q up slightly
04/11/98		15	519.98	500	7.42	
04/11/98		16	521.1	500	7.30	
04/11/98		17	521.28	500	7.28	
04/11/98		18	521.51	500	7.26	
04/11/98		20	521.85	500	7.22	0.08 ml sand, silt: 2,11 ppm
04/11/98		22	522.34	500	7.17	
04/11/98		24	522.77	500	7.13	
04/11/98		26	523.08	500	7.09	
04/11/98		28	523.66	500	7.04	
04/11/98		30	524.03	500	7.00	
04/11/98		32	524.28	500	6.98	
04/11/98		35	524.62	500	6.94	
04/11/98		40	525.2	500	6.89	
04/11/98		46	525.56	500	6.85	
04/11/98		50	525.98	500	6.81	
04/11/98		55	526.41	500	6.77	0.08 ml sand, silt: 0.77 ppm
04/11/98		60	526.92	500	6.73	adj. Q up slightly
04/11/98		65.5	528.16	500	6.62	0.1 ml sand, silt: 0.88 ppm
04/11/98		70	528.44	500	6.59	adj. Q up slightly
04/11/98		75	528.74	500	6.57	
04/11/98		80	529.12	500	6.53	
04/11/98	13:25	85	529.58	500	6.50	
04/11/98	13:31	91	529.86	500	6.47	
04/11/98	13:35	95	530.06	500	6.45	0.1 ml sand, silt: 0.54 ppm

GUAJE REPLACMENT WELL NO. 4
STEP DRAWDOWN TEST - 4/11/98
starting water level: 452.60 ft bgl (pre-development)

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
04/11/98	13:40	100	530.21	500	6.44	
04/11/98		101	535.98	600	7.20	step 2, increase Q
04/11/98		102	539.88	600	6.87	
04/11/98		103	540.47	600	6.83	adj. Q down slightly
04/11/98		104	540.2	600	6.85	
04/11/98		105	539.98	600	6.87	
04/11/98		106	540	600	6.86	
04/11/98		107	540.03	600	6.86	
04/11/98		108	540.2	600	6.85	
04/11/98		109	540.08	600	6.86	adj. Q up slightly
04/11/98	13:51	111	540.76	600	6.81	
04/11/98		112	540.98	600	6.79	
04/11/98		113	541.08	600	6.78	
04/11/98		114	541.24	600	6.77	
04/11/98		116	541.4	600	6.76	
04/11/98		118	541.55	600	6.75	
04/11/98		120	541.72	600	6.73	
04/11/98		122	541.97	600	6.71	
04/11/98		125	541.97	600	6.71	
04/11/98		130	543	600	6.64	adj. Q up slightly
04/11/98		140	543.87	600	6.57	0.1 ml sand, silt: 0.38 ppm
04/11/98	14:30	150	544.71	600	6.51	adj. Q up slightly
04/11/98		160	545.31	600	6.47	
04/11/98		170	545.8	600	6.44	
04/11/98		180	546.24	600	6.41	
04/11/98		190	546.6	600	6.38	0.11 ml sand, silt: 0.31 ppm
04/11/98		200	547.18	600	6.34	
04/11/98		201	553.98	700	6.90	step 3, increase Q
04/11/98		202	556.36	700	6.75	
04/11/98	15:23	203	556.48	700	6.74	
04/11/98		204	557.13	700	6.70	
04/11/98		205	557.3	700	6.69	
04/11/98		206	557.5	700	6.67	
04/11/98		207	557.73	700	6.66	adj Q up slightly
04/11/98		208	557.94	700	6.65	
04/11/98		209	558.11	700	6.63	0.11 ml sand, silt: 0.28 ppm
04/11/98		210	558.33	700	6.62	
04/11/98		211	558.53	700	6.61	

GUAJE REPLACMENT WELL NO. 4
STEP DRAWDOWN TEST - 4/11/98
starting water level: 452.60 ft bgl (pre-development)

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
04/11/98		213	558.88	700	6.59	
04/11/98		215	559.14	700	6.57	0.11 ml sand, silt: 0.27 ppm
04/11/98		217	559.37	700	6.56	
04/11/98		220	559.52	700	6.55	
04/11/98	15:45	225	559.86	700	6.53	
04/11/98		230	560.44	700	6.49	
04/11/98		240	560.79	700	6.47	adj. Q up slightly
04/11/98		250	561.51	700	6.43	
04/11/98		260	561.98	700	6.40	
04/11/98		270	562.38	700	6.38	adj. Q up slightly
04/11/98		280	563.08	700	6.34	
04/11/98	16:50	290	563.69	700	6.30	adj. Q up slightly
04/11/98	17:00	300	563.79	700	6.30	
04/11/98		301	571.14	800	6.75	step 4, increase Q
04/11/98		302	573.06	800	6.64	
04/11/98		303	573.38	800	6.62	
04/11/98		304	573.45	800	6.62	
04/11/98		305	573.5	800	6.62	
04/11/98		306	573.62	800	6.61	
04/11/98	17:07	307	574.14	800	6.58	
04/11/98		308	574.35	800	6.57	
04/11/98		309	574.54	800	6.56	
04/11/98		310	574.67	800	6.55	
04/11/98		312	574.86	800	6.54	
04/11/98		314	574.95	800	6.54	
04/11/98		316	575.12	800	6.53	
04/11/98		318	575.43	800	6.51	
04/11/98		320	575.55	800	6.51	
04/11/98	17:25	325	575.88	800	6.49	
04/11/98		330	576.41	800	6.46	
04/11/98		340	577.05	800	6.43	
04/11/98		350	577.56	800	6.40	
04/11/98		360	577.89	800	6.39	0.2 ml sand, silt: 0.29 ppm
04/11/98		370	578.72	800	6.34	
04/11/98		380	579.27	800	6.32	
04/11/98		390	579.77	800	6.29	
04/11/98	18:40	400	580.5	800	6.25	T=83, K=166, pH=8.25
04/11/98		401	588.52	950	6.99	step 5, increase Q

GUAJE REPLACMENT WELL NO. 4
STEP DRAWDOWN TEST - 4/11/98
starting water level: 452.60 ft bgl (pre-development)

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
04/11/98		402	593.84	950	6.73	
04/11/98		403	595.11	950	6.67	
04/11/98		404	595.59	950	6.64	adj. Q up slightly
04/11/98		405	596.45	950	6.60	
04/11/98		406	596.56	950	6.60	
04/11/98		407	597.18	950	6.57	inst. Meter: approx 1,000 gpm
04/11/98		408	597.51	950	6.56	
04/11/98		409	597.7	950	6.55	
04/11/98		410	597.85	950	6.54	
04/11/98		412	598.4	950	6.52	
04/11/98		414	598.78	950	6.50	adj. Q down slightly
04/11/98		416	598.78	950	6.50	
04/11/98		418	598.78	950	6.50	
04/11/98		420	598.62	950	6.51	adj. Q up slightly
04/11/98		425.5	599.72	950	6.46	
04/11/98		430	600.38	950	6.43	
04/11/98		435	600.87	950	6.41	
04/11/98		440	601.31	950	6.39	
04/11/98		449	602.03	950	6.36	
04/11/98		460	602.72	950	6.33	adj Q up slightly
04/11/98		473	603.66	950	6.29	0.21 ml sand, silt: 0.24 ppm
04/11/98		480	604.16	950	6.27	sand pack grains <1.25 mm in tester
04/11/98	20:10	490	604.78	950	6.24	adj Q up slightly
04/11/98	20:20	500	605.55	950	6.21	totalizer: 7219900 g @ t=489
04/11/98	20:20:30	500.5	503.98			**start recovery**
04/11/98	20:21	501	490.85			S. McLin data logger @ 1 min.
04/11/98		502	500.74			
04/11/98		503	510.15			
04/11/98		504	510.42			
04/11/98		505	510.27			
04/11/98		506.5	510.27			
04/11/98		508.5	509.57			
04/11/98		510	508.67			
04/11/98		512	507.68			
04/11/98		514	505.38			
04/11/98		518	505.15		-	
04/11/98		520	504.52			

GUAJE REPLACMENT WELL NO. 4
STEP DRAWDOWN TEST - 4/11/98
starting water level: 452.60 ft bgl (pre-development)

date	time	elapsed time	water level, ft bgl	flow rate, gpm	Q/s	remarks
04/11/98		525	502.81			
04/11/98	20:50	530	501.05			
04/11/98	21:00	540	499.22			
04/11/98		557	496.75			
04/11/98	21:31	574	494.87			

GUAJE REPLACMENT WELL NO. 4
CONSTANT-RATE TEST
starting water level: 451.70 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
04/08/98	14:01	0						pump on
04/08/98	14:02	1	529.39	527.29			10.3	
04/08/98		2	529.18	527.08			10.3	
04/08/98		3	532.89	530.79			9.9	
04/08/98		4	534.28	532.18			9.7	
04/08/98		5	535.67	533.57	22.5"	780	9.5	
04/08/98		6	536.88	534.78	22.5"	780	9.4	
04/08/98		7	537.84	535.74	22.5"	780	9.3	adjust Q down slightly
04/08/98		8	537.73	535.63	22.5"	780	9.3	
04/08/98		9	537.98	535.88	22.5"	780	9.3	
04/08/98	14:11	10	538.38	536.28	22.5"	780	9.2	
04/08/98		12	539.58	537.48	22.5"	780	9.1	
04/08/98		14	540.62	538.52	22.5"	780	9.0	
04/08/98		16	541.62	539.52	22.5"	780	8.9	
04/08/98		18	542.06	539.96	22.5"	780	8.8	
04/08/98		20	542.74	540.64	22.5"	780	8.8	increase engine rpm
04/08/98		25	544.5	542.4	22.5"	780	8.6	
04/08/98		30	546	543.9	22.5"	780	8.5	
04/08/98		35	547.15	545.05	22.5"	780	8.4	
04/08/98		40	548.23	546.13	22.5"	780	8.3	
04/08/98		45	549.28	547.18	22.5"	780	8.2	
04/08/98		50	550.2	548.1	22.5"	780	8.1	
04/08/98		55	551.08	548.98	22.5"	780	8.0	
04/08/98	15:01	60	551.72	549.62	22.5"	780	8.0	
04/08/98		70	553.18	551.08	22.5"	780	7.8	
04/08/98		80	554.12	552.02	22.5"	780	7.8	adjust valve to increase Q
04/08/98		90	555.11	553.01	22.5"	780	7.7	
04/08/98		100	557.2	555.1	22.5"	780	7.5	
04/08/98		110	557.97	555.87	22.5"	780	7.5	
04/08/98		120	558.88	556.78	22.5"	780	7.4	G6 250 gpm 16:00 to 02:00
04/08/98		130	559.87	557.77	22.5"	780	7.4	
04/08/98		140	560.78	558.68	22.5"	780	7.3	
04/08/98		150	561.69	559.59	22.5"	780	7.2	
04/08/98		160	561.85	559.75	22.5"	780	7.2	increase engine rpm
04/08/98		170	562.55	560.45	22.5"	780	7.2	
04/08/98		180	563.18	561.08	22.5"	780	7.1	
04/08/98		190	563.82	561.72	22.5"	780	7.1	0.1 ml sand, 0.28 ppm
04/08/98		200	565.08	562.98	22.5"	780	7.0	
04/08/98		210	565.25	563.15	22.5"	780	7.0	adjust valve to decrease Q
04/08/98		220	565.69	563.59	22.5"	780	7.0	
04/08/98	17:51	230	565.78	563.68	22.5"	780	7.0	
04/08/98		240	565.9	563.8	22.5"	780	7.0	
04/08/98		250	566.28	564.18	22.5"	780	6.9	increase engine rpm
04/08/98		261	567.95	565.85	22.5"	780	6.8	
04/08/98		270	568.15	566.05	22.5"	780	6.8	adjust valve to decrease Q
04/08/98		280	568.58	566.48	22.5"	780	6.8	0.6 ml sand, 1.13 ppm
04/08/98		290	569.08	566.98	22.5"	780	6.8	
04/08/98		300	569.12	567.02	22.5"	780	6.8	
04/08/98		314	569.12	567.02	22.5"	780	6.8	0.6 ml sand, 1.01 ppm
04/08/98		329	567.68	565.58	22.5"	780	6.8	increase engine rpm
04/08/98		345	572.2	570.1	22.5"	780	6.6	adjust valve to decrease Q
04/08/98		360	570.54	568.44	22.5"	780	6.7	0.6 ml sand, 0.88 ppm
04/08/98		370	572.01	569.91	22.5"	780	6.6	
04/08/98		389	571.8	569.7	22.5"	780	6.6	

GUAJE REPLACMENT WELL NO. 4
CONSTANT-RATE TEST
starting water level: 451.70 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
04/08/98		404	572.61	570.51	22.5"	780	6.6	adjust Q with valve
04/08/98		420	573.5	571.4	22.5"	780	6.5	
04/08/98		435	572.87	570.77	22.5"	780	6.6	
04/08/98		450	574.8	572.7	22.5"	780	6.4	0.6 ml sand, 0.70 ppm
04/08/98		465	574.87	572.77	22.5"	780	6.4	
04/08/98		480	574.85	572.75	22.5"	780	6.4	
04/08/98		495	575.09	572.99	22.5"	780	6.4	
04/08/98	22:30	509	575.25	573.15	22.5"	780	6.4	
04/08/98		524	576.08	573.98	22.5"	780	6.4	
04/08/98		540	576.05	573.95	22.5"	780	6.4	
04/08/98		559	576.27	574.17	22.5"	780	6.4	
04/08/98		523	576.55	574.45	22.5"	780	6.4	
04/08/98		586	577.55	575.45	22.5"	780	6.3	
04/09/98	0:01	600	577.72	575.62	22.5"	780	6.3	
04/09/98		620	576.68	574.58	22.5"	780	6.3	
04/09/98		630	578.25	576.15	22.5"	780	6.3	T=80, k=200, pH=8.46
04/09/98	1:00	660	578.5	576.4	22.5"	780	6.3	
04/09/98		675	579.06	576.96	22.5"	780	6.2	0.6 ml sand, 0.47 ppm
04/09/98		690	579.25	577.15	22.5"	780	6.2	
04/09/98	2:00	720	579.5	577.4	22.5"	780	6.2	
04/09/98		735	579.85	577.75	22.5"	780	6.2	0.7 ml sand, 0.50 ppm
04/09/98		750	580.2	578.1	22.5"	780	6.2	
04/09/98		780	580.5	578.4	22.5"	780	6.2	
04/09/98	3:30	810	581.3	579.2	22.5"	780	6.1	
04/09/98		828	581.46	579.36	22.5"	780	6.1	
04/09/98		840	581.6	579.5	22.5"	780	6.1	K=206, pH=8.38
04/09/98		902	582.37	580.27	22.5"	780	6.1	
04/09/98		920	582.6	580.5	22.5"	780	6.1	
04/09/98		930	582.8	580.7	22.5"	780	6.0	
04/09/98		960	582.8	580.7	22.5"	780	6.0	
04/09/98		990	584.2	582.1	22.5"	780	6.0	increase engine rpm
04/09/98		1020	584.6	582.5	22.5"	780	6.0	air temp = 24 degrees F
04/09/98		1035	584.77	582.67	22.5"	780	6.0	
04/09/98		1050	584.9	582.8	22.5"	780	5.9	
04/09/98		1080	584.68	582.58	22.5"	780	6.0	
04/09/98		1110	584.52	582.42	22.5"	780	6.0	
04/09/98		1215	584.6	582.5	22.5"	780	6.0	
04/09/98		1290	586.1	584	22.5"	780	5.9	
04/09/98		1440	585.8	583.7	22.5"	780	5.9	0.8 ml sand, 0.29 ppm
04/09/98		1665	586.46	584.36	22.5"	780	5.9	
04/09/98		1710	587.6	585.5	22.5"	780	5.8	
04/09/98		1740	587.9	585.8	22.5"	780	5.8	
04/09/98		1770	588.1	586	22.5"	780	5.8	
04/09/98		1787	588.27	586.17	22.5"	780	5.8	0.9 ml sand, 0.27 ppm
04/09/98	20:01	1801	588.3	586.2	22.5"	780	5.8	
04/09/98		1816	588.45	586.35	22.5"	780	5.8	
04/09/98		1830	588.6	586.5	22.5"	780	5.8	
04/09/98		1860	588.6	586.5	22.5"	780	5.8	
04/09/98		1890	588.7	586.6	22.5"	780	5.8	
04/09/98		1920	588.8	586.7	22.5"	780	5.8	
04/09/98		1935	589.08	586.98	22.5"	780	5.8	
04/09/98		1950	589.05	586.95	22.5"	780	5.8	
04/09/98		1980	588.95	586.85	22.5"	780	5.8	
04/09/98		2010	589.2	587.1	22.5"	780	5.8	
04/09/98		2040	589.3	587.2	22.5"	780	5.8	

GUAJE REPLACMENT WELL NO. 4
CONSTANT-RATE TEST
starting water level: 451.70 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
04/08/98		404	572.61	570.51	22.5"	780	6.6	adjust Q with valve
04/08/98		420	573.5	571.4	22.5"	780	6.5	
04/08/98		435	572.87	570.77	22.5"	780	6.6	
04/08/98		450	574.8	572.7	22.5"	780	6.4	0.6 ml sand, 0.70 ppm
04/08/98		465	574.87	572.77	22.5"	780	6.4	
04/08/98		480	574.85	572.75	22.5"	780	6.4	
04/08/98		495	575.09	572.99	22.5"	780	6.4	
04/08/98	22:30	509	575.25	573.15	22.5"	780	6.4	
04/08/98		524	576.08	573.98	22.5"	780	6.4	
04/08/98		540	576.05	573.95	22.5"	780	6.4	
04/08/98		559	576.27	574.17	22.5"	780	6.4	
04/08/98		523	576.55	574.45	22.5"	780	6.4	
04/08/98		586	577.55	575.45	22.5"	780	6.3	
04/09/98	0:01	600	577.72	575.62	22.5"	780	6.3	
04/09/98		620	576.68	574.58	22.5"	780	6.3	
04/09/98		630	578.25	576.15	22.5"	780	6.3	T=80, k=200, pH=8.46
04/09/98	1:00	660	578.5	576.4	22.5"	780	6.3	
04/09/98		675	579.06	576.96	22.5"	780	6.2	0.6 ml sand, 0.47 ppm
04/09/98		690	579.25	577.15	22.5"	780	6.2	
04/09/98	2:00	720	579.5	577.4	22.5"	780	6.2	
04/09/98		735	579.85	577.75	22.5"	780	6.2	0.7 ml sand, 0.50 ppm
04/09/98		750	580.2	578.1	22.5"	780	6.2	
04/09/98		780	580.5	578.4	22.5"	780	6.2	
04/09/98	3:30	810	581.3	579.2	22.5"	780	6.1	
04/09/98		828	581.46	579.36	22.5"	780	6.1	
04/09/98		840	581.6	579.5	22.5"	780	6.1	K=206, pH=8.38
04/09/98		902	582.37	580.27	22.5"	780	6.1	
04/09/98		920	582.6	580.5	22.5"	780	6.1	
04/09/98		930	582.8	580.7	22.5"	780	6.0	
04/09/98		960	582.8	580.7	22.5"	780	6.0	
04/09/98		990	584.2	582.1	22.5"	780	6.0	increase engine rpm
04/09/98		1020	584.6	582.5	22.5"	780	6.0	air temp = 24 degrees F
04/09/98		1035	584.77	582.67	22.5"	780	6.0	
04/09/98		1050	584.9	582.8	22.5"	780	5.9	
04/09/98		1080	584.68	582.58	22.5"	780	6.0	
04/09/98		1110	584.52	582.42	22.5"	780	6.0	
04/09/98		1215	584.6	582.5	22.5"	780	6.0	
04/09/98		1290	586.1	584	22.5"	780	5.9	
04/09/98		1440	585.8	583.7	22.5"	780	5.9	0.8 ml sand, 0.29 ppm
04/09/98		1665	586.46	584.36	22.5"	780	5.9	
04/09/98		1710	587.6	585.5	22.5"	780	5.8	
04/09/98		1740	587.9	585.8	22.5"	780	5.8	
04/09/98		1770	588.1	586	22.5"	780	5.8	
04/09/98		1787	588.27	586.17	22.5"	780	5.8	0.9 ml sand, 0.27 ppm
04/09/98	20:01	1801	588.3	586.2	22.5"	780	5.8	
04/09/98		1816	588.45	586.35	22.5"	780	5.8	
04/09/98		1830	588.6	586.5	22.5"	780	5.8	
04/09/98		1860	588.6	586.5	22.5"	780	5.8	
04/09/98		1890	588.7	586.6	22.5"	780	5.8	
04/09/98		1920	588.8	586.7	22.5"	780	5.8	
04/09/98		1935	589.08	586.98	22.5"	780	5.8	
04/09/98		1950	589.05	586.95	22.5"	780	5.8	
04/09/98		1980	588.95	586.85	22.5"	780	5.8	
04/09/98		2010	589.2	587.1	22.5"	780	5.8	
04/09/98		2040	589.3	587.2	22.5"	780	5.8	

GUAJE REPLACMENT WELL NO. 4
CONSTANT-RATE TEST
starting water level: 451.70 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	mano. 8"x6"	flow rate, gpm	Q/s, gpm/ft	remarks
04/10/98	0:15	2055	589.35	587.25	22.5"	780	5.8	
04/10/98		2070	589.4	587.3	22.5"	780	5.8	
04/10/98		2100	589.48	587.38	22.5"	780	5.7	0.95 ml sand, 0.24 ppm
04/10/98		2117	589.53	587.43	22.5"	780	5.7	
04/10/98		2130	589.7	587.6	22.5"	780	5.7	
04/10/98		2160	589.9	587.8	22.5"	780	5.7	
04/10/98	2:30	2190	589.95	587.85	22.5"	780	5.7	
04/10/98		2223	590.35	588.25	22.5"	780	5.7	1.0 ml sand, 0.24 ppm
04/10/98		2250	590.5	588.4	22.5"	780	5.7	
04/10/98		2265	591.72	589.62	22.5"	780	5.7	
04/10/98		2280	591.7	589.6	22.5"	780	5.7	
04/10/98		2296	590.9	588.8	22.5"	780	5.7	
04/10/98		2325	591.12	589.02	22.5"	780	5.7	
04/10/98		2340	591.1	589	22.5"	780	5.7	
04/10/98		2370	591.1	589	22.5"	780	5.7	
04/10/98		2386	591.38	589.28	22.5"	780	5.7	
04/10/98		2400	591.35	589.25	22.5"	780	5.7	
04/10/98		2416	591.39	589.29	22.5"	780	5.7	
04/10/98		2430	591.42	589.32	22.5"	780	5.7	
04/10/98		2450	591.73	589.63	22.5"	780	5.7	
04/10/98		2480	591.58	589.48	22.5"	780	5.7	
04/10/98		2490	591.5	589.4	22.5"	780	5.7	
04/10/98		2505	591.5	589.4	22.5"	780	5.7	
04/10/98		2520	591.28	589.18	22.5"	780	5.7	
04/10/98		2535	591.23	589.13	22.5"	780	5.7	
04/10/98		2550	591.15	589.05	22.5"	780	5.7	
04/10/98		2565	590.85	588.75	22.5"	780	5.7	
04/10/98		2580	591.5	589.4	22.5"	780	5.7	
04/10/98		2595	591.55	589.45	22.5"	780	5.7	
04/10/98		2610	591.42	589.32	22.5"	780	5.7	
04/10/98		2625	592.28	590.18	22.5"	780	5.6	
04/10/98		2655	592.14	590.04	22.5"	780	5.6	
04/10/98		2685	592.18	590.08	22.5"	780	5.6	T=81, k=178, pH=8.34
04/10/98		2715	592.38	590.28	22.5"	780	5.6	1.0 ml sand, 0.19 ppm
04/10/98	11:35	2735	592.35	590.25	22.5"	780	5.6	

GUAJE REPLACMENT WELL NO. 4
CONSTANT-RATE TEST
starting water level: 451.70 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	t/t'	remarks
04/10/98	11:35:25	0.42	541	538.9	6513	pump off
04/10/98		0.6	498.6	496.5	4559	
04/10/98	11:36:30	1.5	492.4	490.3	1824	stop backspin @ t=2
04/10/98		3	512.15	510.05	913	
04/10/98		4	516.38	514.28	685	
04/10/98		5	517.17	515.07	548	
04/10/98		6	515.48	513.38	457	
04/10/98		7	515.06	512.96	392	
04/10/98	11:43	8	515.95	513.85	343	
04/10/98		9	515.48	513.38	305	
04/10/98		10	515.08	512.98	275	
04/10/98		11	514.65	512.55	250	
04/10/98		12	514.18	512.08	229	
04/10/98		13	513.8	511.7	211	
04/10/98		14	513.38	511.28	196	
04/10/98	11:50	15	512.95	510.85	183	
04/10/98		17	512.32	510.22	162	
04/10/98		19	511.68	509.58	145	
04/10/98		21	511	508.9	131	
04/10/98		23.5	509.6	507.5	117	
04/10/98		25	509.85	507.75	110	
04/10/98		27	507.98	505.88	102	
04/10/98		29	508.88	506.78	95	
04/10/98		31	508.46	506.36	89	
04/10/98		33.5	507.92	505.82	83	
04/10/98		35.5	507.48	505.38	78	
04/10/98		37	507.15	505.05	75	
04/10/98		39.5	506.88	504.78	70	
04/10/98		42	506.2	504.1	66	
04/10/98		44	505.82	503.72	63	
04/10/98		46	505.45	503.35	60	
04/10/98		50	504.82	502.72	56	
04/10/98		55	503.98	501.88	51	
04/10/98	12:35	60	503.28	501.18	47	
04/10/98		65	502.54	500.44	43	
04/10/98		70	501.85	499.75	40	
04/10/98		75	501.25	499.15	37	
04/10/98		80	500.69	498.59	35	
04/10/98		85	500.12	498.02	33	
04/10/98		95	499.12	497.02	30	
04/10/98		105	498.23	496.13	27	
04/10/98		115	497.38	495.28	25	
04/10/98		125	496.58	494.48	23	
04/10/98		135	495.8	493.7	21	
04/10/98		145	495.05	492.95	20	
04/10/98		155	494.38	492.28	19	
04/10/98		165	493.69	491.59	18	
04/10/98		175	493	490.9	17	
04/10/98		185	492.49	490.39	16	
04/10/98		195	491.92	489.82	15	
04/10/98		205	491.38	489.28	14	
04/10/98		215	490.88	488.78	14	
04/10/98		225	490.38	488.28	13	
04/10/98		240	489.65	487.55	12	
04/10/98		245	489.42	487.32	12	

GUAJE REPLACMENT WELL NO. 4
CONSTANT-RATE TEST
starting water level: 451.70 ft bgl

date	clock	elapsed time, min	water level ft bmp	water level ft bgl	t/t'	remarks
04/10/98		259	488.82	486.72	12	
04/10/98		305	488.58	486.48	10	
04/10/98		320	487.98	485.88	10	
04/10/98	16:30	335	487.31	485.21	9	
04/10/98		350	486.85	484.75	9	
04/10/98		365	486.38	484.28	8	
04/10/98		380	485.86	483.76	8	
04/10/98		395	485.32	483.22	8	
04/10/98		410	484.98	482.88	8	
04/10/98		425	484.54	482.44	7	
04/10/98		440	484.1	482	7	
04/10/98		455	483.75	481.65	7	
04/10/98		470	483.35	481.25	7	
04/10/98		485	482.9	480.8	7	
04/10/98		500	482.6	480.5	6	
04/10/98		515	482.3	480.2	6	
04/10/98		530	481.95	479.85	6	
04/10/98		545	481.65	479.55	6	
04/10/98		560	481.36	479.26	6	
04/10/98		575	481.05	478.95	6	
04/10/98		590	480.8	478.7	6	
04/10/98		605	480.9	478.8	6	
04/10/98		620	480.27	478.17	5	
04/10/98	21:30	635	479.95	477.85	5	
04/10/98		651	479.77	477.67	5	
04/10/98		665	479.55	477.45	5	
04/10/98		680	479.34	477.24	5	
04/10/98		695	479.4	477.3	5	
04/10/98		710	479.1	477	5	
04/10/98		735	478.69	476.59	5	
04/10/98	23:30	755	478.3	476.2	5	
04/11/98	0:01	786	477.9	475.8	4	
04/11/98		802	477.66	475.56	4	
04/11/98		815	477.5	475.4	4	
04/11/98		845	477.2	475.1	4	
04/11/98		905	476.5	474.4	4	
04/11/98	3:00	965	475.8	473.7	4	
04/11/98		1025	475.2	473.1	4	
04/11/98		1085	474.65	472.55	4	
04/11/98		1145	474.12	472.02	3	
04/11/98		1205	473.75	471.65	3	
04/11/98		1265	472.4	470.3	3	
04/11/98	9:00	1325	472.24	470.14	3	
04/11/98		1385	472	469.9	3	
04/11/98		1449	471.82	469.72	3	
04/11/98	11:59	1504	471.7	469.6	3	
05/02/98		2115	413	410.9	2	
05/02/98		2175	412.9	410.8	2	
05/02/98		2235	412.83	410.73	2	
05/02/98	6:58	2293	412.6	410.5	2	
05/02/98	12:32	2627	411.2	409.1	2	

Appendix IV-8

gyroscopic survey results, GR-4

****

>>>> Welenco, Inc.>>>>

DIRECTIONAL SURVEY

****

Date: 3-27-1998

Company : LOS ALAMOS NATIONAL LAB
Well No : GR-4
Field : GUAJE
State : N.M.
Witnessed By: RAPPUHN
Location :
Remarks : TOOL #2536

County: SANTA FE
Rec. By: CHRISTY

****

Measured Depth, Feet	Inclination, Degrees True	Direction, Degrees	Course Deviation, Feet	True Vertical Depth, Feet	Closure Distance, Feet	Closure Bearing, Degrees True
0	0.0	142	0.00	0.00	0.00	0.0
10	0.0	132	0.00	10.00	0.00	0.0
20	0.0	123	0.00	20.00	0.00	0.0
30	0.0	90	0.00	30.00	0.00	0.0
40	0.0	86	0.00	40.00	0.00	0.0
50	0.0	90	0.00	50.00	0.00	0.0
60	0.0	65	0.00	60.00	0.00	0.0
70	0.0	95	0.00	70.00	0.00	95.0
80	0.0	77	0.00	80.00	0.00	0.0
90	0.0	58	0.00	90.00	0.00	0.0
100	0.0	153	0.00	100.00	0.00	0.0
110	0.0	86	0.00	110.00	0.00	0.0
120	0.0	84	0.00	120.00	0.00	0.0
130	0.0	180	0.00	130.00	0.00	0.0
140	0.0	83	0.00	140.00	0.00	0.0
150	0.0	96	0.00	150.00	0.00	0.0
160	0.0	96	0.00	160.00	0.00	0.0
170	0.0	106	0.00	170.00	0.00	0.0
180	0.0	85	0.00	180.00	0.00	0.0
190	0.0	98	0.00	190.00	0.00	0.0
200	0.0	72	0.00	200.00	0.00	0.0
210	0.0	116	0.00	210.00	0.00	0.0
220	0.0	86	0.00	220.00	0.00	0.0
230	0.0	85	0.00	230.00	0.00	0.0
240	0.0	101	0.00	240.00	0.00	0.0
250	0.0	116	0.00	250.00	0.00	0.0
260	0.0	84	0.00	260.00	0.00	0.0
270	0.0	78	0.00	270.00	0.00	0.0
280	0.0	76	0.00	280.00	0.00	0.0
290	0.0	84	0.00	290.00	0.00	0.0
300	0.0	102	0.00	300.00	0.00	0.0
310	0.0	90	0.00	310.00	0.00	0.0
320	0.0	63	0.00	320.00	0.00	0.0
330	0.0	96	0.00	330.00	0.00	0.0
340	0.0	6	0.00	340.00	0.00	0.0
350	0.0	104	0.00	350.00	0.00	0.0
360	0.0	78	0.00	360.00	0.00	0.0
370	0.0	84	0.00	370.00	0.00	0.0
380	0.0	146	0.00	380.00	0.00	0.0
390	0.0	83	0.00	390.00	0.00	0.0

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
400	0.0	71	0.00	400.00	0.00	0.0
410	0.0	63	0.00	410.00	0.00	0.0
420	0.0	72	0.00	420.00	0.00	0.0
430	0.0	76	0.00	430.00	0.00	0.0
440	0.0	103	0.00	440.00	0.00	0.0
450	0.0	64	0.00	450.00	0.00	0.0
460	0.0	90	0.00	460.00	0.00	0.0
470	0.0	64	0.00	470.00	0.00	0.0
480	0.0	69	0.00	480.00	0.00	0.0
490	0.0	83	0.00	490.00	0.00	0.0
500	0.0	114	0.00	500.00	0.00	0.0
510	0.0	96	0.00	510.00	0.00	0.0
520	0.0	84	0.00	520.00	0.00	0.0
530	0.0	73	0.00	530.00	0.00	0.0
540	0.0	84	0.00	540.00	0.00	0.0
550	0.0	69	0.00	550.00	0.00	0.0
560	0.0	96	0.00	560.00	0.00	0.0
570	0.0	53	0.00	570.00	0.00	0.0
580	0.0	78	0.00	580.00	0.00	0.0
590	0.0	50	0.00	590.00	0.00	0.0
600	0.0	84	0.00	600.00	0.00	0.0
610	0.0	84	0.00	610.00	0.00	0.0
620	0.0	95	0.00	620.00	0.00	0.0
630	0.0	92	0.00	630.00	0.00	0.0
640	0.0	73	0.00	640.00	0.00	0.0
650	0.0	80	0.00	650.00	0.00	0.0
660	0.0	63	0.00	660.00	0.00	0.0
670	0.0	95	0.00	670.00	0.00	0.0
680	0.0	77	0.00	680.00	0.00	0.0
690	0.0	84	0.00	690.00	0.00	0.0
700	0.0	72	0.00	700.00	0.00	0.0
710	0.0	80	0.00	710.00	0.00	0.0
720	0.0	101	0.00	720.00	0.00	0.0
730	0.0	107	0.00	730.00	0.00	0.0
740	0.0	111	0.00	740.00	0.00	0.0
750	0.0	84	0.00	750.00	0.00	0.0
760	0.0	134	0.00	760.00	0.00	0.0
770	0.0	141	0.00	770.00	0.00	0.0
780	0.0	116	0.00	780.00	0.00	0.0
790	0.0	146	0.00	790.00	0.00	0.0

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
800	0.0	130	0.00	800.00	0.00	0.0
810	0.0	134	0.00	810.00	0.00	0.0
820	0.0	126	0.00	820.00	0.00	0.0
830	0.0	160	0.00	830.00	0.00	0.0
840	0.0	130	0.00	840.00	0.00	0.0
850	0.0	134	0.00	850.00	0.00	0.0
860	0.0	131	0.00	860.00	0.00	0.0
870	0.0	144	0.00	870.00	0.00	0.0
880	0.0	143	0.00	880.00	0.00	0.0
890	0.0	153	0.00	890.00	0.00	0.0
900	0.1	131	0.01	900.00	0.01	131.0
910	0.0	126	0.01	910.00	0.02	131.0
920	0.0	104	0.00	920.00	0.02	131.0
930	0.0	125	0.00	930.00	0.02	131.0
940	0.0	131	0.00	940.00	0.02	131.0
950	0.0	110	0.00	950.00	0.02	131.0
960	0.0	111	0.00	960.00	0.02	131.0
970	0.0	140	0.00	970.00	0.02	131.0
980	0.1	131	0.01	980.00	0.03	131.0
990	0.0	125	0.01	990.00	0.03	131.0
1000	0.0	146	0.00	1000.00	0.03	131.0
1010	0.0	180	0.00	1010.00	0.03	131.0
1020	0.0	144	0.00	1020.00	0.03	131.0
1030	0.0	134	0.00	1030.00	0.03	131.0
1040	0.0	153	0.00	1040.00	0.03	131.0
1050	0.0	201	0.00	1050.00	0.03	131.0
1060	0.0	163	0.00	1060.00	0.03	131.0
1070	0.0	146	0.00	1070.00	0.03	131.0
1080	0.0	138	0.00	1080.00	0.03	131.0
1090	0.0	108	0.00	1090.00	0.03	131.0
1100	0.0	180	0.00	1100.00	0.03	131.0
1110	0.0	180	0.00	1110.00	0.03	131.0
1120	0.0	213	0.00	1120.00	0.03	131.0
1130	0.0	195	0.00	1130.00	0.03	131.0
1140	0.0	150	0.00	1140.00	0.03	131.0
1150	0.0	121	0.00	1150.00	0.03	131.0
1160	0.0	180	0.00	1160.00	0.03	131.0
1170	0.0	243	0.00	1170.00	0.03	131.0
1180	0.0	180	0.00	1180.00	0.03	131.0
1190	0.0	179	0.00	1190.00	0.03	131.0

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
1200	0.0	180	0.00	1200.00	0.03	131.0
1210	0.0	225	0.00	1210.00	0.03	131.0
1220	0.0	196	0.00	1220.00	0.03	131.0
1230	0.0	201	0.00	1230.00	0.03	131.0
1240	0.0	196	0.00	1240.00	0.03	131.0
1250	0.0	168	0.00	1250.00	0.03	131.0
1260	0.0	198	0.00	1260.00	0.03	131.0
1270	0.0	180	0.00	1270.00	0.03	131.0
1280	0.2	161	0.02	1280.00	0.05	140.9
1290	0.2	160	0.03	1290.00	0.08	148.9
1300	0.1	151	0.03	1300.00	0.11	150.8
1310	0.1	161	0.02	1310.00	0.13	151.5
1320	0.1	153	0.02	1320.00	0.15	152.2
1330	0.1	162	0.02	1330.00	0.16	152.7
1340	0.1	171	0.02	1340.00	0.18	154.0
1350	0.1	155	0.02	1350.00	0.20	154.8
1360	0.1	165	0.02	1360.00	0.21	155.3
1370	0.1	172	0.02	1370.00	0.23	156.2
1380	0.1	204	0.02	1380.00	0.25	158.3
1390	0.0	204	0.01	1390.00	0.25	159.7
1400	0.0	112	0.00	1400.00	0.25	159.7
1410	0.0	192	0.00	1410.00	0.25	159.7
1420	0.0	135	0.00	1420.00	0.25	159.7
1430	0.0	244	0.00	1430.00	0.25	159.7
1440	0.0	112	0.00	1440.00	0.25	159.7
1450	0.0	127	0.00	1450.00	0.25	159.7
1460	0.0	33	0.00	1460.00	0.25	159.7
1470	0.0	90	0.00	1470.00	0.25	159.7
1480	0.0	81	0.00	1480.00	0.25	159.7
1490	0.0	59	0.00	1490.00	0.25	159.7
1500	0.0	63	0.00	1500.00	0.25	159.7
1510	0.0	98	0.00	1510.00	0.25	159.7
1520	0.0	73	0.00	1520.00	0.25	159.7
1530	0.0	63	0.00	1530.00	0.25	159.7
1540	0.1	80	0.01	1540.00	0.25	157.8
1550	0.1	107	0.02	1550.00	0.26	154.4
1560	0.1	98	0.02	1560.00	0.27	151.5
1570	0.1	116	0.02	1570.00	0.28	149.1
1580	0.1	105	0.02	1580.00	0.30	147.0
1590	0.0	96	0.01	1590.00	0.30	145.9

Measured Depth	Incli-nation	Direc-tion	Course Deviation	T.V. Depth	Distance	Bearing
1600	0.1	95	0.01	1600.00	0.31	144.7
1610	0.0	106	0.01	1610.00	0.32	143.5
1620	0.1	94	0.01	1620.00	0.32	142.3
1630	0.0	116	0.01	1630.00	0.33	141.1
1640	0.1	102	0.01	1640.00	0.33	140.2
1650	0.1	108	0.02	1650.00	0.35	138.6
1660	0.1	99	0.02	1660.00	0.36	137.0
1670	0.1	123	0.02	1670.00	0.38	135.8
1680	0.1	129	0.02	1680.00	0.40	135.4
1690	0.1	104	0.02	1690.00	0.41	134.6
1700	0.1	120	0.02	1700.00	0.43	133.8
1710	0.1	123	0.02	1710.00	0.45	133.3
1720	0.1	180	0.02	1720.00	0.46	133.9
1730	0.2	180	0.03	1730.00	0.48	136.1
1740	0.2	186	0.03	1740.00	0.50	139.0
1750	0.1	172	0.03	1750.00	0.52	141.0
1760	0.1	180	0.02	1760.00	0.54	142.0
1770	0.0	196	0.01	1770.00	0.54	142.6
1780	0.0	201	0.00	1780.00	0.54	142.6
1790	0.0	190	0.00	1790.00	0.54	142.6
1800	0.0	186	0.00	1800.00	0.54	142.6
1810	0.0	180	0.00	1810.00	0.54	142.6
1820	0.0	180	0.00	1820.00	0.54	142.6
1830	0.0	158	0.00	1830.00	0.54	142.6
1840	0.0	165	0.00	1840.00	0.54	142.6
1850	0.0	180	0.00	1850.00	0.54	142.6
1860	0.1	150	0.01	1860.00	0.55	142.7
1870	0.0	192	0.01	1870.00	0.56	142.8
1880	0.0	156	0.00	1880.00	0.56	142.8
1890	0.1	189	0.01	1890.00	0.57	143.5
1900	0.0	195	0.01	1900.00	0.57	144.1
1910	0.1	146	0.01	1910.00	0.58	144.1
1920	0.2	132	0.03	1920.00	0.61	143.8
1930	0.2	148	0.03	1930.00	0.64	143.6
1940	0.1	155	0.03	1940.00	0.67	143.9
1950	0.2	147	0.03	1950.00	0.69	144.1
1960	0.1	153	0.03	1960.00	0.72	144.2
1970	0.2	155	0.03	1970.00	0.75	144.6
1974	0.2	144	0.01	1974.00	0.76	144.7

****

Equip.: L-21 Office: AZ Job No.: 30576

Calculation Method: Balanced Tangential

****

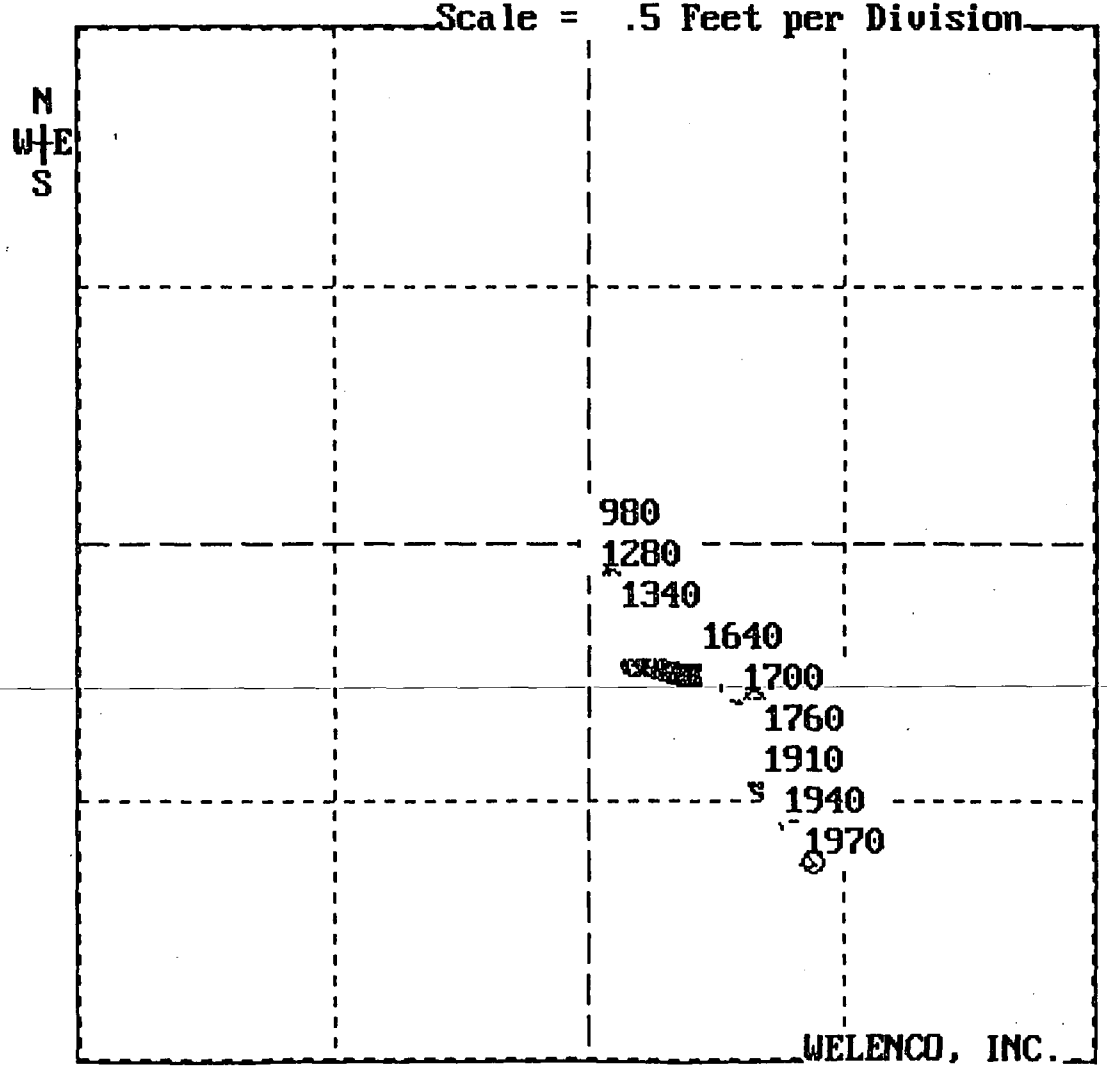
Company: LOS ALAMOS NATIONAL LAB

Well #: GR-4

Date: 3-27-1998

PLAN VIEW

Scale = .5 Feet per Division



CLOSURE

Distance: 0.76 FEET

Bearing: 144.7 DEGREES

T.V.D.: 1974.00 FEET

Calc. Method
Balanced Tangential

WELENCO, INC.

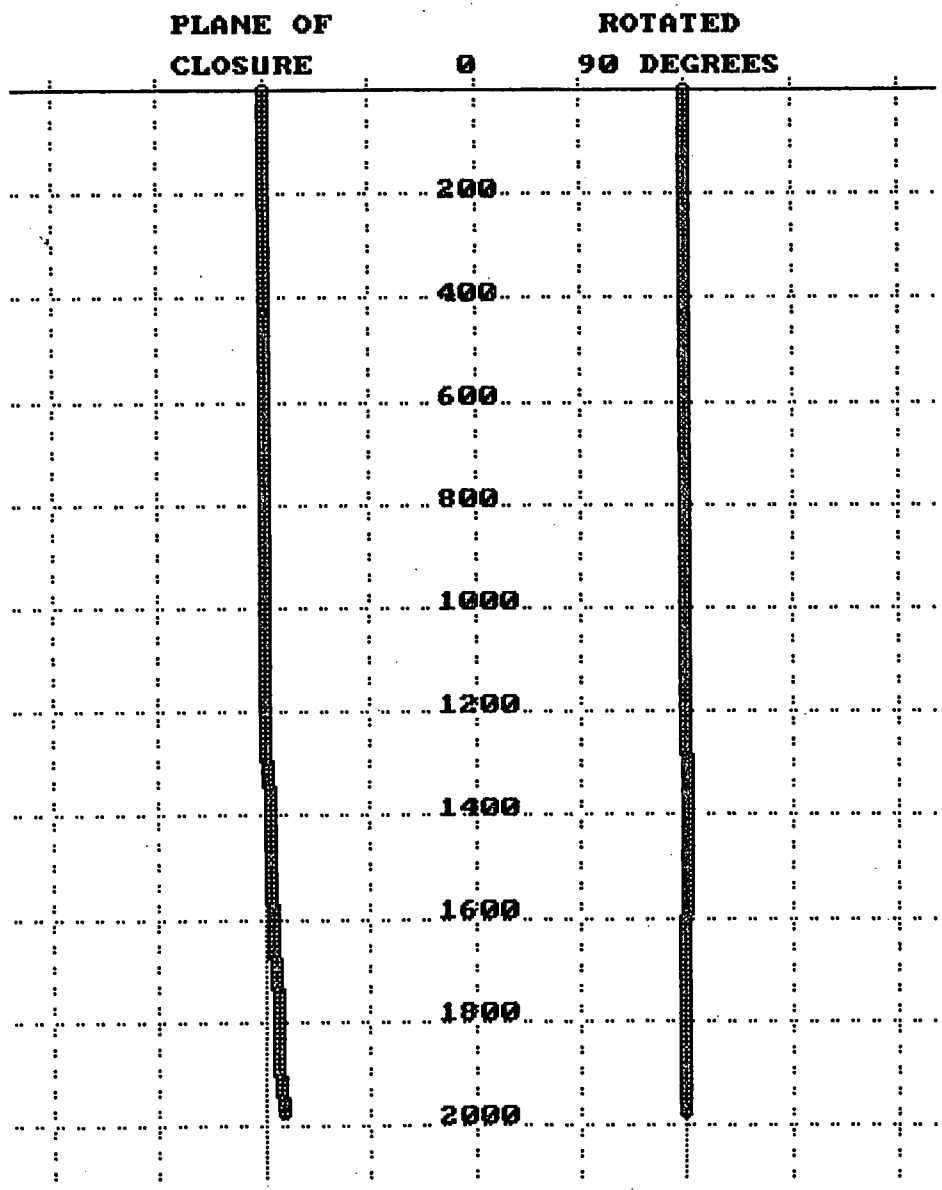
Company:
LOS ALAMOS NATIONAL LAB
Well #:
GR-4

Date: 3-27-1998

VERTICAL SECTION

Vert Scale = 200 Ft/Div
Horz Scale = 4 Ft/Div

CLOSURE

Distance: 0.76 FEET
Bearing: 144.7 DEGREES
T.V.D.: 1974.00 FEET

Calc. Method:
Balanced Tangential