GEOLOGIC INTERPRETATIONS FROM TEST AND PRODUCTION WELLS DRILLED AT THE TOWN OF TAOS RIO PUEBLO DE TAOS SITE, TAOS, NEW MEXICO

Open-file Report 585

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August, 2016

This technical completion report was open-filed with the New Mexico Bureau of Geology by Glorieta Geosciences Inc. (GGI) to facilitate access to data for this important well in the Town of Taos, New Mexico.

This open-file report compiled from two unpublished reports:

(Drakos, P., Riesterer, J., and Lazarus, J.), 2007, Drilling and completion report, Rio Pueblo 3200 feet deep production well (RG-37303-S), Taos, New Mexico: Unpublished technical report prepared for the Town and Taos and Souder, Miller, and Associates, 30 p. plus appendices.

- and -

(Drakos, P and Hodgins, M.), 2001, Drilling and testing report, Rio Pueblo 2500 Feet Deep Production Well, Taos, NM: unpublished consulting report to the Town of Taos, 20 p.

Please cite this open-file report as:

Drakos, P., Riesterer, J., Lazarus, J., and Hodgins, M., 2016, Geologic interpretations from test and production wells drilled at the Town of Taos Rio Pueblo de Taos site, Taos, New Mexico, New Mexico Bureau of Geology Open-File Report 585, 28 p. plus appendices.

GEOLOGIC INTERPRETATIONS FROM TEST AND PRODUCTION WELLS DRILLED AT THE TOWN OF TAOS RIO PUEBLO DE TAOS SITE, TAOS, NEW MEXICO

Site map detail, Rio Pueblo de Taos well field showing location of cross section A-A'

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AUGUST 2016

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INTRODUCTION

As part of a program to develop the Town of Taos San Juan/Chama Water while minimizing surface water effects, the Town of Taos (the Town) completed test and production wells to depths up to 3200 feet below ground surface (bgs) at the Rio Pueblo de Taos site. This site is located approximately 3 ½ miles northwest of Ranchos de Taos near the Rio Pueblo de Taos (Figure 1). This report presents geologic interpretations and hydrologic testing data from 2500-feet deep and 3200-feet deep wells (OSE Well ID RG-37303-S-3/RP2500 and RG-37303-S/RP3200, respectively). The RP2500 and RP3200 drilling projects targeted ground water production zones in Santa Fe Group sediments (primarily the Ojo Caliente and Chama-El Rito Members) below the Servilleta basalts at depths greater than 1000 feet below ground surface (bgs). RP3200 targeted sediments deeper than 2500 feet in an attempt to minimize pumping effects on the nearby 2500 feet deep production well (RP2500), located approximately 209 feet northwest of RP3200. RP2500 was drilled in 2000 and RP3200 was drilled in 2007. Geologic interpretations presented below are based on the RP3200 drilling program, and encompass data collected from the RP2500 drilling program (Drakos et al., 2007). Hydrologic data are from a long-term (8 day) constant-discharge pumping test conducted on RP2500 (Drakos and Hodgins, 2001).

RP3200 DRILLING SUMMARY

Drilling and Geophysical Logging

Drilling of the surface boring began on May 2, 2007 after conductor pipe was installed. A 32-inch boring was drilled to a depth of 40 feet below ground surface (bgs) and 20-inch diameter, 3/8-inch wall mild steel surface casing was installed and cemented in place to a depth of 38 feet bgs on May 3. Cement was installed via tremie pipe from the bottom up in two lifts. The cement seal was allowed to cure prior to continuation of drilling.

On May 4, Henkle Drilling and Supply Company began drilling a 17 1/2" diameter boring with a Challenger 320, reverse circulation mud rotary rig. Deviation surveys were taken at 120-foot intervals using a Totco drift indicator to ensure the boring remained within the 1.0° drift tolerance set forth in the drilling specifications. All drift measurements were less than 0.5° for the entire boring. During drilling, cuttings were collected and logged at

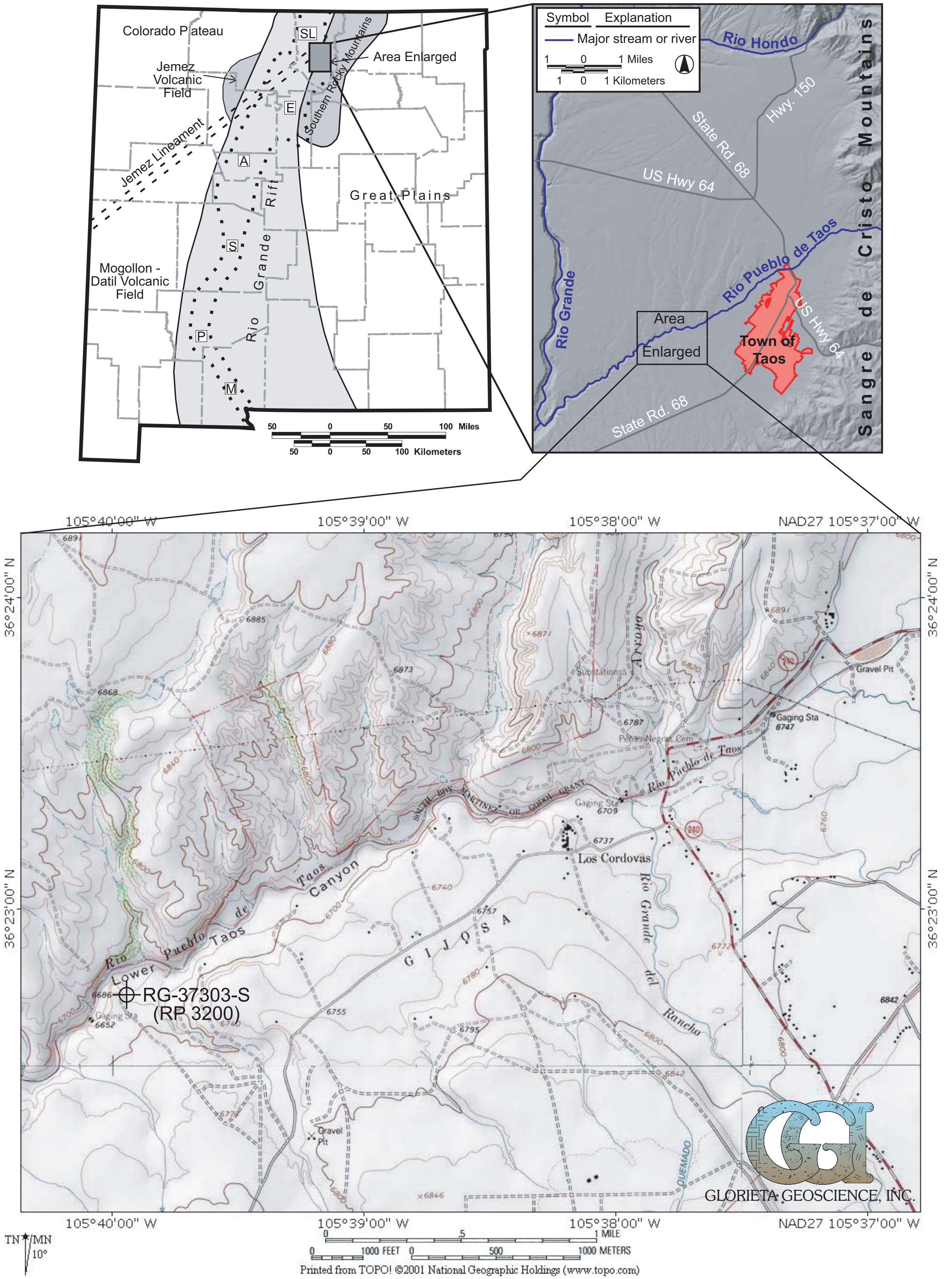

Figure 1. Map showing location of RP3200. Inset (upper left) shows major physiographic provinces in New Mexico and major basins in the Rio Grande Rift, including from north to south: SL=San Luis, E = Española, A = Albuquerque, S = Socorro, P = Palomas, M = Mimbres. State map modified from Sanford et al., 1995 and Keller and Cather, 1994.

ten-foot intervals by the on-site geologist. The resulting lithologic log is shown graphically in Figure 2, and a detailed lithologic log is contained in Appendix A.

The anticipated total depth of the boring (3020 ft) was reached on May 13, 2007. However, because coarse sand and gravel intervals with good production potential were encountered between 3000 and 3020 feet bgs, the total depth of the boring was increased to 3200 feet to maximize the production potential of the well. The revised total depth of 3227 feet was reached on May 16. At that time, Jet West Geophysical Services, Inc. (Jet West) conducted geophysical logs in the open borehole (see discussion below). Geophysical logs were completed on the morning of May 18 and, based on the geophysical and lithological logs, the production well design was finalized with a total cased depth of 3180 feet bgs.

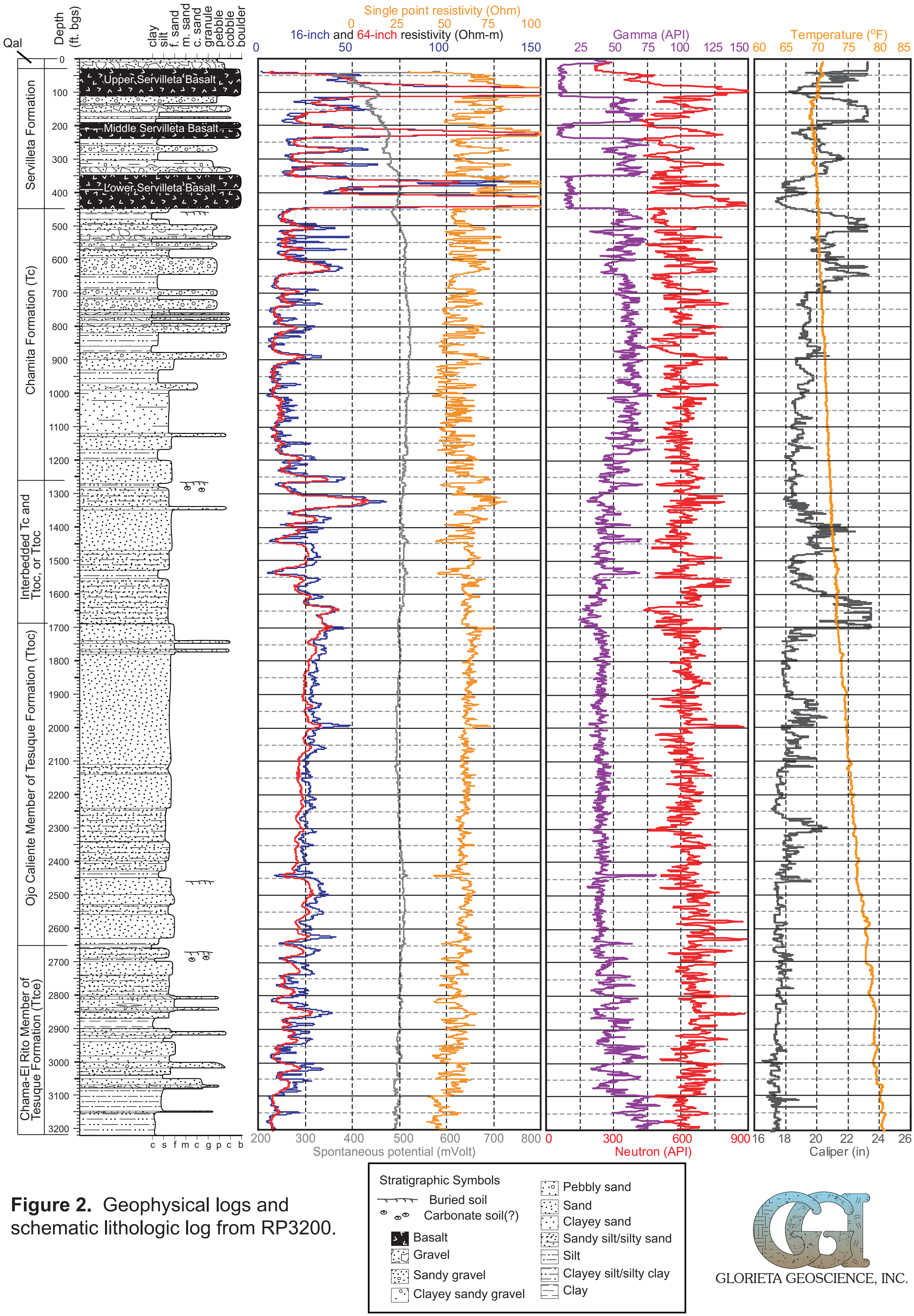

Figure 2. Geophysical logs and schematic lithologic log from RP3200.

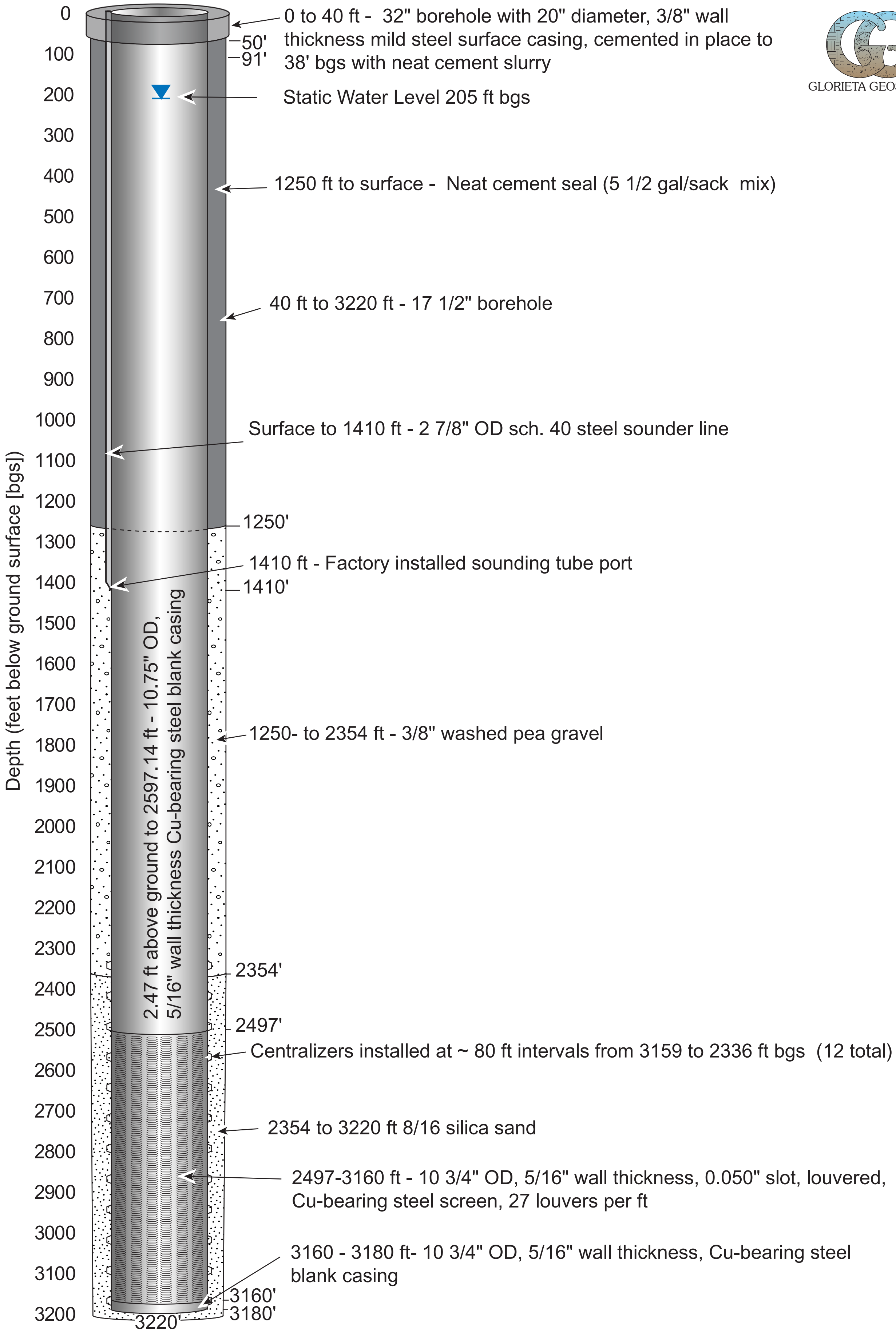

Figure 3. Town of Taos Well RG-37303-S (RP 3200) Well Completion Diagram (not to scale).

GEOHYDROLOGIC SETTING

Regional Geologic and Geohydrologic Setting

The Rio Pueblo site is located within the Rio Grande Rift, which is a northern arm of the Basin and Range physiographic province. The rift is a well-defined series of asymmetrical grabens that extend from Colorado to Mexico for a distance of more than 600 miles (Baldridge, et al., 1984). Taos is situated near the southern boundary and the eastern margin of the San Luis Basin west of the Sangre de Cristo uplift (Figure 1). The asymmetrical basins that define the Rio Grande Rift in northern New Mexico are the Albuquerque, Española, and San Luis Basins, from south to north. The San Luis Basin is an east-tilted basin that is separated from the west-tilted Española Basin by the Embudo Fault Zone (Dungan et al., 1984). The Rio Grande has generally cut its canyon parallel to the axis of the rift, locally through the Servilleta basalts. Sediments deposited to the east of the rift axis dip generally to the west; those on the west side of the axis generally dip less severely and are less uniform in orientation (Coons and Kelley, 1984). Faulting in the rift is dominated by normal faults that dip 50-80 degrees from horizontal (Kelley, 1978). Taos is situated on Quaternary alluvial fan sediments derived from the Sangre de Cristo Mountains, and is located within the Rio Pueblo de Taos drainage basin (Figure 1). The Rio Pueblo de Taos drains the Sangre de Cristo Mountains and enters the Rio Grande within the Rio Grande Gorge. Northern tributaries to Rio Pueblo de Taos drain Precambrian granite and gneiss, and Tertiary granite and rhyolite, whereas southern tributaries drain Paleozoic sandstone and shale.

In the vicinity of the Taos Plateau Volcanic Field the Rio Grande Rift consists of a series of horsts and grabens, with the Rio Grande flowing along the surface of a deep graben separated from the Taos Plateau by a granite-cored horst block. The Taos Plateau volcanic field originated from volcanic centers located primarily in the western side of the rift.

The RP3200 site is underlain by a sequence of Quaternary alluvial deposits, Pliocene basalt flows, and Pliocene through Miocene-age basin fill sediments (Figure 2). Paleozoic sedimentary rocks or Precambrian crystalline rocks underlie the basin fill sediments. Based on regional gravity data, the estimated thickness of Tertiary basin fill sediments in the site vicinity is between 7500 and 8000 feet (Reynolds, 1989). Bauer et al. (1999) estimate the thickness of the Tertiary section in the site vicinity to be approximately 14,000 ft.

Pleistocene and Holocene surficial deposits that underlie the Taos Basin landscapes and overlie the Plio-Pleistocene Blueberry Hill Formation or older units include alluvial fan deposits that interfinger with Rio Grande fluvial deposits and with fluvial terrace deposits of the Rio Grande and Rio Pueblo de Taos stream system. The high terrace surfaces throughout the Taos basin record the culmination of aggradation along the Rio Grande during the Middle Pleistocene (Pazzaglia and Wells, 1990). The thickness of Pleistocene and Holocene terrace deposits ranges from 0 to 100+ ft (0 to 30+ meters (m)) (Pazzaglia and Wells, 1990). The Plio-Pleistocene rift fill sequence underlying younger alluvium in the Taos basin has been informally named the Lama Formation (Pazzaglia and Wells, 1990), but this nomenclature has largely fallen into disuse, and these older fan deposits have been designated the Blueberry Hill Formation (Bauer et al., 1999, 2001; Kelson and Bauer, 2003). Blueberry Hill Formation deposits thin from east to west in a cross section drawn along the Rio Pueblo de Taos using available well log data , from nearly 300 ft at the K2/K3 well site to less than 50 ft between BIA5 and RP3200 (Figure 6a and 6b). .

Interbedded basalt flows and sediments that comprise the Servilleta Formation underlie the Blueberry Hill Formation. Although some authors have separated the basalt flows and sediments into separately named units (e.g. the Cieneguilla Member of the Tesuque Formation of Dungan et al. (1984) and the Servilleta Basalt of Lipman and Mehnert (1979)), other researchers have grouped the interbedded sequence of basalt flows and sediments together as the Servilleta Formation (e.g. Lambert, 1966). Bauer et al (1999) consider the sediments between the Upper, Middle, and Lower Servilleta basalts, and Pliocene sediments overlying the Upper Servilleta basalt, to be part of the Chamita Formation. The Servilleta Formation will be used in this report to include the interbedded basalt flows and sediments from the fine-grained sediments at top of the Upper Servilleta basalt to baked zone at the base of the Lower Servilleta basalt. Sediments interbedded between the basalt flows are a locally important shallow aquifer in parts of the San Luis Basin (Drakos et al., 2004a). The Servilleta basalts range in age from 2.8 to 4.5 million years (Lipman and Mehnert, 1979; Manley, 1976). The thickness of the Servilleta Formation ranges from 0 to 650 ft (0 to 200 m) (Dungan et al., 1984), with flows pinching out to the east.

The Servilleta Formation is underlain by the Miocene-Pliocene-age Chamita Formation, originally defined in the Española Basin as the uppermost formation in the Santa Fe Group (Galusha and Blick, 1971). The Santa Fe Group includes middle Miocene to middle to upper Pliocene rift fill sediments located in the Rio Grande Rift in the north-central part of New Mexico (Galusha and Blick, 1971). In the Ranchos de Taos Quadrangle, the Chamita Formation consists of moderate to poorly sorted sands with clasts of intermediate volcanic rock, quartzite, and other metamorphic rocks (Bauer and Kelson, 1998). Based on previous GGI subsurface data and thickness estimates from Bauer and Kelson (1998), the thickness of the Chamita Formation ranges from 330 to 750 ft (100 to 230 m); however, GGI's interpretations shown in figures 6a and 6b indicate a Chamita Formation apparent thickness of approximately 1600 ft at the K2/K3 site.

The lower formation of the Santa Fe Group is the Miocene-age Tesuque Formation, which has a much greater thickness and lateral extent than the overlying Chamita Formation. Spiegel and Baldwin (1963), who described it as "several thousand feet of pinkish-tan soft arkosic, silty sandstone and minor conglomerate and siltstone" originally named the Tesuque Formation. Galusha and Blick (1971) subdivided the Tesuque Formation into five members. From lowermost to uppermost, the five Members are: (1) Nambe Member, (2) Skull Ridge Member, (3) Pojoaque Member, (4) Chama-El Rito Member, and (5) the Ojo Caliente Sandstone. Additional Tesuque Formation Member names proposed in the Velarde and Dixon areas are the Cejita Member (Manley, 1977) and the Dixon Member (Steinpress, 1981), located stratigraphically above and below the Ojo Caliente Sandstone, respectively. Tesuque Formation sediments penetrated by deep wells in the Taos basin include the Ojo Caliente and Chama-El Rito Members.

The Ojo Caliente Member of the Tesuque Formation is a buff to light brown, fine to very fine-grained, typically poorly consolidated eolian sandstone with large-scale tabular crossbeds (GGI outcrop descriptions; Bauer and Kelson, 1998). In outcrop, the Ojo Caliente ranges from unconsolidated to well-cemented sandstone. Based on previous GGI subsurface data and thickness estimates from Bauer and Kelson (1998), the thickness of the Ojo Caliente Member ranges from 100 to greater than 930 ft (30 to 283 m). The upper part of the Ojo Caliente Member of the Tesuque Formation interfingers with the Chamita Formation in some locations.

The Chama-El Rito Member of the Tesuque Formation consists of roughly equal proportions of interbedded conglomerate and sandstone, with minor mudstone (Steinpress, 1981; Bauer and Kelson, 1998). Conglomerates contain a predominance of volcanic clasts with subordinate Precambrian granitic and quartzite clasts. The Chama-El Rito Member has a thickness of up to 1570 ft (480 m) (Bauer and Kelson, 1998).

The aquifer comprising the combined lower Blueberry Hill Formation and interbedded sediments within the Servilleta Formation is generally a good water producer, with production coming from channel sands and gravels, and locally from fractured basalt. Preliminary testing of the Ojo Caliente sand and Chama-El Rito sandy gravel aquifers indicate potentially good production from these deeper basin fill aquifers in the southern San Luis Basin. Little aquifer testing or production data are available for the Chamita Formation.

Local Geohydrologic Setting

The RP3200 boring penetrated a sequence of Quaternary alluvial sediments, Pliocene basalt flows, and Pliocene - Miocene basin fill sediments (Figure 2 and Appendix A). The upper sequence of alluvial sediments comprising sand and gravel extends from the ground surface to a depth of approximately 30 feet where the weathered Upper Servilleta Basalt (USB) was encountered.

The Upper, Middle and Lower Servilleta basalts (USB, MSB and LSB) were encountered from 30-112 feet, 190-240 feet, and 346 to 448 feet, respectively (Figure 2 and Appendix A). The middle and lower Servilleta Basalts appear to consist of at least two individual flows, with clay, silt, and sand at discrete intervals within the units marking possible flow boundaries (Figure 2, Appendix A). The three Servilleta Basalt flow packages are separated by relatively thick (55 to 86 feet thick) intervals of gravel, sand and clay, with gravel comprising mixed metamorphic, igneous and volcanic clasts with minor sedimentary lithologies. These sedimentary interbeds comprise the Agua Azul aquifer (Drakos et al., 1998; Drakos et al., 2004a).

Moderately cemented to unconsolidated fine to medium-grained poorly sorted sand, silt, gravel and minor clay exhibiting a generally coarsening upward trend, were encountered between 450 and 1260 feet, and are interpreted as the Chamita Formation (Figure 2, Appendix A). Chamita gravel beds contained common sandstone and limestone clasts, plus granite, quartzite, and some felsic volcanics. Gravel beds have well-rounded granule to pebble and larger-size clasts. The apparent thickness of the Chamita Formation at RP3200 is 810 feet. The interval between 1260 and 1690 feet may be interfingering between the Chamita Formation and the underlying Ojo Caliente Sandstone or may represent a transition from predominantly eolian deposition of the Ojo Caliente Sandstone to a more fluvial dominated depositional environment of the Chamita Formation. The sand and gravel beds in the upper part of the Chamita Formation are a potentially productive aquifer that could be targeted by a well with a depth of approximately 900 ft.

The Chamita Formation and Ojo Caliente Sandstone are separated on the basis of sorting, grain size, and geophysical signatures. Fine-grained, well-rounded, well sorted, unconsolidated eolian tan sand with moderate oxidation and a distinctive geophysical signature (see below) encountered from 1690 ft to 2650 feet depth represents the Ojo Caliente Member of the Tesuque Formation. The apparent thickness of the Ojo Caliente Member at this location is at least 960 ft, plus an additional thickness interbedded with the Chamita Formation. This apparent thickness is greater than observed elsewhere for the Ojo Caliente Member in either the subsurface or in outcrop in the southern San Luis Basin. Several inferred paleosols with carbonate horizons, apparent Bt-Bk soil horizons, and intervals containing carbonate nodules were also observed within the Ojo Caliente sediments and at Formation or Member contacts (Figure 2).

At a depth of 2650 feet, cuttings collected from the well show a change from predominantly fine grained, well sorted, eolian sand of the Ojo Caliente Member to a sequence of interbedded silty sand, sand, clay, and gravel below 2650 feet. This change is interpreted to represent the transition from the Ojo Caliente sandstone to the underlying Chama-El Rito Member of Tesuque formation. Total thickness of the Chama-

El Rito Member in RP3200 is greater than 580 feet. Gravel beds in the upper part of the Chama-El Rito are less prevalent than were observed in the Chamita Formation. Chama-El Rito gravels were dominated by Precambrian lithologies (granite and quartzite), plus some felsic volcanics. Paleozoic sedimentary rock clasts were quite rare, if present.

General color trends for sandy and silty intervals range from tan (typically 10YR6/3-4/4) for the Chamita Formation to white and pale brown (10YR8/1-10YR6/3) for the Ojo Caliente, to more reddened colors (7.5YR-5YR) for the Chama-El Rito. Some thin clayey intervals within the Ojo Caliente likely represent paleosols. Baked zones at the base of the Servilleta basalts typically exhibit 5YR colors.

BOREHOLE GEOPHYSICS

As part of the geohydrologic investigation, Jet West Geophysical (Jet West) conducted borehole geophysical surveys including 16" and 64" resistivity, spontaneous potential, single point resistance, gamma ray, neutron, temperature, and three-arm caliper logs on May 17-18, 2007. The logs are presented graphically on Figure 2.

Electric logs

Electric logs, including 16” and 64” resistivity, single point resistivity, and spontaneous potential, were run from TD up to the bottom of the surface casing (40 ft bgs). In general, for sedimentary rocks, electrical resistivity is higher in coarser grained materials than in finer grained materials (e.g. gravel or coarse sand has a higher resistivity value than fine sand or silt). Electrical resistivity in basalt is significantly higher than in sedimentary rocks.

The Upper, Middle, and Lower Servilleta Basalts are clearly shown as intervals of markedly higher resistivity (16” and 64” resistivity >150 ohm-m in the basalt, compared to <70 ohm-m in the overlying and underlying sediments). In addition, the two individual flows of the LSB identified from cuttings are easily identified in the 16” and 64” resistivity logs, where resistivity in the middle of the LSB drops below 50 ohm-m between approximately 380 and 400 feet bgs. The break in the MSB identified from cuttings at approximately 210 feet bgs is not clearly shown in the resistivity logs, possibly because there was limited sedimentation in the interval between flows.

From the bottom of the LSB (~450 feet bgs) to approximately 1260 feet bgs, the 16” and 64” resistivity logs are generally less than 25 ohm-m, with occasional spikes to between 25 and 50 ohm-m that represent interbeds of coarser material (coarse sand and gravel) within the generally finer-grained (lower resistivity) section. Over the interval from 450 to 1260 feet bgs, the 16” and 64” logs are generally not significantly separated from one another or plot on top of one another, indicating that sediments in this interval are relatively poorly sorted. This interval is interpreted to represent the Chamita Formation. Overall, the resistivity logs are suggestive of a coarsening-upward sequence (resistivity values increase up-section) in the Chamita Formation that was also noted in the lithologic log (Figure 2).

From 1260 to approximately 1690 feet bgs, the resistivity logs show a sequence of interbedded higher (>25 ohm-m) and lower (<25 ohm-m) resistivity units. Within the higher resistivity intervals, the 16” and 64” resistivity plots show a clear separation and parallel paths, indicating a well sorted sand. The lower resistivity intervals are less well sorted and are likely silt and silty sand, with a well defined clay from approximately 1530 to 1550 feet bgs. This interval (1260 to 1690 feet bgs) is interpreted as the transition from the Ojo Caliente Sandstone (generally higher resistivity) to the overlying Chamita formation (generally lower resistivity).

The interval from 1690 to 2650 feet bgs is characterized by parallel (‘railroad track’) 16” and 64” resistivity curves, averaging approximately 25 ohm-m and very little variation in the single point resistivity log (averaging approximately 60 ohm). The railroad track signature of the 16” and 64” resistivity logs is characteristic of the Ojo Caliente Sandstone in the Taos area (Drakos et al., 2004b).

From 2650 ft to total depth, the resistivity logs show a sequence of interbedded high (>25 ohm-m) and low (<25 ohm-m) resistivity beds that represent interbedded sand/gravel and silt/clay within the Chama-El Rito Member of Tesuque Formation. The single point resistivity log shifts abruptly from generally > 50 ohm to generally <40 ohm at a depth of 3100 feet bgs, and the 16” and 64” resistivity logs decrease at that depth as well. The lower resistivity observed below 3100 feet may represent water with higher TDS or may simply be a result of the abundant clay encountered below 3100 feet bgs, which may represent gauge along the Los Cordovas fault possibly intersected at this depth (Figure 4).

Nuclear Logs

Nuclear logs conducted in RP3200 include neutron and natural gamma logs. The natural gamma log measures naturally occurring gamma radiation derived from radioactive decay of naturally occurring elements in the rocks. The primary source of gamma radiation in sedimentary rocks of the type encountered in RP3200 is decay of potassium in clays or in potassium feldspar grains in arkosic sandstones. The gamma log from the well clearly shows the location of the Servilleta Basalts (low gamma relative to surrounding sediments). The Chamita Formation from 450 to 1260 feet bgs is characterized by relatively high (generally >50 API units) gamma counts. The transition from the Chamita Formation to Ojo Caliente sandstone (1260 to 1690 feet bgs) shows a gradual decrease in the average gamma count, with occasional spikes representing clay-rich intervals. The gamma log in the Ojo Caliente Sandstone, from 1690 feet to 2650 feet bgs, is relatively constant at approximately 40 API units, reflecting the clean, quartz-rich nature of the unit. Two exceptions are a marked gamma spike at approximately 2440 feet bgs that corresponds to a buried soil identified in cuttings, and a spike from 2640 to 2650 that corresponds to a basal clay unit. Below 2650 feet, the gamma log of the Chama-El Rito Member varies widely, from <40 API units to >75 API units, reflecting a sequence of interbedded sand/gravel (low gamma) and clay (high gamma).

The neutron log of RP3200 shows relatively high neutron values, including peaks >900 API units, in the Servilleta Formation, indicating the presence of both the basalt flows and coarse sediments (coarse sand and gravel), with lower neutron values indicating finer (silt and clay) intervals. This pattern continues through the Chamita Formation and the transition to the Ojo Caliente Sandstone, although the peaks in this interval are generally less than 800 API units. From 1690 to 2650 feet bgs, in the Ojo Caliente Sandstone, the neutron log is relatively constant at approximately 600 API units, with occasional higher counts indicating coarser intervals, and lower counts representing finer intervals. The Chama-El Rito Member to a depth of approximately 3100 feet has slightly higher average neutron counts (approximately 650 API units) than the Ojo

Caliente Sandstone, with many peaks and valleys indicating the interbedded fine- and coarse-grained beds characteristic of the unit. Below 3100 feet, the average neutron counts decrease to approximately 600 API units, with less pronounced highs and lows, reflecting the generally finer-grained (clay rich) nature of the interval from 3100 feet bgs to TD.

Temperature Log

The temperature log run in the well shows a fairly constant temperature gradient (temperature increasing steadily with depth) of approximately 0.22ºF per 100 ft depth in the upper 1600 ft of the boring. From 1600 ft to TD, the temperature gradient more than doubles to an average of approximately 0.48°F per 100 ft, suggesting an upward vertical groundwater gradient in the lower portion of the borehole (below 1600 feet). Throughout the interval below 1600 feet bgs, numerous small (approximately 1°F or less) perturbations are present on the temperature log profile. These intervals are interpreted to represent localized variability of the rate of horizontal groundwater flow through the borehole.

CROSS-SECTIONS THROUGH RP3200

A detailed site cross section (A-A') was drawn through RP2500-RP2000-RP3200 to examine local structure at the well field site (Figures 4 and 5). An additional cross section (B-B' and C-C') was drawn from RP3200 to K2/K3, along the Rio Pueblo de Taos (Figures 6a, 6b, and 7). The cross sections were constructed using a combination of correlations based on geophysical logs and correlation of sediments from descriptions of drill cuttings.

Three-Point Solutions and RP Site Cross Section

To determine the dip of the beds at the site, marker beds were identified in the geophysical logs and a detailed site map was compiled (Figure 5). A three-point solution through RP wells (2000, 2500, and 3200) using a prominent marker bed ("Marker bed 2" on Figure 4) just above top of Ttoc (within interval of interbedded Ojo Caliente (Ttoc) and Chamita (Tc)) results in orientation of N54°W, 50°SW. Note that the three-point solution

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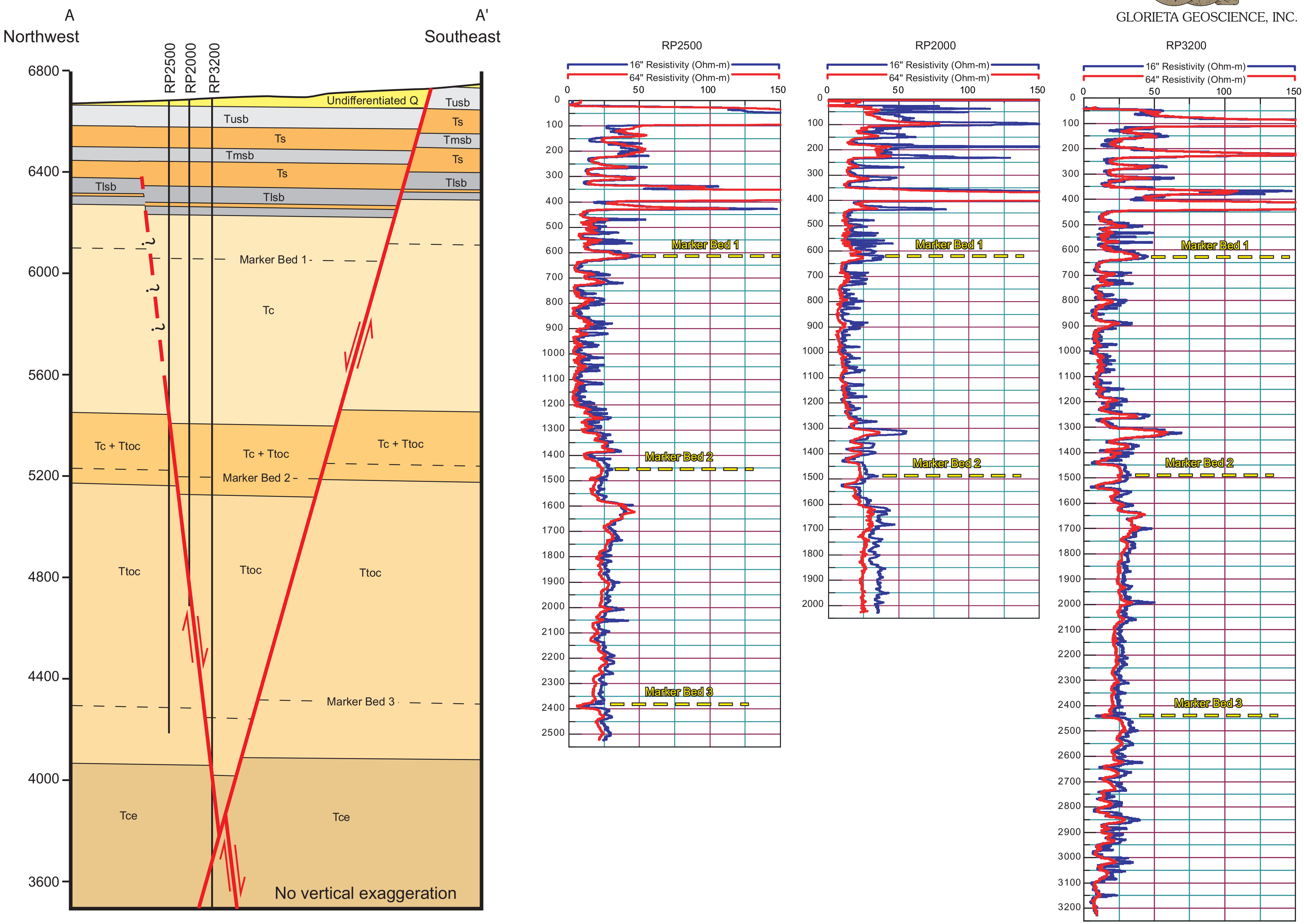


Figure 4. Cross-section through deep wells at Rio Pueblo Site, Taos, New Mexico

Figure 5. Site map detail, Rio Pueblo de Taos well field showing location of cross section A-A' (Figure 4).

is based on a local site map constructed using a hand level, stadia rod, brunton, and tape measure. Based on an elevation of 6665 ft for RP2500, relative ground elevations of 6668 ft are calculated for RP2000 and 6670 ft. for RP3200. The resultant steep dip is unlikely, and suggests an unmapped Los Cordovas fault splay must intersect RP2500, creating a small graben at the site (the marker bed is encountered at a depth of 1735 ft in RP2000, 1745 ft in RP3200, and 1690 ft in RP2500) (Figure 4). Also note that a second, lower marker bed ("Marker Bed 3") is observed at 2395 ft in RP2500 and at 2445 ft in RP3200, providing some confirmation for the difference in depth of Ttoc marker beds in these two wells. If this interpretation is correct, the down to the east fault must intersect RP2500 at a depth of between approximately 900 and 1450 feet bgs (Figure 4). A distinctive geophysical log sequence in the Chamita Fm ("Marker Bed 1") approximately 200-300 ft below the lower Servilleta Basalt does not appear to be offset between the three wells, and was used for an additional 3-pt. solution described below.

A second 3-point solution through the RP wells using a shallow marker bed within the Chamita Formation (approximately 720' bgs in RP2500, 732 ft in RP3200, and 729 ft in RP2000) results in a bedding orientation of N40°W, 10° SW.

Due to the measurement uncertainties (including ground surface zeroing of geophysical logging equipment, rough surveying using eye height measurement, and possible drag into nearby faults), and the fact that the wells are located almost in a straight line with respect to one another (Figure 5), the actual orientation of bedding at Rio Pueblo site cannot be accurately determined using these three wells.

Cross Section from RP3200 to K2/K2

Two versions of the cross section from PR3200 to K3 were constructed using the following criteria.

Version 1 (B-B', Figure 6a):

a) Vertical Exaggeration (VE) = 4x.

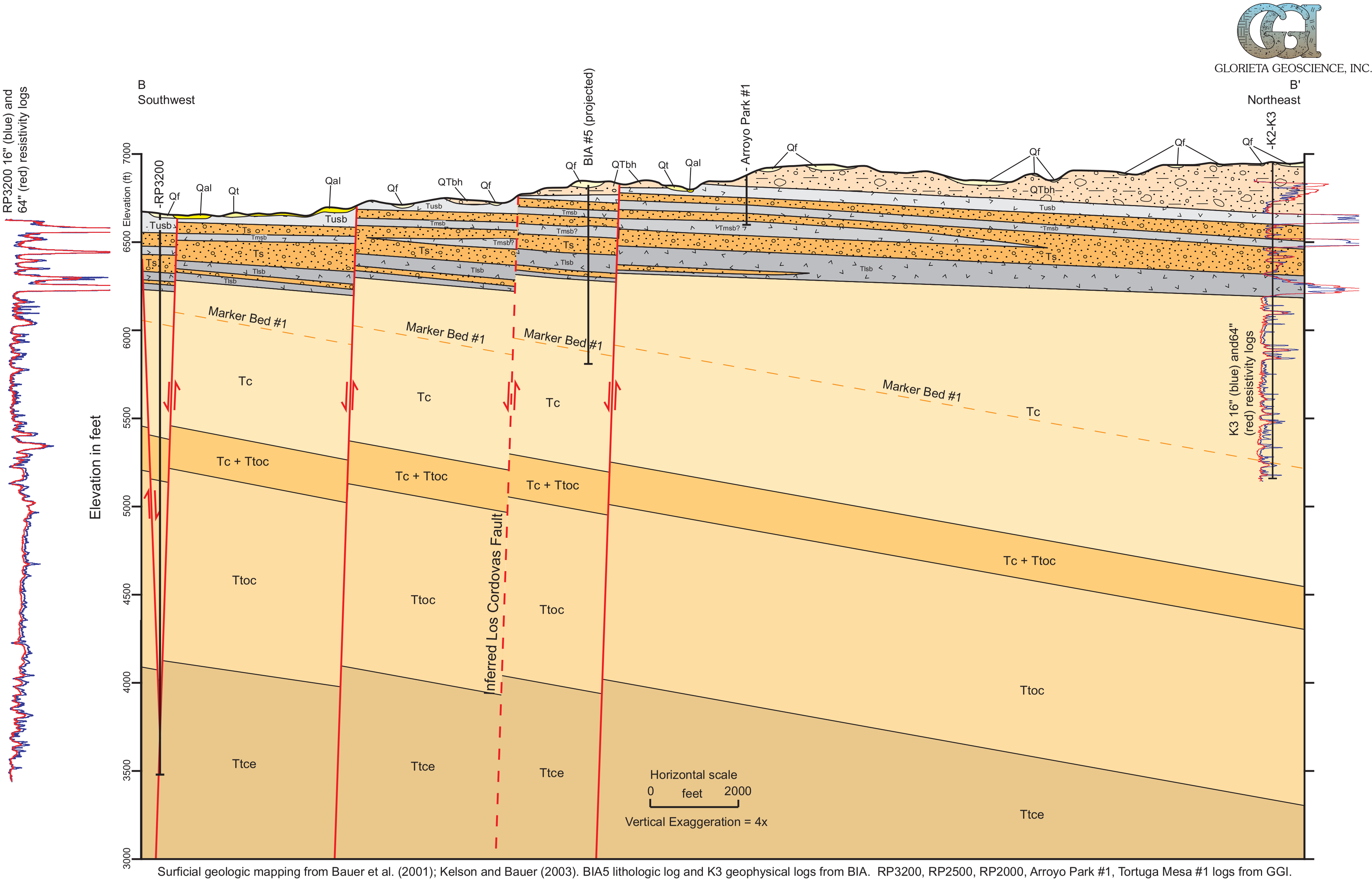
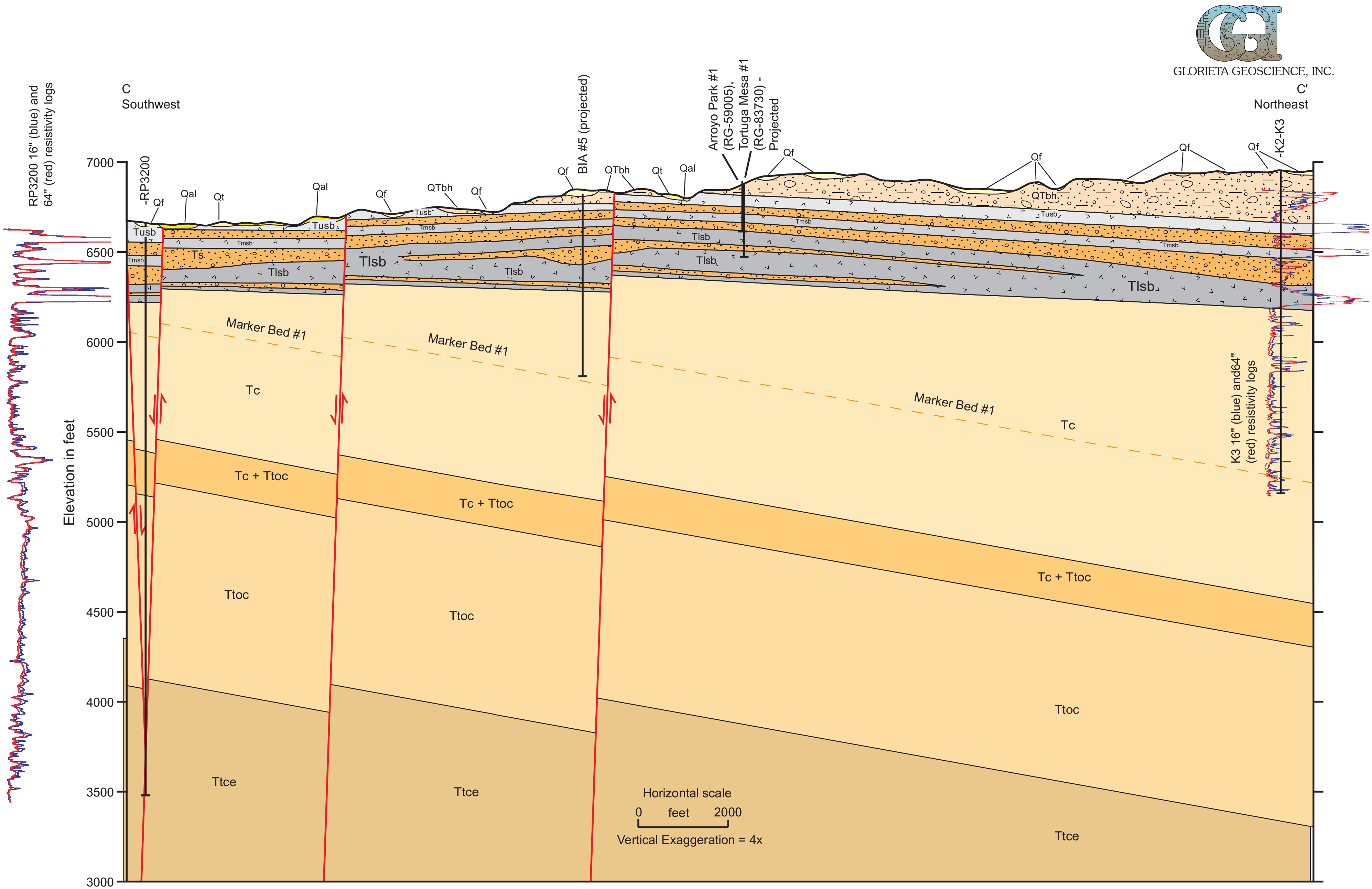


Figure 6A. Cross section from RP3200 to K2/K3 along the Rio Pueblo de Taos, Taos, New Mexico. Location of cross-section shown in Figure 7. In this interpretation (version1), an additional Los Cordovas fault and additional basalt flow in central portion of section are inferred

b) Servilleta basalts have an apparent dip of 0.5-1° to the east (with 4x VE, exaggerated dip is ~ 3°); the dip of the basalts represents the general slope of paleotopography.
c) An additional Middle Servilleta basalt (Tmsb) (?) flow is present in the vicinity of BIA5 and Arroyo Park#1/Tortuga Mesa.
d) Down to the west Los Cordovas faults dip ~70° to the west; exaggerated dip ~80°
e) To make the cross section work, an additional Los Cordovas fault must be located west of BIA5, between the eastern two mapped faults. This fault is dashed in our cross section.
f) Offset across each of the Los Cordovas faults is approximately 100 ft.
g) A graben is present at the RP well site (Figure 4).
h) The deeper Tertiary section (Tc, Toc, and Tce) has an apparent dip of ~3° to the east; exaggerated dip ~10°
i) Marker Bed #1, in the Chamita Fm, can be correlated between RP3200 and K3.

Version 2 (C-C', Figure 6b)**:**

a) VE = 4x
b) Servilleta basalts have an apparent dip of 0.5-1° to the east (with 4x VE, exaggerated dip is ~ 3°. This applies to the Lower Servilleta Basalt (LSB) across the entire section, and to the MSB and USB from Arroyo Park/Tortuga Mesa to K2/K3. The dip of the basalts represents the general slope of paleotopography.
c) Down to the west Los Cordovas faults dip ~70° to the west; exaggerated dip ~80°
d) The LSB flow sequence is thickest in the vicinity of BIA5 and Arroyo Park#1/Tortuga Mesa. A channel is preserved within the LSB at BIA5 (see Drakos, 2005 for detailed cross sections between these wells) and is cut into the top of the LSB at K2/K3
e) To make the cross section work, the MSB and USB must dip to the west at 0.5-1° between BIA5 and RP3200, and the LSB flow package thins from BIA5 to RP3200. This would be due to the presence of a constructional high from the eruption of the thick sequence of LSB



Surficial geologic mapping from Bauer et al. (2001); Kelson and Bauer (2003). BIA5 lithologic log and K3 geophysical logs from BIA. RP3200, RP2500, RP2000, Arroyo Park #1, Tortuga Mesa #1 logs from GGI.

Figure 6B. Cross section from RP3200 to K2/K3 along the Rio Pueblo de Taos, Taos, New Mexico. Location of cross-section shown in Figure 7. In this interpretation (version 2), MSB and USB have variable dips and LSB has variable thickness with abundant inter-flow sediements/channels.

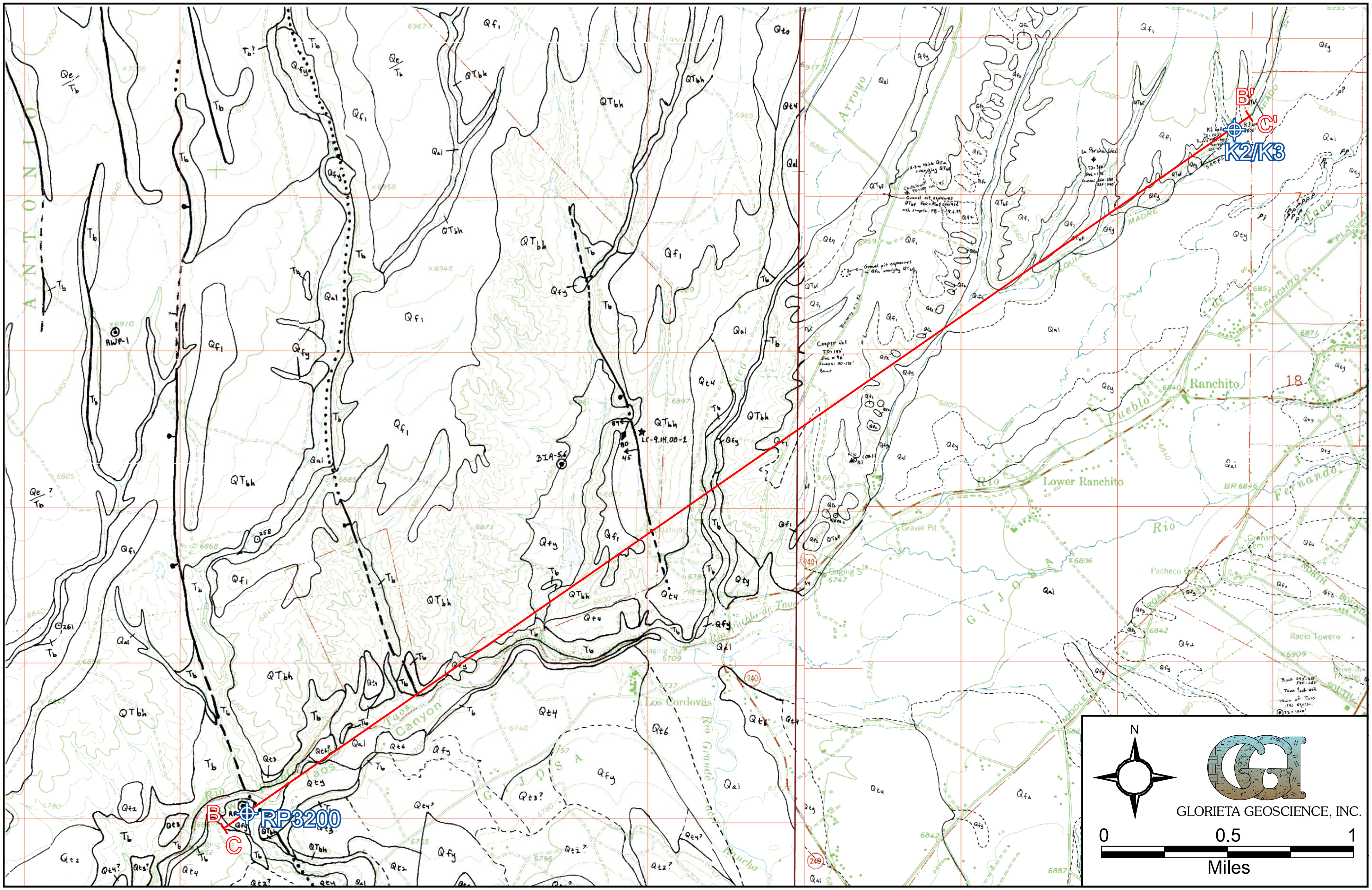


Figure 7. Geologic map showing location of cross-sections B-B' and C-C' (Figures 6a and 6b). Geologic base maps from Bauer et al. (2001) and Kelson and Bauer (2003).

basalts. This version does not require the additional Los Cordovas fault west of BIA5 depicted in figure 6a, between the eastern two mapped faults.

f) Offset across the Los Cordovas faults increases with depth, with greater offset depicted in the Ojo Caliente and Chama-El Rito Mbrs of the Tesuque Formation.

g) Offset across each of the Los Cordovas faults in Tsb is approximately 100 ft.

h) A graben is present at the RP well site (Figure 4).

i) The deeper Tertiary section (Tc, Toc, and Tce) has an apparent dip of ~3° to the east; exaggerated dip ~10°.

j) Marker Bed #1, in the Chamita Fm, can be correlated between RP3200 and K3.

The cross sections drawn between RP3200 and K2/K3 show that basalt flows and flow packages exhibit significant variations in thickness over relatively short distances, and correlations between wells are not definitive. These thickness variations are a result of erosion of individual flows, preservation of paleochannels within the flow sequence, and variations in primary flow thickness and extent. If the geophysical log correlations between RP3200/2500/2000 and K2/K3 are correct, then the pre-Servilleta Tertiary section dips shallowly to the east, and the Chamita Formation shows an increase in apparent thickness from west to east.

During recent mapping in the area, geologists from the New Mexico Bureau of Geology and Mineral Resources searched but could not find evidence for an additional fault in the area shown on GGI's cross section, either due to poor exposure or to the absence of such a fault (P. Bauer, *personal communication*, 2007). The fault is also not apparent on available aeromagnetic data; however, the strong signature of basalt flows makes inference of fault locations difficult (Grouch et al., 2004). More detailed geologic mapping, or evaluation of existing aeromag data, could help resolve which version of the cross section is correct.

RP2500 CONSTANT DISCHARGE PUMPING TEST

The long-term pumping test on the Rio Pueblo 2500 feet deep well (RP2500), which was completed to a total depth of 2520 ft with screened intervals between 1314 and 2499 feet depth, commenced on May 31, 2001 at 9:00am. The test was run at an average discharge of approximately 402 gallons per minute (gpm). The pump was set at a depth of approximately 903 feet (top of pump). The test was planned to run for a total of 14 days; however, on June 8th at 4:35 pm (11975 minutes or 8.32 days into the test), the pump failed. GGI immediately started taking recovery measurements in the pumping well (RP2500) and the nearby observation piezometers in RP2000. The recovery measurements continued until RP2500 was connected to the Town water system on October 16, 2001. Total drawdown during the test was 693.72 ft. Twenty-four hour specific capacity was 0.9 gpm/ft, and specific capacity at the end of the test was 0.58 gpm/ft.

The RP2000 piezometer nest and OW-6 Agua Azul observation well (Figure 8) provided nearby observation well data for four different zones (Table 1), with data collected either manually using a sounder or by dedicated transducers: OW-6 (transducer), RP2000 shallow (transducer), RP2000-intermediate (manual), RP2000-deep (manual). In addition to the piezometers in RP2000, there were also several other distant observation points measured with either automated pressure transducers, or by manual field measurements. These observation points and method of measurement were as follows: BOR2B (transducer), BOR2C (transducer), Taos Airport well (manual), K2/K3 (transducers), and Tract A (transducer). Drawdown was not observed in any of the distant wells (Table 1).

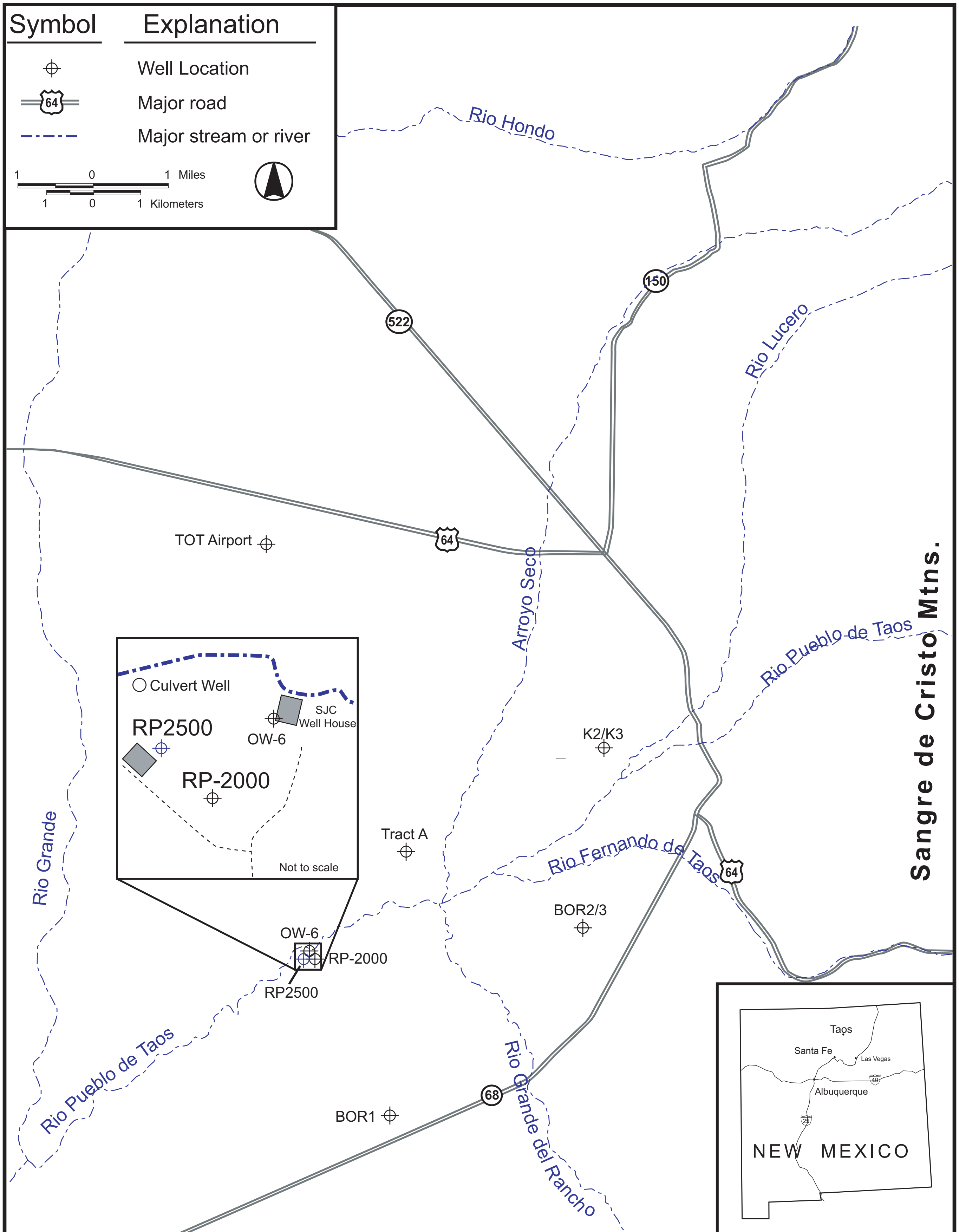


Figure 8. Location map of Rio Pueblo Site wells and off-site observation wells used in the RP 2500 pumping test

Table 1. Observation Well Completion Data and Summary of Pumping Effects

Well	Radial Distance (ft)	Aquifer	Screened Interval (ft)	Pumping Effect	Comments
OW6	328	Agua Azul	88-143.5	none	overlying aquifer
RP2000-shallow	109	Chamita Fm	1000-1180	water level increase	overlying aquifer
RP2000-Intermediate	109	Ojo Caliente	1300-1370	water level fluctuation	upper production zone
RP2000-Deep	109	Ojo Caliente	1750-2000	448 ft drawdown	production zone
BOR2B	17,760	Chama-El Rito	1040-1480	none	
BOR2C	17,760	Chama-El Rito	1608-2020	none	
Airport	28,900	Ojo Caliente	7 intervals 995-1680	none	
K2 shallow	25,400	Servilleta sediments	487-508?	none	
K2 deep (screen 2)	25,400	Chamita or Ojo Caliente?	1096 - 1117	none	
Tract A	9870	Chamita or Ojo Caliente	screened below basalt; TD 1000?	none	

Drawdown was observed in RP2000-deep and RP2000-intermediate after approximately 4 minutes (Appendix B). Although both RP2000-deep and RP2000-intermediate are completed into the Ojo Caliente sand, RP2000-deep displayed progressively greater drawdown throughout the test, whereas RP2000-intermediate displayed both drawdown and recovery during pumping of RP2500. The RP2000-intermediate piezometer exhibited a total decline in head of 12 feet between four and 200 minutes, then a rise in water level to within 4 feet of static at 2500 minutes, then another water level decline to a maximum of 12 feet below the static water by the end of the pumping test (see graph in Appendix A). The recovery measurements in this piezometer show a similar pattern. The RP2000-shallow piezometer showed a small (less than 0.3 feet) rise in water level during the pumping, and a decline back down to slightly below the static water level (-0.14 ft below) after pumping stopped. Neither the drawdown data from the pumping well, nor from the RP2000 deep piezometer exhibited a flattening in the drawdown curve indicative of leakage from an overlying aquifer. Monitoring of overlying aquifers in the RP2000-shallow piezometer and OW6 did not indicate any drawdown in overlying aquifers induced by pumping from the Ojo Caliente at this location. OW-6 appeared to mainly be affected by changes in barometric pressure, and after the test, by intermittent pumping of the adjacent 180 ft deep San Juan Chama well. The drawdown and recovery data and charts for the pumping well and RP2000 deep piezometer are included in Appendix B.

The drawdown and recovery data for the pumping well, RP2500 and the observation well, RP2000-Deep were used to calculate aquifer coefficients. Due to impermeable/limiting boundary effects observed after approximately 1000 minutes of pumping, only the early time data were used to calculate aquifer coefficients. The calculated transmissivity values from early-time data range from 880 gpd/ft (120 ft^2/day) to 2100 gpd/ft (280 ft^2/day) from all data analyzed (Table 2). The average early time T and k were 1500 gpd/ft (200 ft^2/day), and 0.17 ft/day, respectively. A storage coefficient of was $1.0x10^{-3}$ was calculated from the early-time drawdown data from RP2000-Deep. The average k value of 0.17 ft/day calculated from the RP2500 pumping test early-time data is within the same order of magnitude as has been calculated from previous Ojo Caliente test data (Drakos et al., 2004).

Table 2. Aquifer coefficients calculated from RP 2500 pumping test data.

	Method	Transmissivity, T		Hydraulic Conductivity, k	Storage Coefficient, S
		gpd/ft	ft^2/day	ft/day	
RP2500				(b = 1220 ft)	
Drawdown	C&J	990	130	0.11	
Recovery	Jacob	880	120	0.10	
RP2000-Deep					
Drawdown	C&J	1930	260	0.21	0.00088 (0.9×10^{-3})
	Theis	1650	220	0.18	(1.0×10^{-3})
Recovery	T&J	2100	280	0.23	
Averages (RP2500 and RP2000):		1500	200	0.17	9.5×10^{-4} (1.0×10^{-3})

The increase in the slope of the drawdown and recovery graphs for both RP2500 and RP2000-Deep is indicative of a limited aquifer and/or an impermeable boundary (Appendix B). This impermeable boundary is likely a one of the Los Cordovas faults, which projected very close to or through the Rio Pueblo site. A radial distance of 560 feet is calculated using an S of 1×10^{-3}, t = 0.7 day, and the average early-time T of 1500 gpd/ft, and solving for radial distance r_o, using the equation:

$r_o = [0.3Tt/S]^{1/2}$ derived from rearranging the equation $S = 0.3Tt/r_o^2$, where

S = coefficient of storage

T = coefficient of transmissivity, in gpd/ft

t = time since pumping started, in days

r_o = intercept of extended straight line at zero drawdown, if ft

(Driscoll, 1986, p. 237)

CONCLUSIONS

1. The RP3200 boring penetrated a sequence of Quaternary alluvial sediments, Pliocene basalt flows, and Pliocene - Miocene basin fill sediments. The Upper, Middle and Lower Servilleta basalts (USB, MSB and LSB) were encountered from 30 to 112, 190 to 240 and 346 to 448 feet, respectively. The units of the Servilleta Basalt are interlayered with gravel, sand and clay of mixed lithologies. Moderately cemented to unconsolidated coarsening upward sand with interbedded sandy gravel and clay encountered between 448 and 1260 feet is interpreted as the Chamita Formation. Fine-very fine grained, well-rounded, well sorted, unconsolidated eolian sand with moderate oxidation and a distinctive geophysical signature encountered from 1690 ft and 2650 ft is the Ojo Caliente Member of the Tesuque Formation. The interval between 1260 and 1690 ft is interpreted as interbedded Chamita Formation and Ojo Caliente Member sediments. The Chama-El Rito Member of The Tesuque Formation was encountered between 2650 ft and the total depth of the well, and is a predominantly fine-grained sequence of interbedded silty sand, sand, clay, and gravel. Total thickness of the Chama-El Rito Member in RP3200 is greater than 570 feet.

2. RP3200 is completed into well-sorted eolian silty sand of the Ojo Caliente Member and interbedded silty sand with minor channel gravels from depths of 2500 to 3260 feet bgs. This well is capable of production of approximately 250-400 gpm.

3. The cross sections drawn between RP3200 and K2/K3 show that basalt flows and flow packages exhibit significant variations in thickness over relatively short distances. These thickness variations are a result of erosion of individual flows, preservation of paleochannels within the flow sequence, and variations in primary flow thickness and extent. The pre-Servilleta Tertiary section likely dips shallowly to the east, and the Chamita Formation shows an increase in apparent thickness form west to east.

4. The apparent thickness of the Ojo Caliente Member at this location is greater than observed elsewhere in either the subsurface or in outcrop in the southern San Luis Basin.

5. An eight-day, constant discharge pumping test conducted on RP2500 at an average discharge of 402 gpm. An impermeable or limiting boundary interpreted to represent one of the Los Cordovas faults, was observed after approximately 1000 minutes of pumping. The average early time T and k were 1500 gpd/ft (200 ft^2/day), and 0.17 ft/day, respectively. A storage coefficient of was $1.0x10^{-3}$ was calculated from the early-time drawdown data from RP2000-Deep.

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APPENDIX A

RG-37303-s (RP3200) NMOSE well record and lithologic log

NEW MEXICO OFFICE OF THE STATE ENGINEER
WELL RECORD

1. OWNER OF WELL

Name: Town of Taos — Work Phone: (505) 751-2000
Contact: Tomas Benavidez — Home Phone: ____
Address: 400 Camino de la Placita

City: Taos — State: NM Zip: 87571

2. LOCATION OF WELL (A, B, C, or D required, E or F if known)

A. ____1/4 ____1/4 ____1/4 Section:____ Township:____ Range:____ N.M.P.M. in ____ County.

B. X = ____ feet, Y = ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.
U.S.G.S. Quad Map ____

C. Latitude: ____d ____m ____s Longitude: ____d ____m ____s

D. East 440,394 (m), North 4,026,001 (m), UTM Zone 13, NAD 27 (27 or 83)

E. Tract No. ____, Map No. ____ of the ____ Hydrographic Survey

F. Lot No. ____, Block No. ____ of Unit/Tract ____ of the ____ Subdivision recorded in ____ County.

G. Other: ____

H. Give State Engineer File Number if existing well: ____

I. On land owned by (required): Town of Taos

3. DRILLING CONTRACTOR

License Number: WD-767
Name: Henkle Drilling and Supply Co., Inc. — Work Phone: (620) 277-2389
Agent: Bruce Reichmuth — Home Phone: ____
Mailing Address: PO Box 639

City: Garden City — State: KS Zip: 67846

4. DRILLING RECORD

Drilling began: 5/2/2007; Completed: 7/18/2007; Type tools: Reverse Mud;
Size of hole: 17 1/2 in.; Total depth of well: 3180 ft.;
Completed well is: Shallow (shallow, artesian);
Depth to water upon completion of well: 205 ft.

NEW MEXICO OFFICE OF THE STATE ENGINEER
WELL RECORD

5. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	To	Thickness in feet	Description of water-bearing formation	Estimated Yield (GPM)
2497	3160	663	Sand, gravel, silt (Ojo Caliente and Chama-El Rito Members of Tesuque Formation)	250-400 (not yet tested)

6. RECORD OF CASING

Diameter (inches)	Pounds per ft.	Threads per in.	Depth in Feet Top	Bottom	Length (feet)	Type of Shoe	Perforations From	To
20	78.60	N/A	0	38	38		N/A-Surface	Casing
10 3/4" OD	34.78	N/A	+2.47	3180	3182.47		2497	3160

7. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	To	Hole Diameter	Sacks of mud	Cubic Feet of Cement	Method of Placement
0	40	32 inch		129	Pressure grout via tremie (surface casing)
0	1250	17 1/2 inch		1300	Pressure grout via tremie

8. PLUGGING RECORD

Plugging Contractor: ________

Address: ________

Plugging Method: ________

Date Well Plugged: ________

Plugging approved by: ________

State Engineer Representative

No.	Depth in Feet Top	Bottom	Cubic Feetof Cement
1			
2			
3			
4			
5			

NEW MEXICO OFFICE OF THE STATE ENGINEER
WELL RECORD

9. LOG OF HOLE

Depth in Feet From	To	Thickness in feet	Color and Type of Material Encountered
			Please see attached pages

Lithologic Log of RP 3200, RG-37303-S

Logged by P. Drakos, 5/2 - 5/17/07; reviewed by J. Riesterer, Glorieta Geoscience, Inc.

0-10'	**Sand and Gravel:** Yellow-brown, very fine-grained sand and gravel composed of quartzite, sandstone, amphibolite, and granite. Weakly effervescent in Hydrochloric Acid (HCl)
10-30'	**Gravel:** Gravel (as above) and weathered basalt
30-60'	**Basalt:** Small chips of greenish-gray (10Y 6/1) basalt with abundant <1 mm plagioclase phenocrysts. ***Top of Upper Servilleta Basalt.***
60-80'	**Basalt:** Larger chips of gray (2.5Y 5/1) basalt. Abundant plagioclase (≤1 mm phenocrysts), some vesicular basalt, dictytaxitic texture.
80-100'	**Basalt:** Medium size chips of basalt, similar to previous but harder (slow drilling)
100-112'	**Basalt:** Gray basalt with abundant plagioclase phenocrysts
112-135'	**Sandy Gravel:** Reddish-brown (2.5YR 4/3) sandy gravel with reddish clayey, very fine sand at top (baked zone?)
135-140'	**Silt:** Yellowish-brown (10YR 5/6) silt
140-160'	**Gravel:** Pebble-size and larger gravel composed of quartzite, granite, basalt, and felsic volcanics
160-175'	**Clayey silt:** Brown (7.5 YR 5/6) clayey silt, non-effervescent in HCl
175-180'	**Gravel:** Pebble-size and larger gravel, same as 140-160'
180-190'	**Silty Clay:** Brown (7.5 YR 5/6) silty clay, non-effervescent in HCl
190-200'	**Basalt:** Vesicular gray basalt. ***Top of Middle Servilleta Basalt.***
200-210'	**Basalt and clay:** Basalt and brown (10 YR 5/6) clay, possible flow boundary
210-240'	**Basalt:** Dark gray (10YR 4/1) aphanitic basalt with small (<1 mm) vesicles, reddish toward base
240-260'	**Clayey silt and silty clay**: Tan to dark grayish brown (10YR 4/2-5/3) clayey silt and silty clay. Weakly to moderately effervescent in HCl.
260-280'	**Sandy gravel:** Fining upward sequence from coarse pebble to cobble gravel to fine pebble gravel. Gravel includes quartzite, basalt, granite, felsic volcanics (latite) and minor sandstone
280-305'	**Silty clay to clayey silt:** Dark yellowish brown (10YR 4/4) silty clay and clayey silt. Moderately effervescent in HCl
305-325'	**Clayey sandy gravel:** Gravel with abundant sand and clay, reddish (7.5YR 4/4) at base (possible buried soil?)
325-340'	**Gravel:** Coarse pebble to cobble gravel, compositionally same as 260-280 but increased abundance of basalt clasts
340-346'	**Silty clay:** Tan silty clay, non-effervescent in HCl
346-390'	**Basalt:** Basalt, vesicular from 360-370 with zeolite fill in vesicles. ***Top of Lower Servilleta Basalt.***
390-400'	**Basalt, silt, and sand:** Reddish vesicular basalt and scoria with yellowish red (7.5YR 4/6 – 5YR 4/6) silty sand – possible flow boundary
400-448'	**Basalt:** Dark gray, aphanitic basalt, vesicular at top with zeolite fill in vesicles
448-460'	**Sandy Silt:** Reddish-brown (5YR 4/4) fine sandy silt, possible baked zone, non-effervescent in HCl. Top of Chamita Fm.
460-480'	**Clay:** Brown (at top) and gray (10YR 5/1) clay, non- to weakly-effervescent in HCl
480-495'	**Silt and fine sand:** Tan (10YR 6/3) silt and fine say, non-effervescent in HCl

495-510' **Gravel and sand:** Pebble gravel and coarse-grained sand. Gravel composition includes quartzite, granite, latite, and sandstone

510-530' **Clayey sand and gravel:** Brown, clayey fine sand and fine pebble gravel

530-540' **Gravel:** Pebble to cobble gravel, composition is same as 495-510'

540-550' **Clay:** Tan (10YR6/4) clay

550-560' **Gravel and sand:** Pebble to cobble gravel with common coarse sand. Gravel composition is quartzite, granite, minor basalt, and tuff

560- 570' **Clayey sand and gravel:** Tan (10YR 5/4) clayey fine sand and gravel, non-effervescent in HCl

570-598' **Silty sand:** Tan (10YR5/4) silty, very fine-grained sand with minor clay, clayey very fine-grained sand from 580-590'. Non- to very weakly-effervescent in HCl

598-645' **Gravel and sandy gravel:** Fining upward sequence of cobble to pebble gravel with silty, fine sandy gravel from 598-620'. Gravel composition is dark gray limestone, quartzite, latite, sandstone, and minor granite

645-690' **Clay and silty clay:** Tan (10YR 5/4) clay and silty clay, non-effervescent in HCl

690-710' **Sandy gravel:** Sandy gravel, same as 598-645 with increased percentage of granite clasts in gravel

710-720' **Clayey silt:** Tan clayey silt with minor gravel

720-750' **Sand and Gravel:** Coarse sand and gravel, gravel composition is same as 598-645' and 690-710', clayey gravel at base of interval

750-760' **Clayey, silty, sand:** Tan clayey, silty, fine sand, non-effervescent in HCl

760-800' **Gravel and clay:** Interbedded gravel and tan (7.5YR 5/4) silty clay. Clay intervals from 765-775', 785-790' may be soil horizons (?). Some $CaCO_3$ nodules from 765-775'.

800-820' **Gravel:** Sandy pebble to cobble gravel composed of granite, quartzite, sandstone, rhyolite tuff, and limestone

820-860' **Sand and clay:** Brown (10YR 4/4) clayey, fine- to medium-grained sand (820-840'), sandy clay (840-850'), and fine- to coarse-grained sand (850-860'). Weakly to moderately effervescent in HCl

860-880' **Clay and silty clay:** Tan (10YR 5/4) clay and silty clay, strongly effervescent in HCl

880-900' **Sandy gravel:** Sandy pebble to cobble gravel, compositionally same as 800-820' plus latite (?)

900-930' **Sand:** Tan (10YR 4/3), fine-grained sand or sandstone with minor fine gravel. Weakly effervescent in HCl

930-970' **Clayey sandy silt:** Tan (10YR4/3) clayey, sandy silt, strongly effervescent in HCl

970-990' **Sand and gravel:** Coarse-grained sand and gravel

990-1020' **Clayey sand:** Tan (10YR 6/4-7.5YR 6/4) clayey very fine-grained sand, moderately effervescent in HCl

1020-1030' **Sand and gravel:** Fine-grained sand with minor gravel

1030-1120' **Silty, clayey sand:** Tan (10YR 5/4) silty and/or clayey very fine-grained sand, moderately effervescent in HCl

1120-1130' **Gravel:** Silty and/or sandy gravel, same composition as 800-820'

1130-1170' **Sand:** Tan (10YR 5/4) silty, very fine-grained sand with minor gravel, moderately to strongly effervescent in HCl

1170-1200' **Silty clay:** Tan (10YR 6/4) silty clay with sand at base, weakly effervescent in HCL from 1170-1190', non-effervescent from 1190-1200'

1200-1260' **Sand:** Pale brown, well sorted, moderately rounded, very fine-grained quartz lithic sand with common potassium feldspar. Sandy clay from 1230-1240'

1260-1280' Buried soil(?)/silty clay: Carbonate (Bk?) horizon, very fine sandy silt from 1260-1270', reddened tan (7.5YR 4/4) silty clay (Bt horizon?). ***Top of Ojo Caliente Mbr of the Tesuque Fm? Interval from 1260-1690 ft = Interbedded Ojo Caliente Mbr. and Chamita Fm., or Ojo Caliente Mbr.***

1280-1300' **Silty sand:** Well sorted, silty, fine-grained sand

1300-1340' **Silty sand:** Light gray (10YR 7/2), silty, quartz-lithic sand with abundant carbonate (effervesces strongly in HCl)

1340-1350' **Sandy gravel:** Sandy gravel with clasts of sandstone, limestone, granite, and quartzite

1350-1470' **Sand:** Fine- to very fine-grained quartz lithic sand with reddened clayey sand from 1390-1400' and 1430-1450 (buried soils?).

1470-1530' **Silty sand:** White, fine-grained, carbonate-cemented, silty quartz sandstone with common lithics and minor potassium feldspar, effervesces violently in HCl

1530-1555' **Silty clay:** Tan (7.5YR 4/3) silty clay, non-effervescent in HCl. Buried soil?

1555-1600' **Silty sand:** Light gray (10YR 7/2) silty, fine-grained sand, effervesces strongly in HCl.

1600-1690' **Silty sand:** Pale brown (10YR 6/3-5/3), well-sorted, subrounded, very fine- to fine-grained, quartz-lithic sand, weakly to moderately effervescent in HCl.

1690-1780' **Sand and minor gravel:** White to light gray, well-rounded, well-sorted, carbonate cemented, fine-grained quartz-lithic sandstone with minor gravel from 1740-1750' (basalt clasts) and 1760-1780' (sandstone and quartzite). ***(Top of Ojo Caliente Mbr @1700 ft. based on geophysical logs)***

1780-2110' **Sand:** Pale brown and white, well-sorted, rounded, fine- to very fine-grained, sandstone with carbonate cement from 1850-1870', 1950-1960', 1970-1980', 1990-2040', and 2090-2110', minor gravel from 2100-2110'.

2110-2140' **Silty sand:** Silty, very fine-grained sand weakly carbonate-cemented interval from 2120-2130'

2140-2240' **Sand:** White, fine- to very fine-grained quartz-lithic sand and weakly-cemented sandstone, more potassium feldspar than above. Carbonate cemented; effervesces strongly to violently in HCl

2240-2340' **Silty sand and sandy silt:** Pale brown (10YR 6/3), well-sorted, well-rounded, silty very fine-grained quartz plus potassium feldspar lithic sand and sandy silt. Effervesces moderately to weakly in HCl.

2340-2400' **Silty sand:** Pale brown (10YR 6/3), well-sorted, well-rounded, silty, fine- to very fine-grained quartz + potassium feldspar + lithic sand. Effervesces strongly in HCl

2400-2430' **Sandy silt:** Pale brown (10YR 6/3) sandy silt

2430-2450' **Silty clay:** Tan (7.5YR 4/3) silty clay, reddened from 2440-2450, moderately effervescent in HCl. Possible buried soil?

2450-2500' **Sand:** Pale brown (10YR 6/3), well-sorted, well-rounded, very fine-grained, quartz + potassium feldspar + lithic sand

2500-2530' **Sand:** Very pale brown (10YR 8/2), well-sorted, well-rounded, fine-grained, quartz lithic sand with minor potassium feldspar and abundant carbonate (strongly effervescent in HCl)

2530-2560' **Silty sand:** Pale brown (10YR 6/3), well-sorted, well-rounded, very fine- to fine-grained, quartz-lithic silty sand with minor potassium feldspar. Moderately effervescent in HCl

2560-2630' **Sand:** Pale brown (10YR 6/3), well-sorted, well-rounded, fine-grained, quartz sandstone with potassium feldspar and minor lithics. Weakly effervescent in HCl

2630-2650' **Sandy silt:** Light brown (7.5YR 6/3), carbonate cemented, fine-grained sandy silt.

2650-2660' **Clay:** Dark reddish-brown (7.5YR 4/3) clay, possible buried soil. ***Top of Chama-El Rito Mbr of Tesuque Fm?***

2660-2690' **Clayey silty sand:** Light brown (7.5YR 6/3), well-sorted, subrounded, fine- to very fine-grained, clayey, silty, quartz sand with common lithics and potassium feldspar. Strongly effervescent in HCl

2690-2700' **Clayey silt:** Brown (7.5YR 4/4) clayey silt with minor gravel

2700-2740' **Sand:** Fine- to very fine-grained sand with scattered coarser sand and fine quartzite gravel

2740-2800' **Silty sand and sand:** Brown to reddish-brown (7.5YR – 5YR 4/4), moderately-sorted, subrounded, very fine-grained silty sand with minor clay from 2770-2780' and less silt from 2780-2800'

2800-2850' **Sand and gravel:** Brown (7.5YR 4/4), moderately-sorted, fine-grained, quartz lithic sand with minor quartzite gravel from 2800-1810' and 2840-2850', minor clay from 2830-2840'

2850-2870' **Silty sand:** Silty very fine-grained sand with abundant carbonate

2870-2900' **Clayey sand and clay:** Dark reddish-brown (5YR 4/3) clayey, very fine-grained sand and clay, non- to weakly-effervescent in HCl

2900-2930' **Gravelly silty sand:** Brown (7.5YR 4/4), gravelly, silty, fine-grained sand with sandy gravel from 2910-2920'. Clasts are quartzite and granite.

2930-2940' **Silt:** Brown (7.5YR 5/4) silt

2940-2980' **Sand:** Tan (7.5YR 5/4), well-sorted, moderately well-rounded, fine-grained, quartz lithic sand with minor gravel, non-effervescent in HCl

2980-3000' **Clayey sand and silt:** Tan (7.5YR 4/4), clayey, very fine-grained sand and silt

3000-3020' **Sandy gravel:** Fining upward sequence of sandy pebble-gravel to fine sandy granule gravel. Clasts are predominantly quartzite

3020-3040' **Silty sand:** Tan (7.5YR 5/4), well-sorted, subrounded to subangular, silty, very fine-grained sand with carbonate nodules (buried soil at top?). Weakly effervescent in HCl except for carbonate nodules

3040-3050' **Silt:** Brown (7.5YR 4/4) silt, non-effervescent in HCl

3050-3080' **Sand and gravel:** Subrounded to subangular, coarse to very coarse-grained quartz-lithic sand with subrounded pebble gravel from 3070-3080'. Lithics include quartzite, quartz, granite, and felsic volcanics.

3080-3130' **Clayey silt silt:** Reddish-brown (5YR 4/4) silt and sandy silt, non-effervescent in HCl

3130-3150' **Silt and sandy silt:** Reddish-brown (5YR 4/3) clayey silt, non-effervescent in HCl

3150-3155' **Gravel:** Fine granule to pebble gravel

3155-3220' **Silty clay and clay:** Reddish brown (5YR 4/3) silty clay/clayey silt (3155-3190'), and clay (3190-3220')

NEW MEXICO OFFICE OF THE STATE ENGINEER
WELL RECORD

10. ADDITIONAL STATEMENTS OR EXPLANATIONS:

Well testing has not yet been performed

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.

Jim Hale 08/07/2007

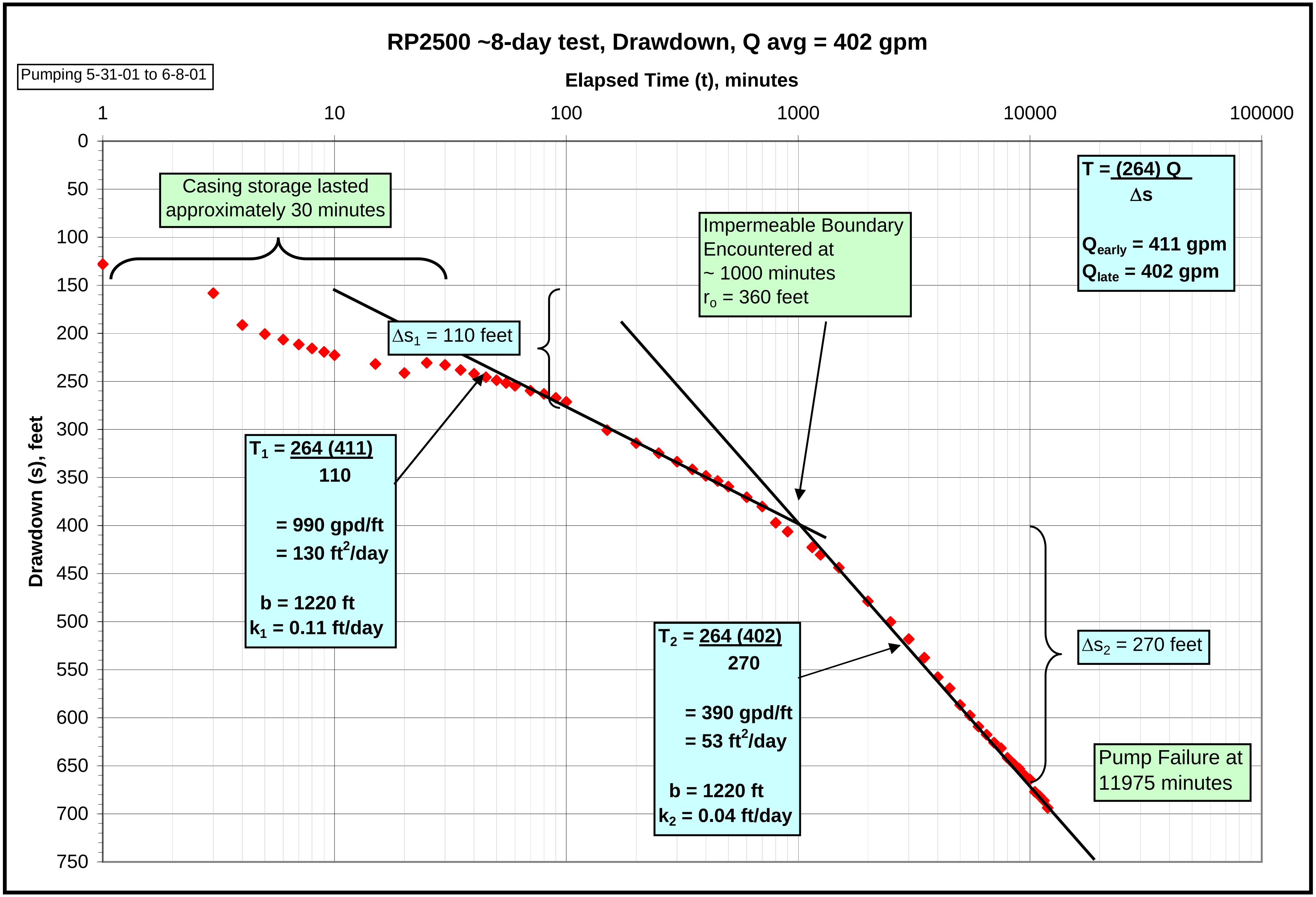
Driller (mm/dd/year)

FOR STATE ENGINEER USE ONLY

Quad _____; **FWL** _____; **FSL** _____; **Use** _________; **Location No.** ___________

APPENDIX B

RP2500 Pumping Test Data and Charts



RP2500 ~8-day test, Drawdown, Q avg = 402 gpm
Pumping 5-31-01 to 6-8-01
Elapsed Time (t), minutes
1
10
100
1000
10000
100000
Drawdown (s), feet
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Casing storage lasted approximately 30 minutes
Δs1 = 110 feet
T1 = 264 (411) / 110
= 990 gpd/ft
= 130 ft2/day
b = 1220 ft
k1 = 0.11 ft/day
Impermeable Boundary Encountered at ~ 1000 minutes
ro = 360 feet
T = (264) Q / Δs
Qearly = 411 gpm
Qlate = 402 gpm
T2 = 264 (402) / 270
= 390 gpd/ft
= 53 ft2/day
b = 1220 ft
k2 = 0.04 ft/day
Δs2 = 270 feet
Pump Failure at 11975 minutes

FOURTEEN-DAY PUMP TEST -- DRAWDOWN RP2500

JOB: RIO PUEBLO 2500
LOCATION: TAOS, NM
TECHNICIAN: CHRIS OLSON
WELL I.D.: RP2500

STATIC W.L.: 153.78
WELL DEPTH: 2500 ft
M.P. CORRECTION: -1.82 ft
CASING TYPE: steel   Diameter: 10"
Pump at ~903 ft   avail drdn (ft) = 747

DATE	TIME	ELAPSED TIME, t	WATER LEVEL, ft	DRAWDOWN, s, in feet	inches weir	Q, GPM	COMMENTS
5/31/2001	9:00	0	153.78			~	
		1	281.71	127.93			
		2	-				
		3	311.95	158.17			
		4	344.97	191.19			
	9:05	5	354.45	200.67			
		6	360.22	206.44			
		7	365.34	211.56			
		8	369.60	215.82			
		9	373.18	219.40		482	
	9:10	10	376.42	222.64	33		
		15	385.56	231.78	32.5		
	9:20	20	395.05	241.27	29		
		25	384.53	230.75	25	416	
	9:30	30	386.61	232.83	24.5		
		35	391.96	238.18			
	9:40	40	395.78	242.00			
		45	399.32	245.54			
	9:50	50	402.52	248.74	24.5	415	
		55	405.50	251.72			
	10:00	60	408.45	254.67	24.5	415	
	10:10	70	413.51	259.73	24	411	
	10:20	80	416.79	263.01	24	411	
	10:30	90	421.03	267.25	24.5	415	
	10:40	100	425.11	271.33			
	11:30	150	454.54	300.76	24.5	415	
	12:20	200	467.99	314.21	24.5	415	
	13:10	250	478.44	324.66	24	411	
	14:00	300	487.42	333.64	24.5	415	
	14:50	350	495.23	341.45	24.5	415	
	15:40	400	502.09	348.31	24	411	
	16:30	450	507.39	353.61	24	411	
	17:20	500	513.23	359.45	24	411	
	19:00	600	524.25	370.47	24	411	
	20:40	700	534.07	380.29	23.5	406	>Q to 24"
	22:20	800	550.79	397.01	24	411	
Midnight	0:00	900	560.13	406.35	24	411	
6/1/2001	4:10	1150	576.43	422.65	24	411	
	5:50	1250	584.27	430.49	24	411	
	10:00	1500	597.60	443.82	23/24	402/411	
	18:20	2000	632.53	478.75	24	411	
6/2/2001	2:40	2500	654.07	500.29	24	411	
	11:00	3000	671.86	518.08	23/24	402/411	
	19:20	3500	691.31	537.53	23/24	402/411	
6/3/2001	3:40	4000	711.42	557.64	24	411	
	12:00	4500	723.09	569.31	23/24	402/411	
	20:20	5000	740.52	586.74	24	411	
6/4/2001	4:40	5500	751.46	597.68	23/24	402/411	barometric
	13:00	6000	762.93	609.15	23	402	1002
	21:20	6500	771.50	617.72	23	402	
6/5/2001	5:40	7000	779.64	625.86	23	402	
	14:00	7500	785.54	631.76	22.5/23	402	1002
	22:20	8000	795.68	641.90	23		1009
6/6/2001	6:40	8500	801.69	647.91	23		1012
	15:00	9000	806.93	653.15	22/23		1011
	23:20	9500	814.02	660.24	22.5		1012
6/7/2001	7:40	10000	818.06	664.28	22/23		1014
	16:00	10500	830.88	677.10	23		1013
6/8/2001	0:20	11000	835.2	681.42			
	8:40	11500	840.07	686.29			
	15:45	11925	847.5	693.72		pump died @ 16:35	

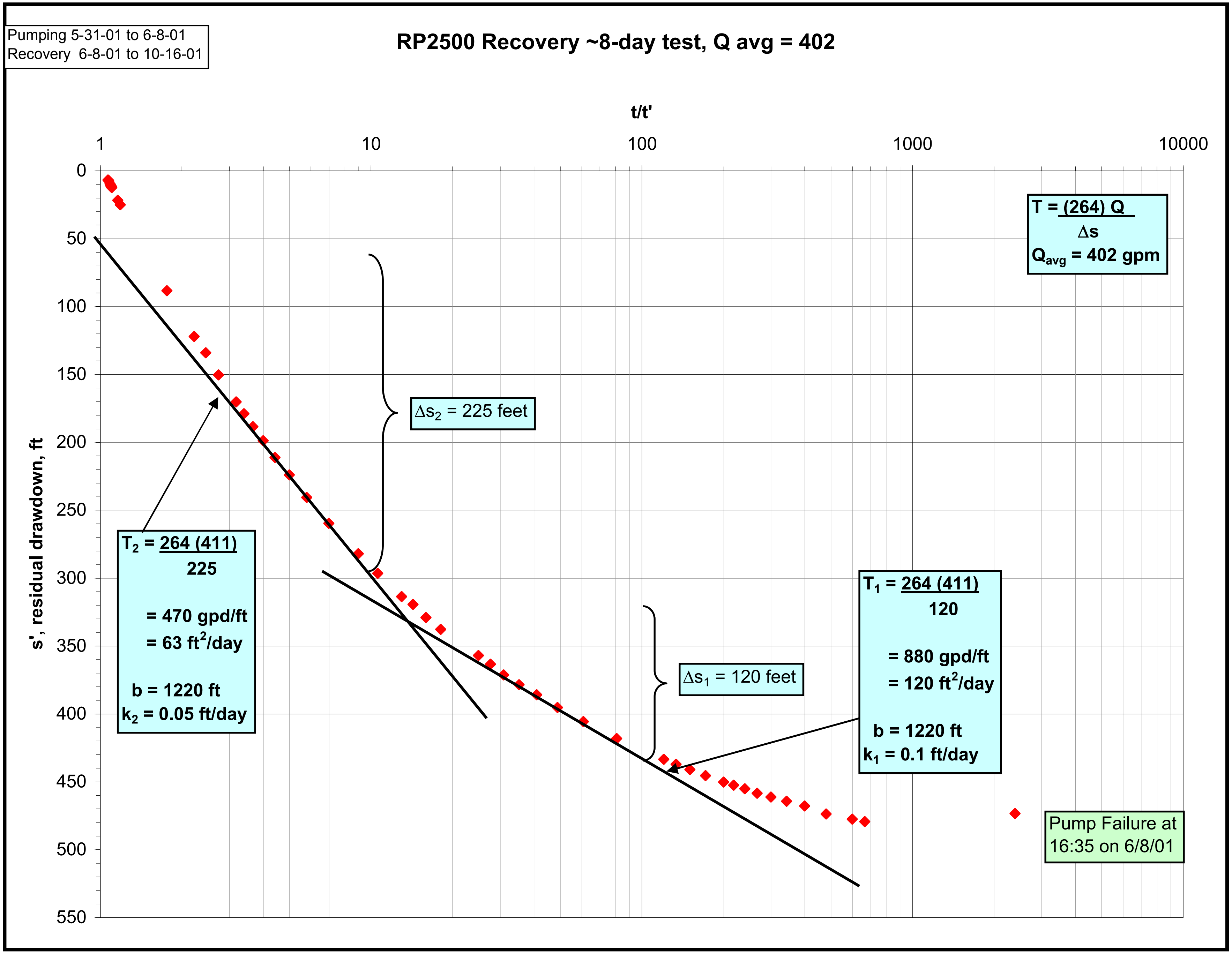
enter initial drawdown value and subsequent values from graph

initial value can be at any point on the graph, does not have to be first minute value

iteration	d_c (inches)	d_p (inches)	s (feet)	Q (gpm)	Q/s (gpm/ft)	$t_c = [0.6 (d_c^2 - d_p^2)] / (Q/s)$
1	10.126	4	127.93	482	3.767685453	13.78074849
2	10.126	4	225	482	2.142222222	24.23722668
3	10.126	4	230	416	1.808695652	28.70661271
4	10.126	4	232	416	1.793103448	28.95623543
5	10.126	4	232.5	416	1.789247312	29.01864111
6	10.126	4	232.7	416	1.787709497	29.04360338
7	10.126	4	232.7	416	1.787709497	29.04360338

t_c time, in minutes, when casing storage effect becomes negligible
d_c inside diameter of well casing, in inches
d_p outside diameter of pump column pipe, in inches
Q/s specific capacity of the wel in gpm/ft of drawdown at time tc

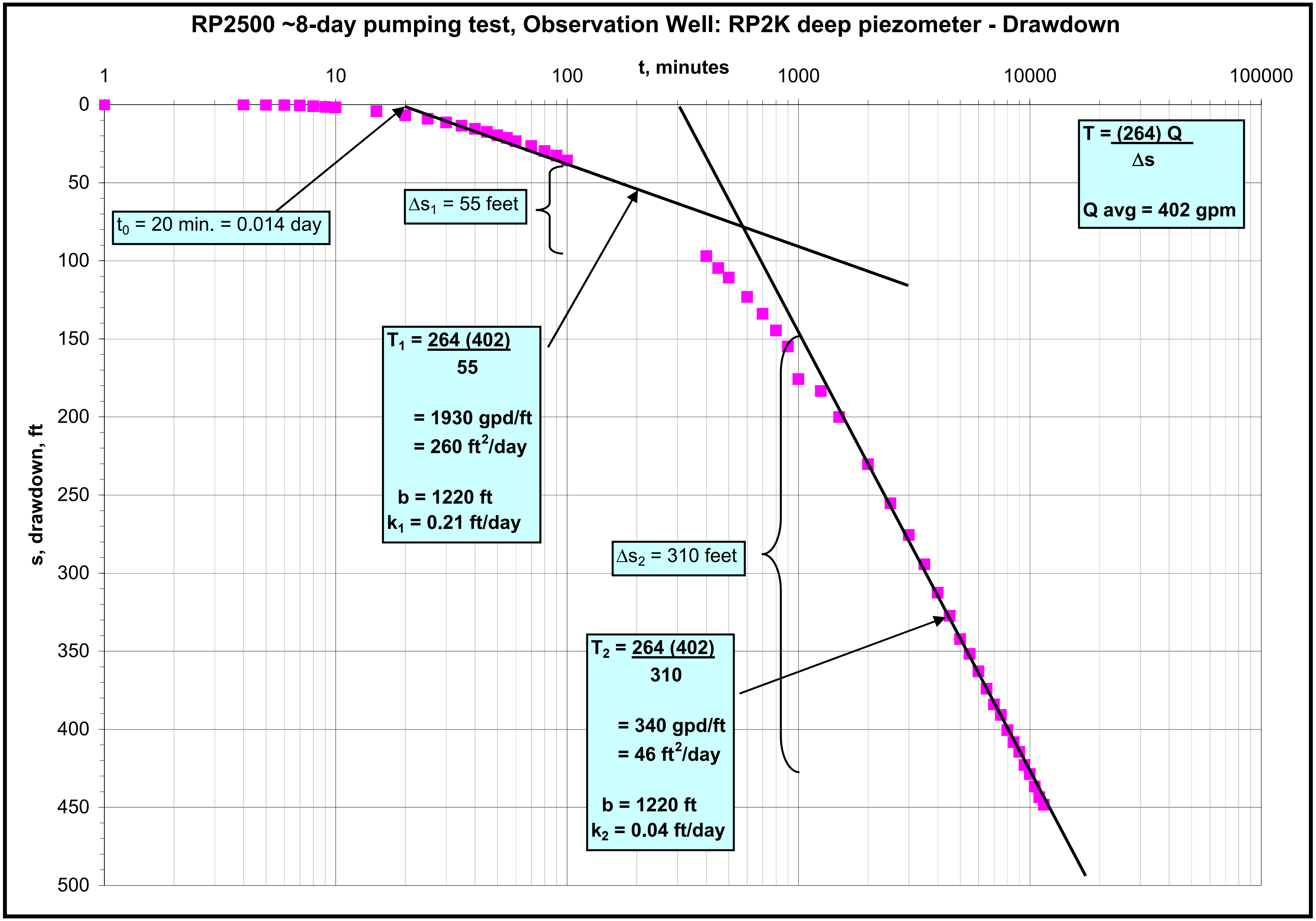
RP2500 ~8-day pumping test (May/June 2001)
casing storage effects lasted approximately 30 minutes
(note that discharge was decreasing from the beginning from the test to an overall average of ~406 gpm by the end of the test)


Pumping 5-31-01 to 6-8-01
Recovery 6-8-01 to 10-16-01
RP2500 Recovery ~8-day test, Q avg = 402
t/t'
1
10
100
1000
10000
s', residual drawdown, ft
0
50
100
150
200
250
300
350
400
450
500
550
T = (264) Q / Δs
Qavg = 402 gpm
Δs2 = 225 feet
Δs1 = 120 feet
T2 = 264 (411) / 225
= 470 gpd/ft
= 63 ft2/day
b = 1220 ft
k2 = 0.05 ft/day
T1 = 264 (411) / 120
= 880 gpd/ft
= 120 ft2/day
b = 1220 ft
k1 = 0.1 ft/day
Pump Failure at
16:35 on 6/8/01

FOURTEEN-DAY PUMP TEST: RECOVERY RP2500

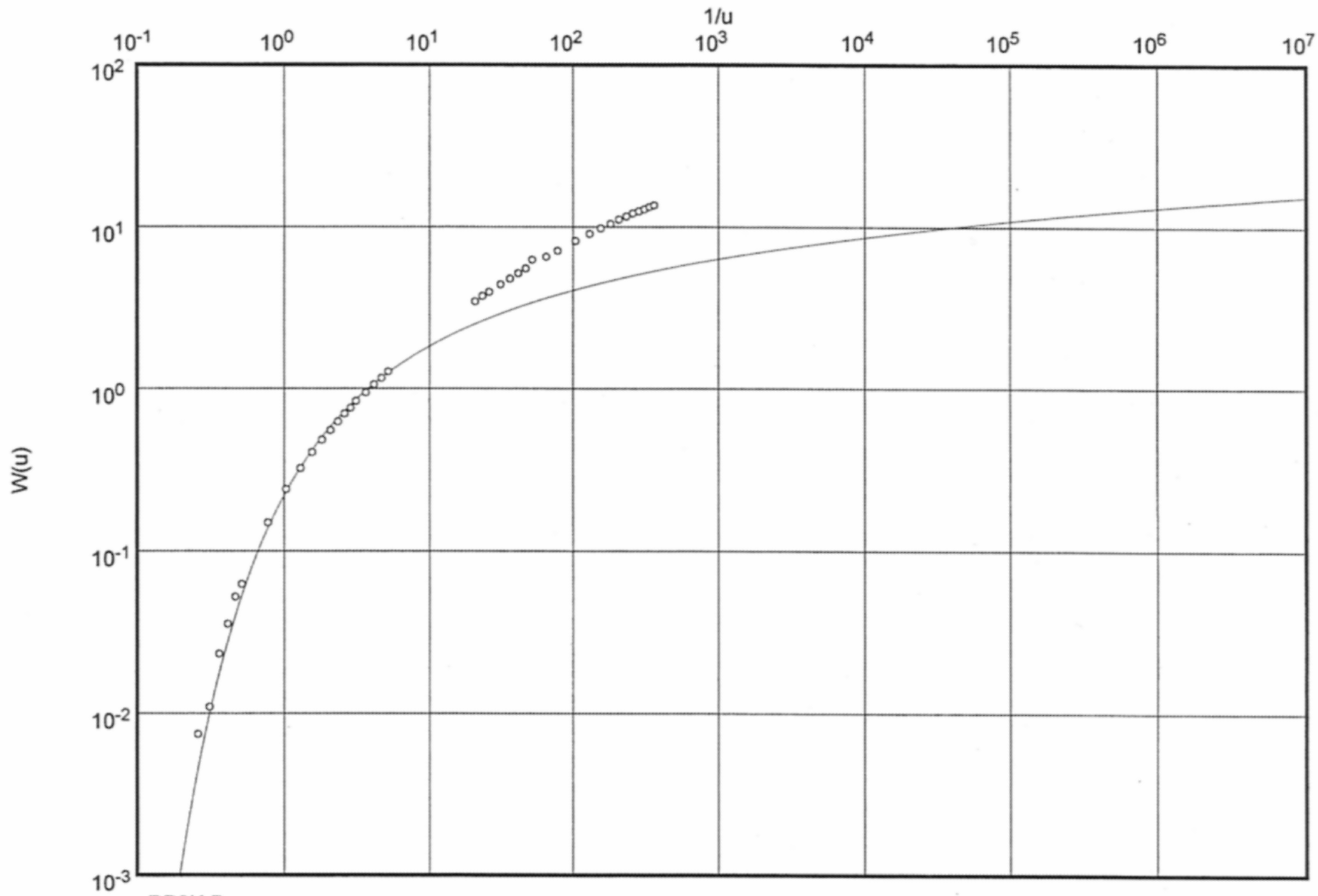
JOB: RIO PUEBLO 2500 | STATIC W.L. (ft): 153.78 (toc)
LOCATION: TAOS, NM | WELL DEPTH: 2500 ft bgs
TECHNICIAN: CHRIS OLSON | M.P. CORRECTION: -1.82 until 10-4-01, -1.1 ft
WELL I.D.: RP2500 | CASING TYPE: steel Diameter: 10"

DATE	TIME	ELAPSED TIME, t	time, t', min	WATER LEVEL, ft 153.78	RESIDUAL DRAWDOWN, s', in feet	t/t'	COMMENTS
6/8/2001	16:35	11965	0	see notes			pump died at ~4:35
fri		11966	1			11966	
		11967	2			5983.5	
		11968	3			3989.333333	
		11969	4			2992.25	
	16:40	11970	5	627.14	473.36	2394	
		11971	6			1995.166667	
		11972	7			1710.285714	
		11973	8			1496.625	
		11974	9			1330.444444	
		11975	10			1197.5	
	16:53	11983	18	633.07	479.29	665.7222222	
	16:55	11985	20	631.23	477.45	599.25	
		11990	25	627.49	473.71	479.6	
	17:05	11995	30	621.59	467.81	399.8333333	
		12000	35	618.08	464.30	342.8571429	
	17:15	12005	40	614.98	461.20	300.125	
		12010	45	612.13	458.35	266.8888889	
	17:25	12015	50	608.98	455.20	240.3	
		12020	55	606.34	452.56	218.5454545	
	17:35	12025	60	603.90	450.12	200.4166667	
	17:45	12035	70	599.13	445.35	171.9285714	
	17:55	12045	80	594.73	440.95	150.5625	
	18:05	12055	90	590.86	437.08	133.9444444	
	18:15	12065	100	587.20	433.42	120.65	
	19:05	12115	150	571.83	418.05	80.76666667	
	19:55	12165	200	559.38	405.60	60.825	
	20:45	12215	250	549.00	395.22	48.86	
	21:35	12265	300	539.66	385.88	40.88333333	
	22:25	12315	350	532.34	378.56	35.18571429	
	23:15	12365	400	525.00	371.22	30.9125	
6/9/2001	0:05	12415	450	517.20	363.42	27.58888889	
sat	0:55	12465	500	510.74	356.96	24.93	
	2:35	12565	600	-		20.94166667	
	4:15	12665	700	491.43	337.65	18.09285714	
	5:55	12765	800	482.84	329.06	15.95625	
	7:35	12865	900	473.07	319.29	14.29444444	
	9:15	12965	1000	467.27	313.49	12.965	
	13:25	13215	1250	450.18	296.40	10.572	
	17:35	13465	1500	435.80	282.02	8.976666667	
6/10/2001	1:55	13965	2000	413.38	259.60	6.9825	
sun	10:15	14465	2500	394.29	240.51	5.786	
	18:35	14965	3000	377.72	223.94	4.988333333	
6/11/2001	2:55	15465	3500	364.84	211.06	4.418571429	
mon	11:15	15965	4000	352.55	198.77	3.99125	
	19:35	16465	4500	342.20	188.42	3.658888889	
6/12/2001	3:55	16965	5000	332.69	178.91	3.393	
tue	12:15	17465	5500	323.93	170.15	3.175454545	
6/13/2001	11:50	18870	6905	304.02	150.24	2.732802317	
6/14/2001	10:00	20200	8235	287.72	133.94	2.452944748	
6/15/2001	11:55	21755	9790	275.72	121.94	2.222165475	
6/19/2001	14:25	27665	15700	242.10	88.32	1.762101911	
7/23/2001	16:50	76770	64805	178.7	24.92	1.184630816	
7/30/2001	16:20	86820	74855	175.53	21.75	1.159842362	
8/28/2001	11:30	128990	117025	166.04	12.26	1.10224311	
8/29/2001	15:18	130658	118693	165.8	12.02	1.100806282	
8/30/2001	11:35	131875	119910	165.73	11.95	1.099783171	
8/31/2001	12:35	133375	121410	165.6	11.82	1.098550367	
9/2/2001	17:35	136555	124590	165.05	11.27	1.096034995	
9/3/2001	10:15	137555	125590	165.03	11.25	1.095270324	
9/4/2001	18:30	139490	127525	164.74	10.96	1.09382474	
9/5/2001	16:30	140810	128845	164.66	10.88	1.092863518	
9/6/2001	11:30	141950	129985	164.28	10.50	1.092049083	
9/13/2001	11:30	152030	140065	163.27	9.49	1.085424624	
9/28/2001	9:30	173510	161545	161.42	7.64	1.07406605	
10/4/2001	10:30	182210	170245	160.75	6.97	1.070281066	
10/9/2001	8:50	189310	177345	160.5	6.72	1.067467366	


RP2500 ~8-day pumping test, Observation Well: RP2K deep piezometer - Drawdown
t, minutes
1
10
100
1000
10000
100000
s, drawdown, ft
0
50
100
150
200
250
300
350
400
450
500
t_0 = 20 min. = 0.014 day
Δs_1 = 55 feet
T_1 = 264 (402) / 55
= 1930 gpd/ft
= 260 ft^2/day
b = 1220 ft
k_1 = 0.21 ft/day
Δs_2 = 310 feet
T_2 = 264 (402) / 310
= 340 gpd/ft
= 46 ft^2/day
b = 1220 ft
k_2 = 0.04 ft/day
T = (264) Q / Δs
Q avg = 402 gpm

Glorieta Geoscience, Inc P.O. Box 5727 Santa Fe, NM 87502 (505) 983 - 5446	Pumping test analysis Theis analysis method Confined aquifer	Date: 08.08.2001	Page 1
		Project: RP2500 ~8-day pumping test	
		Evaluated by: MH	

Pumping Test No.	Test conducted on: May 31 - June 8
RP2500 w/ RP2K Deep obs	
Discharge 406.90 U.S.gal/min	



o RP2K Deep

Transmissivity [ft²/d]: 2.21×10^{2} 1653 gpd/ft

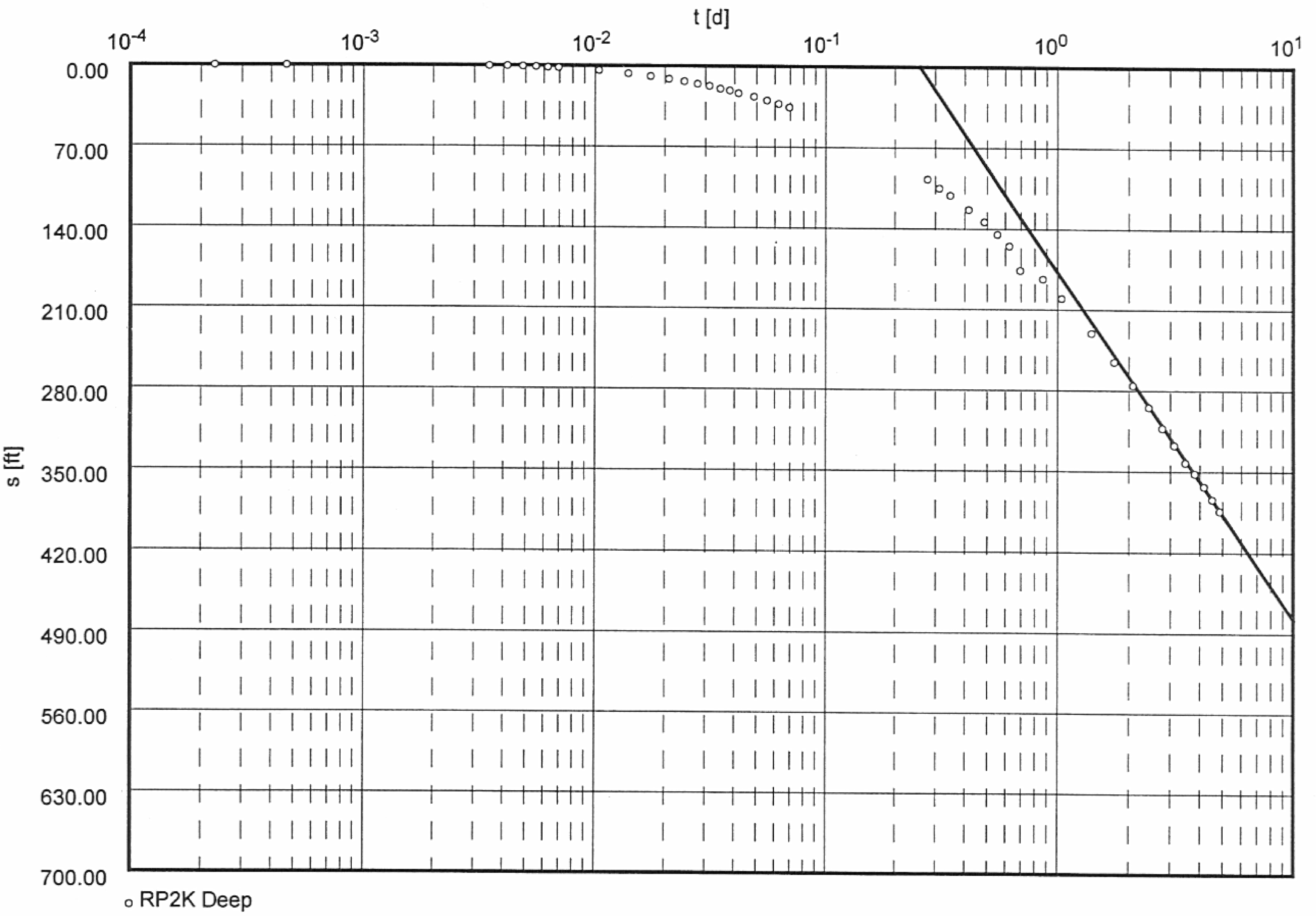
Hydraulic conductivity [ft/d]: 1.73×10^{-1}

Aquifer thickness [ft]: 1277.00

Storativity: 9.92×10^{-4}

Glorieta Geoscience, Inc P.O. Box 5727 Santa Fe, NM 87502 (505) 983 - 5446	Pumping test analysis Time-Drawdown-method after COOPER & JACOB Confined aquifer	Date: 08.08.2001	Page 1
		Project: RP2500 ~8-day pumping test	
		Evaluated by: MH	

Pumping Test No.	Test conducted on: May 31 - June 8
RP2500 w/ RP2K Deep obs	
Discharge 406.90 U.S.gal/min	



Transmissivity [ft²/d]: 4.77×10^{1}

357 gpd/ft

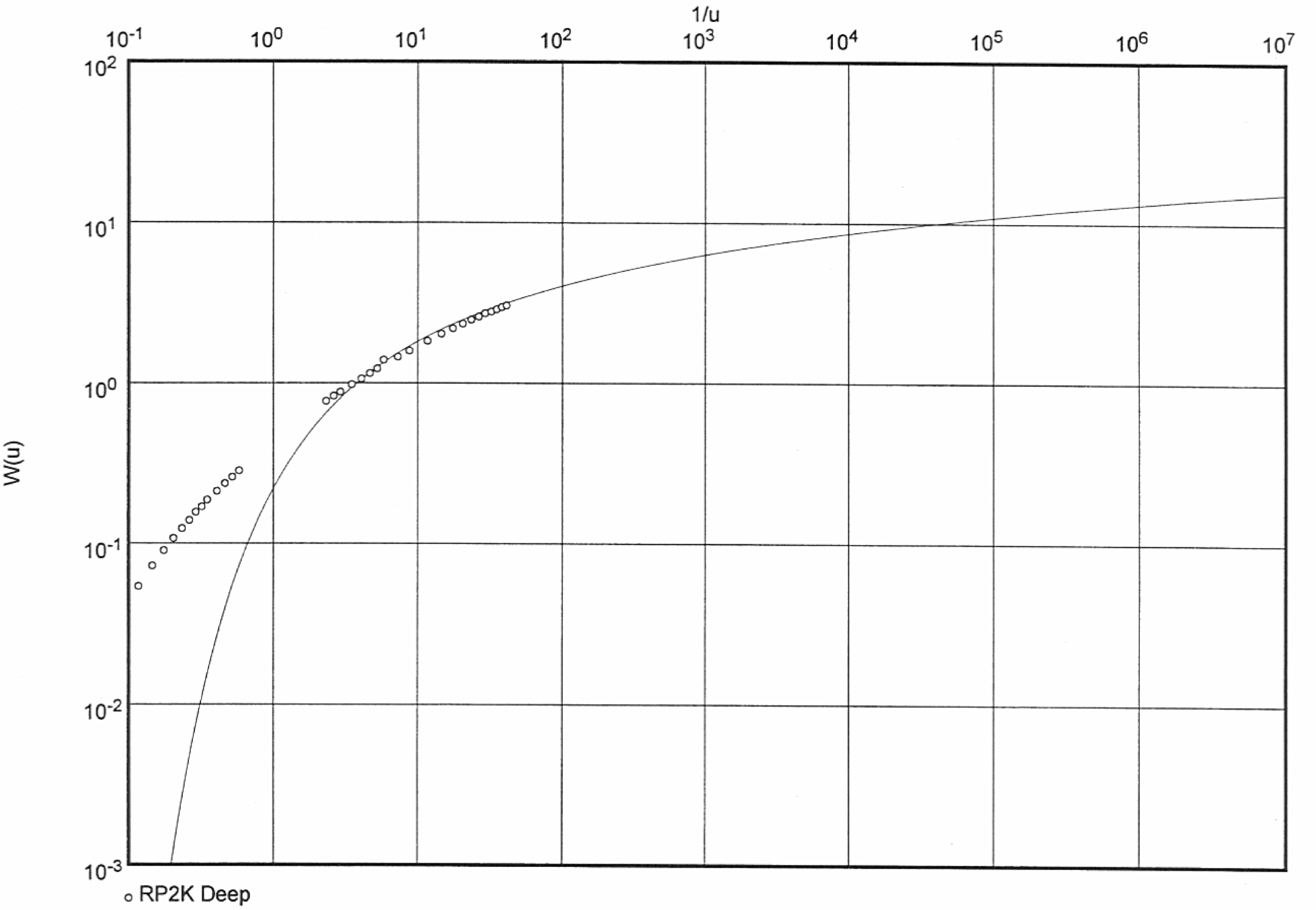
Hydraulic conductivity [ft/d]: 3.73×10^{-2}

Aquifer thickness [ft]: 1277.00

Storativity: 2.31×10^{-3}

Glorieta Geoscience, Inc P.O. Box 5727 Santa Fe, NM 87502 (505) 983 - 5446	Pumping test analysis Theis analysis method Confined aquifer	Date: 08.08.2001	Page 1
		Project: RP2500 ~8-day pumping test	
		Evaluated by: MH	

Pumping Test No.	Test conducted on: May 31 - June 8
RP2500 w/ RP2K Deep obs	
Discharge 406.90 U.S.gal/min	



∘ RP2K Deep

Transmissivity [ft²/d]: 4.95×10^{1} 370 gpd/ft

Hydraulic conductivity [ft/d]: 3.87×10^{-2}

Aquifer thickness [ft]: 1277.00

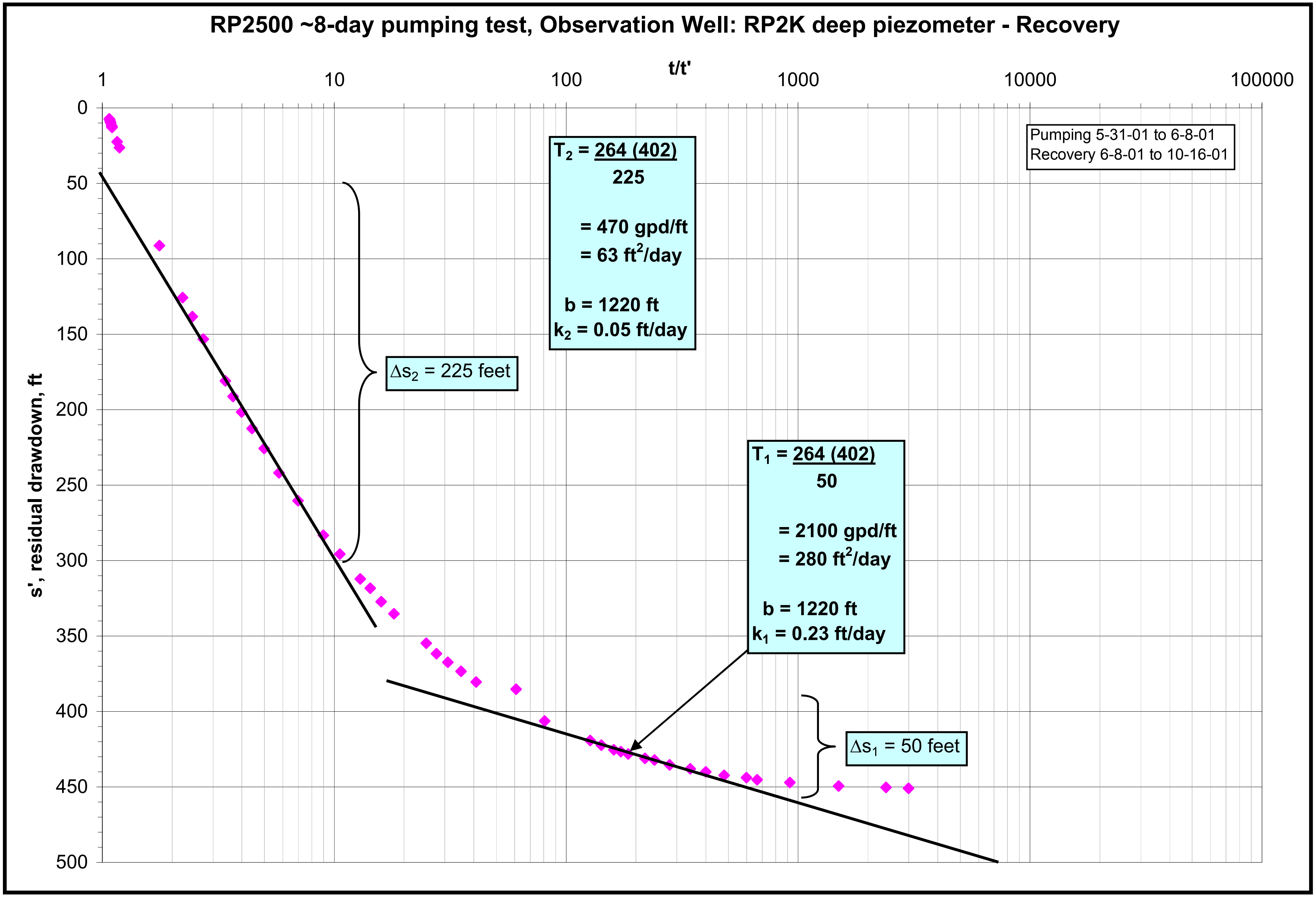
Storativity: 1.98×10^{-3}

FOURTEEN-DAY PUMP TEST: DRAWDOWN RP2K Deep Piezometer

JOB: **RIO PUEBLO 2K DEEP**
LOCATION: TAOS, NM
TECHNICIAN: CHRIS OLSON
WELL I.D.: RP2K deep

STATIC W.L.: 156.52 ft (toc)
WELL DEPTH: 2000 ft bgs
M.P. CORRECTION: -2.31
CASING TYPE: 6" steel (1" steel piez pipe)

DATE	TIME	ELAPSED TIME, t	WATER LEVEL, ft	DRAWDOWN, s, in feet	COMMENTS
5/31/2001	9:00	0	156.52	~	
		0.33	156.53	0.01	
		0.67	156.55	0.03	
		1	156.50	-0.02	
		2	156.38	-0.14	
		3	156.39	-0.13	
		4	156.47	-0.05	
	9:05	5	156.73	0.21	
		6	156.83	0.31	
		7	157.18	0.66	
		8	157.53	1.01	
		9	158.00	1.48	
	9:10	10	158.29	1.77	
		15	160.75	4.23	
	9:20	20	163.32	6.80	
		25	165.67	9.15	
	9:30	30	167.93	11.41	
		35	170.08	13.56	
	9:40	40	172.10	15.58	
		45	174.06	17.54	
	9:50	50	176.21	19.69	
		55	177.84	21.32	
	10:00	60	180.02	23.50	
	10:10	70	183.11	26.59	
	10:20	80	186.35	29.83	
	10:30	90	189.23	32.71	
	10:40	100	192.34	35.82	
	15:40	400	253.60	97.08	
	16:30	450	261.15	104.63	
	17:20	500	267.31	110.79	
	19:00	600	279.70	123.18	
	20:40	700	290.45	133.93	
	22:20	800	301.22	144.70	
Midnight	0:00	900	311.44	154.92	
6/1/2001	1:40	1000	332.41	175.89	
	5:50	1250	340.00	183.48	
	10:00	1500	356.61	200.09	
	18:20	2000	386.88	230.36	
6/2/2001	2:40	2500	411.80	255.28	
	11:00	3000	432.20	275.68	
	19:20	3500	451.00	294.48	
6/3/2001	3:40	4000	469.16	312.64	
	12:00	4500	483.89	327.37	
	20:20	5000	498.92	342.40	
6/4/2001	4:40	5500	508.30	351.78	
	13:00	6000	519.42	362.90	
	21:20	6500	530.60	374.08	
6/5/2001	5:40	7000	540.63	384.11	
	14:00	7500	547.35	390.83	
	22:20	8000	557.15	400.63	
6/6/2001	6:40	8500	564.79	408.27	
	15:00	9000	571.07	414.55	
	23:20	9500	579.42	422.90	
6/7/2001	7:40	10000	585.24	428.72	
	16:00	10500	593.24	436.72	
6/8/2001	0:20	11000	600.02	443.50	
	8:40	11500	604.99	448.47	pump died at 16:35 6-8-01



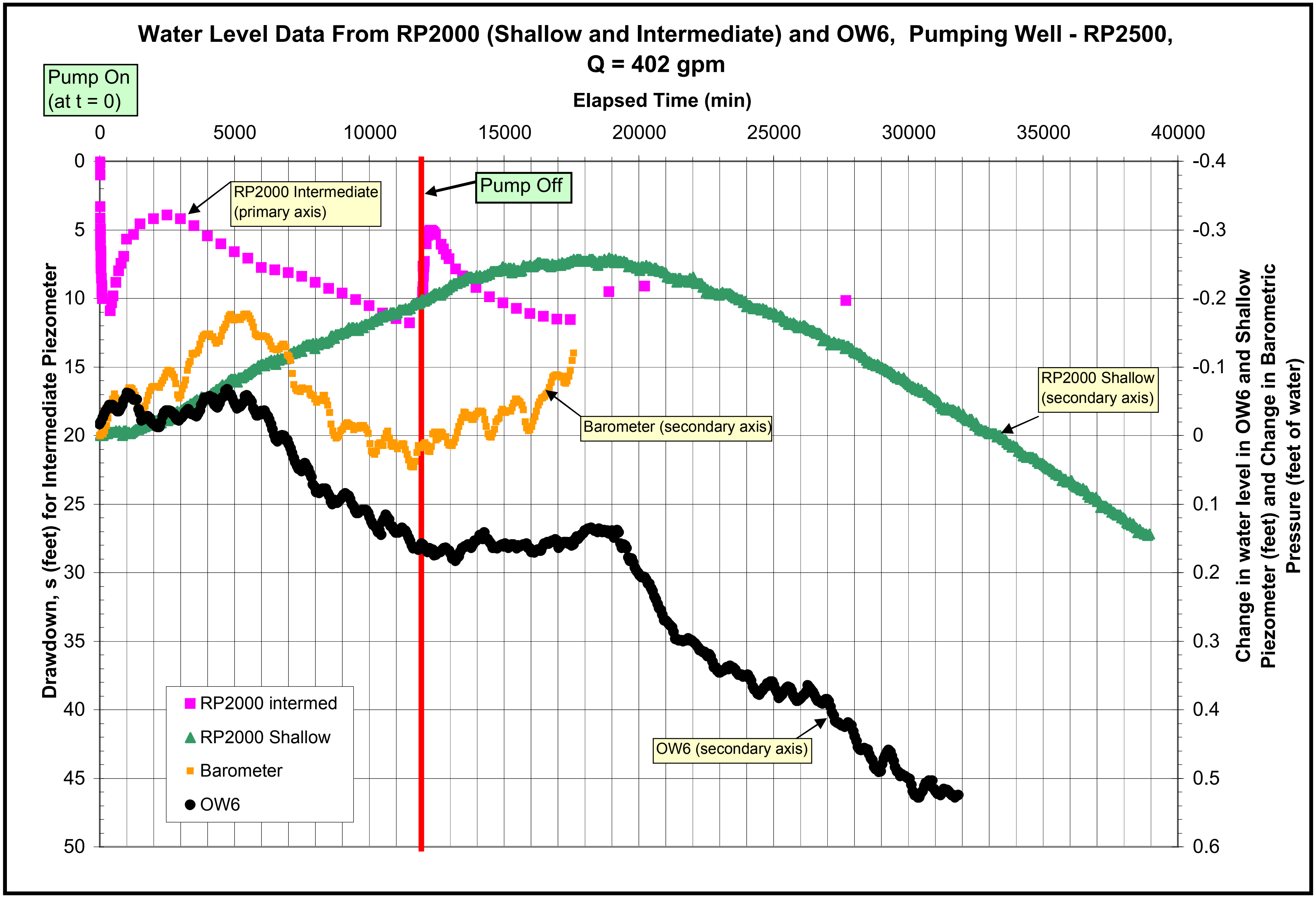
RP2500 ~8-day pumping test, Observation Well: RP2K deep piezometer - Recovery
t/t'
1
10
100
1000
10000
100000
s', residual drawdown, ft
0
50
100
150
200
250
300
350
400
450
500
Pumping 5-31-01 to 6-8-01
Recovery 6-8-01 to 10-16-01
T₂ = 264 (402) / 225
= 470 gpd/ft
= 63 ft²/day
b = 1220 ft
k₂ = 0.05 ft/day
Δs₂ = 225 feet
T₁ = 264 (402) / 50
= 2100 gpd/ft
= 280 ft²/day
b = 1220 ft
k₁ = 0.23 ft/day
Δs₁ = 50 feet

FOURTEEN-DAY PUMP TEST: RECOVERY RP2K Deep Piezometer

JOB: **RIO PUEBLO 2K DEEP**
LOCATION: TAOS, NM
TECHNICIAN: CHRIS OLSON
WELL I.D.: RP2K Deep

STATIC W.L.: 156.52 ft (toc)
WELL DEPTH: 2000
M.P. CORRECTION: -2.31
CASING TYPE: 6" steel (1" steel piez pipe)

DATE	TIME	ELAPSED TIME, t	time, t', min	WATER LEVEL, ft	RESIDUAL DRAWDOWN, s', in feet	t/t'	COMMENTS
6/8/2001	16:35	11965	0				
fri		11966	1			11966.0	
		11967	2			5983.5	
		11968	3			3989.3	
		11969	4	607.50	450.98	2992.3	
		11970	5	606.85	450.33	2394.0	
		11971	6			1995.2	
		11972	7			1710.3	
		11973	8	605.90	449.38	1496.6	
		11974	9			1330.4	
	16:45	11978	13	603.60	447.08	921.4	
		11983	18	601.80	445.28	665.7	
		11985	20	600.40	443.88	599.3	
	17:00	11990	25	598.86	442.34	479.6	
		11995	30	596.52	440.00	399.8	
		12000	35	594.59	438.07	342.9	
		12008	43	591.89	435.37	279.3	
		12010	45	-		266.9	
		12015	50	588.68	432.16	240.3	
		12020	55	587.54	431.02	218.5	
	17:35	12030	65	584.74	428.22	185.1	
		12035	70	583.10	426.58	171.9	
		12040	75	581.85	425.33	160.5	
		12050	85	578.82	422.30	141.8	
	18:15	12060	95	575.77	419.25	126.9	
	19:05	12115	150	562.80	406.28	80.8	
	19:55	12165	200	541.70	385.18	60.8	
	20:45	12215	250	see notes		48.9	
	21:35	12265	300	537.00	380.48	40.9	
	22:25	12315	350	529.88	373.36	35.2	
	23:15	12365	400	523.98	367.46	30.9	
6/9/2001	0:05	12415	450	518.14	361.62	27.6	
sat	0:55	12465	500	511.30	354.78	24.9	
	2:35	12565	600	-		20.9	
	4:15	12665	700	491.80	335.28	18.1	
	5:55	12765	800	483.76	327.24	16.0	
	7:35	12865	900	474.77	318.25	14.3	
	9:15	12965	1000	468.71	312.19	13.0	
	13:25	13215	1250	452.28	295.76	10.6	
	17:35	13465	1500	439.72	283.20	9.0	
6/10/2001	1:55	13965	2000	416.82	260.30	7.0	
sun	10:15	14465	2500	398.43	241.91	5.8	
	18:35	14965	3000	382.22	225.70	5.0	
6/11/2001	2:55	15465	3500	368.97	212.45	4.4	
mon	11:15	15965	4000	358.03	201.51	4.0	
	19:35	16465	4500	347.74	191.22	3.7	
6/12/2001	3:55	16965	5000	337.49	180.97	3.4	
tue	12:15	17465	5500			3.2	
6/13/2001	12:18	18908	6943	309.72	153.20	2.7	
6/14/2001	10:30	20240	8275	294.90	138.38	2.4	
6/15/2001	11:45	21755	9790	282.21	125.69	2.2	
6/19/2001	14:25	27645	15680	247.73	91.21	1.8	
7/23/2001	16:50	76750	64785	182.85	26.33	1.2	
7/30/2001	16:30	86810	74845	178.93	22.41	1.2	
8/28/2001	11:30	128270	116305	169.38	12.86	1.1	
8/29/2001	15:15	129935	117970	168.92	12.40	1.1	
8/30/2001	11:30	131150	119185	168.9	12.38	1.1	
8/31/2001	12:30	132650	120685	168.71	12.19	1.1	
9/2/2001	17:15	135785	123820	168.17	11.65	1.1	
9/13/2001	11:00	148370	136405	166.37	9.85	1.1	
9/19/2001	11:00	157010	145045	165.42	8.90	1.1	
9/28/2001	9:30	170060	158095	164.38	7.86	1.1	
10/4/2001	10:30	178760	166795	163.75	7.23	1.07	


Water Level Data From RP2000 (Shallow and Intermediate) and OW6, Pumping Well - RP2500,
Q = 402 gpm
Elapsed Time (min)
Pump On
(at t = 0)
Pump Off
RP2000 Intermediate
(primary axis)
RP2000 Shallow
(secondary axis)
Barometer (secondary axis)
OW6 (secondary axis)
Drawdown, s (feet) for Intermediate Piezometer
Change in water level in OW6 and Shallow Piezometer (feet) and Change in Barometric Pressure (feet of water)
RP2000 intermed
RP2000 Shallow
Barometer
OW6
0
5000
10000
15000
20000
25000
30000
35000
40000
0
5
10
15
20
25
30
35
40
45
50
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6

FOURTEEN-DAY PUMP TEST: DRAWDOWN

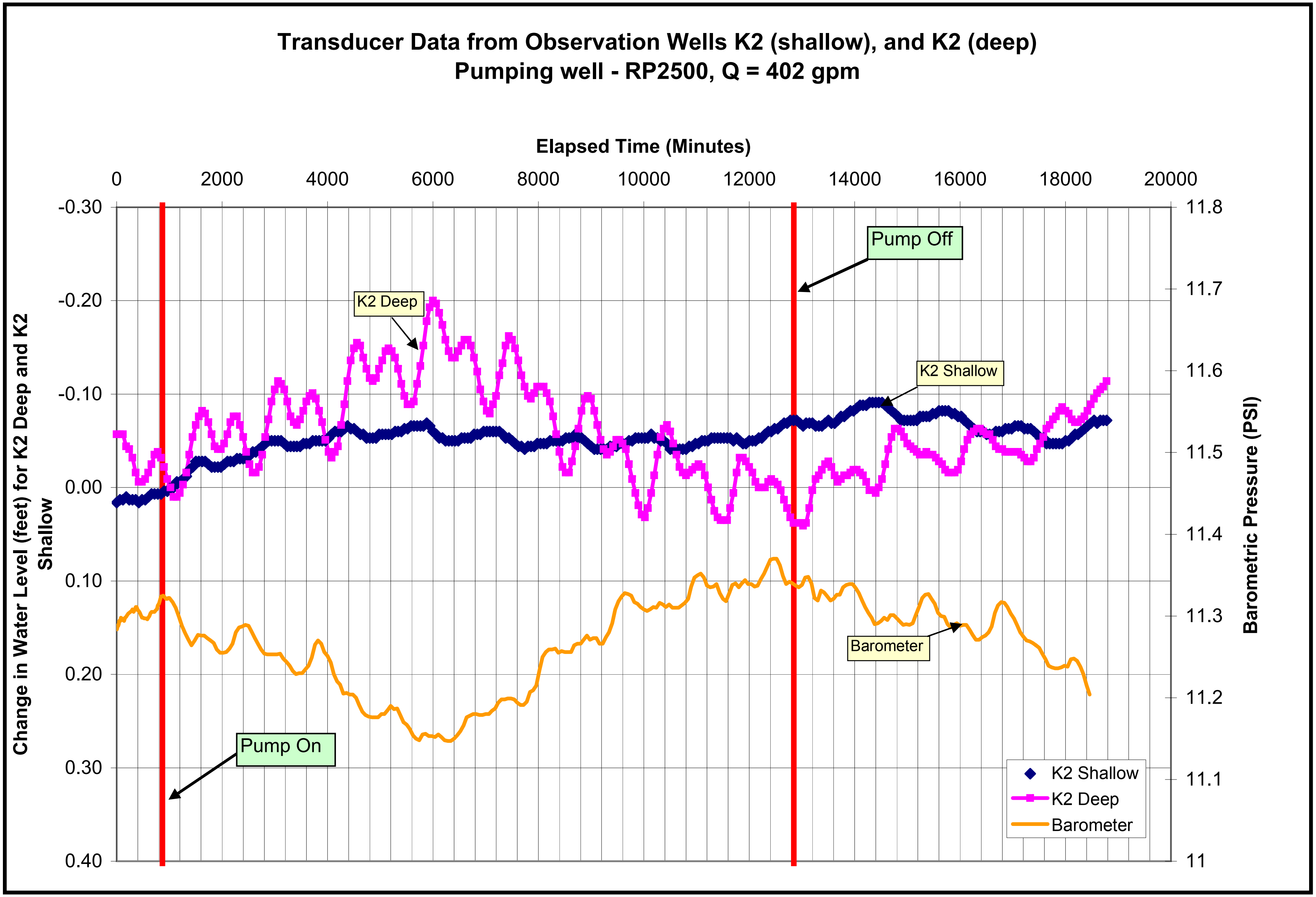
JOB: **RIO PUEBLO 2K INTERMEDIATE** | STATIC W.L.: | Weir Diameter:
LOCATION: TAOS, NM | WELL DEPTH: | Orifice Diameter:
TECHNICIAN: CHRIS OLSON | M.P. CORRECTION:
WELL I.D.: | CASING TYPE: | Casing Diameter:

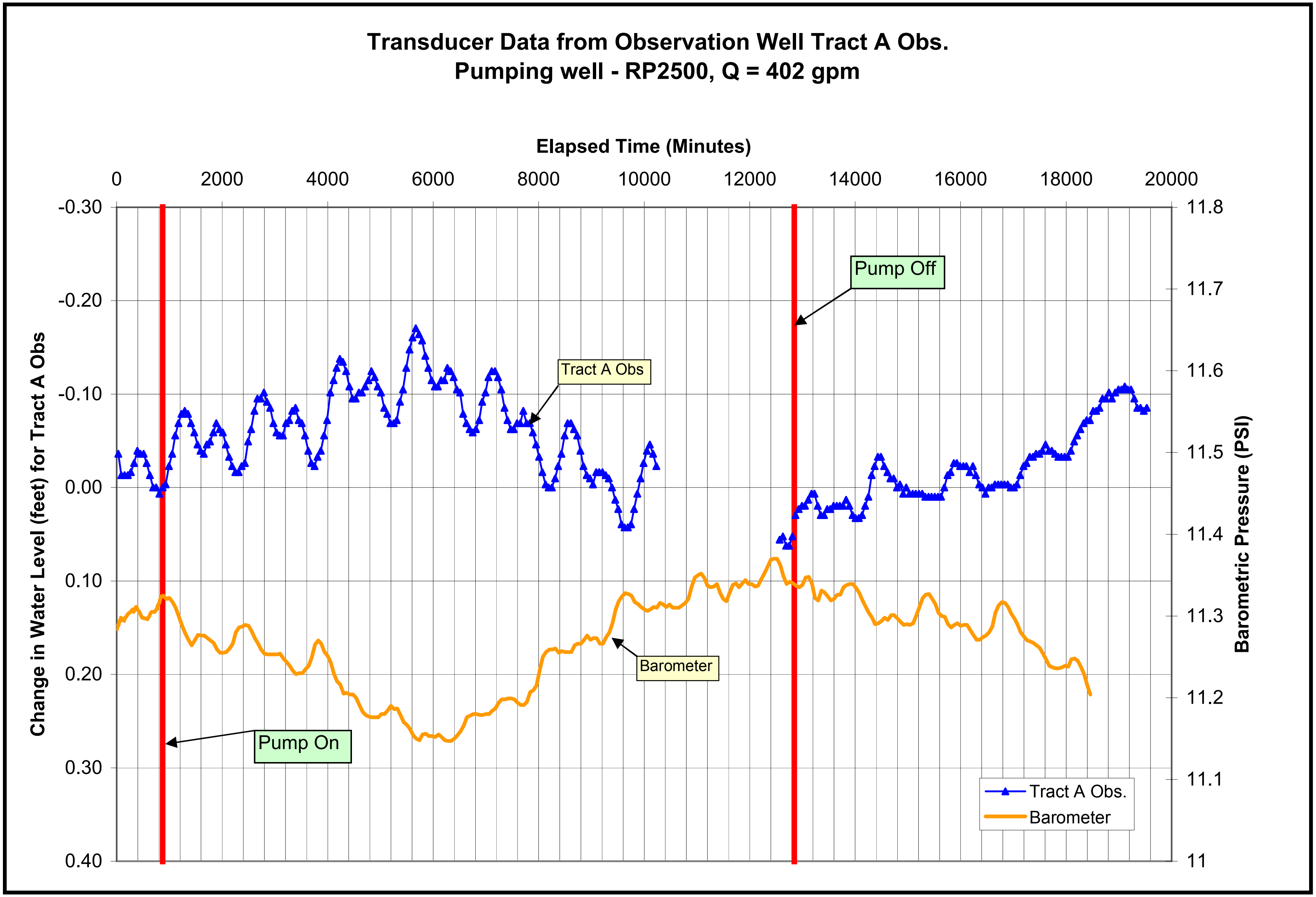
DATE	TIME	ELAPSED TIME, t	WATER LEVEL, ft	DRAWDOWN, s, in feet			COMMENTS
5/31/2001	9:00	0	163.44	~	~	~	
		1	163.39	-0.05			
		2	163.36	-0.08			
		3	163.34	-0.10			
		4	163.40	-0.04			
	9:05	5	163.52	0.08			
		6	163.66	0.22			
		7	163.83	0.39			
		8	164.22	0.78			
		9	-				
	9:10	10	164.44	1.00			
		15	163.59	0.15			
	9:20	20	166.76	3.32			
		25	167.62	4.18			
	9:30	30	168.39	4.95			
		35	169.00	5.56			
	9:40	40	169.60	6.16			
		45	170.03	6.59			
	9:50	50	170.45	7.01			
		55	170.91	7.47			
	10:00	60	171.26	7.82			
	10:10	70	171.97	8.53			
	10:20	80	172.54	9.10			
	10:30	90	173.04	9.60			
	10:40	100	173.49	10.05			
	15:40	400	174.35	10.91			
	16:30	450	173.77	10.33			
	17:20	500	173.27	9.83			
	19:00	600	172.30	8.86			
	20:40	700	171.45	8.01			
	22:20	800	170.90	7.46			
Midnight	0:00	900	170.40	6.96			
6/1/2001	1:40	1000	169.15	5.71			
	5:50	1250	168.80	5.36			
	10:00	1500	168.00	4.56			
	18:20	2000	167.63	4.19			
6/2/2001	2:40	2500	167.37	3.93			
	11:00	3000	167.66	4.22			
	19:20	3500	168.15	4.71			
6/3/2001	3:40	4000	168.9	5.46			
	12:00	4500	169.47	6.03			
	20:20	5000	170.05	6.61			
6/4/2001	4:40	5500	170.53	7.09			
	13:00	6000	171.2	7.76			
	21:20	6500	171.36	7.92			
6/5/2001	5:40	7000	171.59	8.15			
	14:00	7500	171.85	8.41			
	22:20	8000	172.28	8.84			
6/6/2001	6:40	8500	172.72	9.28			
	15:00	9000	173.08	9.64			
	23:20	9500	173.55	10.11			
6/7/2001	7:40	10000	173.97	10.53			
	16:00	10500	174.54	11.10			
6/8/2001	0:20	11000	174.93	11.49			
	8:40	11500	175.25	11.81			

FOURTEEN-DAY PUMP TEST: RECOVERY

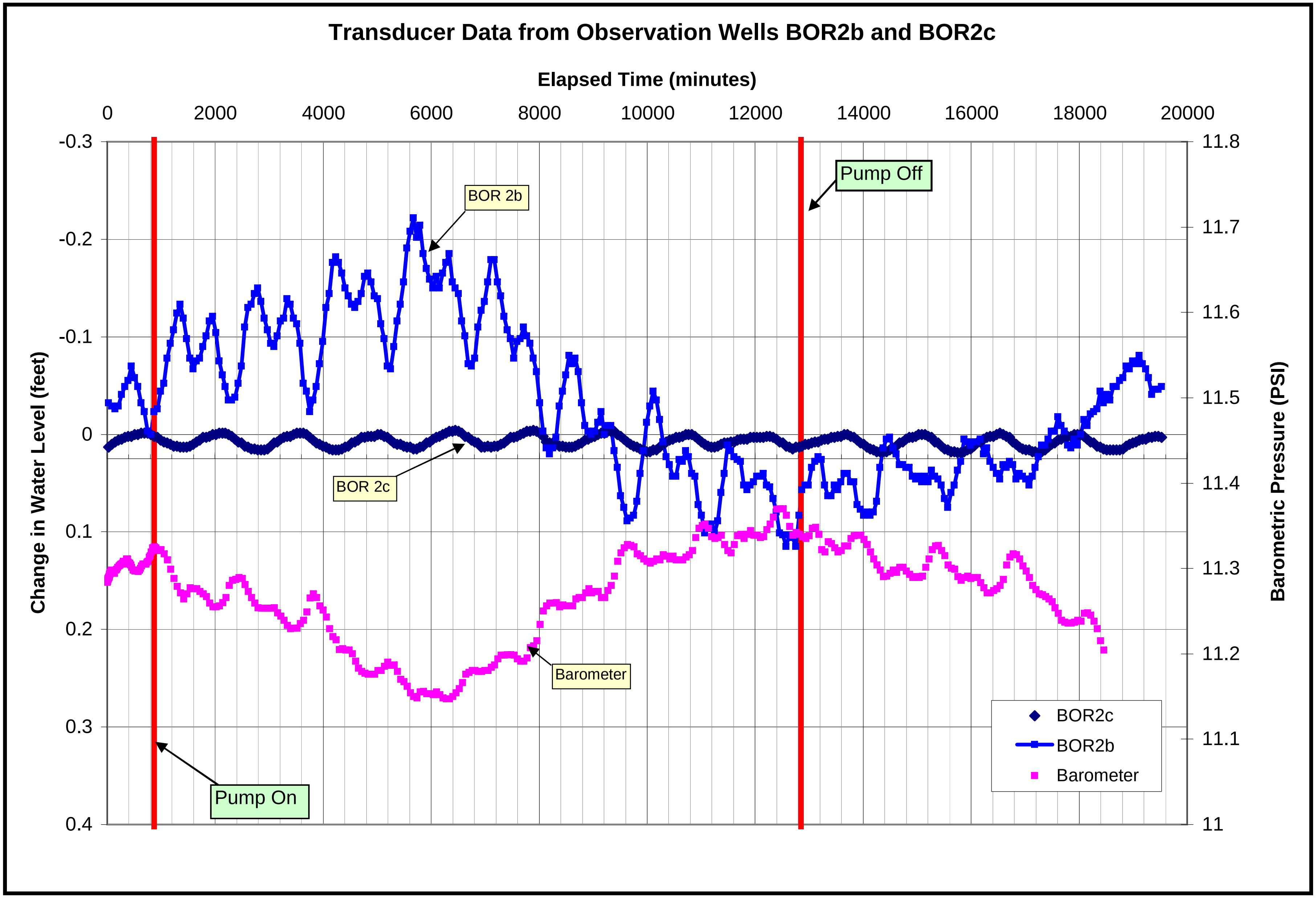
JOB: **RIO PUEBLO 2K INTERMEDIATE** STATIC W.L.:
LOCATION: TAOS, NM WELL DEPTH:
TECHNICIAN: CHRIS OLSON M.P. CORRECTION:
WELL I.D.: CASING TYPE: Diameter:

DATE	TIME	ELAPSED TIME, t	time, t', min	WATER LEVEL, ft 163.44	RESIDUAL DRAWDOWN, s', in feet	t/t'
6/8/2001	16:35	11965	0			
fri		11966	1			11966.0
		11967	2			5983.5
		11968	3			3989.3
		11969	4			2992.3
	16:40	11970	5			2394.0
		11971	6			1995.2
		11972	7			1710.3
		11973	8			1496.6
		11974	9			1330.4
		11975	10			1197.5
		11980	15			798.7
	16:55	11985	20	173.45	10.01	599.3
	17:00	11990	25	173.00	9.56	479.6
	17:05	11995	30	172.85	9.41	399.8
	17:10	12000	35	172.58	9.14	342.9
	17:18	12008	43	171.10	7.66	279.3
		12010	45	-		266.9
	17:25	12015	50	171.85	8.41	240.3
	17:30	12020	55	171.67	8.23	218.5
	17:35	12025	60	171.41	7.97	200.4
	17:45	12035	70	171.17	7.73	171.9
	17:50	12040	75	170.95	7.51	160.5
	18:00	12050	85	170.75	7.31	141.8
	18:10	12060	95	169.30	5.86	126.9
	19:05	12115	150	169.46	6.02	80.8
	19:55	12165	200	168.86	5.42	60.8
	20:45	12215	250	168.60	5.16	48.9
	21:35	12265	300	168.50	5.06	40.9
	22:25	12315	350	168.50	5.06	35.2
	23:15	12365	400	168.55	5.11	30.9
6/9/2001	0:05	12415	450	168.65	5.21	27.6
sat	0:55	12465	500	168.80	5.36	24.9
	2:35	12565	600	-		20.9
	4:15	12665	700	169.50	6.06	18.1
	5:55	12765	800	169.85	6.41	16.0
	7:35	12865	900	170.25	6.81	14.3
	9:15	12965	1000	170.55	7.11	13.0
	13:25	13215	1250	171.30	7.86	10.6
	17:35	13465	1500	171.80	8.36	9.0
6/10/2001	1:55	13965	2000	172.65	9.21	7.0
sun	10:15	14465	2500	173.35	9.91	5.8
	18:35	14965	3000	173.77	10.33	5.0
6/11/2001	2:55	15465	3500	174.17	10.73	4.4
mon	11:15	15965	4000	174.57	11.13	4.0
	19:35	16465	4500	174.75	11.31	3.7
6/12/2001	3:55	16965	5000	174.95	11.51	3.4
tue	12:15	17465	5500	175.00	11.56	3.2
6/13/2001	12:08	18898	6933	172.95	9.51	2.7
6/14/2001	10:17	20227	8262	172.55	9.11	2.4
6/19/2001	14:40	27690	15725	173.60	10.16	1.8
7/23/2001	16:50	76780	64815	173.94	10.50	1.2
8/28/2001	11:30	128270	116305	170.08	6.64	1.1
8/29/2001	15:15	129935	117970	169.95	6.51	1.1
8/30/2001	11:30	131150	119185	169.92	6.48	1.1
8/31/2001	12:30	132650	120685	169.57	6.13	1.1
9/2/2001	17:15	135785	123820	169.55	6.11	1.1
9/13/2001	11:00	148370	136405	168.88	5.44	1.1
9/19/2001	11:00	157010	145045	168.34	4.90	1.1
9/28/2001	9:30	170060	158095	167.85	4.41	1.1
10/4/2001	10:30	178760	166795	167.43	3.99	1.1
10/16/2001	13:00	196190	184225	166.92	3.48	1.1


Transducer Data from Observation Wells K2 (shallow), and K2 (deep)
Pumping well - RP2500, Q = 402 gpm
Elapsed Time (Minutes)
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Change in Water Level (feet) for K2 Deep and K2 Shallow
-0.30
-0.20
-0.10
0.00
0.10
0.20
0.30
0.40
Barometric Pressure (PSI)
11.8
11.7
11.6
11.5
11.4
11.3
11.2
11.1
11
Pump On
Pump Off
K2 Deep
K2 Shallow
Barometer
K2 Shallow
K2 Deep
Barometer



Transducer Data from Observation Well Tract A Obs.
Pumping well - RP2500, Q = 402 gpm
Elapsed Time (Minutes)
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Change in Water Level (feet) for Tract A Obs
-0.30
-0.20
-0.10
0.00
0.10
0.20
0.30
0.40
Barometric Pressure (PSI)
11.8
11.7
11.6
11.5
11.4
11.3
11.2
11.1
11
Pump On
Pump Off
Tract A Obs
Barometer
Tract A Obs.
Barometer



Transducer Data from Observation Wells BOR2b and BOR2c
Elapsed Time (minutes)
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Change in Water Level (feet)
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
Barometric Pressure (PSI)
11.8
11.7
11.6
11.5
11.4
11.3
11.2
11.1
11
BOR 2b
BOR 2c
Barometer
Pump On
Pump Off
BOR2c
BOR2b
Barometer

Plate 1. Lithologic log, geophysical logs, and well completion diagram for Town of Taos Well RP3200, RG-37303-S

Driller: Henkle Drilling and Supply Co., Inc.
Lithologic Log Compilation: P. Drakos, J. Riesterer - Glorieta Geoscience, Inc.
Geophysical Logs: Jet West Geophysical Services, Inc.
Location: 440394 m E, 4026001 m N (NAD 1927, UTM Zone 13)

GLORIETA GEOSCIENCE, INC.

Lithologic Log of RP 3200, RG-37303-S
Logged by P. Drakos, 5/2 - 5/17/07; reviewed by J. Riesterer, Glorieta Geoscience, Inc.

0-10' Sand and Gravel: Yellow-brown, very fine-grained sand and gravel composed of quartzite, sandstone, amphibolite, and granite. Weakly effervescent in Hydrochloric Acid (HCl)
10-30' Gravel: Gravel (as above) and weathered basalt
30-60' Basalt: Small chips of greenish-gray (10Y 6/1) basalt with abundant <1 mm plagioclase phenocrysts. Top of Upper Servilleta Basalt.
60-80' Basalt: Larger chips of gray (2.5Y 5/1) basalt. Abundant plagioclase (?1 mm phenocrysts), some vesicular basalt, dictytaxitic texture.
80-100' Basalt: Medium size chips of basalt, similar to previous but harder (slow drilling)
100-112' Basalt: Gray basalt with abundant plagioclase phenocrysts
112-135' Sandy Gravel: Reddish-brown (2.5YR 4/3) sandy gravel with reddish clayey, very fine sand at top (baked zone?)
135-140' Silt: Yellowish-brown (10YR 5/6) silt
140-160' Gravel: Pebble-size and larger gravel composed of quartzite, granite, basalt, and felsic volcanics
160-175' Clayey silt: Brown (7.5 YR 5/6) clayey silt, non-effervescent in HCl
175-180' Gravel: Pebble-size and larger gravel, same as 140-160'
180-190' Silty Clay: Brown (7.5 YR 5/6) silty clay, non-effervescent in HCl
190-200' Basalt: Vesicular gray basalt. Top of Middle Servilleta Basalt.
200-210' Basalt and clay: Basalt and brown (10 YR 5/6) clay, possible flow boundary
210-240' Basalt: Dark gray (10YR 4/1) aphanitic basalt with small (<1 mm) vesicles, reddish toward base
240-260' Clayey silt and silty clay: Tan to dark grayish brown (10YR 4/2-5/3) clayey silt and silty clay. Weakly to moderately effervescent in HCl.
260-280' Sandy gravel: Fining upward sequence from coarse pebble to cobble gravel to fine pebble gravel. Gravel includes quartzite, basalt, granite, felsic volcanics (latite) and minor sandstone
280-305' Silty clay to clayey silt: Dark yellowish brown (10YR 4/4) silty clay and clayey silt. Moderately effervescent in HCl
305-325' Clayey sandy gravel: Gravel with abundant sand and clay, reddish (7.5YR 4/4) at base (possible buried soil?)
325-340' Gravel: Coarse pebble to cobble gravel, compositionally same as 260-280 but increased abundance of basalt clasts
340-346' Silty clay: Tan silty clay, non-effervescent in HCl
346-390' Basalt: Basalt, vesicular from 360-370 with zeolite fill in vesicles. Top of Lower Servilleta Basalt.
390-400' Basalt, silt, and sand: Reddish vesicular basalt and scoria with yellowish red (7.5YR 4/6 - 5YR 4/6) silty sand - possible flow boundary
400-448' Basalt: Dark gray, aphanitic basalt, vesicular at top with zeolite fill in vesicles
448-460' Sandy Silt: Reddish-brown (5YR 4/4) fine sandy silt, possible baked zone, non-effervescent in HCl. Top of Chamita Fm.
460-480' Clay: Brown (at top) and gray (10YR 5/1) clay, non- to weakly-effervescent in HCl
480-495' Silt and fine sand: Tan (10YR 6/3) silt and fine say, non-effervescent in HCl
495-510' Gravel and sand: Pebble gravel and coarse-grained sand. Gravel composition includes quartzite, granite, latite, and sandstone
510-530' Clayey sand and gravel: Brown, clayey fine sand and fine pebble gravel
530-540' Gravel: Pebble to cobble gravel, composition is same as 495-510'
540-550' Clay: Tan (10YR6/4) clay
550-560' Gravel and sand: Pebble to cobble gravel with common coarse sand. Gravel composition is quartzite, granite, minor basalt, and tuff
560- 570' Clayey sand and gravel: Tan (10YR 5/4) clayey fine sand and gravel, non-effervescent in HCl
570-598' Silty sand: Tan (10YR5/4) silty, very fine-grained sand with minor clay, clayey very fine-grained sand from 580-590'. Non- to very weakly-effervescent in HCl
598-645' Gravel and sandy gravel: Fining upward sequence of cobble to pebble gravel with silty, fine sandy gravel from 598-620'. Gravel composition is dark gray limestone, quartzite, latite, sandstone, and minor granite
645-690' Clay and silty clay: Tan (10YR 5/4) clay and silty clay, non-effervescent in HCl
690-710' Sandy gravel: Sandy gravel, same as 598-645 with increased percentage of granite clasts in gravel
710-720' Clayey silt: Tan clayey silt with minor gravel
720-750' Sand and Gravel: Coarse sand and gravel, gravel composition is same as 598-645' and 690-710', clayey gravel at base of interval
750-760' Clayey, silty, sand: Tan clayey, silty, fine sand, non-effervescent in HCl
760-800' Gravel and clay: Interbedded gravel and tan (7.5YR 5/4) silty clay. Clay intervals from 765-775', 785-790' may be soil horizons (?). Some CaCO3 nodules from 765-775'.
800-820' Gravel: Sandy pebble to cobble gravel composed of granite, quartzite, sandstone, rhyolite tuff, and limestone
820-860' Sand and clay: Brown (10YR 4/4) clayey, fine- to medium-grained sand (820-840'), sandy clay (840-850'), and fine- to coarse-grained sand (850-860'). Weakly to moderately effervescent in HCl
860-880' Clay and silty clay: Tan (10YR 5/4) clay and silty clay, strongly effervescent in HCl
880-900' Sandy gravel: Sandy pebble to cobble gravel, compositionally same as 800-820' plus latite (?)
900-930' Sand: Tan (10YR 4/3), fine-grained sand or sandstone with minor fine gravel. Weakly effervescent in HCl
930-970' Clayey sandy silt: Tan (10YR4/3) clayey, sandy silt, strongly effervescent in HCl
970-990' Sand and gravel: Coarse-grained sand and gravel
990-1020' Clayey sand: Tan (10YR 6/4-7.5YR 6/4) clayey very fine-grained sand, moderately effervescent in HCl
1020-1030' Sand and gravel: Fine-grained sand with minor gravel
1030-1120' Silty, clayey sand: Tan (10YR 5/4) silty and/or clayey very fine-grained sand, moderately effervescent in HCl
1120-1130' Gravel: Silty and/or sandy gravel, same composition as 800-820'
1130-1170' Sand: Tan (10YR 5/4) silty, very fine-grained sand with minor gravel, moderately to strongly effervescent in HCl
1170-1200' Silty clay: Tan (10YR 6/4) silty clay with sand at base, weakly effervescent in HCL from 1170-1190', non-effervescent from 1190-1200'
1200-1260' Sand: Pale brown, well sorted, moderately rounded, very fine-grained quartz lithic sand with common potassium feldspar. Sandy clay from 1230-1240'
1260-1280' Buried soil(?)/silty clay: Carbonate (Bk?) horizon, very fine sandy silt from 1260-1270', reddened tan (7.5YR 4/4) silty clay (Bt horizon?). Top of Ojo Caliente Mbr of the Tesuque Fm? Interval from 1260-1690 ft = Interbedded Ojo Caliente Mbr. and Chamita Fm., or Ojo Caliente Mbr.
1280-1300' Silty sand: Well sorted, silty, fine-grained sand
1300-1340' Silty sand: Light gray (10YR 7/2), silty, quartz-lithic sand with abundant carbonate (effervesces strongly in HCl)
1340-1350' Sandy gravel: Sandy gravel with clasts of sandstone, limestone, granite, and quartzite
1350-1470' Sand: Fine- to very fine-grained quartz lithic sand with reddened clayey sand from 1390-1400' and 1430-1450 (buried soils?).
1470-1530' Silty sand: White, fine-grained, carbonate-cemented, silty quartz sandstone with common lithics and minor potassium feldspar, effervesces violently in HCl
1530-1555' Silty clay: Tan (7.5YR 4/3) silty clay, non-effervescent in HCl. Buried soil?
1555-1600' Silty sand: Light gray (10YR 7/2) silty, fine-grained sand, effervesces strongly in HCl.
1600-1690' Silty sand: Pale brown (10YR 6/3-5/3), well-sorted, subrounded, very fine- to fine-grained, quartz-lithic sand, weakly to moderately effervescent in HCl.
1690-1780' Sand and minor gravel: White to light gray, well-rounded, well-sorted, carbonate cemented, fine-grained quartz-lithic sandstone with minor gravel from 1740-1750' (basalt clasts) and 1760-1780' (sandstone and quartzite). (Top of Ojo Caliente Mbr @1700 ft. based on geophysical logs)
1780-2110' Sand: Pale brown and white, well-sorted, rounded, fine- to very fine-grained, sandstone with carbonate cement from 1850-1870', 1950-1960', 1970-1980', 1990-2040', and 2090-2110', minor gravel from 2100-2110'.
2110-2140' Silty sand: Silty, very fine-grained sand weakly carbonate-cemented interval from 2120-2130'
2140-2240' Sand: White, fine- to very fine-grained quartz-lithic sand and weakly-cemented sandstone, more potassium feldspar than above. Carbonate cemented; effervesces strongly to violently in HCl
2240-2340' Silty sand and sandy silt: Pale brown (10YR 6/3), well-sorted, well-rounded, silty very fine-grained quartz plus potassium feldspar lithic sand and sandy silt. Effervesces moderately to weakly in HCl.
2340-2400' Silty sand: Pale brown (10YR 6/3), well-sorted, well-rounded, silty, fine- to very fine-grained quartz + potassium feldspar + lithic sand. Effervesces strongly in HCl
2400-2430' Sandy silt: Pale brown (10YR 6/3) sandy silt
2430-2450' Silty clay: Tan (7.5YR 4/3) silty clay, reddened from 2440-2450, moderately effervescent in HCl. Possible buried soil?
2450-2500' Sand: Pale brown (10YR 6/3), well-sorted, well-rounded, very fine-grained, quartz + potassium feldspar + lithic sand
2500-2530' Sand: Very pale brown (10YR 8/2), well-sorted, well-rounded, fine-grained, quartz lithic sand with minor potassium feldspar and abundant carbonate (strongly effervescent in HCl)
2530-2560' Silty sand: Pale brown (10YR 6/3), well-sorted, well-rounded, very fine- to fine-grained, quartz-lithic silty sand with minor potassium feldspar. Moderately effervescent in HCl
2560-2630' Sand: Pale brown (10YR 6/3), well-sorted, well-rounded, fine-grained, quartz sandstone with potassium feldspar and minor lithics. Weakly effervescent in HCl
2630-2650' Sandy silt: Light brown (7.5YR 6/3), carbonate cemented, fine-grained sandy silt.
2650-2660' Clay: Dark reddish-brown (7.5YR 4/3) clay, possible buried soil. Top of Chama-El Rito Mbr of Tesuque Fm?
2660-2690' Clayey silty sand: Light brown (7.5YR 6/3), well-sorted, subrounded, fine- to very fine-grained, clayey, silty, quartz sand with common lithics and potassium feldspar. Strongly effervescent in HCl
2690-2700' Clayey silt: Brown (7.5YR 4/4) clayey silt with minor gravel
2700-2740' Sand: Fine- to very fine-grained sand with scattered coarser sand and fine quartzite gravel
2740-2800' Silty sand and sand: Brown to reddish-brown (7.5YR - 5YR 4/4), moderately-sorted, subrounded, very fine-grained silty sand with minor clay from 2770-2780' and less silt from 2780-2800'
2800-2850' Sand and gravel: Brown (7.5YR 4/4), moderately-sorted, fine-grained, quartz lithic sand with minor quartzite gravel from 2800-1810' and 2840-2850', minor clay from 2830-2840'
2850-2870' Silty sand: Silty very fine-grained sand with abundant carbonate
2870-2900' Clayey sand and clay: Dark reddish-brown (5YR 4/3) clayey, very fine-grained sand and clay, non- to weakly-effervescent in HCl
2900-2930' Gravelly silty sand: Brown (7.5YR 4/4), gravelly, silty, fine-grained sand with sandy gravel from 2910-2920'. Clasts are quartzite and granite.
2930-2940' Silt: Brown (7.5YR 5/4) silt
2940-2980' Sand: Tan (7.5YR 5/4), well-sorted, moderately well-rounded, fine-grained, quartz lithic sand with minor gravel, non-effervescent in HCl
2980-3000' Clayey sand and silt: Tan (7.5YR 4/4), clayey, very fine-grained sand and silt
3000-3020' Sandy gravel: Fining upward sequence of sandy pebble-gravel to fine sandy granule gravel. Clasts are predominantly quartzite
3020-3040' Silty sand: Tan (7.5YR 5/4), well-sorted, subrounded to subangular, silty, very fine-grained sand with carbonate nodules (buried soil at top?). Weakly effervescent in HCl except for carbonate nodules
3040-3050' Silt: Brown (7.5YR 4/4) silt, non-effervescent in HCl
3050-3080' Sand and gravel: Subrounded to subangular, coarse to very coarse-grained quartz-lithic sand with subrounded pebble gravel from 3070-3080'. Lithics include quartzite, quartz, granite, and felsic volcanics.
3080-3130' Clayey silt silt: Reddish-brown (5YR 4/4) silt and sandy silt, non-effervescent in HCl
3130-3150' Silt and sandy silt: Reddish-brown (5YR 4/3) clayey silt, non-effervescent in HCl
3150-3155' Gravel: Fine granule to pebble gravel
3155-3220' Silty clay and clay: Reddish brown (5YR 4/3) silty clay/clayey silt (3155-3190'), and clay (3190-3220')