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Los Alamos
NATIONAL LABORATORY
EST. 1943

Environmental Programs
P.O. Box 1663, MS M991
Los Alamos, New Mexico 87545
(505) 606-2337/FAX (505) 665-1812

National Nuclear Security Administration
Los Alamos Site Office, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
(505) 667-4255/FAX (505) 606-2132

Date: June 4, 2009
Refer To: EP2009-0256

James P. Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Submittal of the Completion Report for Regional Aquifer Well R-40

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the Completion Report for Regional Aquifer Well R-40.

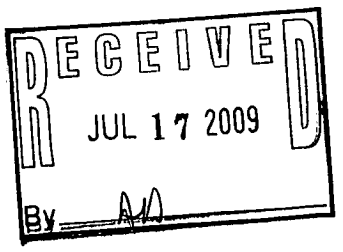
If you have any questions, please contact Mark Everett at (505) 667-5931 (meverett@lanl.gov) or Nancy Werdel at (505) 665-3619 (nwerdel@doeal.gov).

Sincerely,

Michael J. Graham, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

David R. Gregory, Project Director
Environmental Operations
Los Alamos Site Office



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Nancy Werdel, DOE-LASO, MS A316
Mark Everett, EP-LWSP, MS M992
RPF, MS M707 (with two CDs)
Public Reading Room, MS M992

Cy: (Letter and CD only)
Laurie King, EPA Region 6, Dallas, TX
Steve Yanicak, NMED-OB, White Rock, NM
Joe Sena, LATA, Los Alamos, NM
Kristine Smeltz, EP-WES, MS M992
EP-LWSP File, MS M992

Cy: (w/o enc.)
Tom Skibitski, NMED-OB, Santa Fe, NM
Keyana DeAguero, DOE-LASO (date-stamped letter emailed)
Michael J. Graham, ADEP, MS M991
Alison M. Dorries, EP-WES, MS M992
Paul Huber, EP-LWSP, MS M992
IRM-RMMSO, MS A150 (date-stamped letter emailed)

LA-UR-09-3067
June 2009
EP2009-0256

Completion Report for Regional Aquifer Well R-40

Los Alamos
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Prepared by the Environmental Programs Directorate

LA-UR-09-3067
EP2009-0256

Completion Report for Regional Aquifer Well R-40

June 2009

Responsible project leader:

Printed Name	Signature	Title	Organization	Date
Mark Everett	Mark Everett	Project Leader	Environmental Programs	6-2-09

Responsible LANS representative:

Printed Name	Signature	Title	Organization	Date
Michael J. Graham	Michael J. Graham	Associate Director	Environmental Programs	5/29/09

Responsible DOE representative:

Printed Name	Signature	Title	Organization	Date
David R. Gregory	Chris P. Watts for	Project Director	DOE-LASO	6/4/09

EXECUTIVE SUMMARY

The primary purpose of well R-40 is to provide detection monitoring for potential releases of hazardous or radioactive chemicals from Material Disposal Area H at Technical Area 54.

The "Drilling Work Plan for Regional and Intermediate Wells at Technical Area 54" states that "R-40 shall be drilled 100 ft into the regional aquifer, and [a] single completion well will be installed in the uppermost transmissive zone that is identified as optimal based on variations in production and on stratigraphic considerations within the Cerros del Rio basalt." Based on the stratigraphy encountered in production well PM-2 located approximately 500 ft south-south east from R-40, the R-40 borehole and well were expected to remain in basalt, and the regional groundwater was expected to be at 853 ft below ground surface (bgs).

Well R-40 was drilled and completed from September 24, 2008, to January 5, 2009. The borehole was drilled to a total depth of 910 ft bgs, extending approximately 75 ft into the saturated portion of the regional aquifer. Groundwater-screening samples were collected during drilling and well development. Cased-borehole geophysical logging was conducted to aid well design.

A multiple completion well was installed in the borehole. R-40 screen 1 is 33.4 ft long, positioned from 751.6 to 785.0 ft bgs in perched groundwater, and contains a 2.1-ft-long blank casing. R-40 screen 2 is 20.7 ft long and positioned from 849.7 to 870.0 ft bgs in the regional aquifer. A 3-in.-diameter polyvinyl chloride well designated as R-40i was also installed in the R-40 borehole to monitor perched groundwater. R-40i contains a 19.3-ft-long screen positioned from 649.7 to 669.0 ft bgs.

This well completion report describes site preparation, drilling, sampling, well installation, well completion, well development, aquifer testing, surface completion, geodetic survey, permanent pump and sampling system installation. Ongoing activities include permanent pump and sampling system installation, waste management, and site restoration.

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1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility that is located in north-central New Mexico, approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers 40 mi^2 of the Pajarito Plateau, which consists of a series of fingerlike mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 to 7800 ft above sea level.

Technical Area 54 (TA-54) is used for the management of radioactive solid and hazardous chemical wastes pursuant to the Laboratory's Resource Conservation and Recovery Act (RCRA) operating permit. TA-54 consists of Material Disposal Areas (MDAs) G, H, J, and L atop Mesita del Buey on the Pajarito Plateau at TA-54 (Figure 1.0-1). These four MDAs, consisting of underground pits, shafts, and trenches that contain hazardous chemicals and radionuclides, are located within the unsaturated units of Bandelier Tuff. MDA H is no longer actively receiving wastes; MDAs L and G currently are accepting wastes.

Well R-40 is one of several regional aquifer wells at TA-54 installed for groundwater monitoring to comply with the RCRA permit. Well R-40 is located approximately 1500 ft southeast of MDA H and upgradient of MDAs L and G (Figure 1.0-2).

Well R-40 was proposed in the "Technical Area 54 Well Evaluation and Network Recommendations, Revision 1" (LANL 2007, 098548) and "Drilling Work Plan for Regional and Intermediate Wells at Technical Area 54" (LANL 2007, 099662). The New Mexico Environment Department (NMED) approved these documents in 2007 (NMED 2007, 099257). This completion report summarizes the site preparation, drilling and sampling, well installation, and well completion activities for well R-40, in accordance with the requirements in Section IV.A.3.e.iv of the March 1, 2005, Compliance Order on Consent (the Consent Order).

1.1 Overview of R-40 Well Completion Report

The information presented in this report is compiled from field reports and daily activity summaries. Records, including field reports, field logs, and survey information, are on file at the Laboratory's Records Processing Facility (RPF). This report contains brief descriptions of all activities associated with the R-40 project, as well as supporting figures, tables, and appendixes.

Section 1 of this completion report describes the site, the purposes of well R-40, and an overview of the installation activities. Section 2 presents the scope of activities for site preparation, drilling, and sampling. Section 3 presents the results of field investigations. Well installation activities and well completion activities are described in Sections 4 and 5, respectively. Section 6 explains deviations from planned activities. References are provided in Section 7.

Appendixes include acronyms and abbreviations, a metric conversion table, and definitions of the data qualifiers used in this report (Appendix A); lithologic log (Appendix B); groundwater analytical results (Appendix C); borehole video logging (Appendix D, on DVD); Schlumberger geophysical logging report (Appendix E on CD); aquifer testing report (Appendix F); and a borehole abandonment information form (Appendix G).

1.2 Overview of Regional Well R-40

The purpose of well R-40 is to provide detection monitoring for potential releases of hazardous or radioactive chemicals from MDA H (Figure 1.0-2). The first R-40 borehole was drilled dry from July 11 to September 23, 2008, and was abandoned before reaching the regional aquifer due to stuck drilling tools. Perched groundwater was noted at 584 ft below ground surface (bgs).

The second R-40 borehole was drilled from September 24, 2008, to November 12, 2008, using the foam-assisted air-rotary casing hammer drilling method in an open and cased borehole. Perched groundwater was first observed at 784 ft bgs, and the regional aquifer was encountered at approximately 835 ft bgs. LANL Water Stewardship Program (LWSP) had predicted the regional groundwater at 853 ft bgs. A multiple screened well was designed and well installation activities were completed on November 20 and November 21, 2008.

R-40 screen 1 is 33.5 ft long, positioned from 751.6 to 785.1 ft bgs in perched groundwater. R-40 screen 2 is 20.7 ft long and positioned from 849.3 to 870.0 ft bgs in the regional aquifer. A 3-in.-diameter polyvinyl chloride (PVC) intermediate well designated as R-40i was also installed in the R-40 borehole to monitor perched groundwater higher in the borehole. R-40i contains a 19.4-ft-long screen positioned from 649.6 to 669.0 ft bgs.

Annular backfill materials were installed from November 22, 2008, to January 5, 2009, as the 11.75-in. removable casing was withdrawn from the borehole. As stipulated by the Consent Order, the R-40 borehole was drilled, and the well was installed, causing minimal impact to the in situ characteristics of the regional groundwater.

On January 6, 2009, well development activities were initiated on screen 2, and a 24-h aquifer test was conducted from January 14 to January 15, 2009. On January 16, 2009, a TAM packer was installed above screen 2 to isolate screen 1 and evaluate the perched groundwater above the regional aquifer. The perched groundwater in screen 1 was bailed dry and indicated a meager recovery rate of approximately 7 gpd. On January 25, 2009, well development activities were initiated on R-40i, and a 24-h aquifer test was conducted from January 27 to January 28, 2009.

In March and April 2009, well development pumping of R-40i and R-40 screen 1 was continued to meet the total organic carbon (TOC) target water-quality parameter. Once achieved, the TAM packer was removed and well development pumping continued at R-40 screen 2 to meet the turbidity water-quality parameter.

2.0 SCOPE OF ACTIVITIES

2.1 Preliminary Activities

Preliminary activities included preparing administrative planning documents, receiving contractual notice to proceed with field activities, and constructing the drill pad and access road.

2.1.1 Administrative Preparation

The following documents were prepared to support the implementation of the scope of work: "LSRS TA-54 Wells IWD" (Work Document # 327703-01); "R-37, R-40, and R-40 Construction Project Storm Water Pollution Prevention Plan Addendum" (LANL 2008); and "Waste Characterization Strategy Form for Drilling and Installation of Wells at TA-54 R-37, R-40 and R40."

2.1.2 Site Preparation

Site preparation activities were performed between June 25 and July 3, 2008, and involved constructing a drill pad and a 350-ft access road north of Pajarito Road and south of Mesita del Buey (Figure 1.0-2); excavating and lining a cuttings containment pit; and installing straw waddles to limit stormwater flow and prevent erosion. The drill pad was 21,800 ft^2 and elongated because of its location between Pajarito Road and an archeological buffer area at the slope of the south-facing cliff of Mesita del Buey. An existing gate off Pajarito Road was enlarged and used to control access to the R-40 access road and drill site. Except for the pit, the pad area and road were surfaced with base coarse gravel. Because of space limitations, the cuttings pit was obliquely trapezoidal and measured at an approximate depth of 50 ft × 30 ft × 15 ft × 8 ft. Radiation control technicians from the Laboratory's Radiation Protection Group performed radiological screening of the site before pad and road construction and of samples and equipment before transport from the site, as needed.

LATA/SHARP Remediation Service, LLC, set up an office trailer and generator, and WDC Exploration & Wells (WDC) mobilized drilling equipment on July 11, 2008. Municipal water for construction and drilling activities was obtained from a fire hydrant located at TA-18. A safety fence was installed around the cuttings containment pit, and signs were posted at the entrance to the site to limit access to authorized personnel.

2.2 Drilling Activities

This section describes the drilling strategy and provides a chronology of drilling activities conducted at R-40.

2.2.1 Drilling Strategy

The R-40 boreholes were drilled using a Speedstar 50K air-rotary drilling rig manufactured by George E. Failing & Co. The field crew worked one 10-h shift per day, 10 d on and 4 d off. From July 11 to September 23, 2008, the first R-40 borehole was drilled with air as the primary drilling fluid. On July 30, 2008, perched groundwater was encountered at a depth of 594 ft bgs, and a screening sample was bailed from 608.2 ft bgs. This borehole encountered multiple drilling problems, including stuck tools, and was abandoned before reaching the regional aquifer.

From September 24 to November 10, 2008, the second R-40 borehole was drilled to a total depth (TD) of 910 ft bgs using air rotary and casing advance. The second borehole was located 20 ft north-northeast from the first borehole. A relatively thick mixture of municipal water and Baroid AQF-2 foaming agent were added from below the surface casing to 750 ft bgs to cool the bit and lift cuttings from the borehole. From 750 to 910 ft bgs, no foam was added and only municipal water and air were used as the drilling fluids; this allowed for drilling and completion of the well in the saturated portion of the regional aquifer without using drilling mud or additives. The estimated cumulative total of liquid drilling fluids introduced to and recovered from the borehole is presented in Table 2.2-1.

Below the surface conductor casing, the borehole was drilled "open" to a depth of 753 ft bgs using 14.75-in. tricone or downhole hammer bits. Because of injection of municipal water and foaming agent in the second borehole, the perched groundwater encountered at 594 ft bgs in the first borehole was obscured. From 753 to 902 ft, 11.75-in. diameter removable threaded casing was advanced using a hammer and Stradex underreamer bit. From 902 to 910 ft bgs, the borehole was finished using an 11.5-in. tricone bit, and the casing freely advanced because of the weight of the casing string.

Groundwater was first noted during drilling the second R-40 borehole at 778 ft bgs on October 27, 2008. After that, water levels were collected each morning before drilling resumed; the measurements rose and stabilized at approximately 633 ft bgs. Subsequent evaluation determined this groundwater to be perched. After the borehole and casing advanced beyond 872 ft bgs, the morning water levels steadily dropped and stabilized at approximately 835 ft bgs. LWSP had predicted the regional groundwater level at R-40 to be 853 ft bgs.

2.2.2 Chronological Drilling Activities

On September 24, 2008, the drilling rig was moved to the second borehole location, 20 ft north-northeast of the first borehole.

On September 25, 2008, drilling started and a 16-in. surface conductor casing was installed to 40.5 ft bgs.

On September 26, 2008, the open borehole beneath the surface casing reached 85 ft bgs using a 14.75-in. tricone button bit in the Tshirege Member of the Bandelier Tuff.

On September 27, 2008, the open borehole reached 260 ft bgs using the 14.75-in. tricone button bit in the Tshirege and Otowi Members of the Bandelier Tuff.

On September 28, 2008, the drilling rate slowed significantly upon encountering the Guaje Pumice Bed at 430 ft bgs. At 445 ft bgs, WDC tripped out to replace the tricone bit with the hammer bit.

On September 29, 2008, WDC removed the tricone bit and started tripping in the hammer bit. The open borehole depth remained at 445 ft bgs.

On September 30, 2008, the hammer bit encountered the Cerros del Rio basalt at 448 ft bgs and loose material lodged the bit at 490 ft bgs. The bit was free by the end of the day.

On October 1, 2008, the hammer bit was replaced by the tricone button bit, which reached 510 ft bgs by the end of the day.

On October 2, 2008, the open borehole and tricone button bit reached 523 ft bgs at the end of the day.

From October 3 to October 6, 2008, drilling activities were suspended for a 4-d break.

On October 7, 2008, the open borehole and tricone button bit reached 563 ft bgs at the end of the day.

On October 8, 2008, the open borehole and tricone button bit reached 615 ft bgs at the end of the day. Because of injecting municipal water and foam, the perched groundwater observed at 594 ft bgs in the first borehole was not observed.

On October 9, 2008, recovery of drill cuttings stopped at 643 ft bgs and the open borehole and tricone button bit reached 646 ft bgs. The Laboratory camera was mobilized to the site to assess the borehole.

On October 10, 2008, the Laboratory camera was deployed to 645 ft bgs. The results of the video log indicated that the borehole was enlarged and irregular from 470 to 490 ft bgs but relatively consistent below 500 ft bgs. Open borehole drilling continued using the 14.75-in. tricone button bit and reached 655 ft bgs at the end of the day.

On October 11, 2008, the open borehole and tricone button bit reached 670 ft bgs at the end of the day. Foamy water was recovered but not drill cuttings.

On October 12, 2008, the open borehole and tricone button bit reached 690 ft bgs at the end of the day. Foamy water was recovered but not drill cuttings.

On October 13, 2008, the open borehole and tricone button bit reached 702 ft bgs at the end of the day. Foamy water was recovered but not drill cuttings.

On October 14, 2008, the open borehole and tricone button bit reached 717 ft bgs at the end of the day. Foamy water was recovered but not drill cuttings.

On October 15, 2008, the drilling rate increased slightly at 725 ft bgs and reached 743 ft bgs at the end of the day. Sandstone fragments were observed in the returned drill cuttings.

On October 16, 2008, the borehole reached 750 ft bgs and foam was no longer added to the municipal water drilling fluid. At 753 ft bgs, the drilling rate slowed significantly and preparation began for installing 11.75-in. casing next week.

From October 17 to October 20, 2008, drilling activities were suspended for a 4-d break.

On October 21, 2008, bulk sand was transported from the Pajarito Lay-Down Yard to the R-40 site and backfilled into the open borehole from 753 to 664 ft bgs. The sand was required to support the weight of the 11.75-in. casing.

On October 22, 2008, the sand backfill rose to 427 ft bgs in the open borehole and 11.75-in. casing was tripped in 327 ft bgs.

On October 23, 2008, the 11.75-in. casing was tripped in to 427 ft bgs. The drill rods, hammer, and Stradex bit were tripped in and advanced the casing within the sand backfill to 487 ft bgs.

On October 24, 2008, the 11.75-in. casing was advanced within the sand backfill to 587 ft bgs.

On October 25, 2008, the 11.75-in. casing was advanced within the sand backfill to 687 ft bgs.

On October 26, 2008, the 11.75-in. casing reached the bottom of the sand backfill at 753 ft bgs.

On October 27, 2008, WDC advanced the 11.75-in. casing below the 14.75-in borehole at 753 ft bgs. From 778 to 784 ft bgs, the driller reported that the borehole was making water; injecting municipal water was stopped because formation water was sufficient to recover cuttings.

On October 28, 2008, the depth to water (DTW) was measured at 734 ft bgs inside the 11.75-in. casing with the drill string (rods, hammer, Stradex bit) in-place. A groundwater-screening sample was air-lifted from 784 ft bgs and the casing was advanced to 798 ft bgs. At the end of the day, the Stradex bit was retracted and the casing was lowered to the bottom of the borehole.

On October 29, 2008, the DTW was measured at 633.4 ft bgs inside the 11.75-in. casing. The casing was advanced and groundwater-screening samples were air-lifted at casing joint connections at 807 and 827 ft bgs. At the end of the day, the Stradex bit was retracted and the casing was lowered to the bottom of the borehole.

On October 30, 2008, the DTW was measured at 633.8 ft bgs inside the 11.75-in. casing. The casing was advanced, and a groundwater-screening sample was air-lifted at the 847 ft bgs casing joint connection. At the end of the day, the Stradex bit was retracted and the casing was lowered to the bottom of the borehole.

From October 31 to November 3, 2008, drilling activities were suspended for a 4-d break.

On November 4, 2008, the DTW was measured at 636 ft bgs inside the 11.75-in. casing. The casing was advanced from 847 ft bgs and a groundwater-screening sample was air-lifted at the 867 ft bgs casing joint connection. As the casing was advanced from 867 to 872 ft bgs, no water or cuttings were recovered, although municipal water was injected to aid cuttings recovery. At the end of the day, the Stradex bit was retracted and the casing was lowered to the bottom of the borehole.

On November 5, 2008, the DTW was measured at 769 ft bgs inside the 11.75-in. casing, and a groundwater-screening sample was air-lifted from 872 ft bgs. The casing was advanced from 872 ft bgs in Puye Formation dacitic gravel and pebbles; a groundwater-screening sample was air-lifted at the 887 ft bgs casing joint connection. At the end of the day, the 11.75-in. casing was advanced to 892 ft bgs; the Stradex bit was retracted and the casing was lowered to the bottom of the borehole.

On November 6, 2008, the DTW was measured at 811 ft bgs inside the 11.75-in. casing. The casing was advanced from 892 to 902 ft bgs and WDC tripped out the Stradex bit for evaluation. The DTW was measured at 840 ft bgs inside the 11.75-in. casing with the drill string removed. LWSP indicated that the well could be installed with the casing at 910 ft. Schlumberger, Inc., was called to perform cased-borehole geophysical logging to aid the well design.

On November 7, 2008, the DTW was measured at 839 ft bgs inside the 11.75-in. casing and WDC tripped in the drill string with an 11.5-in. tricone bit. The tricone bit drilled and removed poorly sorted Puye Formation dacitic pebbles and cobbles from the borehole, allowing the casing to advance from 902 to 910 ft bgs. The TD of the R-40 borehole was 910 ft bgs.

2.3 Sampling Activities

The following sampling activities were performed at R-40.

Drill cuttings were collected at 2- to 5-ft intervals from the cuttings discharged into the lined cuttings containment pit. The cuttings were sieved, collected in chip trays, and examined to characterize the lithology and stratigraphy of the R-40 borehole and to generate the lithologic log in Appendix B.

In the first borehole, a screening sample was bailed from perched groundwater at 608.2 ft bgs and analyzed for volatile organic compounds (VOCs), high explosives (HE), and low-level tritium at off-site laboratories and for dissolved cations/metals and anions at the Laboratory's Earth and Environmental Science Group (EES-14) chemistry laboratory.

In the second borehole, a screening sample was air-lifted from perched groundwater at 784 ft bgs and analyzed for the same suite (VOCs, HE, and low-level tritium at off-site laboratories and for dissolved cations/metals and anions at the EES-14 chemistry laboratory).

Subsequent groundwater-screening samples from the second borehole were collected at 807 ft, 827 ft, 847 ft, 867 ft, 872 ft, 887 ft, and 910 ft bgs and analyzed for dissolved cations/metals and anions at the EES-14 chemistry laboratory.

After well installation, a predevelopment groundwater-screening sample was collected from screen 2 and analyzed for low-level tritium at an off-site laboratory and for dissolved cations/metals and anions at the EES-14 chemistry laboratory. Screen 2 development groundwater was sampled and measured for the following water parameters: pH, specific conductivity, temperature, turbidity, dissolved oxygen, and salinity. In addition, samples were also submitted for TOC analysis at the EES-14 chemistry laboratory. LWSP collected a full-suite groundwater sample from R-40 screen 2 on January 19, 2008, at the conclusion of the 24-h aquifer test.

From R-40i, a predevelopment perched groundwater-screening sample was collected and analyzed for low-level tritium at an off-site laboratory and for dissolved cations/metals and anions at the EES-14 chemistry laboratory. R-40i development water was sampled and measured for the following water parameters: pH, specific conductivity, temperature, turbidity, dissolved, and salinity. In addition, some samples were also submitted for TOC analysis at the EES-14 chemistry laboratory. On January 28, 2008, LWSP collected a full suite groundwater sample from R-40i at the conclusion of the 24-h aquifer test.

In March and April 2009, additional samples were collected from continued development pumping from R-40i and R-40 screens 1 and 2. These additional development samples were analyzed for TOC and dissolved cations/metals and anions at EES-14 chemistry laboratory.

Waste characterization samples were collected of dry cuttings dumped into rolloff containers, wet cuttings and drilling water discharged into the lined cuttings containment pit, and well development water contained in aboveground storage tanks.

Sampling documentation and containers were provided by the Laboratory and processed through the Laboratory's Sample Management Office. Groundwater analytical results and details of groundwater chemistry at R-40 are presented in Appendix C. Table 2.3-1 presents a summary of groundwater samples collected during drilling, well development, and aquifer testing at well R-40.

2.4 Geophysical Testing

On October 10, 2008, the Laboratory camera was used to evaluated the borehole and determine why drill cuttings were not returning to the surface. The borehole video is included as Appendix D.

On November 8, 2008, Schlumberger, Inc., performed geophysical logging of the cased borehole. The logging suite consisted of Accelerator Porosity Sonde, Triple Litho-Density, Natural Gamma, Natural Gamma-Ray Spectrometer, Elemental Capture Sonde, Thermal Neutron, and Epithermal Neutron. The results of the geophysical logging are included in Appendix E and were used to further define lithologic contacts (Appendix B) and design the R-40 well.

On November 10, 2008, the Laboratory ran natural gamma and induction logs of the cased borehole.

3.0 FIELD INVESTIGATION RESULTS

3.1 Geology and Hydrogeology

A brief description of the geologic and hydrogeologic features encountered at R-40 is presented here, and a more detailed log is included in Appendix B. The Laboratory's geology task leader and site geologists examined cuttings and geophysical logs to determine geologic contacts. Drilling observations, video logging, water-level measurements, and geophysical logs were used to characterize the perched and regional groundwater encountered at R-40.

3.1.1 Stratigraphy

The stratigraphy for the R-40 borehole is presented in order of youngest to oldest geologic units. Lithologic descriptions are based on samples of discharged cuttings. Cuttings and borehole geophysical logs were used to identify geologic contacts. Figure 3.1-1 illustrates the stratigraphy at R-40. A detailed lithologic log is presented in Appendix B.

Quaternary Alluvium, Qal (0–40 ft bgs)

Quaternary alluvium consisting of loamy soil and silty sand with volcaniclastic gravel and pebbles was encountered from 0 to 40 ft bgs. Alluvial groundwater was observed and sealed by the surface conductor casing.

Cooling Unit 1g, Tshirege Member of the Bandelier Tuff, Qbt 1g (40–154 ft bgs)

Cooling Unit 1g of the Tshirege Member of the Bandelier Tuff is present from 40 to 154 ft bgs. Unit 1g is a glassy, lithic-bearing, pumiceous, poorly welded ash-flow tuff. At its upper contact, the unit is reddish gray and moderately indurated and typically transitions within 10 to 20 ft to a light pinkish gray, less indurated (softer) ash-flow tuff. It contains reddish gray to gray, subangular to subrounded, intermediate composition volcanic rocks (lithics) up to 15 mm in diameter. Light olive-green vitric pumice lapilli have a waxy luster and well-developed flow-tube structure. The lapilli are harder than the surrounding tuff matrix.

Tephra and Volcaniclastic Rocks of the Cerro Toledo Interval, Qct (154–172 ft bgs)

Tephra and volcaniclastic rocks of the Cerro Toledo interval are present from 154 to 172 ft bgs. The Cerro Toledo interval is time hiatus, represented by tuffaceous sedimentary deposits separating the Tshirege and Otowi Members of the Bandelier Tuff. The deposits are predominantly reworked tuff with some sands, gravels, and cobbles derived from the Tshicoma dacite in the Jemez Mountains west of the Pajarito Plateau.

Otowi Member of the Bandelier Tuff, Qbo (172–430 ft bgs)

The Otowi Member of the Bandelier Tuff is present from 172 to 430 ft bgs. The Otowi Member is a glassy, lithic-bearing, pumiceous, poorly welded ash-flow tuff. It contains reddish gray to gray, subangular to subrounded, intermediate composition volcanic rocks up to 15 mm in diameter. Vitric pale yellow to white pumice lapilli contain conspicuous phenocrysts of quartz and sanidine.

Guaje Pumice Bed of the Otowi Member of the Bandelier Tuff, Qbog (430–448 ft bgs)

The Guaje Pumice Bed is present from 430 to 448 ft bgs. The pumice bed contains abundant pumice fragments (up to 97%) with subordinate amounts of volcanic lithics, quartz and sanidine phenocrysts, trace mafic minerals, and fine ash.

Cerros del Rio Basalt (448–795 ft bgs)

Cerros del Rio basalt, from 448 to 795 ft bgs, consists of multiple lava flows of vesicular to massive porphyritic basalt with an aphanitic groundmass. Local cinder and basaltic sedimentary deposits may represent interflow horizons. Basalt ranges from dark to medium gray; cinder is typically red to reddish gray.

Basalt-Rich Puye Formation Fanglomerate (795–845 ft bgs)

From 795 to 845 ft bgs, the cuttings consist predominantly of basalt and dacitic pebbles and cobbles; however, a small percentage (<5%) consists of sandstone, siltstone, and pre-Cambrian quartzite and granite. Because some of the fragments are well rounded (i.e., not caused by drilling), the origin of the unit was interpreted to be sedimentary. The presence of exotic lithologies and the sedimentary nature of the basalt and dacitic clasts designated this unit as basalt-rich Puye Formation fanglomerate.

Transition Zone (845–862 ft bgs)

Below 862 ft bgs, basalt fragments were absent. From 845 to 862 ft bgs, the bulk amount of basalt decreased and dacite increased; this indicated a transition zone.

Puye Formation Fanglomerate (862–910 ft bgs)

Puye Formation fanglomerate is present from 862 to 910 ft bgs and consists predominantly of porphyritic dacitic gravel, pebbles, and cobbles. Basalt fragments are absent.

3.1.2 Groundwater

On October 27, 2008, groundwater was first noted in the second R-40 borehole while drilling from 778 to 784 ft bgs. At the start of operations on October 28, 2008, the DTW was measured at 734 ft bgs inside the 11.75-in. casing. Table 3.1-1 provides water levels measured during R-40 drilling.

LWSP had predicted the depth to the regional aquifer at 853 ft bgs. From October 28 to November 4 as the casing and borehole advanced from 784 to 872 ft, the DTW measured inside the 11.75-in. casing ranged from 559.6 to 705 ft bgs; these measurements were interpreted to be perched water (Table 3.1-1). After advancing deeper than 872 ft, the DTW measurements progressively dropped to values more indicative of the regional aquifer.

After drilling ended at 910 ft bgs and before well construction, the DTW was measured from 833 to 838 ft bgs. During well construction and following periods of inactivity, DTW was measured from 852 to 855 ft bgs. Table 3.1-1 also provides DTW measurements before and during well construction.

4.0 WELL INSTALLATION

4.1 Well Design

The R-40 well was designed in accordance with the Consent Order and the well design was approved by NMED before installation. R-40 was designed as a multiple completion well using two screens; the lower screen (R-40 screen 2) was designed to monitor the regional groundwater. The upper screen (R-40 screen 1) was installed to monitor perched groundwater. In addition, a separate intermediate well designated as R-40i was designed to monitor perched groundwater at a higher elevation in the borehole.

4.2 R-40 Well Construction

R-40 well installation activities were started on November 20, 2008, and completed on January 5, 2009. The Speedstar 50K rig was used for all well construction activities.

The R-40 well was constructed of 5.0-in.-inside diameter (I.D.)/5.563-in.-outside diameter (O.D.) type A304 stainless-steel casing fabricated to American Society for Testing and Materials (ASTM) A312 standards. External couplings (also type A304 stainless steel fabricated to ASTM A312 standards) were used to connect individual casing and screen sections.

R-40 screen 2 was designed from 850 to 870 ft bgs and was positioned from 849.27 to 870.0 ft bgs. Screen 2 consisted of two 10-ft sections of 5.0-in.-I.D. rod-based 0.020-in. wire-wrapped screen slots. The coupled union between threaded sections was approximately 0.7 ft long. The bottom of screen 2 at 870.0 ft bgs exactly matched the design; however, the top depth was slightly off the target depth due to

the threaded connection. The casing and screens were factory-cleaned and steam-cleaned on-site before installation. A 25-ft stainless-steel sump with bottom cap was placed below screen 2.

R-40 screen 1 was designed from 755 to 785 ft bgs and was positioned from 751.59 to 785.06 ft bgs. Screen 1 consisted of three 10-ft sections of 5.0-in.-I.D. rod-based 0.020-in. wire-wrapped screen slots. The coupled unions between threaded sections were 0.7 ft long, and a 2.1-ft-long blank casing was required to clamp the well on the drill rig table as the third screen section was hoisted into place. If applied incorrectly, the table clamp would have damaged the slotted portion of the second screen section. The bottom of screen 1 at 785.06 ft bgs nearly matches the design target; however, the top depth was 3.41 ft above the target depth due to the threaded connections and casing blank.

The well was assembled from the bottom up and lowered into the borehole. The bottom of the sump was positioned at 895 ft bgs. Figure 4.2-1 presents an as-built schematic showing construction details for the completed well.

After the well casing was assembled and lowered into the borehole, the process of installing annular backfill materials was started. A 2.0-in.-I.D. steel tremie pipe was used to deliver the annular backfill materials under pressure; the materials were mixed with municipal water and pumped through the tremie pipe. To document that the annular materials settled to the proper position, the depth of the annular material was repeatedly measured using a depth to bottom tagger and recorded. As the backfilling process progressed, the tremie pipe and 11.75-in. casing were withdrawn from the well.

Figure 4.2-1 also illustrates the types, depths, calculated volumes, and actual volumes of annular materials used in relation to the R-40 well screens. As the sand filter pack was installed around screen 2, over three times the calculated volume was required to fill fractures and voids in the basalt. During annular material installation, the screened intervals were mechanically surged to settle the sand filter packs before installing subsequent annular materials.

After annular material had been installed around R-40 screens 2 and 1 and a 10-ft bentonite seal was installed and hydrated above screen 1, water levels were repeatedly measured using a depth to water meter from 643 to 647 ft bgs outside the 5.0-in.-I.D. well casing. The bentonite chip seal was brought up to 675 ft bgs as the 11.75-in. casing was withdrawn in 40-ft increments. The remainder of the casing was removed in preparation for the installation of well R-40i.

4.2.1 R-40i Construction

Well R-40i installation activities were started on December 17, 2008, and completed on December 18, 2008.

Well R-40i was constructed of 3.0-in.-I.D./3.5-in.-O.D. flush-threaded schedule 80 PVC pipe. The screen was designed from 650 to 670 ft bgs and was positioned from 649.67 to 669.02 ft bgs. The screen consisted of two 10-ft sections (end-to-end) of 3.0-in.-I.D. 0.020-in. PVC screen slots and couplings. The slotted interval was 19.35 ft long, including the coupled union between the threaded sections. The casing and screens were factory-cleaned and steam-cleaned on-site before installation. A 5.58-ft PVC sump with bottom cap was placed below the screen.

The PVC well was assembled from the bottom up and lowered into the borehole adjacent to the R-40 stainless-steel well. The bottom of the PVC sump was positioned at 674.6 ft bgs. Figure 4.2-1 also illustrates the R-40i well and annular backfill material.

After the R-40i well casing was assembled and lowered into the borehole, the process of installing annular backfill materials continued. The 2.0-in.-I.D. steel tremie pipe was reinstalled to deliver the annular backfill materials under pressure using municipal water. To document that the annular materials

settled to the proper position, the depth of the annular material was repeatedly measured using a depth-to-bottom tagger and recorded. The R-40i screen was mechanically surged to settle the sand filter pack before installing subsequent annular materials.

Once the transition sand and a 20-ft thick bentonite seal were installed above the R-40i screened interval, backfilling operations consisted of slowly pouring bentonite chips into the well annular space while the hydration water was pumped to depth. The tremie pipe was withdrawn in increments.

On January 5, 2009, the bentonite seal was brought up to 16 ft bgs. LWSP designated January 5, 2009, as the well completion date for R-40 and R-40i, as defined in Section IV.A.3.e.iv of the Consent Order.

5.0 WELL COMPLETION

5.1 Well Development

The R-40 screens (2 and 1), and R-40i were developed by mechanical means, including swabbing, bailing, and pumping. Target water-quality parameters were turbidity <5 nephelometric turbidity units (NTUs), TOC <2 ppm, and other parameters stable. A Pulstar 1200 work-over rig was used for all well development activities.

In general, development activities started at screen 2 and proceeded to screen 1 and R-40i.

5.1.1 R-40 Screen 2

Initial well development of screen 2 was conducted between January 6, 2009, and January 12, 2009. First, the well sump was bailed using a bailer fitted with a mechanical suction device to remove silt and sand accumulated in the sump. Next, the screen was swabbed to disturb formation fines settled in the sand filter pack. The swabbing tool was a 5.0-in.-O.D. 1-in.-thick nylon disc attached to a steel rod, lowered by wireline and drawn repeatedly across the screened interval. Then the bailer was used to remove groundwater until the recovered water was clear.

After swabbing and bailing, a 5.0-hp, 4-in.-O.D. Grundfos submersible pump was lowered into the well to continue well development. During well development pumping, water levels were measured to ensure that the pumping did not draw down the water column in the well and expose the pump. This also helped establish a preliminary flow rate of approximately 4 gpm for screen 2. Table 5.1-1 lists water levels measured in screen 2 during development.

Also during well development pumping, groundwater was sampled and measured on-site for pH, specific conductivity, temperature, turbidity, dissolved, and salinity. The instrument used was a Horiba Water Quality Checker Model U-10. Additional groundwater samples were collected for TOC analysis. The field parameter measurements for screen 2 are tabulated in Table 5.1-2 and included in Appendix C.

5.1.2 R-40 Screen 2 Aquifer Testing

On January 12, 2009, well development pumping was halted and preparation began for aquifer testing by David Schafer and Associates. To perform the aquifer testing, an inflatable packer was positioned above a 5-hp Grundfos submersible pump and deployed into the well. Simultaneously, nonvented In-Situ Level Troll 700 transducers were positioned below the pump, above the packer, and in R-40i. The packer was inflated to isolate screen 2 from screen 1 and minimize the effects of casing storage on the test data. Short-duration pumping tests were conducted on January 13, 2009, and a 24-h aquifer pumping test was

conducted between January 14 and 15, 2009. The transducers remained in the well, collecting aquifer recovery data until they were removed on January 20, 2009. Results of the aquifer tests are described in Appendix E.

At the conclusion of the 24-h aquifer test, the measured water-quality parameters were turbidity at 8 NTUs and TOC at 1.47 mg/L. TOC was below the development target (2 mg/L; however, turbidity was above the target [5 NTUs]).

5.1.3 R-40 Screen 1

As preparation for development of screen 1, a TAM packer was deployed and positioned in the well above screen 2. Municipal water under pressure was used to inflate the packer. The top of the TAM packer element was set at 845 ft bgs. The delivery pipe was detached from the packer and removed from the well.

Development of screen 1 was initiated on January 21, 2009. The DTW measured in screen 1 (761.33 ft bgs) indicated that approximately 10 ft of screen 1 was not submerged in water (Table 5.1-3). Therefore, municipal water was injected to flood the screened interval to allow swabbing the screen. Following swabbing, the water and suspended sediment were bailed from the well. The recovery of groundwater in screen 1 following bailing indicated a meager recharge of approximately 7 gpd. The injection/swabbing process was repeated several times and had little impact on the sluggish recovery. The rate of groundwater flowing into screen 1 was insufficient to conduct a 24-h aquifer pumping test.

Development activities were directed to well R-40i.

5.1.4 R-40i

On January 8, 2009, the DTW was measured in R-40i at 640.45 ft bgs (Table 5.1-4). This measurement was collected 4 wk after R-40i was constructed and is approximately 9 ft above the screen slots.

The first perched groundwater recovered from R-40i was 12 gal. bailed on January 12, 2009. The sample was characterized as light brown and emitted a slight sulfur odor. Turbidity was measured at 60 NTUs. A TOC sample was not collected; however, a screening sample (RC54-09-1038) was collected. On January 25, 2009, a 1.5-hp, 3-in.-O.D. SQ submersible pump was positioned in the PVC well with the intake set at 656.5 ft bgs. The groundwater was very foamy and was measured on-site for pH, specific conductivity, temperature, turbidity, dissolved oxygen, and salinity. The instrument used was a Horiba Water Quality Checker Model U-10. Initial turbidity was 23 NTUs and quickly dropped to 1 NTU. TOC was analyzed at 8.75 mg/L. The field parameter measurements are included in Appendix C.

The flow rate was estimated at 1.5 to 2.0 gpm without drawing down the water column. The decision was reached to conduct a 24-h aquifer test in R-40i.

5.1.5 R-40i Aquifer Testing

On January 26, 2009, well-development pumping of R-40i was halted, and preparation began for aquifer testing by David Schafer and Associates. To perform the aquifer testing in R-40i, a nonvented In-Situ Level Troll 700 transducer was positioned below the pump in R-40i. Short-duration pumping tests were conducted on January 26, 2009, and a 24-h aquifer pumping test was conducted between January 27 and 28, 2009. The transducer remained in the well collecting aquifer recovery data until it was removed on February 3, 2009. Results of the aquifer tests are described in Appendix E.

At the end of the aquifer testing in R-40i, water-quality parameters were turbidity at 1 NTU and TOC at 11.22 mg/L. Turbidity was below the development threshold of 5 NTUs, but TOC was above the development threshold of 2 ppm (mg/L) due to the presence of drilling foam.

5.2 Continued Development Pumping

On March 3, 2009, the WDC Pulstar 1200 work-over rig returned to R-40 for continued development pumping to meet the target well-development parameters. The TAM packer remained at 845 ft bgs between screen 1 and 2. Separate pumps and discharge pipes were deployed into well R-40i and R-40 screen 1. Well R-40i was pumped daily at approximately 3 gpm without going dry. Periodically, the pump in R-40i was stopped, and the discharge apparatus (including meter) was transferred to the discharge pipe in R-40 screen 1. Because of the meager recovery, from 45 to 82 gal. was pumped following recovery of groundwater in R-40 screen 1. Development pumping resumed in R-40i on March 5, 2009, and R-40 screen 1 on March 6, 2009.

5.2.1 R-40 Screen 1

Continued development pumping from R-40 screen 1 occurred in seven periodic pumping events from March 6 to April 10, 2009. The dates and volumes of the pumping events are listed as bold subheadings in Table 5.2-1. On April 10, 2009, the concentrations of TOC in samples collected were 1.9 mg/L and 1.8 mg/L; turbidity was consistently 0 NTU. LWSP directed that development of R-40 screen 1 was complete. Water-quality parameters, TOC results, and end-of-day cumulative volume pumped from R-40 screen 1 are tabulated in Table 5.2-1.

To collect the first full suite groundwater sample from R-40 screen 1, the pump and discharge pipe remained in place while the groundwater recharged. On April 21, 2009, LWSP collected the end-of-development full suite groundwater sample. The total volume of water removed from R-40 screen 1, including the end-of-development sample event, was 1238.7 gal.

5.2.2 R-40i

Continued development pumping from R-40i extended from March 5 to April 28, 2009. On April 24, 2009, the concentrations of TOC in samples collected were 1.7 mg/L and 1.4 mg/L, respectively. On April 27, 2009, the concentrations of TOC in samples collected were 1.8 mg/L and 2.4 mg/L, respectively. Turbidity was consistently 0 NTU. Before receiving the TOC result for the second sample collected on April 27, 2009, LWSP directed that development of R-40i was complete.

A total volume of 37163.2 gal. of perched groundwater was removed from R-40i. Water-quality parameters, TOC results, and end-of-day cumulative volume pumped from R-40i are tabulated in Table 5.2-2.

5.2.3 R-40 Screen 2

On April 21, 2009, the pump and discharge pipe were removed from R-40 screen 1, and the TAM packer was removed from between screens 1 and 2. The 5.0-hp, 4-in.-O.D. Grundfos submersible pump was positioned below an inflatable packer and deployed to screen 2 to continue well development pumping. The packer was inflated to isolate screen 2 from screen 1.

Continued development pumping from R-40 screen 2 extended from April 23 to April 28, 2009. On April 27, 2009, the turbidity of groundwater collected for field parameters was at or below the threshold of 5 NTUs. On April 28, 2009, the final turbidity measurement was 2 NTUs. The concentration of TOC in all

samples from R-40 screen 2 during continued development pumping was consistently below the threshold of 2 mg/L. LWSP directed that development of R-40 screen 2 was complete. Water-quality parameters, TOC results, and end-of-day cumulative volume pumped from R-40 screen 2 are tabulated in Table 5.1-2.

5.3 Dedicated Sampling System Installation

In June 2009, a dedicated Baski dual completion sampling system and transducers were installed for sampling and monitoring R-40 screens 1 and 2. The Baski system relies on a permanent packer and liquid inflation chamber to separate groundwater in screens 1 and 2. Details of the dedicated sampling system designed for R-40 are presented in Figure 5.3-1.

For screen 2, a 4.0-in.-O.D. Grundfos pump and 2-hp electric motor were deployed into the well on a type A304 grade stainless-steel 1.0-in.-I.D. discharge pipe. The intake for the Grundfos pump was set at 871 ft bgs. For screen 1, a 1.8-in.-O.D. Bennett pump and associated air tubes (supply and exhaust), water-level indicator, and discharge tube were deployed. The intake for the Bennett pump was set at 788 ft bgs. Simultaneously, two 1.0-in.-I.D. flush-threaded schedule 40 PVC pipes were installed for a dedicated In-Situ Level Troll 500 vented transducer in each screened interval. For passing through the Baski packer, the screen 2 transducer access tube was constructed of 1.0-in. type A304 grade stainless-steel pipe and adapters. The transducers must be removed to conduct manual water-level measurements.

For R-40i, a 1.8-in.-O.D. Bennett electric pump was deployed on type A304 grade stainless-steel 1.0-in.-I.D.discharge pipe. The intake for the Bennett pump in R-40i was set at 669 ft bgs. Simultaneously, a 1.0-in.-I.D. flush threaded schedule 40 PVC pipe was installed for a dedicated In-Situ Level Troll 500 vented transducer. The transducer must be removed to conduct manual water-level measurements.

For R-40, the sampling system discharge pipes and the transducer tubes rest on a 0.5-in. thick 6-in. diameter stainless-steel landing plate positioned atop the stainless-steel well riser. For R-40i, a PVC landing plate was positioned over the PVC well riser. Details of the dedicated sampling system installed in R-40 and R-40i are presented in Figures 5.3-1 and 5.3-2.

5.4 Wellhead Completion

On April 30, 2009, a surface pad consisting of 4000-psi reinforced concrete, 10 ft × 10 ft × 6 in. thick, was installed at the R-40 wellhead. A 10-in.-I.D. steel protective casing with a locking lid was positioned over the stainless-steel and PVC well risers and cemented into the pad. In addition, four removable 4-in. steel bollards were installed around the pad. The pad and bollards will provide long-term structural integrity for the wellhead. A brass survey monument displaying the well name and elevation was embedded in the northwest corner of the pad. The concrete pad was slightly elevated above the ground surface and crowned to promote runoff.

A permanent electric starter box with a connection for three-phase, 460-V portable generator power for the Gundfos pump, and for the electric Bennett pump were mounted by the Laboratory on the pad adjacent to the protective casing. The Laboratory connected the starter box and the power cables to the dedicated pumps in the well. During site restoration, base coarse gravel was graded around the edges of the pad. Details of the wellhead completion are also presented in Figure 5.3-2.

5.5 Geodetic Survey

On May 6, 2009, geodetic survey data for the center of the landing plates, 10-in. protective casing, brass monument, and ground surface at R-40 were collected by Precision Surveying, Inc. The survey data are presented in Table 5.5-1. Geodetic surveys were conducted using a Topcon Hiper+ global positioning system and Wild Heerbrugg NA1 level. The survey data were collected by a New Mexico licensed surveyor and conform to Laboratory Information Architecture project standards IA-CB02, "GIS Horizontal Spatial Reference System," and IA-D802, "Geospatial Positioning Accuracy Standard for A/E/C and Facility Management." All coordinates are expressed as New Mexico State Plane Coordinate System Central Zone (NAD 83); elevation is expressed in feet above mean sea level using the National Geodetic Vertical Datum of 1929.

5.6 Waste Management and Site Restoration

Wastes produced during drilling were managed in accordance with the "Waste Characterization Strategy Form for Drilling and Installation of Wells at TA-54 R-37, R-39, and R-40." Wastes generated at the R-40 project include a small quantity of contact waste, drill cuttings, discharged drilling water, development groundwater, and New Mexico special waste (NMSW), consisting of base coarse gravel and hydraulic oil. Following the completion of drilling, waste characterization samples were collected from cuttings and drilling water in the lined retention pit, and drilling and development water was sampled in aboveground storage tanks during well development. A summary of waste characterization samples collected from the R-40 well is presented in Table 5.6-1.

On May 14, 2009, some of the dry drill cuttings were land-applied in accordance with the NMED-approved Notice of Intent (NOI): Land Application of IDW Solids from Construction of Wells and Boreholes (October 2007). Final disposition is ongoing of the rest of the dry drill cuttings, the drill wet cuttings, and drilling and development water. If approved, liquid wastes will be land applied in accordance with the NMED-approved NOI Decision Tree: Drilling, Development, Rehabilitation, and Sampling Purge Water (July 2006); wet drill cuttings will be land-applied in accordance with the NMED-approved NOI: Land Application of IDW Solids from Construction of Wells and Boreholes (October 2007).

Site restoration activities will include removing drilling fluids from the pit and managing the fluids in accordance with Standard Operating Procedure (SOP) 010.1, removing the polyethylene liner, removing the containment area berms, and backfilling and regrading the containment area, as appropriate. Cuttings will be removed from the pit and managed in accordance with SOP-011.1. The site will be reseeded with a Laboratory-approved seed mix consisting of Indian rice grass, mountain broam, blue stem, sand drop, and slender wheat grass seed.

6.0 DEVIATIONS FROM PLANNED ACTIVITIES

In general, drilling, sampling, and well construction at R-40 were performed as specified in the "Drilling Work Plan for Regional and Intermediate Wells at Technical Area 54" (LANL 2007, 099662) and LANS subcontract 22851-009-08, Exhibit D "Scope of Work and Technical Specifications—Drilling and Installation of Wells at TA-54."

The following changes to the original work plan were implemented after approval by LWSP.

- Drilling TD: Drilling at R-40 stopped at 910 ft bgs after advancing approximately 75 ft into the saturated portion of the regional aquifer. The planned TD for the R-40 borehole in the approved work plan (LANL 2007, 099662) was 953 ft bgs, or 100 ft below the regional aquifer pieziometric surface estimated to be at 853 ft.

- Well Completion: R-40 was initially designed as a single completion well. However, the discovery of perched groundwater required the installation of a multiple screened well plus a separate intermediate well (R-40i) in the same borehole.

7.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's RPF and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

LANL (Los Alamos National Laboratory), October 2007. "Technical Area 54 Well Evaluation and Network Recommendations, Revision 1," Los Alamos National Laboratory document LA-UR-07-6436, Los Alamos, New Mexico. (LANL 2007, 098548)

LANL (Los Alamos National Laboratory), November 2007. "Drilling Work Plan for Regional and Intermediate Wells at Technical Area 54," Los Alamos National Laboratory document LA-UR-07-7578, Los Alamos, New Mexico. (LANL 2007, 099662)

NMED (New Mexico Environment Department), December 7, 2007. "Approval with Direction, Drilling Work Plan for Regional and Intermediate Wells at Technical Area 54," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2007, 099257)

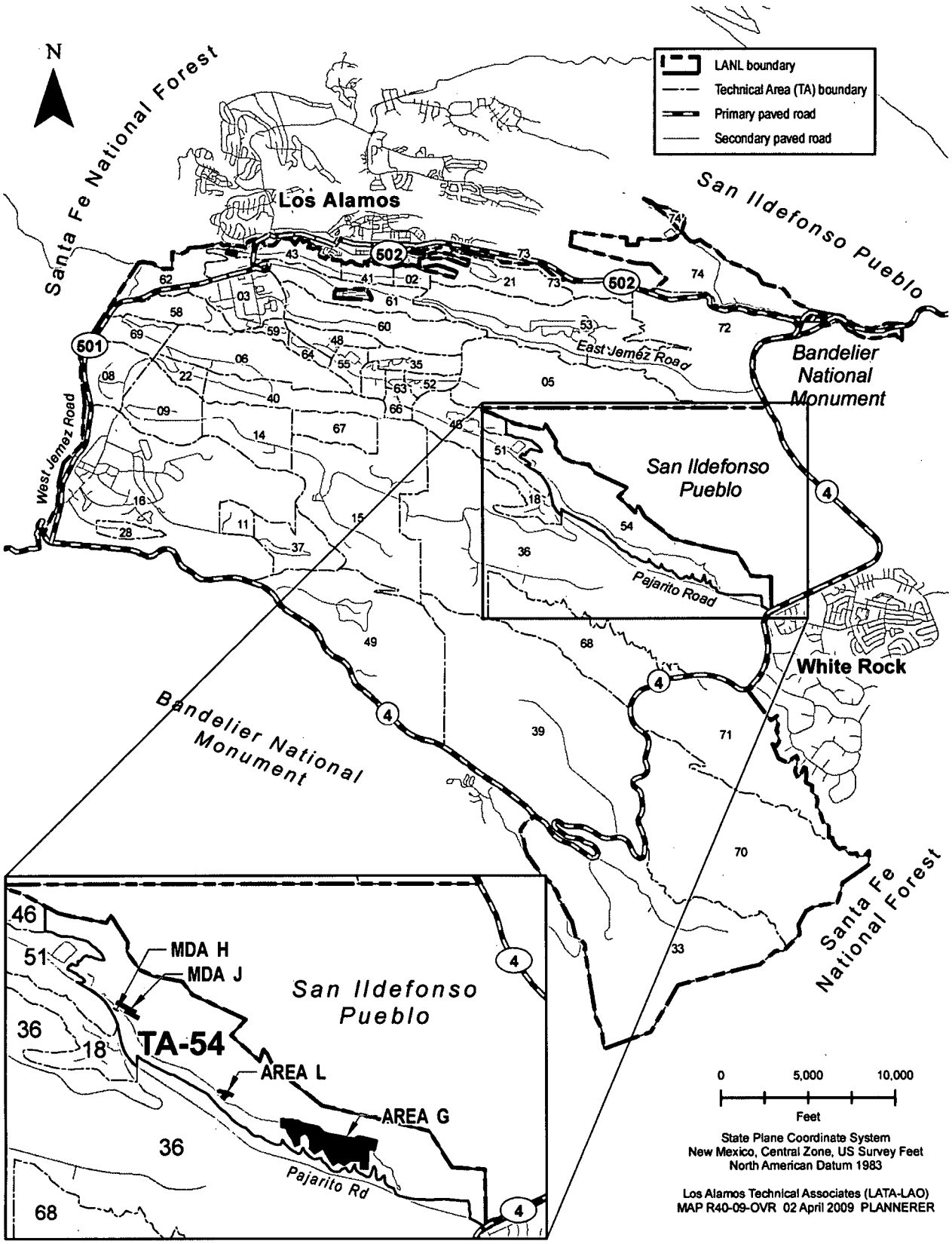


Figure 1.0-1 Area G in TA-54 with respect to Laboratory technical areas and surrounding land holdings

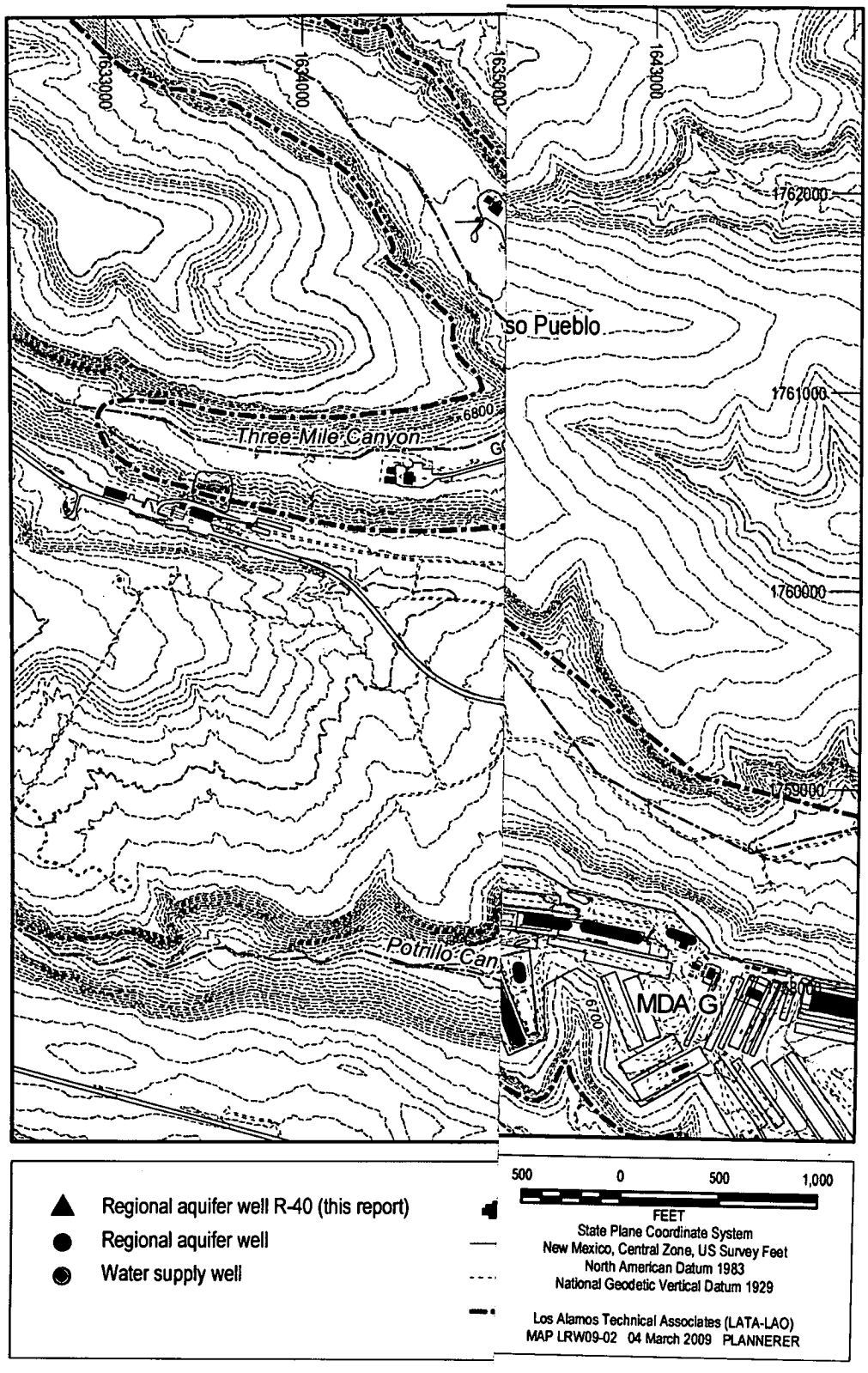
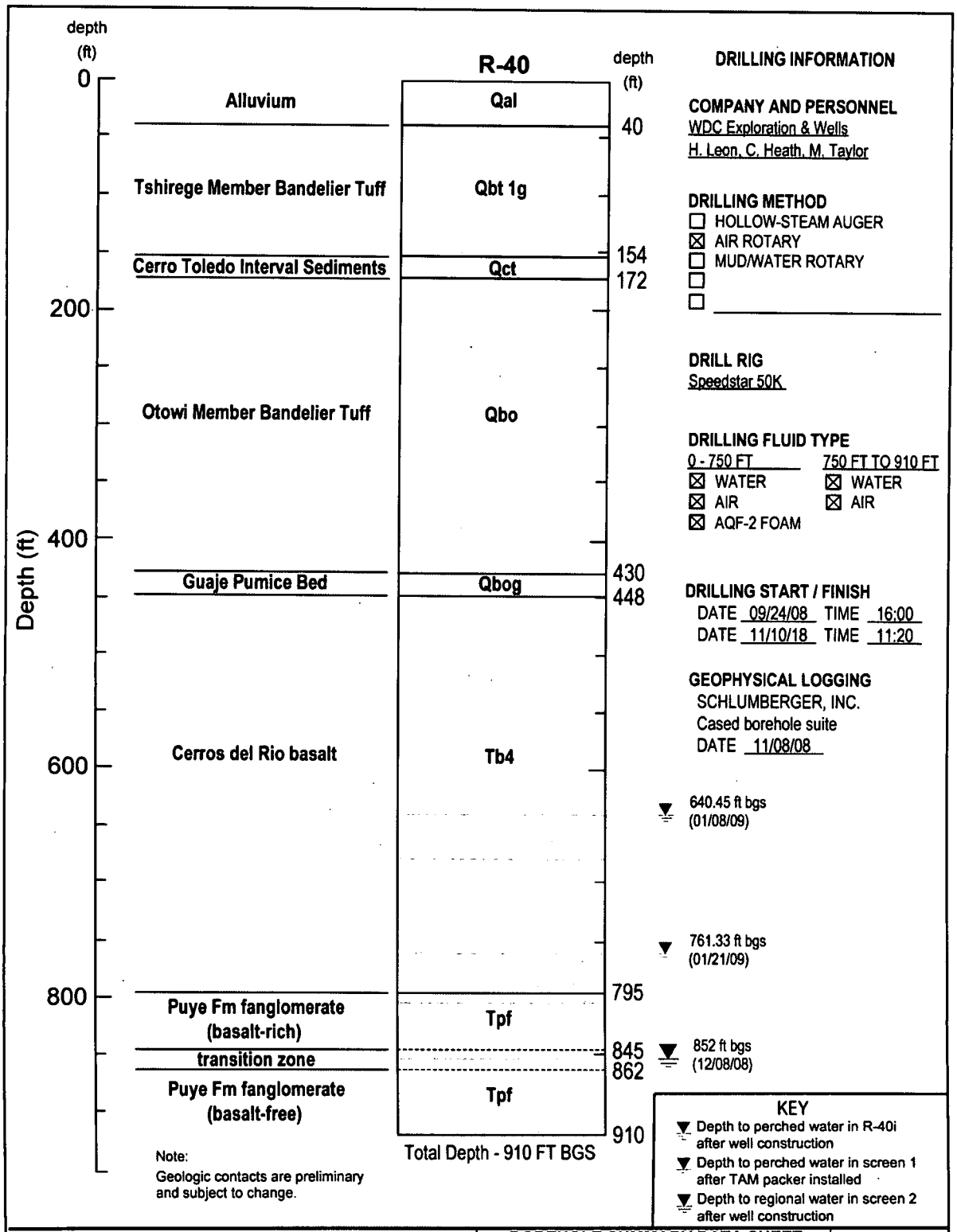


Figure 1.0-2 Regional aquifer well R-40



LATA-Sharp Remediation Services, Inc.		BOREHOLE SUMMARY DATA SHEET Borehole Stratigraphy LANL Well R-40 TA-54 Los Alamos, New Mexico	FIGURE 3.1-1
Drawn By: J. Marin	Date: April, 2009		
Project No.: 22851-009-08	Filename: R-40_Figure 3.1-1		
Scale: not-to-scale	Revision: 1		

Figure 3.1-1 Borehole summary data sheet

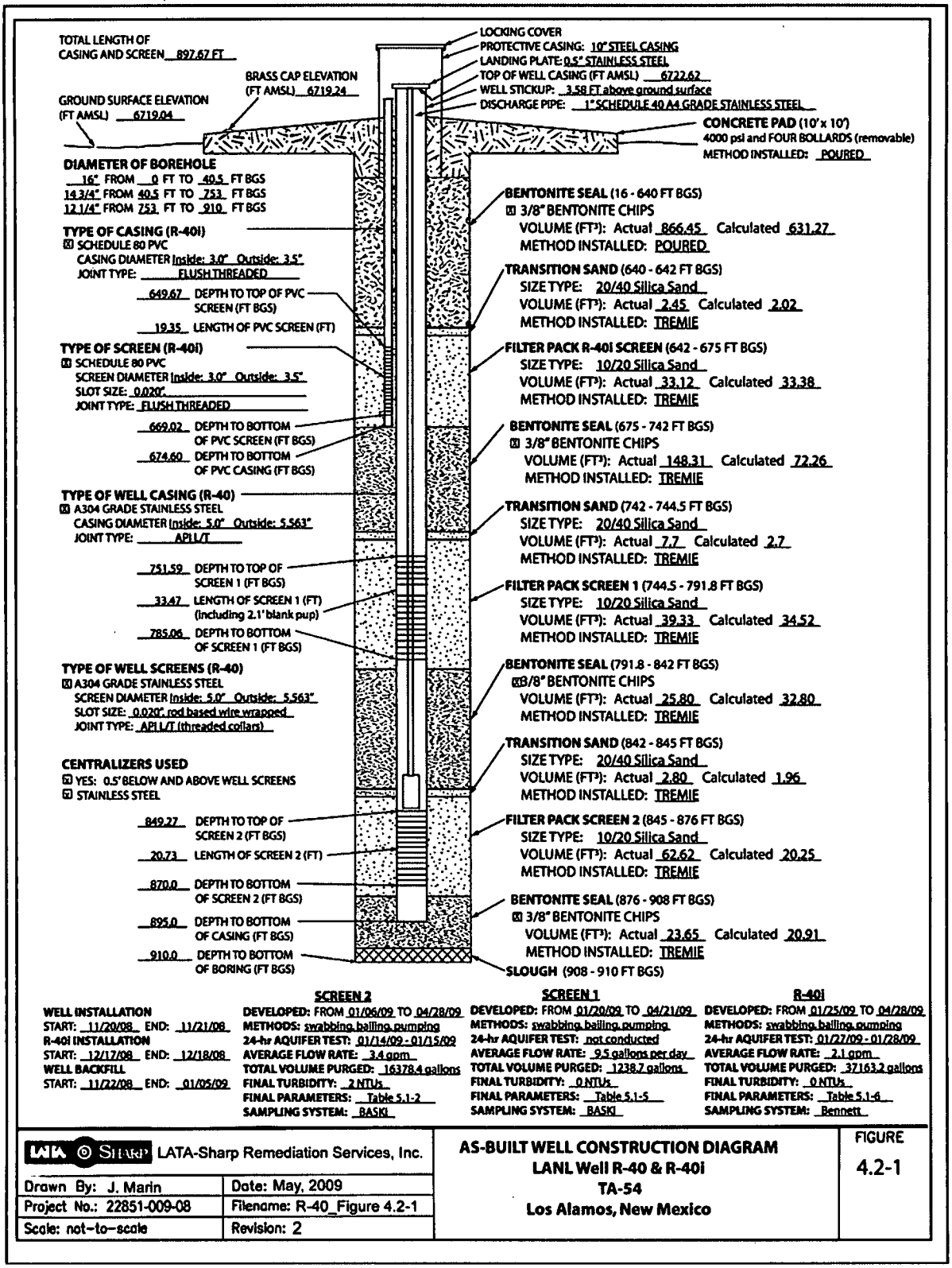
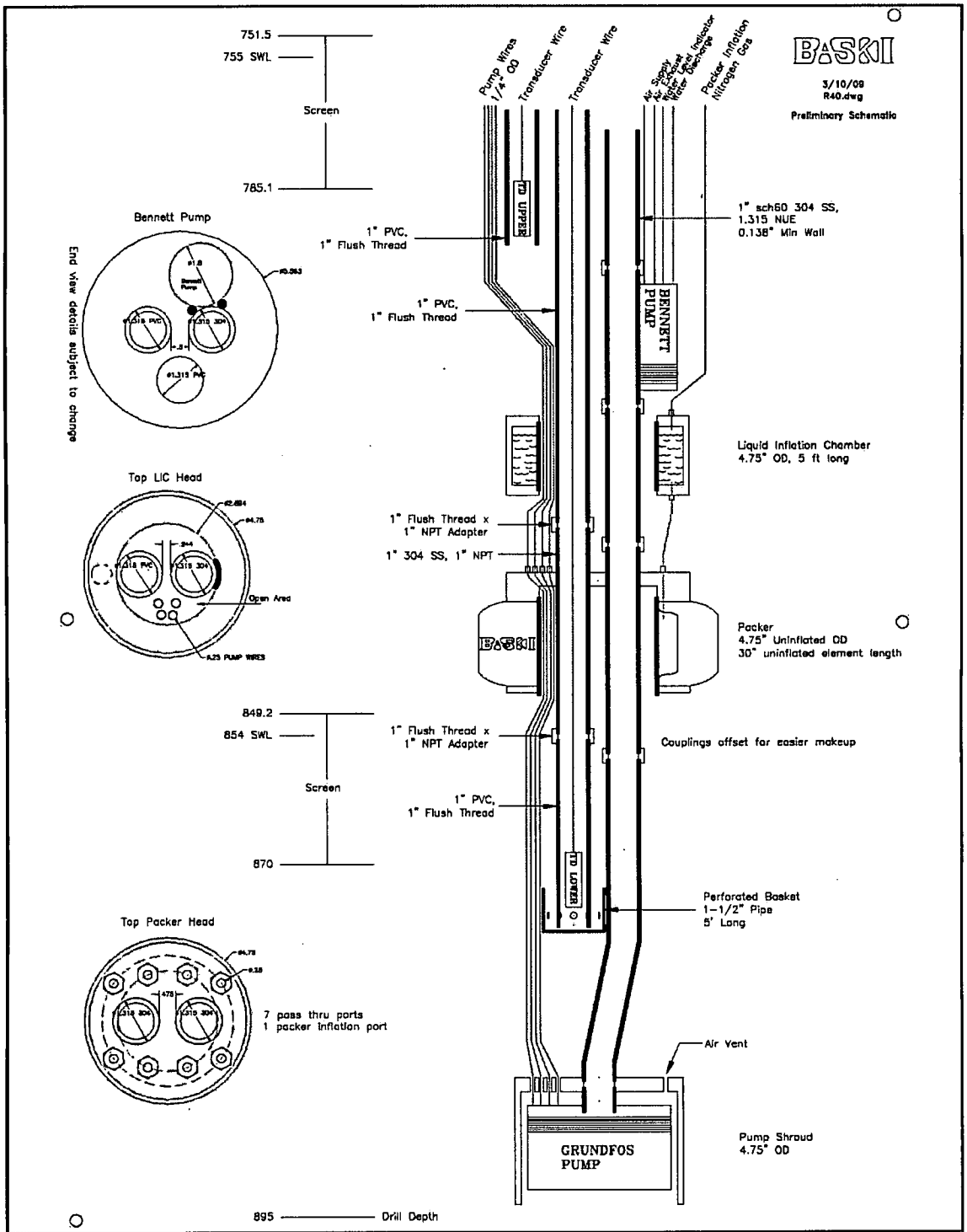


Figure 4.2-1 As-built well construction diagram



LATA-Sharp Remediation Services, Inc.		BASKI Sampling System LANL Well R-40 TA-54 Los Alamos, New Mexico	FIGURE 5.3-1
Drawn By: BASKI	Date: April, 2009		
Project No.: 22851-009-08	Filename: R-40_Figure 5.3-1		
Scale: not-to-scale	Revision: 0		

Figure 5.3-1 As-built completion schematic for regional aquifer well R-40

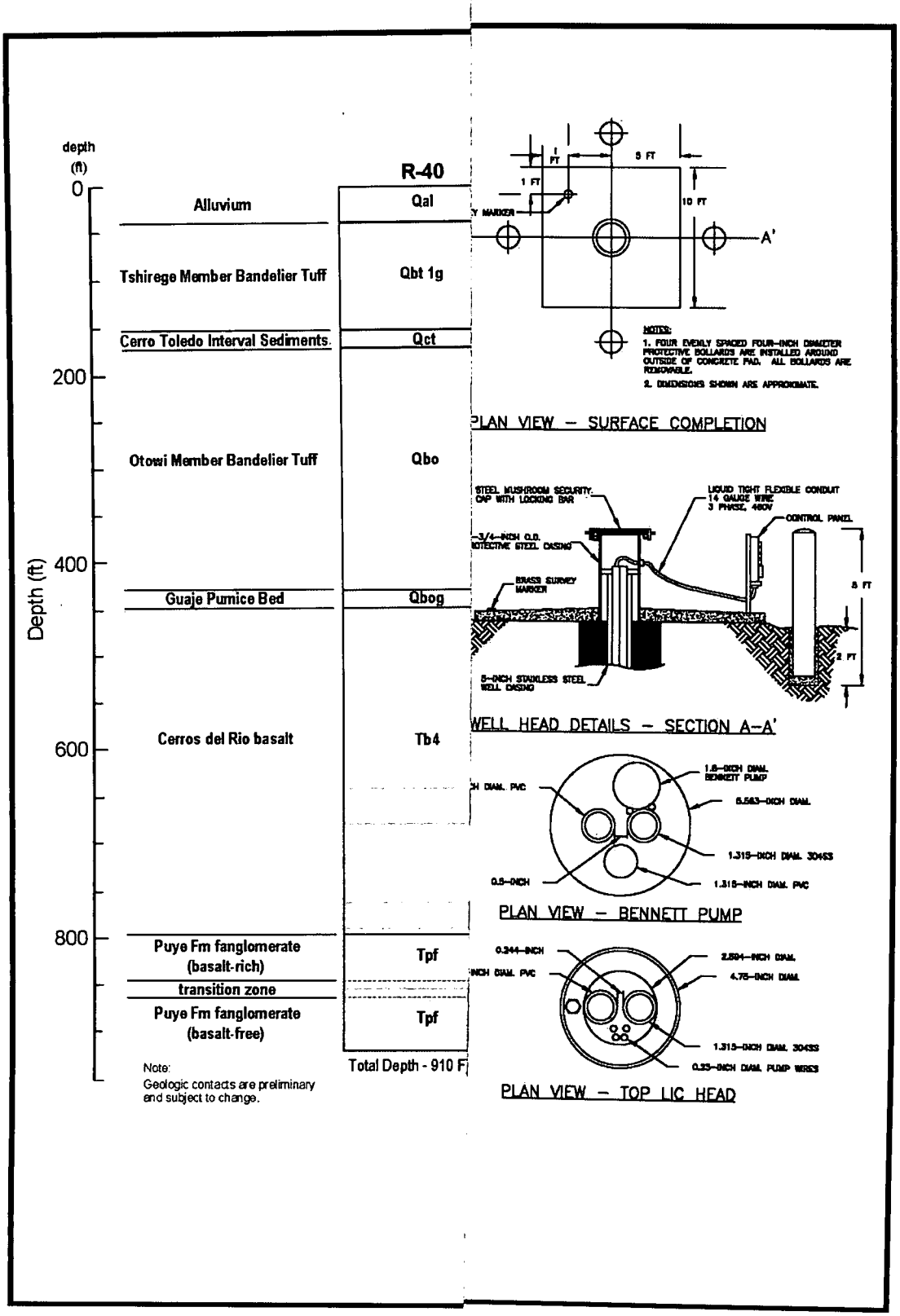


Figure 5.3-2 As-built completion schematic

Table 2.2-1
Municipal Water and AQF-2 Foam
Used during Drilling and Well Construction at Well R-40

Date	Water (gal.)	Cumulative Water (gal.)	AQF-2 Foam (gal.)	Cumulative AQF-2 Foam (gal.)	Cumulative Returns in Pit (gal.)
Drilling					
09/24/08	0	0	0	0	0
09/25/08	0	0	0	0	0
09/26/08	175	175	2	2	125
09/27/08	800	975	3	5	680
09/28/08	850	1825	12.5	17.5	1275
09/29/08	0	1825	0	17.5	1275
09/30/08	4500	6325	62.5	80	4430
10/01/08	600	6925	20	100	4850
10/02/08	1200	8125	20	120	5685
10/07/08	1800	9925	15	135	6950
10/08/08	1500	11,425	20	155	8000
10/09/08	3000	14,425	30	185	10,100
10/10/08	1600	16,025	15	200	11,220
10/11/08	3000	19,025	25	225	13,350
10/12/08	1000	20,025	10	235	14,000
10/13/08	1000	21,025	10	245	14,750
10/14/08	1000	22,025	10	255	15,420
10/15/08	3000	25,025	20	275	17,500
10/16/08	1000	26,025	10	285	18,200
10/21/08	0	26,025	0	285	18,200
10/23/08	0	26,025	0	285	18,200
10/24/08	0	26,025	0	285	18,200
10/25/08	0	26,025	0	285	18,200
10/26/08	800	26,825	0	285	18,800
10/27/08	1000	27825	0	285	19,800
10/28/08	0	27,825	0	285	21,300
10/29/08	0	27,825	0	285	22,800
10/30/08	0	27,825	0	285	24,300
11/04/08	800	28,625	0	285	23,300
11/05/08	0	28,625	0	285	24,800
11/06/08	0	28,625	0	285	26,300
11/07/08	0	28,625	0	285	27,300
Subtotal Drilling (gal.)	**28,625**	**28,625**	**285**	**285**	**27,300**

Table 2.2-1 (continued)

Date	Water (gal.)	Cumulative Water (gal.)	AQF-2 Foam (gal.)	Cumulative AQF-2 Foam (gal.)	Cumulative Returns in Pit (gal.)
Well Construction					
11/19/08	0	0	0	0	0
11/20/08	0	0	0	0	0
11/21/08	0	0	0	0	0
11/22/08	2200	2200	0	0	0
11/23/08	1300	3500	0	0	0
11/24/08	1000	4500	0	0	0
11/25/08	250	4750	0	0	0
12/01/08	1500	6250	0	0	0
12/02/08	2000	8250	0	0	0
12/03/08	500	8750	0	0	0
12/04/08	1200	9950	0	0	0
12/05/08	0	9950	0	0	0
12/06/08	0	9950	0	0	0
12/07/08	750	10,700	0	0	0
12/08/08	0	10,700	0	0	0
12/09/08	0	10,700	0	0	0
12/10/08	0	10,700	0	0	0
12/11/08	0	10,700	0	0	0
12/12/08	0	10,700	0	0	0
12/17/08	0	10,700	0	0	0
12/18/08	500	11,200	0	0	0
12/19/08	1500	12,700	0	0	0
12/20/08	0	12,700	0	0	0
12/21/08	1000	13,700	0	0	0
12/22/08	0	13,700	0	0	0
01/05/09	0	13,700	0	0	0
Subtotal Well Construction (gal.)	**13,700**	**13,700**	**0**	**0**	**0**
Total Volume (gal.)	**42,325**	**42,325**	**285**	**285**	**27,300**

Table 2.3-1
Summary of Groundwater-Screening Samples Collected during Drilling, Well Development, and Aquifer Testing of Well R-40

Location ID	Sample ID	Date Collected	Collection Depth (ft bgs)	Sample Type
Drilling				
R-40 (first borehole)	GW40-08-14400	07/30/08	608.2	Screening
R-40 (second borehole)	GW40-08-14402	10/28/08	784	Screening
R-40 (second borehole)	GW40-08-14404	10/29/08	809	Screening
R-40 (second borehole)	GW40-08-14405	10/29/08	827	Screening
R-40 (second borehole)	GW40-08-14401	10/30/08	847	Screening
R-40 (second borehole)	RC54-09-1031	11/04/08	867	Screening
R-40 (second borehole)	RC54-09-1033	11/05/08	872	Screening
R-40 (second borehole)	RC54-09-1032	11/05/08	887	Screening
R-40 (second borehole)	RC54-09-1034	11/07/08	910	Screening
R-40 Screen 2				
Prewell Development				
R-40 screen 2	RC54-09-1037	01/06/09	853	Screening
Well Development				
R-40 screen 2	GW40-09-1615	01/09/09	867.4	TOC
R-40 screen 2	GW40-09-1616	01/10/09	867.4	TOC
Aquifer Test				
R-40 screen 2	GW40-09-1617	01/15/09	871.8	TOC
R-40 screen 2	CAPA-09-1888	01/15/09	858.78	Full Suite
R-40 screen 2	GW40-09-8323	04/23/09	867.14	TOC, metals
R-40 screen 2	GW40-09-8324	04/24/09	867.14	TOC, metals
R-40 screen 2	GW40-09-8325	04/24/09	867.14	TOC, metals
R-40 screen 2	GW40-09-8328	04/27/09	867.14	TOC, metals
R-40 screen 2	GW40-09-8331	04/27/09	867.14	TOC, metals
R-40 screen 2	GW40-09-8333	04/28/09	867.14	TOC, metals
R-40 Screen 1				
Well Development				
R-40 screen 1	GW40-09-1621	03/03/09	829.93	TOC
R-40 screen 1	GW40-09-1622	03/03/09	829.93	TOC
R-40 screen 1	GW40-09-1626	03/06/09	834.89	TOC
R-40 screen 1	GW40-09-1630	03/12/09	834.89	TOC
R-40 screen 1	GW40-09-1631	03/12/09	834.89	TOC
R-40 screen 1	GW40-09-5867	03/17/09	834.89	TOC
R-40 screen 1	GW40-09-5868	03/17/09	834.89	TOC
R-40 screen 1	GW40-09-5868	03/24/09	834.89	TOC
R-40 screen 1	GW40-09-5868	03/24/09	834.89	TOC
R-40 screen 1	GW40-09-6937	04/03/09	834.89	TOC, metals

Table 2.3-1 (continued)

Location ID	Sample ID	Date Collected	Collection Depth (ft bgs)	Sample Type
R-40 Screen 1 (continued)				
R-40 screen 1	GW40-09-6938	04/03/09	834.89	TOC, metals
R-40 screen 1	GW40-09-6949	04/10/09	834.89	TOC, metals
R-40 screen 1	GW40-09-6950	04/10/09	834.89	TOC, metals
R-40 screen 1	CAPA-09-8346	04/21/09	834.89	Full Suite
R-40i				
Prewell Development				
R-40i	RC54-09-1038	01/12/09	641.7	Screening
Well Development				
R-40i	GW40-09-1618	01/26/09	656.6	TOC
R-40i	GW40-09-1619	01/26/09	656.6	TOC
Aquifer Test				
R-40i	GW40-09-1620	01/28/09	656.6	TOC
R-40i	CAPA-09-2797	01/28/09	656.6	Full Suite
Continued Well Development				
R-40i	GW40-09-1623	03/05/09	668.11	TOC
R-40i	GW40-09-1624	03/06/09	668.11	TOC
R-40i	GW40-09-1625	03/06/09	668.11	TOC
R-40i	GW40-09-1627	03/09/09	668.11	TOC
R-40i	GW40-09-1628	03/10/09	668.11	TOC
R-40i	GW40-09-1629	03/11/09	668.11	TOC
R-40i	GW40-09-1632	03/12/09	668.11	TOC
R-40i	GW40-09-1633	03/13/09	668.11	TOC
R-40i	GW40-09-1634	03/16/09	668.11	TOC
R-40i	GW40-09-1635	03/16/09	668.11	TOC
R-40i	GW40-09-5868	03/17/09	668.11	TOC
R-40i	GW40-09-5869	03/17/09	668.11	TOC
R-40i	GW40-09-5870	03/18/09	668.11	TOC
R-40i	GW40-09-5871	03/19/09	668.11	TOC
R-40i	GW40-09-5872	03/20/09	668.11	TOC
R-40i	GW40-09-5873	03/23/09	668.11	TOC
R-40i	GW40-09-5876	03/24/09	668.11	TOC
R-40i	GW40-09-5877	03/25/09	668.11	TOC
R-40i	GW40-09-5878	03/26/09	668.11	TOC
R-40i	GW40-09-6939	04/03/09	668.11	TOC, metals
R-40i	GW40-09-6940	04/03/09	668.11	TOC, metals
R-40i	GW40-09-6941	04/06/09	668.11	TOC, metals
R-40i	GW40-09-6942	04/06/09	668.11	TOC, metals

Table 2.3-1 (continued)

Location ID	Sample ID	Date Collected	Collection Depth (ft bgs)	Sample Type
R-40i (continued)				
R-40i	GW40-09-6943	04/07/09	668.11	TOC, metals
R-40i	GW40-09-6944	04/07/09	668.11	TOC, metals
R-40i	GW40-09-6945	04/08/09	668.11	TOC, metals
R-40i	GW40-09-6946	04/08/09	668.11	TOC, metals
R-40i	GW40-09-6947	04/09/09	668.11	TOC, metals
R-40i	GW40-09-6948	04/09/09	668.11	TOC, metals
R-40i	GW40-09-6951	04/10/09	668.11	TOC, metals
R-40i	GW40-09-6952	04/10/09	668.11	TOC, metals
R-40i	GW40-09-6953	04/13/09	668.11	TOC, metals
R-40i	GW40-09-6954	04/13/09	668.11	TOC, metals
R-40i	GW40-09-6955	04/14/09	668.11	TOC, metals
R-40i	GW40-09-6956	04/14/09	668.11	TOC, metals
R-40i	GW40-09-8320	04/20/09	668.11	TOC, metals
R-40i	GW40-09-8321	04/20/09	668.11	TOC, metals
R-40i	GW40-09-8322	04/21/09	668.11	TOC, metals
R-40i	GW40-09-8326	04/24/09	668.11	TOC, metals
R-40i	GW40-09-8327	04/24/09	668.11	TOC, metals
R-40i	GW40-09-8329	04/27/09	668.11	TOC, metals
R-40i	GW40-09-8330	04/27/09	668.11	TOC, metals
R-40i	GW40-09-8332	04/28/09	668.11	TOC, metals

Table 3.1-1
Summary of Water-Level Measurements during Drilling and Well Construction at Well R-40

Date	Time	DTW (ft bgs)	Source	Type	After
Drilling					
10/28/08	0745	734	DTW Meter	Perched	Resting
10/29/08	0815	633.4	DTW Meter	Perched	Resting
10/29/08	1315	600	DTW Meter	Perched	Drilling
10/29/08	1730	337.02	DTW Meter	Perched	Drilling
10/29/08	1800	559.60	DTW Meter	Perched	Drilling
10/30/08	0740	633.8	DTW Meter	Perched	Resting
10/30/08	0815	633.8	DTW Meter	Perched	Resting
10/30/08	1311	705	DTW Meter	Perched	Drilling
10/30/08	1355	670	DTW Meter	Perched	Drilling
11/04/08	0733	636	DTW Meter	Perched	Resting
11/04/08	0803	636	DTW Meter	Perched	Resting
Drilling (past 872 ft bgs)					
11/05/08	0756	796	DTW Meter	Perched	Resting
11/05/08	0840	796	DTW Meter	Perched	Resting
11/05/08	1400	801	DTW Meter	Perched	Drilling
11/06/08	0725	811	DTW Meter	Perched	Resting
11/06/08	0800	811	DTW Meter	Perched	Resting
11/06/08	1550	840	DTW Meter	Regional	Trip out
11/07/08	0722	839	DTW Meter	Regional	Resting
11/07/08	0755	839	DTW Meter	Regional	Resting
11/07/08	1413	820	DTW Meter	Regional	Drilling
Prewell Construction					
11/10/08	1400	838	DTW Meter	Regional	Resting
11/10/08	1415	834	DTW Meter	Regional	Resting
11/12/08	0800	838	DTW Meter	Regional	Resting
11/12/08	0735	836	DTW Meter	Regional	Resting
11/19/08	0815	833	DTW Meter	Regional	Resting
Well Construction					
12/03/08	1300	791	DTW Meter	Perched?	Backfilling
12/04/08	1135	791	DTW Meter	Perched?	Backfilling
12/05/08	0735	855	DTW Meter	Regional	Resting
12/05/08	1120	854	DTW Meter	Regional	Resting
12/05/08	1505	854	DTW Meter	Regional	Resting
12/06/08	0745	854	DTW Meter	Regional	Resting
12/08/08	0755	852	DTW Meter	Regional	Resting

Table 5.1-1
Summary of Water-Level Measurements at Well R-40 Screen 2

Date	Time	DTW (ft bgs)	Source	Type	After
Prewell Development (R-40 Screen 2)					
01/06/09	1440	853.33	DTW Meter	Regional	Resting
01/07/09	0745	853.98	DTW Meter	Regional	Resting
Well Development (R-40 Screen 2)					
01/07/09	1030	856.03	DTW Meter	Regional	Bail/Swab
01/07/09	1345	853.3	DTW Meter	Regional	Set pump
01/07/09	1436	859.53	DTW Meter	Regional	Pump on
01/07/09	1455	857.73	DTW Meter	Regional	Pumping
01/08/09	0645	854.13	DTW Meter	Regional	Resting
01/08/09	0745	858.53	DTW Meter	Regional	Pumping
01/08/09	1245	860.08	DTW Meter	Regional	Pumping
01/09/09	0644	853.33	DTW Meter	Regional	Resting
04/22/09	0800	853.46	DTW Meter	Regional	Resting
Aquifer Test (R-40 Screen 2)					
01/14/09 – 01/15/09	See Appendix F				

Table 5.1-2
Well Development and Aquifer Test Volumes and
Field Water-Quality Parameter Measurements at Well R-40 Screen 2

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (ppm)	Comment	End-of-Day Cumulative Purge Volume –Screen 2 (gal.)
R-40 Screen 2 Well Development										
01/06/09	1502	3.95	4.43	13.3	0	5.2	0.22	—[e]	Calibrate Horiba	—
01/06/09	1510	4	4.44	12	0	5.23	0.22	—	Calibrate Horiba	—
01/06/09	1540	6.64	0.317	16.4	999	5.29	0.01	—	Turbid	110
01/07/09	1515	7.14	0.33	17.2	58	2.07	0	—	Soap	—
01/07/09	1535	7.32	0.335	16.9	34	1.43	0.01	—	Soap	—
01/07/09	1550	7.34	0.332	16.7	19	4.95	0.01	—	Soap	—
01/07/09	1605	7.28	0.004	18.2	16	1.85	0.01	—	Soap	—
01/07/09	1700	7.28	0.333	15.3	13	4.06	0	—	Soap	490
01/08/09	0800	7.53	0.306	15.2	9	1.7	0.01	—	Soap	—
01/08/09	0935	7.23	0.29	17.2	14	1.86	0.01	—	Soap	—
01/08/09	1000	7.38	0.289	19.4	14	1.87	0	—	Soap	—
01/08/09	1100	7.41	0.279	19.4	11	2.25	0	—	Soap	—
01/08/09	1145	7.33	0.268	19.7	10	4.39	0	—	Soap	—
01/08/09	1245	7.34	0.267	19.1	12	4.25	0	—	Soap	—
01/08/09	1310	7.29	0.265	19.5	12	4.32	0	—	—	—
01/08/09	1342	7.33	0.257	19.6	76	4.64	0	—	—	—
01/08/09	1423	7.35	0.262	14.4	7	4.52	0.01	—	—	—
01/08/09	1511	7.33	0.258	17.4	10	2.03	0.01	—	—	—
01/08/09	1545	7.3	0.255	17.2	10	1.98	0	—	—	—
01/08/09	1613	7.17	0.256	15.6	10	2.28	0	—	—	—
01/08/09	1655	7.22	0.251	15.8	10	2.02	0	—	—	—
01/08/09	1657	—	—	—	—	—	—	—	Pump off	2352
01/09/09	0755	7.47	0.256	19.2	12	4.32	0	—	—	—
01/09/09	0824	7.36	0.25	15.8	21	1.35	0	—	—	—

Table 5.1-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (ppm)	Comment	End-of-Day Cumulative Purge Volume –Screen 2 (gal.)
R-40 Screen 2 Well Development (continued)										
01/09/09	0958	6.66	0.25	15.8	18	—	0	—	—	—
01/09/09	1130	7.68	0.247	16.6	13	1.68	0	—	—	—
01/09/09	1342	7.49	0.243	18.4	12	1.82	0	—	—	—
01/09/09	1438	7.38	0.235	19.2	14	1.49	0	—	—	—
01/09/09	1515	3.97	4.48	16.2	0	6.1	0.22	—	Calibrate Horiba	—
01/09/09	1520	—	—	—	10	—	—	—	—	—
01/09/09	1526	6.8	0.216	17.6	6	5.06	0	—	—	—
01/09/09	1615	6.97	0.214	18.2	7	2.52	0	—	—	—
01/09/09	1641	7.24	0.21	17.6	6	2.69	0	—	—	—
01/09/09	1700	7.21	0.207	18	6	2.19	0	1.9/1.6	—	—
01/09/09	1701	—	—	—	—	—	—	—	Pump off	4521
01/10/09	0700	7.04	0.21	15.6	12	1.83	0	—	—	—
01/10/09	0900	6.74	0.214	18.2	10	2.24	0	—	—	—
01/10/09	1045	7.02	0.208	17.2	18	2.41	0	—	—	—
01/10/09	1117	6.89	0.208	17.7	15	2.29	0	—	—	—
01/10/09	1150	7.14	0.206	16.5	13	2.16	0	—	—	—
01/10/09	1243	7.08	0.206	18.8	13	4.12	0	—	—	—
01/10/09	1516	—	0.201	18.3	12	—	0	—	—	—
01/10/09	1522	3.98	4.58	15.2	0	0.23	0.22	—	Calibrate Horiba	—
01/10/09	1552	6.78	0.2	16.4	11	—	0	—	—	—
01/10/09	1603	3.98	4.45	14	0	6.39	0.22	—	Calibrate Horiba	—
01/10/09	1640	6.37	0.223	18.4	4	2.56	0	—	—	7145
01/10/09	1700	6.44	0.206	17.6	3	2.71	0	4.4/3.8	—	—
01/13/09	0855	7.33	0.205	20	10	1.69	0	—	—	—
01/13/09	1232	3.98	4.52	12.9	0	4.73	0.23	—	Calibrate Horiba	—
01/13/09	1255	6.92	0.227	19.2	24	1.57	0	—	—	8032

Table 5.1-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (ppm)	Comment	End-of-Day Cumulative Purge Volume –Screen 2 (gal.)
R-40 Screen 2 Aquifer Test (24 h)										
01/14/09	0800	—	—	—	—	—	—	—	Pump on	—
01/14/09	0806	7.21	0.225	15	25	0.51	0	—	—	—
01/14/09	1056	7.04	0.209	19.1	22	—	0	—	—	—
01/14/09	1124	3.93	4.48	12.4	0	—	0.22	—	Calibrate Horiba	—
01/14/09	1130	6.21	0.209	19.2	20	0.99	0	—	—	—
01/14/09	1345	6.72	0.197	19.6	15	1	0	—	—	—
01/14/09	1645	7.09	0.194	18.1	13	1.4	0	—	—	—
01/14/09	1730	7.03	0.192	18.2	12	0.9	0	—	—	—
01/14/09	1752	6.97	0.192	14.2	12	0.88	0	—	—	—
01/14/09	1900	6.66	0.197	17.3	12	2.17	0	—	—	—
01/14/09	2000	7.1	0.19	17.9	12	1.14	0	—	—	—
01/14/09	2100	7.38	0.189	20.2	12	1.79	0	—	—	—
01/14/09	2200	7.38	0.186	19.9	11	0.91	0	—	—	—
01/14/09	2300	7.32	0.187	19.6	10	0.93	0	—	—	—
01/14/09	2400	—	—	—	—	—	—	—	—	11296
01/15/09	0000	7.29	0.184	19	10	0.93	0	—	—	—
01/15/09	0100	7.24	0.186	21	9	0.73	0	—	—	—
01/15/09	0200	7.22	0.182	19.3	9	1.23	0	—	—	—
01/15/09	0300	7.09	0.181	19.2	9	1.23	0	—	—	—
01/15/09	0400	7.26	0.181	18.9	10	1	0	—	—	—
01/15/09	0500	7.28	0.181	20.8	8	1.33	0	—	—	—
01/15/09	0600	7.34	0.181	19	8	1.44	0	—	—	—
01/15/09	0700	7.39	0.179	20	8	0.81	0	—	—	—
01/15/09	0745	7.29	0.18	19.8	8	0.81	0	1.41/1.47	—	—
01/15/09	0800	—	—	—	—	—	—	—	Pump off	12987

Table 5.1-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (ppm)	Comment	End-of-Day Cumulative Purge Volume –Screen 2 (gal.)
R-40 Screen 2 Aquifer Test (24 h) (continued)										
04/21/09	1101	3.99	4.99	21.9	0	1.13	0.23	—	Calibrate Horiba	—
04/21/09	1104	4	4.48	22.4	0	9.02 FTC	0.23	—	Calibrate Horiba	—
04/23/09	1530	—	—	—	—	—	—	—	Pump on	—
04/23/09	1605	5.15	0.208	21.5	63	8.33	0	—	DO FTC	—
04/23/09	1615	5.58	0.176	19.1	32	8.57	0	—	DO FTC	—
04/23/09	1630	6.18	0.177	20	24	7.37	0	—	DO FTC	—
04/23/09	1645	6.54	0.176	20.1	7	8.39	0	0.7	DO FTC	—
04/23/09	1700	—	—	—	—	—	—	—	Pump off	13314.9
04/24/09	0705	6.61	0.221	15.2	13	8.47	0	—	Pump on	—
04/24/09	0740	—	—	—	—	—	—	0.6	—	—
04/24/09	0800	6.93	0.182	17.3	0	8.32	0	—		—
04/24/09	0900	7.01	0.18	19.1	0	7.85	0	—	DO FTC	—
04/24/09	1000	7.13	0.18	19.7	0	8.15	0	—	DO FTC	—
04/24/09	1100	7.57	0.205	21.9	0	8.63	0	—	DO FTC	—
04/24/09	1200	7.45	0.187	24.8	0	8.43	0	—	DO FTC	—
04/24/09	1300	7.51	0.187	25.3	0	8.51	0	—	DO FTC	—
04/24/09	1400	7.46	0.19	26.8	0	9.23	0	—	DO FTC	—
04/24/09	1500	7.77	0.166	22.6	0	8.92	0	—	DO FTC	—
04/24/09	1600	7.7	0.163	21.6	1	7.95	0	0.5	Pump off	14544.9
04/27/09	700	7.54	0.203	19.1	6	4.15	0	0.6	Pump on	—
04/27/09	800	7.61	0.173	19.8	5	4.23	0	—	DO FTC	—
04/27/09	900	7.69	0.166	20.7	3	4.35	0	—	DO FTC	—
04/27/09	1000	7.68	0.175	19.9	2	4.42	0	—	DO FTC	—
04/27/09	1100	7.79	0.176	20.5	2	4.49	0	—	DO FTC	—
04/27/09	1200	7.39	0.163	22.2	2	4.86	0	—	DO FTC	—
04/27/09	1300	7.56	0.157	20.5	3	4.36	0	—	DO FTC	—

Table 5.1-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (ppm)	Comment	End-of-Day Cumulative Purge Volume –Screen 2 (gal.)
R-40 Screen 2 Aquifer Test (24 h) (continued)										
04/27/09	1400	7.63	0.155	23.3	2	4.45	0	—	DO FTC	—
04/27/09	1500	7.65	0.158	23.4	3	4.41	0	—	DO FTC	—
04/27/09	1600	7.62	0.154	23.5	3	4.4	0	0.4	Pump off	16378.4
04/28/09	700	7.68	0.155	20.3	4	4.48	0	0.5	Pump on	—
04/28/09	800	7.48	0.155	21.2	3	4.33	0	—	DO FTC	—
04/28/09	900	7.63	0.156	21.6	2	4.25	0	—	Pump off	16750.9

[a] SP = Specific conductance.

[b] µm/cm = Micrometer per centimeter.

[c] T = Temperature.

[d] DO = Dissolved oxygen.

[e] — = Analysis not conducted. DO FLC = Dissolved oxygen measured by the Horiba instrument in a flow-through cell.

Table 5.1-3
Summary of Water-Level Measurements at Well R-40 Screen 1

Date	Time	DTW (ft bgs)	Column above TAM packer (845 ft bgs)	Source	Type	After
Prewell Development (R-40 screen 1)						
01/21/09	1500	761.33	83.67	DTW Meter	Perched	TAM packer installed
Well Development (R-40 screen 1)						
01/21/09	1715	781.33	63.67	DTW Meter	Perched	Injecting & Bailing
01/22/09	0710	742.63	102.37	DTW Meter	Perched	Injecting Bailing & Resting
01/23/09	0755	779.74	65.26	DTW Meter	Perched	Injecting Bailing & Resting
01/24/09	0745	802.48	42.52	DTW Meter	Perched	Injecting Bailing & Resting
01/25/09	1215	776.13	68.87	DTW Meter	Perched	Bailing
01/26/09	0715	755.38	89.62	DTW Meter	Perched	Resting
03/03/09	0950	762.83	82.17	DTW Meter	Perched	Resting
03/03/09 Pump 74 gal. (R-40 Screen 1)						
03/04/09	1140	807.32	37.68	DTW Meter	Perched	Pumping & Resting
03/05/09	1110	797.23	47.77	DTW Meter	Perched	Resting
03/05/09	1500	795.83	49.17	DTW Meter	Perched	Resting
03/06/09	1455	785.01	59.99	DTW Meter	Perched	Resting
03/06/09 Pump 40.2 gal. (R-40 Screen 1)						
03/09/09	1700	804.9	40.10	DTW Meter	Perched	Pumping & Resting
03/10/09	1717	794.54	50.48	DTW Meter	Perched	Resting
03/11/09	1658	784.98	60.02	DTW Meter	Perched	Resting
03/12/09	0930	782.2	62.8	DTW Meter	Perched	Resting
03/12/09 Pump 44.5 gal. (R-40 Screen 1)						
03/16/09	1530	783.33	61.67	DTW Meter	Perched	Resting
03/17/09	0705	780.14	64.86	DTW Meter	Perched	Resting

Table 5.1-3 (continued)

Date	Time	DTW (ft bgs)	Column above TAM packer (845 ft bgs)	Source	Type	After
03/17/09 Pump 46.4 gal. (R-40 Screen 1)						
03/17/09	1740	833.13	11.87	DTW Meter	Perched	Pumping
03/18/09	1740	821.48	23.52	DTW Meter	Perched	Resting
03/19/09	0702	816.28	28.72	DTW Meter	Perched	Resting
03/19/09	1800	812.01	32.99	DTW Meter	Perched	Resting
03/20/09	0705	806.75	38.25	DTW Meter	Perched	Resting
03/20/09	1305	803.48	41.52	DTW Meter	Perched	Resting
03/23/09	0710	781.45	63.55	DTW Meter	Perched	Resting
03/23/09	1735	780.68	64.32	DTW Meter	Perched	Resting
03/24/09	0710	778.63	66.37	DTW Meter	Perched	Resting
03/24/09 Pump 63.4 gal. (R-40 Screen 1)						
04/03/09 Pump 80.4 gal. (R-40 Screen 1)						
04/10/09 Pump 61.3 gal. (R-40 Screen 1)						
04/21/09	0845	769.33	75.67	DTW Meter	Perched	Resting
04/21/09 Pump 82.2 gal. (R-40 Screen 1)						

Table 5.1-4
Summary of Water-Level Measurements at Well R-40i

Date	Time	DTW (ft bgs)	Source	Type	After
Prewell Development (R-40i)					
01/08/09	0730	640.45	DTW Meter	Perched	Resting
01/12/09	0840	640.15	DTW Meter	Perched	Resting
Well Development (R-40i)					
01/12/09	1115	674.6	DTW Meter	Perched	Bailing
01/21/09	0730	640.04	DTW Meter	Perched	Resting
01/21/09	0750	640.25	DTW Meter	Perched	Resting
03/04/09	1140	639.38	DTW Meter	Perched	Resting
Aquifer Test (R-40i)					
01/27/09 – 01/28/09	See Appendix F				

Table 5.2-1
Well Development Volumes and Field Water-Quality Parameter Measurements at Well R-40 Screen 1

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume Screen 1 (gal.)
Well Development										
01/21/09	1605	7.57	0.246	16.6	999	2.89	0	—[e]	Bail	100
01/25/09	1100	7.05	0.229	19.2	18	2.95	0	—	Bail	—
01/25/09	1125	5.59	0.279	18.7	24	2.88	0.01	—	Bail	—
01/25/09	1215	—	—	—	—	—	—	—	—	640
02/03/09	1615	—	—	—	—	—	—	—	Bail	747
03/03/09	1356	4	4.55	19.1	0	1.85	0.23	—	Calibrate Horiba	—
03/03/09	1435	6.28	0.313	15.2	25	0.009	0	12.4	Pump on	—
03/03/09	1442	6.56	0.26	17	2	0.21	0.01	—	—	—
03/03/09	1449	6.8	0.258	17.6	1	1.41	0.01	—	—	—
03/03/09	1456	7.06	0.256	16.5	1	0.31	0	—	—	—
03/03/09	1501	7.13	0.257	16.7	2	0.21	0.01	—	—	—
03/03/09	1504	7.16	0.259	17.8	3	1.33	0.01	—	—	—
03/03/09	1509	7.21	0.259	17.3	3	0.32	0.01	—	—	—
03/03/09	1515	7.25	0.263	17.5	3	0.28	0	4.9	Pump off	821
03/06/09	1515	7.39	0.27	12.2	2	0.37	0	—	Pump on	—
03/06/09	1530	7.38	0.267	14.2	4	0.21	0.01	7.7	—	—
03/06/09	1545	—	—	—	—	—	—	—	Pump off	861.2
03/12/09	0950	8.01	0.274	10.8	9	-0.14	01	—	Pump on	—
03/12/09	1000	7.78	0.256	12.8	15	-0.25	0	—	—	—
03/12/09	1007	7.73	0.243	15.2	1	-0.05	0	—	—	—
03/12/09	1012	7.69	0.235	15.4	1	0.18	0	—	—	—
03/12/09	1013	7.65	0.235	16.1	1	0.25	0	5.1	—	—
03/12/09	1017	7.63	0.235	16.1	1	0.26	0	5.1	—	—
03/12/09	1018	—	—	—	—	—	—	—	Pump off	905.7
03/17/09	0859	—	—	—	—	—	—	—	Pump on	—

Table 5.2-1 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume Screen 1 (gal.)
Well Development (continued)										
03/17/09	0902	7.95	0.25	10.2	1	-0.61	0	—	—	—
03/17/09	0906	7.81	0.249	12.3	25	0.73	0	—	—	—
03/17/09	0908	7.89	0.244	13.5	11	-0.08	0	—	—	—
03/17/09	0912	7.81	0.248	12.7	7	-0.15	0	—	—	—
03/17/09	0917	7.72	0.235	15.5	3	0.16	0	—	—	—
03/17/09	0920	7.7	0.233	14.2	2	0.24	0	4.2	—	—
03/17/09	09 22	7.68	0.232	16.1	1	0.39	0	—	—	—
03/17/09	924	7.67	0.233	14.7	2	0.28	0	4.2	Pump off	952.1
03/24/09	1508	7.98	0.236	17.4	14	-0.45	0	—	Pump on	—
03/24/09	1515	8.13	0.222	14.8	22	-0.55	0	—	—	—
03/24/09	1520	8.06	0.241	14.5	11	-0.33	0	—	—	—
03/24/09	1523	7.87	0.246	14.8	2	-0.38	0	—	—	—
03/24/09	1525	7.79	0.225	15.2	1	-0.17	0	3.4	—	—
03/24/09	1529	7.7	0.224	16.6	1	-0.18	0	—	—	—
03/24/09	1530	7.67	0.224	14.7	0	-0.14	0	3.2	—	—
03/24/09	1533	7.71	0.226	15.8	0	-0.17	0	—	—	—
03/24/09	1538	7.68	0.225	17	0	-0.12	0	—	Pump off	1014.8
04/03/09	1058	8.14	0.232	8.8	14	-0.68	0	—	Pump on	—
04/03/09	1101	7.97	0.221	12.3	43	-0.67	0	—	—	—
04/03/09	1104	7.7	0.24	12.8	15	-0.4	0	—	—	—
04/03/09	1107	7.68	0.24	11.9	12	-0.47	0	—	—	—
04/03/09	1108	7.66	0.238	11.7	11	-0.48	0	—	—	—
04/03/09	1111	7.64	0.238	11.5	8	-0.1	0	—	—	—
04/03/09	1113	7.54	0.226	15.2	1	-0.31	0	—	—	—
04/03/09	1115	7.5	0.223	15.1	1	-0.3	0	2.1	—	—
04/03/09	1117	7.47	0.223	16.1	0	-0.3	0	—	—	—
04/03/09	1119	7.48	0.223	15.9	0	-0.35	0	—	—	—

Table 5.2-1 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume Screen 1 (gal.)
Well Development (continued)										
04/03/09	1121	7.43	0.222	16.4	0	-0.31	0	—	—	—
04/03/09	1123	7.41	0.224	16	0	-0.33	0	—	—	—
04/03/09	1125	7.43	0.223	15.7	0	-0.3	0	—	—	—
04/03/09	1127	7.43	0.223	16.3	0	-0.37	0	—	—	—
04/03/09	1129	7.43	0.222	16.5	0	-0.33	0	—	—	—
04/03/09	1131	7.44	0.222	17.1	0	-*0.32	0	—	—	—
04/03/09	1133	7.45	0.223	17.3	0	-0.3	0	—	—	—
04/03/09	1135	7.47	0.222	14.1	0	-0.34	0	—	—	—
04/03/09	1137	7.49	0.223	16.4	0	-0.35	0	2.3	—	—
04/03/09	1138	7.52	0.223	16.4	0	-0.4	0	—	—	—
04/03/09	1140	—	—	—	—	—	—	—	Pump off	1095.2
04/10/09	0736	8.15	0.269	11.1	22	-0.32	0	—	Pump on	—
04/10/09	0740	8.03	0.242	11.7	1	-0.67	0	—	—	—
04/10/09	0745	7.94	0.245	13.1	2	-0.78	0	—	—	—
04/10/09	0750	7.88	0.249	13.3	3	-0.76	0	1.9	—	—
04/10/09	0755	7.81	0.237	14.9	1	-0.66	0	—	—	—
04/10/09	0800	7.69	0.217	15.7	0	-0.63	0	—	—	—
04/10/09	0805	7.65	0.218	16.3	0	-0.52	0	—	—	—
04/10/09	0807	7.62	0.218	17	0	-0.13	0	—	—	—
04/10/09	0808	—	—	—	—	—	—	1.8	Pump off	1156.5
04/21/09	0857	—	—	—	—	—	—	—	Pump on	
04/21/09	0940	—	—	—	—	—	—	—	Pump off	1238.7

[a] SP = Specific conductance.

[b] µm/cm = Micrometer per centimeter.

[c] T = Temperature.

[d] DO = Dissolved oxygen.

[e] — = Analysis not conducted. DO FLC = Dissolved oxygen measured by the Horiba instrument in a flow-through cell.

Table 5.2-2
Well Development and Aquifer Test Volumes and
Field Water-Quality Parameter Measurements at Well R-40i

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Well Development										
01/12/09	1015	7.54	0.383	14.6	60	4.2	0	—[e]	Bailed	100
01/25/09	1725	6.37	0.421	19.4	23	0.3	0.01	—	Pumped	100
R-40i Preaquifer Test (24 h)										
01/26/09	0806	7.15	0.365	12.4	20	1.09	0.01	—	very (v) Foamy	—
01/26/09	0840	7.12	0.311	17.5	2	1.09	0.01	—	v. Foamy	—
01/26/09	1000	7.32	0.237	17.7	2	1.13	0	10/9.7	Foamy	—
01/26/09	1040	7.38	0.227	17.2	1	1.27	0	—	Foamy	—
01/26/09	1100	7.41	0.224	18.2	1	1.21	0	8.75/8.4	Foamy	660.5
R-40i Aquifer Test (24 h)										
01/27/09	0800	—	—	—	—	—	—	—	Pump on	—
01/27/09	0810	7.97	0.225	8.4	1	0.19	0	—	Foamy	—
01/27/09	1046	7.66	0.225	17	1	0.12	0	—	Foamy	—
01/27/09	1115	7.71	0.219	17.9	1	0.59	0	—	Foamy	—
01/27/09	1200	7.74	0.222	17.4	1	0.71	0	—	Foamy	—
01/27/09	1620	7.77	0.226	17.6	1	0.41	0	—	Less Foam	—
01/27/09	1720	7.74	0.226	16.4	1	0.45	0	—	—	—
01/27/09	1805	7.59	0.228	16.6	1	0.44	0	—	—	—
01/27/09	1905	7.66	0.228	16.9	1	1.71	0	—	—	—
01/27/09	2000	7.77	0.229	17.3	1	0.03	0	—	—	—
01/27/09	2100	7.71	0.227	17	1	0.36	0	—	—	—
01/27/09	2200	7.83	0.23	18.1	1	1.41	0	—	—	—
01/27/09	2300	7.92	.0228	17.2	1	0.45	0	—	—	—
01/27/09	2400	—	—	—	—	—	—	—	—	2708.4

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
01/28/09	0000	7.92	0.23	17.5	1	0.43	0	—	—	—
01/28/09	0100	8	0.23	17.4	1	0.58	0	—	—	—
01/28/09	0200	7.96	0.202	17.2	1	0.47	0	—	—	—
01/28/09	0300	8.17	0.23	16.9	1	1.39	0	—	—	—
01/28/09	0400	8.04	0.229	17.4	1	0.39	0	—	—	—
01/28/09	0503	8.02	0.232	17.2	1	1.47	0	—	—	—
01/28/09	0605	7.95	0.231	17.3	1	0.42	0	—	—	—
01/28/09	0721	7.8	0.231	11	1	0.51	0	11.22	—	—
01/28/09	0800	—	—	—	—	—	—	—	Pump off	3784.6
03/05/09	1032	4	4.87	10.7	0	1.61	0.23	—	Calibrate Horiba	—
03/05/09	1045	7.19	0.32	17.1	9	0.08	0.01	—	—	—
03/05/09	1127	7.39	0.253	18.2	3	0.26	0	—	—	03/05/09
03/05/09	1150	7.46	0.246	19.2	2	0.12	0	—	—	03/05/09
03/05/09	1300	7.25	0.225	19.7	1	0.46	0	—	—	03/05/09
03/05/09	1419	7.22	0.218	18	1	0.05	0	—	—	03/05/09
03/05/09	1517	7.45	0.218	17.8	1	1.55	0	—	—	—
03/05/09	1640	7.46	0.217	17.4	0	0.01	0	—	—	—
03/05/09	1700	7.59	0.218	17.1	1	0.35	0	9	Pump off	4577.9
03/06/09	0700	—	—	—	—	—	—	—	Pump on	—
03/06/09	0716	7.27	0.226	13.8	2	0.84	0	14	—	—
03/06/09	0805	7.5	0.215	15.9	2	0.59	0	—	—	—
03/06/09	0903	7.6	0.212	17.7	2	0.5	0	—	—	—
03/06/09	1003	7.67	0.219	18.1	2	0.26	0	—	—	—
03/06/09	1108	7.66	0.215	18.1	0	0.26	0	—	—	—
03/06/09	1203	7.72	0.218	19.8	1	0.65	0	—	—	—
03/06/09	1305	7.68	0.219	19.1	1	0.64	0	—	—	—

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
03/06/09	1402	7.71	0.218	18.7	1	0.58	0	—	—	—
03/06/09	1500	7.38	0.22	18	1	0.22	0	10	Pump off	5569.4
03/09/09	0740	—	—	—	—	—	—	—	Pump on	—
03/09/09	0808	7.75	0.246	16	1	0.97	0	—	—	—
03/09/09	0923	7.48	0.215	18.2	0	0.9	0	—	—	—
03/09/09	1615	7.44	0.214	19.4	0	0.42	0	—	—	—
03/09/09	1730	7.61	0.213	19.4	0	0.67	0	—	—	—
03/09/09	1745	7.55	0.214	17.9	0	0.3	0	6.6	Pump off	6701.7
03/10/09	0700	—	—	—	—	—	—	—	Pump on	—
03/10/09	0800	7.71	0.214	16.5	1	0.19	0	—	—	—
03/10/09	0900	7.73	0.212	17.4	1	0.22	0	—	—	—
03/10/09	1000	7.82	0.213	17.5	0	1.02	0	—	—	—
03/10/09	1100	8.02	0.213	19.3	0	1.36	0	—	—	—
03/10/09	1200	7.98	0.214	19.5	1	0.98	0	—	—	—
03/10/09	1300	7.95	0.215	20	1	0.37	0	—	—	—
03/10/09	1400	7.91	0.215	20	0	0.39	0	—	—	—
03/10/09	1500	7.81	0.215	20	0	0.38	0	—	—	—
03/10/09	1600	7.77	0.215	19.4	0	0.49	0	—	—	—
03/10/09	1700	7.7	0.218	19.3	0	0.53	0	—	—	—
03/10/09	1730	7.68	0.217	19.2	0	0.46	0	5	—	—
03/10/09	1745	7.76	0.218	19.3	0	0.47	0	—	Pump off	7797.7
03/11/09	0705	—	—	—	—	—	—	—	Pump on	—
03/11/09	0812	7.48	0.217	16.5	1	0.09	0	—	—	—
03/11/09	0900	7.46	0.217	16.5	0	0.19	0	—	—	—
03/11/09	1000	7.77	0.212	18.2	0	0.21	0	—	—	—
03/11/09	1100	7.78	0.212	18.6	0	0.41	0	—	—	—

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
03/11/09	1200	7.78	0.219	19.1	0	0.94	0	—	—	—
03/11/09	1300	7.81	0.215	19.6	0	0.81	0	—	—	—
03/11/09	1400	7.83	0.214	19.9	0	0.46	0	—	—	—
03/11/09	1500	7.83	0.214	19.9	0	0.96	0	—	—	—
03/11/09	16:00	7.73	0.214	19.9	0	0.43	0	—	—	—
03/11/09	1700	7.74	0.215	18.6	0	0.45	0	—	—	—
03/11/09	1800	7.75	0.215	18.4	0	0.2	0	6.9	Pump off	8737.2
03/12/09	1020	—	—	—	—	—	—	—	Pump on	—
03/12/09	10:30	7.75	0.226	16.6	1	0.42	0	—	—	—
03/12/09	1130	7.75	0.224	17.2	0	0.33	0	—	—	—
03/12/09	1230	7.7	0.21	18.6	0	0.18	0	—	—	—
03/12/09	1330	7.7	0.214	19	0	0.08	0	—	—	—
03/12/09	1430	7.72	0.213	19.6	0	0.01	0	—	—	—
03/12/09	1550	7.74	0.217	19.9	0	0.01	0	—	—	—
03/12/09	1650	7.67	0.215	19.4	0	-0.02	0	6	Pump off	9603.2
03/13/09	0700	7.75	0.214	17.6	0	-0.04	0	—	Pump on	—
03/13/09	0800	7.75	0.21	—	—	-0.01	0	—	—	—
03/13/09	0900	7.76	1.209	18.9	1	0.01	0	—	—	—
03/13/09	1000	7.78	0.209	18.9	0	0.08	0	—	—	—
03/13/09	1100	7.92	0.207	18.8	0	0.25	0	—	—	—
03/13/09	1300	7.9	0.209	18.8	0	0.21	0	—	—	—
03/13/09	1400	7.86	0.213	19.2	0	-0.06	0	—	—	—
03/13/09	1500	7.86	0.213	19	0	0.02	0	—	—	—
03/13/09	1600	7.88	0.216	18.7	0	0.03	0	—	—	—
03/13/09	1630	7.88	0.214	17.9	0	0.05	0	5	Pump off	10606.95
03/16/09	0700	7.73	0.24	14.7	1	0.3	0	—	—	—

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
03/16/09	0800	.767	0.213	18.2	0	0.38	0	—	—	—
03/16/09	0900	7.78	0.21	18.7	0	0.23	0	—	—	—
03/16/09	1000	7.8	0.205	19.3	0	0.012	0	—	—	—
03/16/09	1100	7.88	0.205	19.4	0	0.18	0	—	—	—
03/16/09	1200	7.9	0.206	19.4	0	0.3	0	—	—	—
03/16/09	1300	7.9	0.207	20	0	0.19	0	—	—	—
03/16/09	1400	7.92	0.207	20.2	0	0.17	0	—	—	—
03/16/09	1500	7.84	0.211	19.2	0	-0.04	0	—	—	—
03/16/09	1600	7.94	0.216	20.2	0	-0.06	0	4.4	direct	—
03/16/09	1601	—	—	—	—	—	—	6	beaker	—
03/16/09	1700	7.95	0.214	20.5	0	0.15	0	—	—	—
03/16/09	1800	7.85	0.214	17	0	0.18	0	—	Pump off	11755.2
03/17/09	0700	7.92	0.218	11.4	0	0.04	0	—	Pump on	—
03/17/09	0800	7.85	0.208	18.1	0	0.08	0	—	—	—
03/17/09	0850	—	—	—	—	—	—	—	Pump off	—
03/17/09	0932	—	—	—	—	—	—	—	Pump on	—
03/17/09	1030	7.87	0.204	17.4	0	-0.61	0	—	—	—
03/17/09	1200	7.94	0.209	19.1	0	0.25	0	—	—	—
03/17/09	1300	7.94	0.211	19.2	0	0.25	0	—	—	—
03/17/09	1400	7.96	0.212	20.5	0	0.24	0	—	—	—
03/17/09	1500	7.85	0.212	20.5	0	0.18	0	—	—	—
03/17/09	1600	7.88	0.216	20.7	0	-0.13	0	—	—	—
03/17/09	1720	7.8	0.216	20.4	0	0.24	0	—	—	—
03/17/09	1800	7.65	0.217	19.5	0	-0.05	0	5.4	Pump off	12976.8
03/18/09	0700	—	—	—	—	—	—	—	Pump on	—
03/18/09	0800	7.72	0.211	17	0	0.08	0	—	—	—

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
03/18/09	0900	7.76	0.211	17.1	0	0.02	0	—	—	—
03/18/09	1000	7.82	0.205	17.8	0	0.07	0	—	—	—
03/18/09	1100	7.99	0.212	18.7	0	0.13	0	—	—	—
03/18/09	1200	7.99	0.215	—	0	0.07	0	—	—	—
03/18/09	1300	7.98	0.219	19.3	0	-0.02	0	—	—	—
03/18/09	1400	7.99	0.219	19.6	0	-0.03	0	—	—	—
03/18/09	1500	8.04	0.0218	19.7	0	-0.08	0	—	—	—
03/18/09	1600	7.96	0.219	20.1	0	.018	0	—	—	—
03/18/09	1745	8.02	0.022	20.1	0	0.12	0	6.1	Pump off	14666.8
03/19/09	0702	7.98	0.224	9.1	1	0.62	0	—	Pump on	—
03/19/09	0802	7.96	0.221	9.9	0	0.51	0	—	—	—
03/19/09	1000	7.87	0.213	16.3	0	0.19	0	—	—	—
03/19/09	1100	7.87	0.215	17.3	0	0.05	0	—	—	—
03/19/09	1200	7.89	0.218	18.2	0	-0.04	0	—	—	—
03/19/09	1300	7.89	0.218	18.8	0	-0.04	0	—	—	—
03/19/09	1400	7.96	0.216	19.7	0	0.14	0	—	—	—
03/19/09	1500	7.94	0.221	20.1	1	-0.2	0	—	—	—
03/19/09	1600	7.86	0.218	19.9	1	-0.36	0	—	—	—
03/19/09	1645	7.83	0.222	19.8	0	-0.05	0	—	—	—
03/19/09	1730	7.69	0.22	18.4	0	0.8	0	—	—	—
03/19/09	1800	7.79	0.218	17.9	0	-0.06	0	4.4	Pump off	14666.8
03/20/09	0700	7.88	0.225	11.1	1	-0.15	0	—	Pump on	—
03/20/09	0800	7.84	0.221	15.4	0	-0.12	0	—	—	—
03/20/09	0900	7.76	0.209	18.2	0	-0.08	0	—	—	—
03/20/09	1002	7.81	0.216	18.7	0	-0.25	0	—	—	—
03/20/09	1100	7.87	0.218	19.1	0	-0.46	0	—	—	—

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
03/20/09	1200	7.95	0.218	19.1	0	-0.35	0	—	—	—
03/20/09	1300	7.87	0.221	19.2	0	-0.28	0	—	—	—
03/20/09	1400	7.92	0.221	19.4	0	-0.28	0	—	—	—
03/20/09	1500	7.95	0.219	20.1	0	-0.22	0	—	—	—
03/20/09	1545	7.95	0.219	20.3	0	0.01	0	4.1	Pump off	17205.65
03/23/09	0700	7.99	0.214	16	0	-0.37	0	—	—	—
03/23/09	0800	8	0.212	—	0	-.037	0	—	—	—
03/23/09	0900	8.02	0.208	19.9	0	-.032	0	—	—	—
03/23/09	1000	7.99	0.21	19.1	0	-0.38	0	—	—	—
03/23/09	1100	7.96	0.213	18.6	0	-0.45	0	—	—	—
03/23/09	1200	7.98	0.213	18.7	0	-0.44	0	—	—	—
03/23/09	1300	7.99	0.211	18.7	0	-0.41	0	—	—	—
03/23/09	1400	7.92	0.213	18.8	0	0.42	0	—	—	—
03/23/09	1500	7.8	—	—	0	0.36	0	—	—	—
03/23/09	1730	7.89	0.219	19	0	-0.33	0	—	—	—
03/23/09	1800	7.83	0.216	17.7	0	-0.22	0	4.98	Pump off	18990.9
03/24/09	0700	7.71	0.227	14.3	1	-0.17	0	—	—	—
03/24/09	0800	7.89	0.218	16.3	0	-0.21	0	—	—	—
03/24/09	0900	7.94	0.0214	17	0	-0.26	0	—	—	—
03/24/09	1000	7.96	0.215	17.6	0	-0.19	0	—	—	—
03/24/09	1100	7.83	0.0215	18.3	0	-0.23	0	—	—	—
03/24/09	1200	7.83	0.0218	17.4	0	-.024	0	—	—	—
03/24/09	1300	7.84	0.22	18.9	0	-.021	0	—	—	—
03/24/09	1400	7.92	0.0218	19.2	0	-0.21	0	—	—	—
03/24/09	1500	7.8	0.222	19.4	0	-0.29	0	—	—	—
03/24/09	1600	7.96	0.216	18.1	0	-0.08	0	—	—	—

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
03/24/09	1700	7.88	0.215	18.9	0	-0.23	0	—	—	—
03/24/09	1740	7.85	0.217	18.4	0	0.43	0	5.8	Pump off	20726.8
03/25/09	0730	7.69	0.218	13.2	1	-0.3	0	—	—	—
03/25/09	0840	7.87	0.207	16.8	0	-0.18	0	—	—	—
03/25/09	1000	7.82	0.213	15.9	0	-0.33	0	—	—	—
03/25/09	1115	7.87	0.213	15.7	0	-0.4	0	—	—	—
03/25/09	1330	7.95	0.21	15.4	0	-0.64	0	—	—	—
03/25/09	1430	8.09	0.207	18.3	0	-0.17	0	—	—	—
03/25/09	1530	7.96	0.213	18.9	0	-0.42	0	—	—	—
03/25/09	1640	7.95	0.214	18.4	0	-0.24	0	3.9	Pump off	21843.5
03/26/09	1030	7.53	0.235	16.1	0	-0.01	0	—	—	—
03/26/09	1200	7.84	0.204	18.1	0	-0.18	0	—	—	—
03/26/09	1300	8.14	0.206	16.8	0	-0.2	0	—	—	—
03/26/09	1430	7.93	0.208	15.7	0	-0.31	0	—	—	—
03/26/09	1600	8.04	0.213	17.4	0	-0.19	0	3.8	Pump off	22768.9
04/03/09	1144	—	—	—	—	—	—	—	Pump on	—
04/03/09	1202	8.19	0.212	13.6	3	-0.34	0	—	—	—
04/03/09	1205	—	—	—	—	—	—	18.7	—	—
04/03/09	1300	8.34	0.203	15	0	-0.02	0	—	—	—
04/03/09	1400	8.2	0.202	16.1	0	-0.11	0	—	—	—
04/03/09	1500	7.99	0.204	18.5	0	-0.22	0	—	—	—
04/03/09	1600	—	—	—	—	—	—	3.1	—	—
04/03/09	1601	7.95	0.201	19.1	0	0.2	0	—	Pump off	23348.3
04/06/09	0815	7.97	0.227	13.9	0	-0.65	0	—	Pump on	—
04/06/09	0850	—	—	—	—	—	—	3.8	—	—
04/06/09	0930	8.02	0.203	17.2	0	-0.44	0	—	—	—

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
04/06/09	1030	7.99	0.202	17.1	0	-0.24	0	—	—	—
04/06/09	1130	8.05	0.203	18.6	0	-0.35	0	—	—	—
04/06/09	1230	7.03	0.203	19.1	0	-0.32	0	—	—	—
04/06/09	1330	8.01	0.203	19.9	0	-0.47	0	—	—	—
04/06/09	1430	8.02	0.204	19.9	0	-0.47	0	—	—	—
04/06/09	1600	7.93	0.207	19.8	0	-0.42	0	—	—	—
04/06/09	1700	7.95	0.208	18.3	0	-0.03	0	3.8	Pump off	25045.3
04/07/09	0753	—	—	—	—	—	—	—	Pump on	—
04/07/09	0830	7.91	0.208	12.8	1	-0.3	0	4	—	—
04/07/09	1000	7.99	0.206	18	0	-0.4	0	—	—	—
04/07/09	1100	7.9	0.206	19	0	-0.38	0	—	—	—
04/07/09	1230	7.89	0.205	17.9	0	-0.37	0	—	—	—
04/07/09	1300	7.96	0.204	18.3	0	-0.43	0	—	—	—
04/07/09	1400	7.95	0.208	18.9	0	-0.38	0	—	—	—
04/07/09	1500	7.91	0.209	19.9	0	-0.39	0	—	—	—
04/07/09	1600	7.89	0.209	20.1	0	-0.44	0	—	—	—
04/07/09	1630	7.89	0.209	20.6	0	-0.46	0	4	—	—
04/07/09	1700	7.9	0.212	21.4	0	-0.34	0	—	Pump off	26213.1
04/08/09	0710	—	—	—	—	—	—	—	Pump on	—
04/08/09	0730	7.78	0.217	17.6	0	-0.62	0	6.5	—	—
04/08/09	0830	7.82	0.213	17.6	0	-0.35	0	—	—	—
04/08/09	0930	7.94	0.201	17.9	0	-0.12	0	—	—	—
04/08/09	1030	8.2	0.205	19	0	-0.16	0	—	—	—
04/08/09	1130	8.22	0.207	19.8	0	-0.05	0	—	—	—
04/08/09	1230	8.03	0.209	20.2	0	-0.48	0	—	—	—
04/08/09	1330	8.1	0.211	20.3	0	-0.46	0	—	—	—

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
04/08/09	1430	8.16	0.211	20.8	0	-0.07	0	—	—	—
04/08/09	1530	8.03	0.213	20.5	0	-0.48	0	—	—	—
04/08/09	1630	8.02	0.212	20.2	0	-0.14	0	—	—	—
04/08/09	1700	8.09	0.212	19.9	0	0.68	0	3.9	Pump off	28093.1
04/09/09	0700	7.95	0.222	16.7	0	-0.56	0	—	Pump on	—
04/09/09	0730	7.88	0.213	16.9	0	-0.29	0	6.3	—	—
04/09/09	0800	7.9	0.202	16.1	0	-0.32	0	—	—	—
04/09/09	0900	7.93	0.204	17.2	0	-0.51	0	—	—	—
04/09/09	1000	8.02	0.205	17.7	0	-0.37	0	—	—	—
04/09/09	1100	8.06	0.206	18.2	0	0.01	0	—	—	—
04/09/09	1200	7.97	0.21	18.6	0	-0.6	0	—	—	—
04/09/09	1300	7.95	0.21	18.8	0	-0.48	0	—	—	—
04/09/09	1400	7.86	0.211	19.2	1	-0.49	0	—	—	—
04/09/09	1500	8.03	0.212	19.3	0	-0.3	0	—	—	—
04/09/09	1600	8.01	0.0212	19.2	0	-0.41	0	—	—	—
04/09/09	1700	8.02	0.213	19.2	0	-0.25	0	4.1	Pump off	30003.3
04/10/09	0817	—	—	—	—	—	—	—	Pump on	—
04/10/09	0833	8	0.226	12.4	0	-0.31	0	7.1	—	—
04/10/09	0930	7.97	0.203	15.2	0	-0.03	0	—	—	—
04/10/09	1030	8.02	0.206	18	0	-0.21	0	—	—	—
04/10/09	1130	7.89	0.206	19	0	-0.43	0	—	—	—
04/10/09	1200	7.82	0.206	19.3	0	-0.56	0	3.2	Pump off	30781.8
04/13/09	0730	7.96	0.223	16.2	0	-0.7	0	—	Pump on	—
04/13/09	0830	7.97	0.223	16.5	0	-0.72	0	6.6	—	—
04/13/09	0930	8.06	0.202	17.8	0	-0.55	0	—	—	—
04/13/09	1030	7.93	0.199	16	0	-0.77	0	—	—	—

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
04/13/09	1130	7.91	0.198	18.2	0	-0.62	0	—	—	—
04/13/09	1230	7.82	0.201	19.1	0	-0.32	0	—	—	—
04/13/09	1330	8.04	0.204	20.4	0	-0.47	0	—	—	—
04/13/09	1430	8.06	0.203	19.7	0	-0.45	0	—	—	—
04/13/09	1530	7.98	0.206	19.7	0	-0.56	0	—	—	—
04/13/09	1630	7.93	0.207	20.1	0	-0.57	0	2.8	—	—
04/13/09	1648	—	—	—	—	—	—	—	Pump off	32441.8
04/14/09	0710	—	—	—	—	—	—	—	Pump on	—
04/14/09	0730	8.09	0.207	16.8	1	-0.28	0	3.8	—	—
04/14/09	0830	8.01	0.207	17.4	0	-0.33	0	—	—	—
04/14/09	0930	8.01	0.206	17.6	1	-0.44	0	—	—	—
04/14/09	1030	8.06	0.206	18.1	1	-0.37	0	—	—	—
04/14/09	1130	8.12	2.207	17.3	0	-0.43	0	—	—	—
04/14/09	1230	7.97	0.201	19.3	0	-0.53	0	—	—	—
04/14/09	1330	7.86	0.203	20	0	-0.54	0	—	—	—
04/14/09	1430	7.92	0.203	20.1	0	-0.06	0	2.1	Pump off	33247.0
04/20/09	0835	—	—	—	—	—	—	—	Pump on	—
04/20/09	0908	6.4	0.255	16.4	0	7.29	0	—	DO FLC	—
04/20/09	0914	4	4.48	14.5	0	0.31	0.22	—	Calibrate Horiba	—
04/20/09	0925	6.28	0.211	17.2	0	7.84	0	1.9	DO FLC	—
04/20/09	1000	7.05	0.201	17.5	0	7.18	0	—	DO FLC	—
04/20/09	1030	7.35	0.199	18.7	0	7.2	0	—	DO FLC	—
04/20/09	1100	7.43	0.203	20	0	7.35	0	—	DO FLC	—
04/20/09	1130	7.6	0.202	19.5	0	7.75	0	—	DO FLC	—
04/20/09	1300	7.76	0.199	17.7	0	8.4	0	—	DO FLC	—
04/20/09	1330	7.91	0.197	20.6	0	8.36	0	—	DO FLC	—

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
04/20/09	1400	7.84	0.202	20.2	0	8.26	0	—	DO FLC	—
04/20/09	1430	7.92	0.199	19.6	0	8.22	0	—	DO FLC	—
04/20/09	1515	7.83	0.2	20.8	0	8.12	0	—	DO FLC	—
04/20/09	1600	7.88	0.202	18.8	0	8.07	0	—	DO FLC	—
04/20/09	1630	7.76	0.203	20.4	0	7.82	0	—	DO FLC	—
04/20/09	1645	7.85	0.206	19.7	0	7.71	0	1.7	Pump off	34541.8
04/21/09	0700	—	—	—	—	—	—	—	Pump on	—
04/21/09	0730	—	—	—	—	—	—	3.5	—	—
04/21/09	0845	—	—	—	—	—	—	—	Pump off	34791.8
04/21/09	1101	3.99	4.99	21.9	0	1.13	0.23	—	Calibrate Horiba	—
04/21/09	1104	4	4.48	22.4	0	9.02	0.23	—	Calibrate Horiba	—
04/24/09	1445	—	—	—	—	—	—	—	Pump on	—
04/24/09	1500	7.81	0.203	21.1	0	-0.18	0	1.7	—	—
04/24/09	1600	—	—	—	—	—	—	—	Pump off	35002.2
04/27/09	0745	—	—	—	—	—	—	—	Pump on	—
04/27/09	0800	7.44	0.196	18.6	0	0.22	0	1.4	—	—
04/27/09	0900	7.44	0.195	19.1	0	0.37	0	—	—	—
04/27/09	1000	7.49	0.196	19.2	0	-0.34	0	—	—	—
04/27/09	1100	7.57	0.198	19.6	0	-0.28	0	—	—	—
04/27/09	1200	7.43	0.198	19.6	0	0.01	0	—	—	—
04/27/09	1300	7.57	0.201	19.6	0	0.15	0	—	—	—
04/27/09	1400	7.41	0.202	18.5	0	0.28	0	—	—	—
04/27/09	1500	7.46	0.201	20	0	0.19	0	—	—	—
04/27/09	1600	7.39	0.201	21.2	0	0.21	0	—	—	—
04/27/09	1700	7.42	0.203	19.6	0	0.15	0	2.4	Pump off	36804.0

Table 5.2-2 (continued)

Date	Time	pH	SP[a] (µS/cm)[b]	T[c] (°C)	Turbidity (NTU)	DO[d] (mg/L)	Salinity %	TOC Result (mg/L)	Comment	End-of-Day Cumulative Purge Volume R-40i (gal.)
R-40i Aquifer Test (24 h) (continued)										
04/28/09	0700	7.45	0.196	17.9	0	0.25	0	—	Pump on	—
04/28/09	0730	7.45	0.196	17.9	0	0.25	0	2.7	DO FLC	—
04/28/09	0830	7.48	0.198	18.6	0	0.18	0	—	DO FLC	—
04/28/09	0900	7.53	0.201	19.2	0	0.22	0	—	Pump off	37163.2

[a] SP = Specific conductance.

[b] µS/cm = microsiemens per centimeter.

[c] T = Temperature.

[d] DO = Dissolved oxygen.

[e] — = Analysis not conducted. DO FLC = Dissolved oxygen measured by the Horiba instrument in a flow-through cell.

Table 5.5-1
R-40 Survey Coordinates

Northing	Easting	Elevation	Identification
1760801.14	1636628.23	6719.24	R-40 brass monument in cement pad
1760802.14	1636628.23	6719.04	R-40 ground surface adjacent to pad
1760795.42	1636628.21	6722.62	R-40 top of 10-in protective casing
1760795.49	1636628.14	6722.10	R-40 top of stainless steel well casing
1760795.43	1636628.43	6720.01	R-40i top of PVC well casing

Note: All coordinates are expressed as New Mexico State Plane Coordinate System Central Zone (NAD 83); elevation is expressed in feet above mean sea level using the National Geodetic Vertical Datum of 1929.

Table 5.6-1
Summary of Waste Samples Collected during Drilling and Development of R-40

Location ID	Sample ID	Date Collected	Description	Container	Sample Type
R-40	GW40-08-14315	07/28/2008	Dry drill cuttings	Rolloff	Solid
R-40	GW40-08-14316	07/28/2008	Dry drill cuttings	Rolloff	Solid
R-40	GW40-08-14317	07/30/2008	Dry drill cuttings	Rolloff	Solid
R-40	GW40-08-14807	08/07/2008	Hydraulic-oil gravel	Drum	NMSW
R-40	GW37-08-15265	09/18/2008	Dry drill cuttings	Rolloff	Solid
R-40	GW37-08-15267	10/16/2008	Dry drill cuttings	Rolloff	Solid
R-40	GW40-09-516	11/20/2008	Drilling water	1st tank	Liquid
R-40	GW40-09-1609	12/21/2008	Drilling water	Containment pit	Liquid
R-40	GW37-09-1545	12/22/2008	Wet drill cuttings	Containment pit	Solid
R-40	GW40-09-1610	01/29/2009	Development water	2nd tank	Liquid
R-40	GW37-09-6294	03/26/2009	Development water	3rd tank	Liquid
R-40	GW37-09-6305	03/26/2009	Development water	1st tank, resample	Liquid
R-40	GW37-09-6307	03/29/2009	Development water	2nd tank, resample	Liquid
R-40	GW37-09-6304	03/30/2009	Drilling water, resample	Containment pit resample	Liquid
R-40	GW37-09-6296	04/29/2009	Development water	4th tank	Liquid
R-40	GW37-09-6297	04/29/2009	Development water	Poly tanks (2)	Liquid

Appendix A

Acronyms and Abbreviations, Metric Conversion Table, and Data Qualifier Definitions

A-1.0 ACRONYMS AND ABBREVIATIONS

µS/cm	microsiemens per centimeter
amsl	above mean sea level
APS	Accelerator Porosity Sonde
ASTM	American Society for Testing and Materials
bgs	below ground surface
Consent Order	Compliance Order on Consent
cu	capture unit
DO	dissolved oxygen
DTW	depth to water
ECS	Elemental Capture Spectroscopy
EES-14	Earth and Environmental Science Group
ENV-MAQ	Environmental Division–Meteorology and Air Quality
FLC	flow-through cell
gAPI	American Petroleum Institute gamma ray
GR	gamma ray
HE	high explosives
HNGS	Hostile Natural Gamma Spectroscopy
IC	ion chromatography
ICPMS	inductively coupled (argon) plasma mass spectrometry
ICPOES	inductively coupled (argon) plasma optical emission spectroscopy (I
I.D.	inside diameter
LANL	Los Alamos National Laboratory
lbf	pound force
LWSP	LANL Water Stewardship Program
MDA	material disposal area
NMED	New Mexico Environment Department
NMSW	New Mexico special waste
NOI	notice of intent
NTU	nephelometric turbidity unit
O.D.	outside diameter
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act

RPF	Records Processing Facility
SP	specific conductance
T	temperature
TA	technical area
TD	total depth
TLD	Triple Detector Litho-Density
TOC	total organic carbon
VOC	volatile organic compounds
WDC	WDC Exploration & Wells

A-2.0 METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain U.S. Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (µm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (µg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

A-3.0 DATA QUALIFIER DEFINITIONS

Data Qualifier	Definition
U	The analyte was analyzed for but not detected.
J	The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.
J+	The analyte was positively identified, and the result is likely to be biased high.
J-	The analyte was positively identified, and the result is likely to be biased low.
UJ	The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific detection or quantitation limit.
R	The data are rejected as a result of major problems with quality assurance/quality control (QA/QC) parameters.

Appendix B

Well R-40 Lithologic Log

LATA-Sharp Remediation Services, Inc.
Borehole Log

Project: LWSP Regional Aquifer Wells

Borehole Location ID: R-40 **Date:** September 9 to November 7, 2008

TA- 54 **Attitude:** Vertical

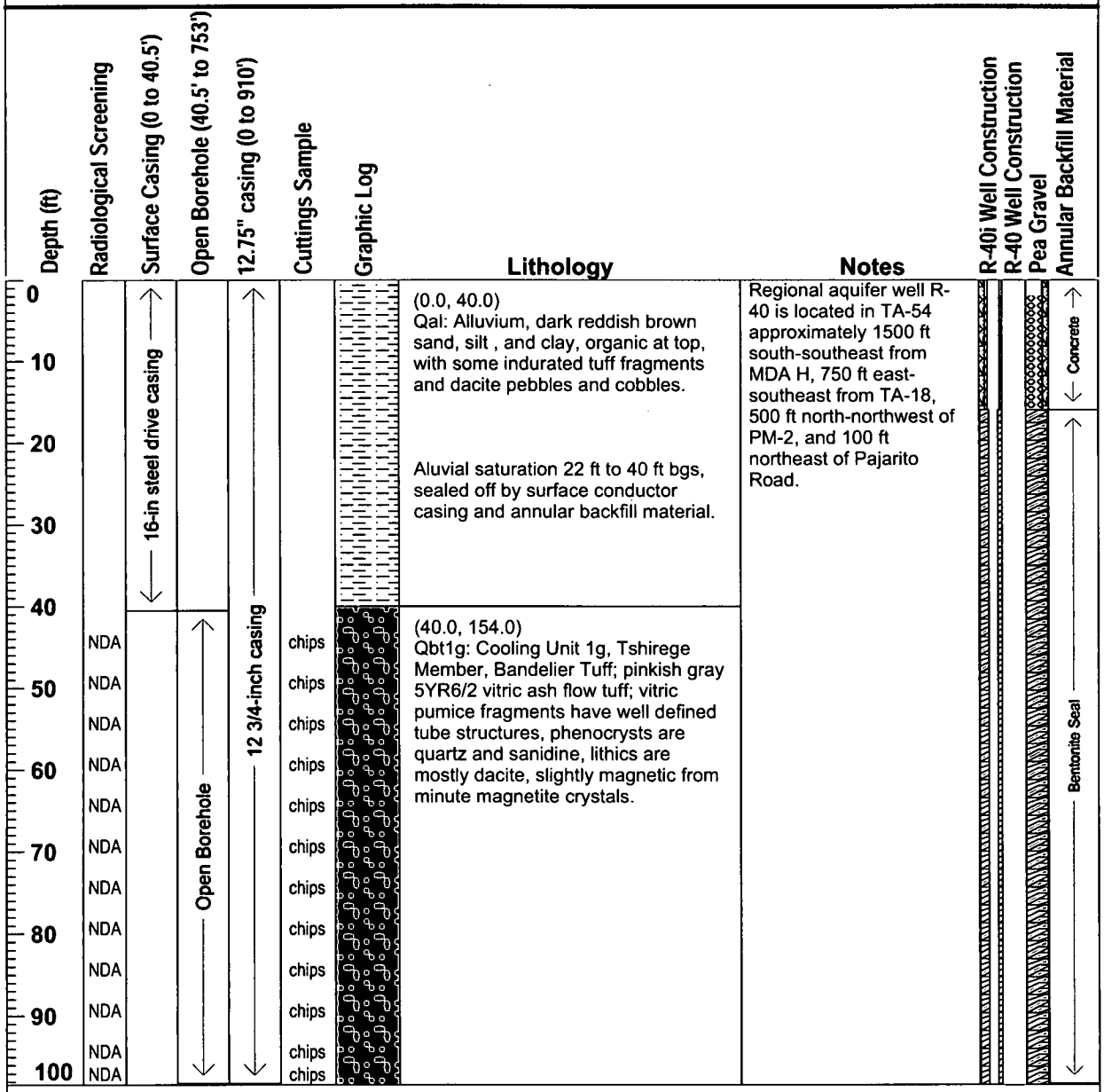
AOC/SWMU: NA **Drill Operator:** Hector Leon

Drilling Company: WDC Exploration and Wells **DTW R-40i Perched (ft):** 640.45 ft

Drilling Equipment: Speedstar 50K **DTW R-40 Screen 1 Perched (ft):** 761.33 ft

Geologist: Jon Marin **DTW R-40 Screen 2 Regional (ft):** 852.0 ft

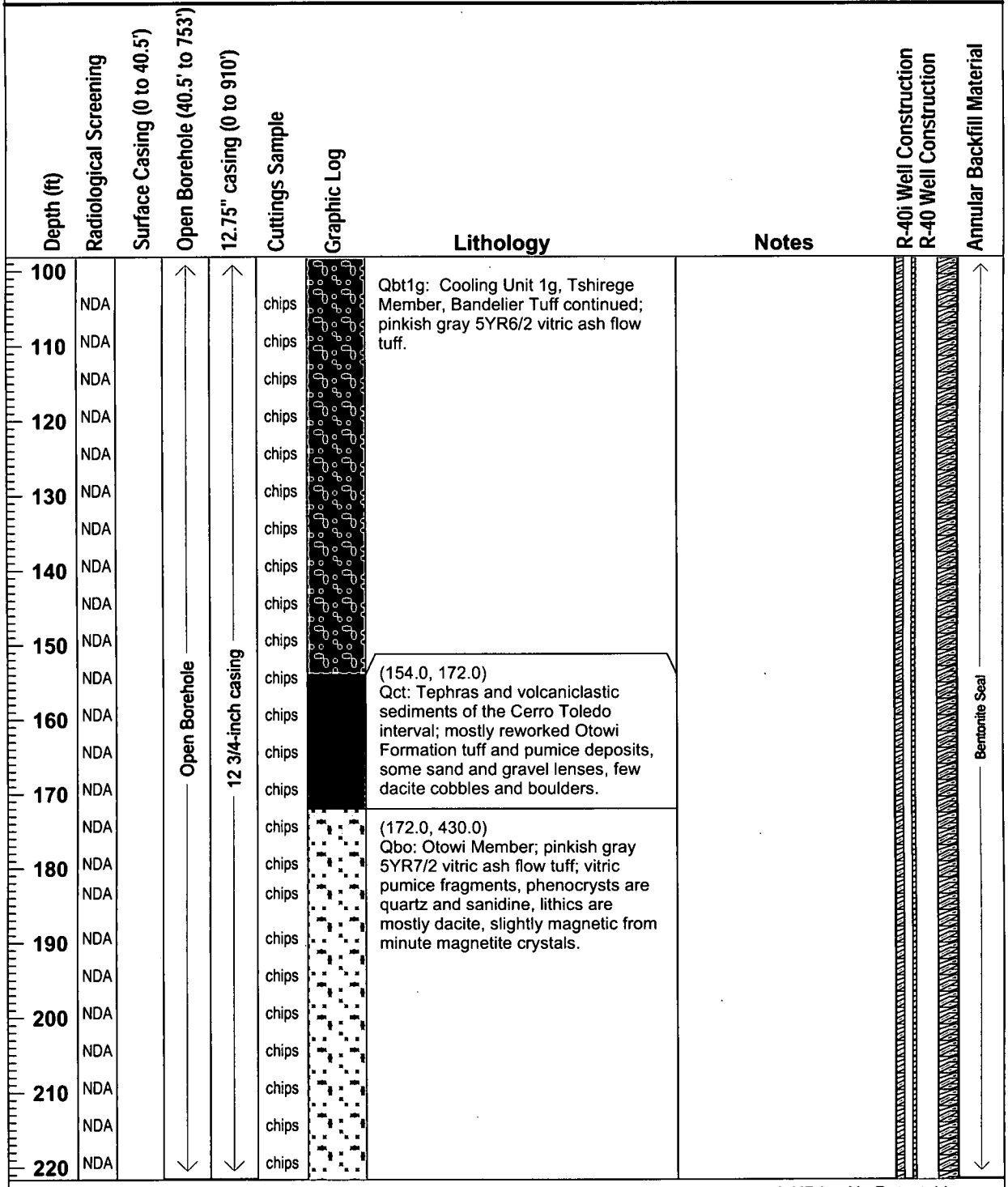
Sampling Equipment: Airlift, bail, and pump **Total Depth (ft):** 910 ft



bgs = below ground surface; DTW = Depth to Water (ft bgs); NA = not applicable or not encountered; NDA = No Detectable Activity > 2 X daily- and location-specific radiological background value; Radiological Screening peformed on cuttings for curation; SAA = same as above; SS = A304 stainless steel; TA = Technical Area; TD = Total Depth; WDC = Water Development Corporation.

LATA-Sharp Remediation Services, Inc.
Borehole Log

LWSP Regional Aquifer Wells
Well Location ID: R-40



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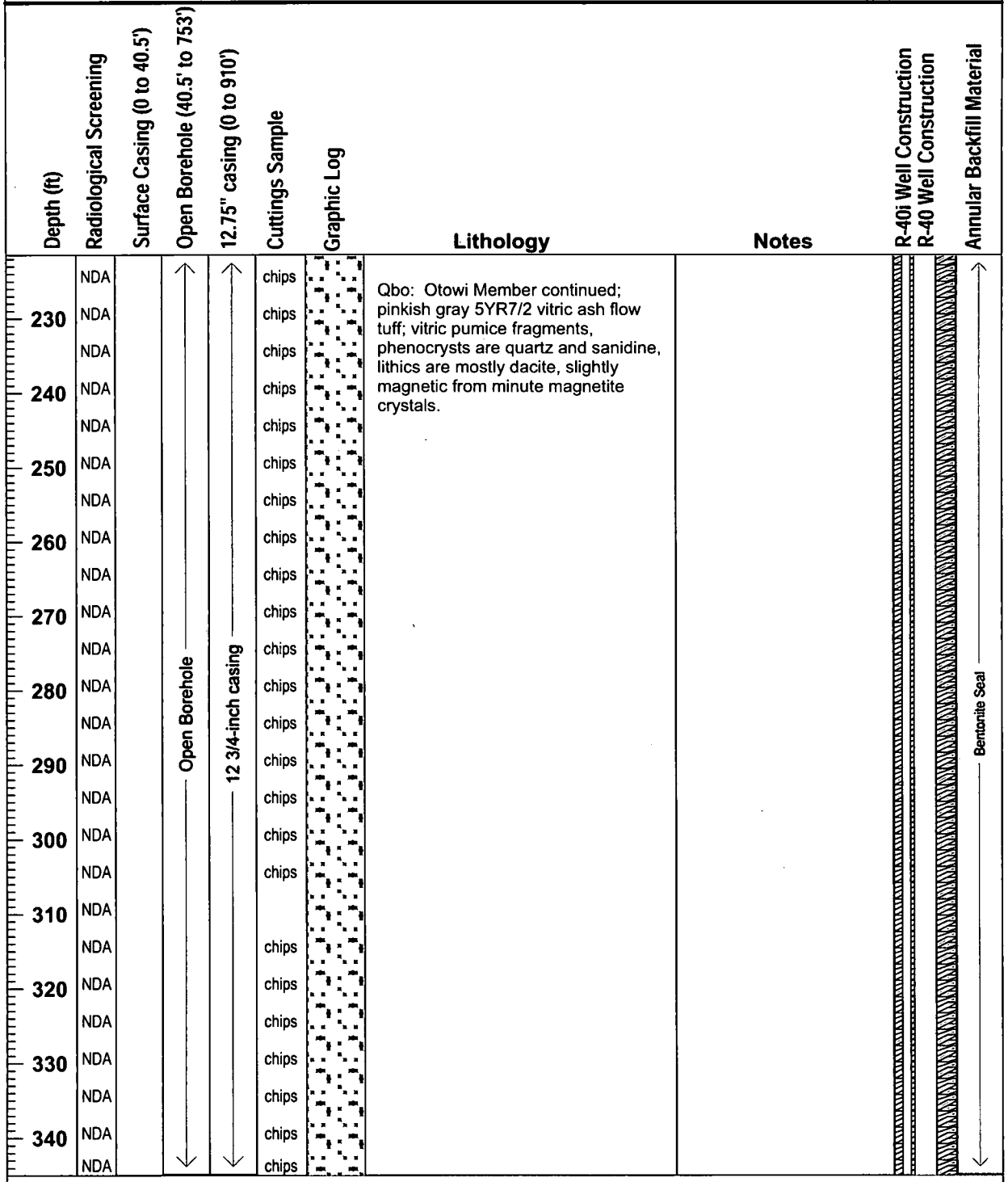
LATA-Sharp Remediation Services, Inc.
Borehole Log

LWSP Regional Aquifer Wells
Well Location ID: R-40



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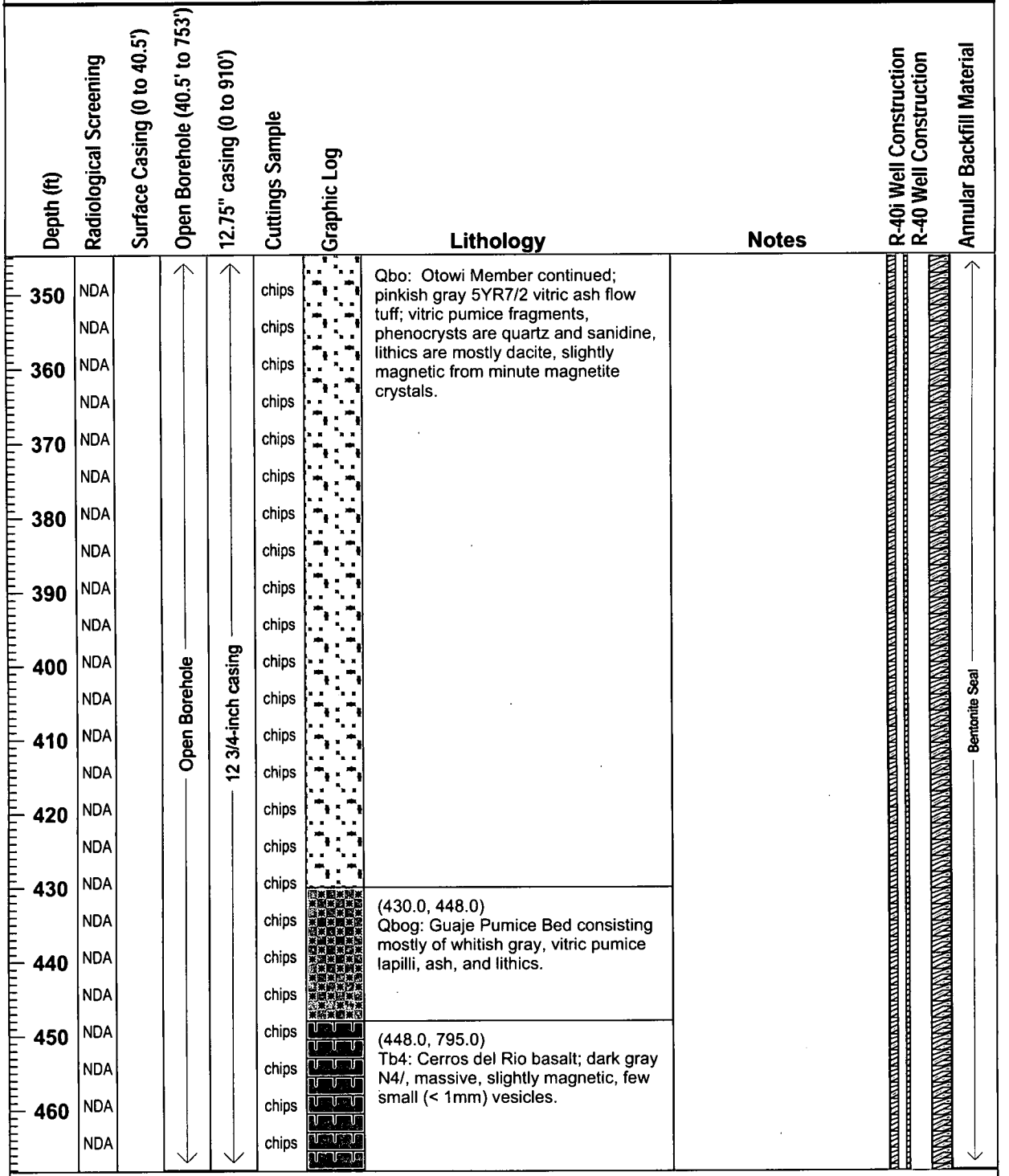
LATA-Sharp Remediation Services, Inc.
Borehole Log

LWSP Regional Aquifer Wells
Well Location ID: R-40

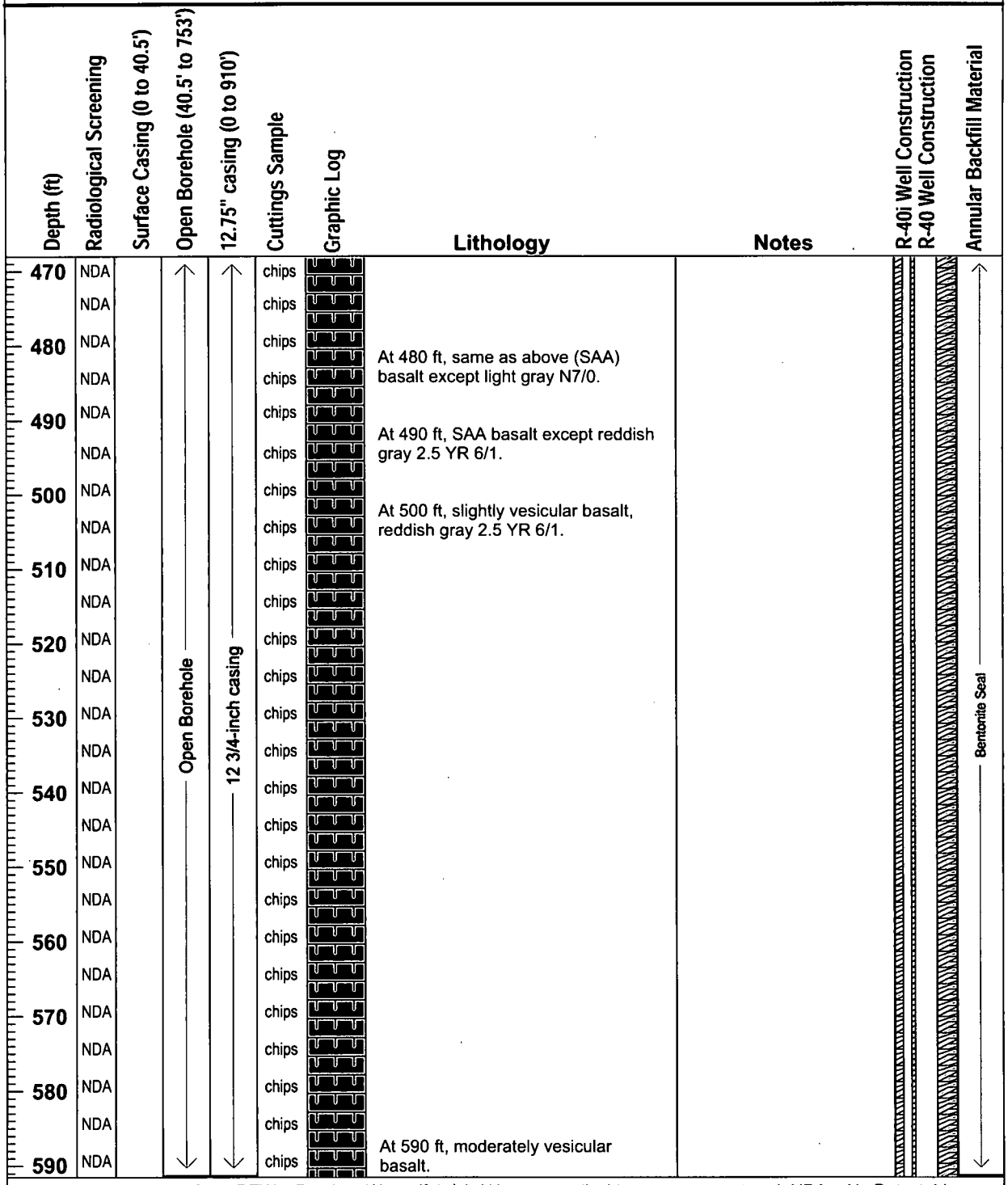


bgs = below ground surface; DTW = Depth to Water (ft bgs); NA = not applicable or not encountered; NDA = No Detectable Activity > 2 X daily- and location-specific radiological background value; Radiological Screening peformed on cuttings for curation; SAA = same as above; SS = A304 stainless steel; TA = Technical Area; TD = Total Depth; WDC = Water Development Corporation.

LATA-Sharp Remediation Services, Inc.
Borehole Log

LWSP Regional Aquifer Wells

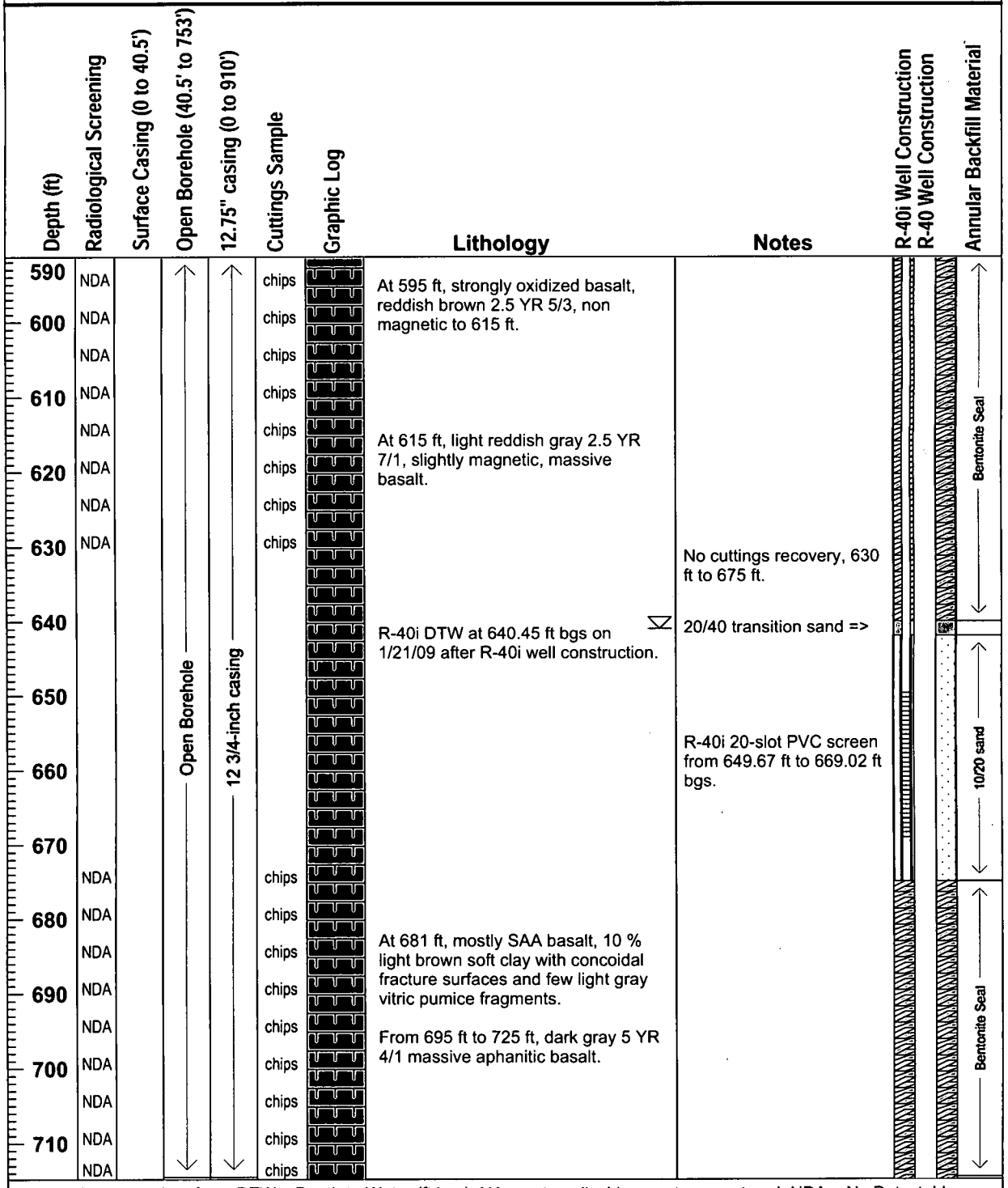
Well Location ID: R-40



bgs = below ground surface; DTW = Depth to Water (ft bgs); NA = not applicable or not encountered; NDA = No Detectable Activity > 2 X daily- and location-specific radiological background value; Radiological Screening peformed on cuttings for curation; SAA = same as above; SS = A304 stainless steel; TA = Technical Area; TD = Total Depth; WDC = Water Development Corporation.

LATA-Sharp Remediation Services, Inc.
Borehole Log

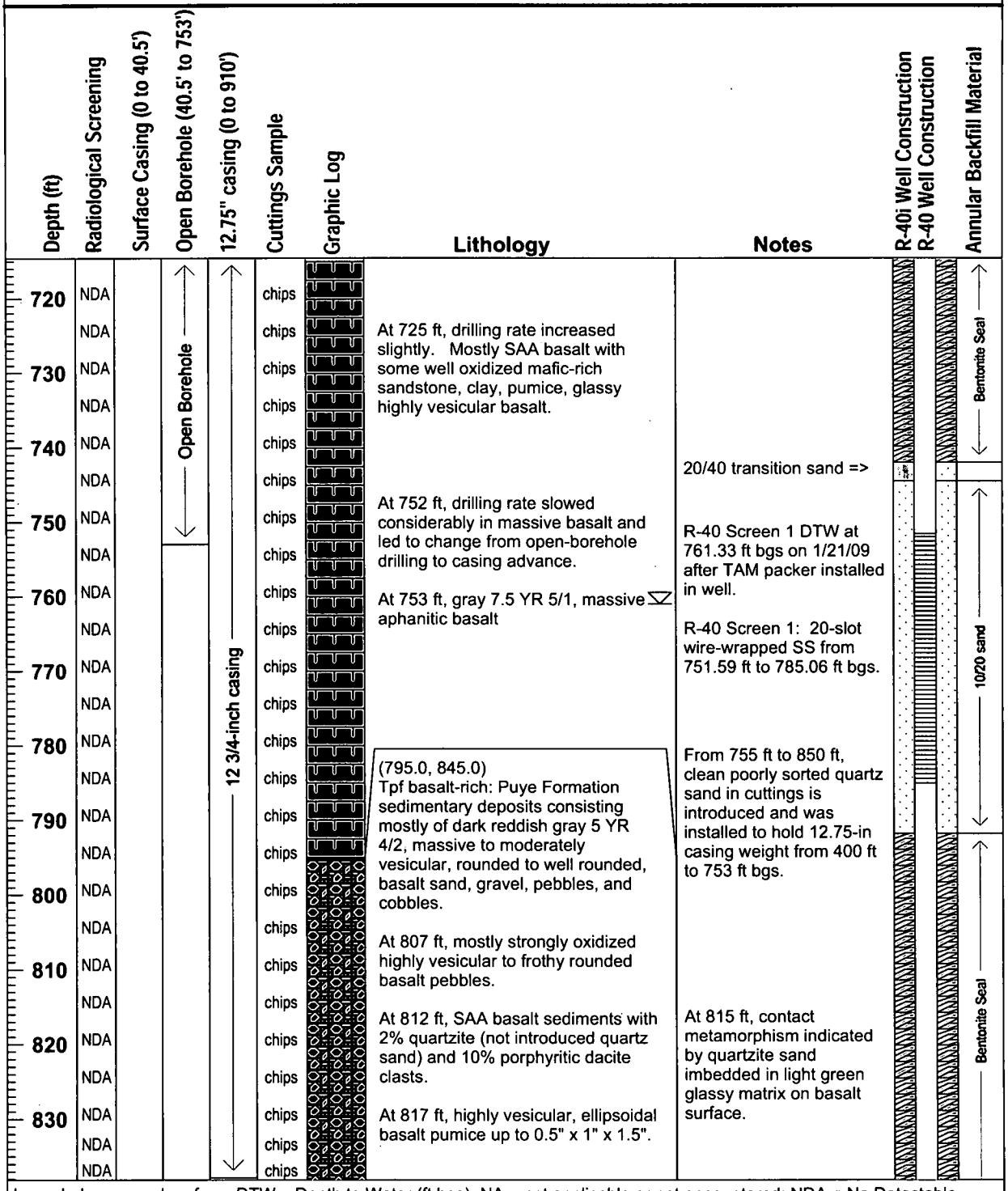
LWSP Regional Aquifer Wells
Well Location ID: R-40



bgs = below ground surface; DTW = Depth to Water (ft bgs); NA = not applicable or not encountered; NDA = No Detectable Activity > 2 X daily- and location-specific radiological background value; Radiological Screening peformed on cuttings for curation; SAA = same as above; SS = A304 stainless steel; TA = Technical Area; TD = Total Depth; WDC = Water Development Corporation.

LATA-Sharp Remediation Services, Inc.
Borehole Log

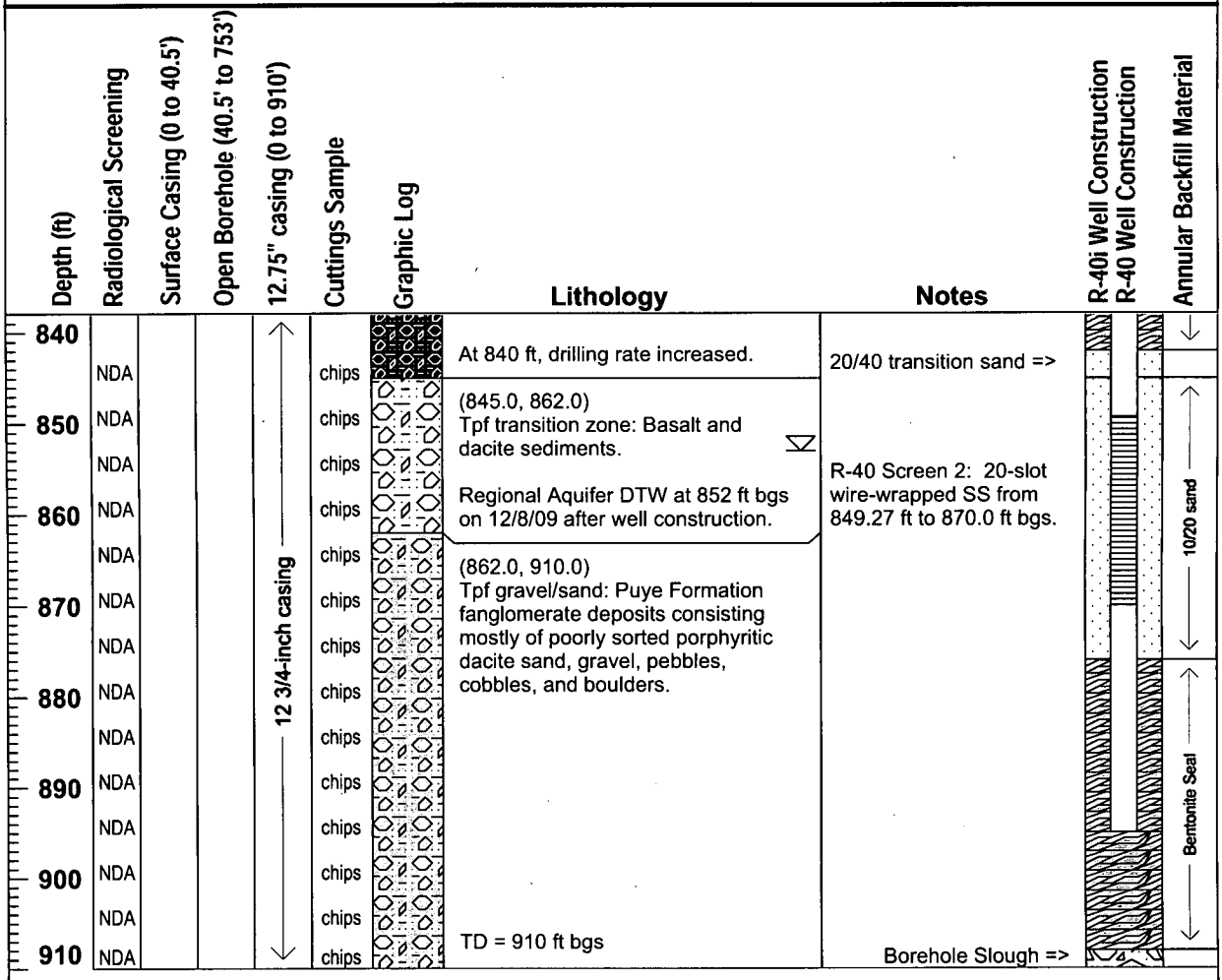
LWSP Regional Aquifer Wells
Well Location ID: R-40



bgs = below ground surface; DTW = Depth to Water (ft bgs); NA = not applicable or not encountered; NDA = No Detectable Activity > 2 X daily- and location-specific radiological background value; Radiological Screening peformed on cuttings for curation; SAA = same as above; SS = A304 stainless steel; TA = Technical Area; TD = Total Depth; WDC = Water Development Corporation.

LATA-Sharp Remediation Services, Inc.
Borehole Log

LWSP Regional Aquifer Wells
Well Location ID: R-40



bgs = below ground surface; DTW = Depth to Water (ft bgs); NA = not applicable or not encountered; NDA = No Detectable Activity > 2 X daily- and location-specific radiological background value; Radiological Screening peformed on cuttings for curation; SAA = same as above; SS = A304 stainless steel; TA = Technical Area; TD = Total Depth; WDC = Water Development Corporation.

Appendix C

Groundwater Analytical Results

C-1.0 SAMPLING AND ANALYSIS OF GROUNDWATER AT WELLS R-40 AND R-40I

A total of 28 groundwater-screening samples were collected and analyzed for inorganic chemicals during drilling (9 samples) and well development (19 samples) at the vadose zone well R-40i and regional aquifer well R-40 screens 1 and 2. Fifteen and 13 groundwater-screening samples were collected from wells R-40i and R-40, respectively, during development. Well R-40i is completed within the Cerros del Rio basalt, and groundwater-screening samples were collected between a depth interval ranging from 649.7 and 674.6 ft below ground surface (bgs). A total of 34,792 gal. of groundwater was pumped from well R-40i during development. Four groundwater-screening samples were collected from R-40 screen 1 during development between a depth interval ranging from 751.6 to 785.1 ft bgs. Two groundwater-screening samples were collected from R-40 screen 2 between a depth interval ranging from 849.3 and 870.0 ft bgs. Well R-40, screens 1 and 2, are completed within the Cerros del Rio basalt and Puye Formation, respectively. The filtered samples were analyzed for cations, anions, perchlorate, and metals. A total of 18,009 gal. of groundwater was pumped from well R-40 during development.

C-1.1 Field Preparation and Analytical Techniques

Chemical analyses of groundwater-screening samples collected from wells R-40i and R-40 were performed at Los Alamos National Laboratory's (LANL's, or the Laboratory's) Earth and Environmental Sciences Group 14 (EES-14). Groundwater-screening samples were filtered (0.45-µm membranes) before preservation and chemical analyses. Samples were acidified at the EES-14 wet chemistry laboratory with analytical grade nitric acid to a pH of 2.0 or less for metal and major cation analyses.

Groundwater samples were analyzed using techniques specified in the U.S. Environmental Protection Agency SW-846 manual. Ion chromatography (IC) was the analytical method for bromide, chloride, fluoride, nitrate, nitrite, oxalate, perchlorate, phosphate, and sulfate. The instrument detection limits for perchlorate were 0.002 and 0.005 ppm, depending on sample matrix (borehole samples) with interfering anions and presence of residual drilling fluid (AQF-2). Analytical results for perchlorate for groundwater-screening samples collected during well development and aquifer testing at R-40i and R-40 are pending. Inductively coupled (argon) plasma optical emission spectroscopy (ICPOES) was used for analyses of dissolved aluminum, barium, boron, calcium, total chromium, iron, lithium, magnesium, manganese, potassium, silica, sodium, strontium, titanium, and zinc. Dissolved aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, cesium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, rubidium, selenium, silver, thallium, thorium, tin, vanadium, uranium, and zinc were analyzed by inductively coupled (argon) plasma mass spectrometry (ICPMS). The precision limits (analytical error) for major ions and trace elements were generally less than ±7% using ICPOES and ICPMS. Concentrations of total organic carbon (TOC) in nonfiltered groundwater-screening samples collected during well development and aquifer testing were determined by using an organic carbon analyzer. Charge balance errors for total cations and anions were generally less than ±10% for complete analyses of the above inorganic chemicals. The negative cation-anion charge balance values indicate excess anions for the filtered samples. Total carbonate alkalinity was measured using standard titration techniques.

C-1.2 Field Parameters

C-1.2.1 Well Development

Results of field parameters, consisting of pH, temperature, dissolved oxygen (DO), specific conductance, and turbidity measured during development and aquifer testing at well R-40 and R-40i are provided in Table C-1.2-1. Some of the groundwater used for measuring field parameters was bailed from well R-40, which provided aeration that influences pH, DO, and turbidity. Negative DO measurements are considered to be unreliable and are not included in any discussions regarding this field parameter.

Improper calibration of the DO instrument is the suspected cause of the erroneous measurements or readings. Measurements of pH and temperature varied from 5.59 to 8.13 and from 10.2°C to 19.2°C, respectively, in groundwater pumped from well R-40 screen 1 during development and aquifer testing. Groundwater pumped from well R-40 was exposed to the atmosphere, resulting in notable variations in temperature. Reliable concentrations of DO range from 0.16 to 2.95 mg/L, which suggest the presence of residual drilling fluid (AQF-2) and possible microbial degradation of AQF-2, resulting in decreasing DO concentrations. Specific conductance ranged from 222 to 313 microsiemens per centimeter (µS/cm), and turbidity ranged from 0 to 999 nephelometric turbidity units (NTUs) during development of well R-40 screen 1 (Table C-1.2-1), with the initial bailed sample having the highest turbidity. Twenty-four of the 36 turbidity measurements had values less than 5 NTUs during development of well R-40 screen 1. Turbidity values generally decreased during development of well R-40 screen 1.

Measurements of pH and temperature varied from 6.37 to 7.53 and from 14°C to 20°C, respectively, in groundwater pumped from well R-40 screen 2 during development (Table C-1.2-1). Concentrations of DO varied from 1.35 to 5.29 mg/L, which is slightly more oxic than groundwater pumped from R-40 screen 1. Specific conductance ranged from 200 to 335 µS/cm in groundwater pumped from well R-40 screen 2 during development, and turbidity varied from 0 to 999 NTUs. Two of the 40 measurements had turbidity less than 5 NTUs during development of well R-40 screen 2.

Two measurements of pH decreased from 7.54 to 6.37, and temperature increased from 14.6°C to 19.4°C, respectively, in groundwater extracted from the vadose zone well R-40i during development (Table C-1.2-1). Concentrations of DO decreased from 4.2 to 0.3 mg/L, whereas specific conductance increased from 383 to 421 µS/cm, and turbidity decreased from 60 to 23 NTUs during development at well R-40i.

C-1.2.2 Aquifer Performance Testing

Aquifer performance testing was not conducted on well R-40 screen 1 due to a low hydraulic conductivity or permeability of the Cerros del Rio basalt within the screen interval. During aquifer performance testing of well R-40 screen 2, 21 measurements of pH and temperature varied from 6.21 to 7.39 and from 12.4°C to 20.8°C, respectively (Table C-1.2-1). Concentrations of DO varied from 0.51 to 2.17 mg/L during aquifer performance testing of R-40 screen 2. Specific conductance and turbidity decreased from 225 to 179 µS/cm and from 25 to 8 NTUs, respectively, for groundwater pumped from well R-40 screen 2 during development.

Five measurements of pH and temperature generally increased from 7.12 to 7.41 and from 12.4°C to 18.2°C, respectively, during preaquifer performance testing conducted at vadose zone well R-40i (Table C-1.2-1). Concentrations of DO slightly varied from 1.09 to 1.27 mg/L. Specific conductance decreased from 365 to 224 µS/cm, and turbidity decreased from 20 to 1 NTUs for the R-40i groundwater-screening samples taken during preaquifer performance testing.

During aquifer performance testing conducted at well R-40i, 171 measurements of pH and temperature varied from 7.19 to 8.14 and from 8.4°C to 20.3°C, respectively (Table C-1.2-1). Reliable (positive) concentrations of DO ranged from 0.01 to 1.71 mg/L. Specific conductance significantly varied from 202 to 1209 µS/cm, and turbidity varied from 0 to 9 NTU for the R-40i groundwater-screening samples taken during aquifer performance testing. Most of the specific conductance values measured on the groundwater-screening samples, however, were between 202 and 230 µS/cm. Only one turbidity measurement exceeded 5 NTUs during this phase of testing at well R-40i.

C-1.3 Analytical Results for Well R-40i Groundwater-Screening Samples

Analytical results for groundwater-screening samples collected at wells R-40i and R-40 during drilling, well development, and aquifer testing are provided in Table C-1.3-1. Thirty-one groundwater-screening samples were collected and analyzed only for TOC to determine the presence of residual drilling fluid (AQF-2) within the Cerros del Rio basalt and Puye Formation during development at wells R-40i and R-40. Other groundwater-screening samples were collected and analyzed for TOC and inorganic solutes during development at wells R-40i and R-40. Calcium and sodium are the dominant cations in perched intermediate-depth groundwater pumped from well R-40i. During development, dissolved concentrations of calcium and sodium ranged from 15.49 to 17.68 ppm (15.49 to 17.68 mg/L) and from 13.96 to 20.54 ppm, respectively. Dissolved concentrations of chloride and fluoride varied from 3.02 to 4.26 ppm and from 0.34 to 0.52 ppm, respectively, during development at well R-40i (Table C-1.3-1). Dissolved concentrations of nitrate(N) and sulfate ranged from 0.003 to 0.408 ppm and from 6.15 to 7.99 ppm, respectively, at well R-40i. Dissolved concentrations of chloride, nitrate(N), and sulfate do not exceeded Laboratory background within perched intermediate-depth groundwater at well R-40i (LANL 2007, 095817). Maximum background concentrations for dissolved chloride, nitrate plus nitrite(N), and sulfate for perched intermediate-depth groundwater are 6.43 mg/L, 1.78 mg/L, and 34.8 mg/L, respectively (LANL 2007, 095817). Concentrations of TOC generally decreased from 13.9 to 1.4 mgC/L during development at well R-40i (Table C-1.3-1). The background concentration of TOC is 0.45 mgC/L (one sample) for perched intermediate-depth groundwater (LANL 2007, 095817). Concentrations of perchlorate were less than analytical detection (<0.002 and <0.005 ppm, IC method) during drilling at well R-40i (Table C-1.3-1). The combination of low concentrations of nitrate(N) and elevated above-background concentrations of TOC suggest the presence of residual drilling fluid (AQF-2) during early stages of development at well R-40i.

Dissolved concentrations of iron ranged from 0.011 to 0.084 ppm (from 11 to 84 µg/L, or from 11 to 84 ppb) using ICPOES at well R-40i. Dissolved concentrations of manganese ranged from 0.054 to 0.165 ppm (Table C.1-3-1), which exceeded the maximum background value of 3.63 µg/L for perched intermediate-depth groundwater (LANL 2007, 095817). The measured concentrations of dissolved iron and manganese most likely result from using a carbon-steel discharge pipe for sample collection at well R-40i during development. Dissolved concentrations of boron ranged from 0.016 to 0.064 ppm (Table C-1.3-1) at well R-40i, for which most of the groundwater-screening samples have concentrations of this trace element above the maximum background value of 18.0 µg/L for perched intermediate-depth groundwater (LANL 2007, 095817). Dissolved concentrations of nickel ranged from 0.001 to 0.116 ppm (Table C-1.3-1) at well R-40i, which only one groundwater-screening sample exceeded the maximum background value of 29.0 µg/L for perched intermediate-depth groundwater (LANL 2007, 095817). Background mean and median concentrations of nickel in filtered samples, however, are 3.04 and 0.50 µg/L, respectively, for perched intermediate-depth groundwater (LANL 2007, 095817). Dissolved concentrations of zinc ranged from 0.280 to 1.510 ppm in groundwater-screening samples collected from well R-40i (Table C.1-3-1). Background mean, median, and maximum dissolved concentrations of zinc are 3.21 µg/L, 0.75 µg/L, and 19.0 µg/L, respectively, for perched intermediate-depth groundwater (LANL 2007, 095817). Total dissolved concentrations of chromium ranged from 0.001 to 0.006 ppm (1 to 6 µg/L) at well R-40i (Table C-1.3-1). Background mean, median, and maximum concentrations of total dissolved chromium are 0.86 µg/L, 0.50 µg/L, and 2.40 µg/L, respectively, for perched intermediate-depth groundwater (LANL 2007, 095817). Dissolved concentrations of molybdenum ranged from 0.004 to 0.011 ppm (Table C-1.3-1) at well R-40i. Most of the groundwater-screening samples collected from R-40i exceeded the maximum background value of 4.3 µg/L for perched intermediate-depth groundwater (LANL 2007, 095817). Background mean and median concentrations of molybdenum in filtered samples, however, are 1.09 and 0.50 µg/L, respectively, for perched intermediate-depth groundwater (LANL 2007, 095817).

C-1.4 Analytical Results for Well R-40 Groundwater-Screening Samples

Analytical results for groundwater-screening samples collected at well R-40 during drilling, development, and aquifer testing are provided in Table C-1.3-1. Calcium and sodium are the dominant cations in regional aquifer groundwater pumped from well R-40 screens 1 and 2. During well development and aquifer testing of R-40 screen 1, dissolved concentrations of calcium and sodium varied slightly from 20.93 to 21.04 ppm and from 13.58 to 14.89 ppm, respectively (Table C-1.3-1). Dissolved concentrations of chloride and fluoride varied slightly from 2.97 to 3.02 ppm and from 0.38 to 0.53 ppm, respectively, during development and aquifer testing of this screen (Table C-1.3-1). Dissolved concentrations of nitrate(N) were less than analytical detection (0.002 mg/L) in groundwater-screening samples collected from well R-40 screen 1 during development and aquifer testing. It is very likely that nitrate(N) has been reduced by the degradation (oxidation) of residual drilling fluid (AQF-2) in the groundwater-screening samples. Dissolved concentrations of sulfate ranged from 4.80 to 5.19 ppm in the R-40 screen 1 samples. Dissolved concentrations of chloride and sulfate at well R-40 screen 1 do not exceed Laboratory background for the regional aquifer (LANL 2007, 095817). Maximum background concentrations for dissolved chloride and sulfate in the regional aquifer are 5.95 mg/L and 8.63 mg/L, respectively (LANL 2007, 095817). Concentrations of TOC generally decreased from 12.5 to 1.8 mgC/L during development and aquifer testing of well R-40 screen 1 (Table C-1.3-1). The maximum background concentration of TOC is 1.37 mgC/L for the regional aquifer (LANL 2007, 095817).

During development and aquifer testing of well R-40 screen 1, dissolved concentrations of iron and manganese decreased from 0.348 to 0.116 ppm and from 0.101 to 0.069 ppm, respectively (Table C-1.3-1). The measured dissolved concentrations of iron and manganese most likely result from using a corroded carbon-steel discharge pipe for sample collection at well R-40 screen 1 during development and aquifer performance testing. Dissolved concentrations of iron in three of the four groundwater-screening samples exceeded the maximum background value of 147 µg/L for the regional aquifer; however, dissolved concentrations of manganese did not exceed the maximum background value of 124 µg/L (LANL 2007, 095817). Dissolved concentrations of boron ranged from 0.019 to 0.036 ppm (Table C-1.3-1) at well R-40 screen 1, which is below the maximum background value of 51.6 µg/L for the regional aquifer (LANL 2007, 095817). Dissolved concentrations of nickel ranged from 0.003 to 0.009 ppm in groundwater samples collected during both development and aquifer performance testing at well R-40 screen 1. Background mean and median concentrations of nickel in filtered samples are 2.14 and 0.50 µg/L, respectively, for regional aquifer groundwater (LANL 2007, 095817). Dissolved concentrations of zinc ranged from 0.934 to 1.316 ppm in groundwater-screening samples collected at well R-40 screen 1 during development (Table C-1.3-1). The measured concentrations of dissolved zinc most likely result from using a carbon-steel discharge pipe for sample collection at well R-40 during development and aquifer performance testing. Background mean, median, and maximum concentrations of zinc in filtered samples are 3.08 µg/L, 1.45 µg/L, and 32.0 µg/L, respectively, for the regional aquifer (LANL 2007, 095817). The detectable concentration of total dissolved chromium was 0.002 ppm (2 µg/L) in two samples collected from well R-40 screen 1 during aquifer testing (Table C-1.3-1). Background mean, median, and maximum concentrations of total dissolved chromium are 3.07 µg/L, 3.05 µg/L, and 7.20 µg/L, respectively, for the regional aquifer (LANL 2007, 095817). Adsorption of chromium (III, VI) onto the corroded carbon-steel pipe may have taken place during development and aquifer testing of R-40 screen 1. Dissolved concentrations of molybdenum ranged from 0.005 to 0.008 ppm (Table C-1.3-1) at well R-40 screen 1, which all four groundwater-screening samples exceeded the maximum background value of 4.4 µg/L for this trace metal in regional aquifer groundwater (LANL 2007, 095817). Background mean and median concentrations of molybdenum in filtered samples are 1.53 and 1.11 µg/L, respectively, for regional aquifer groundwater (LANL 2007, 095817).

During development of well R-40 screen 2, dissolved concentrations of calcium and sodium varied from 10.90 to 11.89 ppm and from 14.17 to 24.80 ppm, respectively (Table C-1.3-1). Dissolved concentrations of chloride and fluoride varied slightly from 3.48 to 3.74 ppm and from 0.26 to 0.29 ppm, respectively, during development of this screen (Table C-1.3-1). Dissolved concentrations of nitrate(N) increased from 0.103 to 0.316 mg/L in groundwater-screening samples collected from well R-40 screen 2 during development. Dissolved concentrations of sulfate decreased from 16.42 to 6.13 ppm in the R-40 screen 2 samples. Dissolved concentrations of chloride and nitrate(N) at well R-40 screen 1 do not exceed Laboratory background for the regional aquifer (LANL 2007, 095817). Maximum background concentrations for dissolved chloride and nitrate plus nitrite(N) in the regional aquifer are 5.95 mg/L and 1.05 mg/L, respectively (LANL 2007, 095817). Concentrations of dissolved sulfate in several groundwater-screening samples collected from well R-40 screen 2, however, exceed the maximum dissolved concentration for this anion (8.63 mg/L) in the regional aquifer (LANL 2007, 095817). Concentrations of TOC generally decreased from 1.43 to 0.4 mgC/L during development and aquifer testing of well R-40 screen 2 (Table C.1-3-1). The maximum background concentration of TOC is 1.37 mgC/L for the regional aquifer (LANL 2007, 095817).

During development of well R-40 screen 2, dissolved concentrations of iron and manganese varied from 0.010 to 0.012 ppm and from 0.055 to 0.235 ppm, respectively (Table C-1.3-1). The measured dissolved concentrations of manganese most likely result from using a corroded carbon-steel discharge pipe for sample collection at R-40 screen 2 during well development. The low dissolved concentrations of iron, however, are typical of oxidizing conditions prevalent in the regional aquifer (LANL 2007, 095817), and additional iron produced from the corroded carbon-steel discharge pipe is unlikely during this phase of testing at well R-40 screen 2. Dissolved concentrations of boron decreased from 0.042 to 0.015 ppm (Table C-1.3-1) at well R-40 screen 2, which is below the maximum background value of 51.6 µg/L for the regional aquifer (LANL 2007, 095817). Dissolved concentrations of nickel ranged from 0.001 to 0.038 ppm in groundwater samples collected during development at well R-40 screen 2. Background mean and median concentrations of nickel in filtered samples are 2.14 and 0.50 µg/L, respectively, for regional aquifer groundwater (LANL 2007, 095817). There is no obvious explanation of why the concentration of dissolved nickel was elevated in one groundwater-screening sample (GW40-09-8333) collected from well R-40 screen 2 with an analytical error (±0.000 ppm) being acceptable using ICPMS. Dissolved concentrations of zinc ranged from 0.350 to 2.883 ppm in groundwater-screening samples collected at well R-40 screen 2 during development (Table C-1.3-1). The measured concentrations of dissolved zinc most likely result from using a corroded carbon-steel discharge pipe for sample collection at R-40 screen 2 during well development. Background mean, median, and maximum concentrations of zinc in filtered samples are 3.08 µg/L, 1.45 µg/L, and 32.0 µg/L, respectively, for the regional aquifer (LANL 2007, 095817). Concentrations of total dissolved chromium ranged from 0.003 to 0.005 ppm (3 to 5 µg/L) in groundwater-screening samples collected from well R-40 screen 2 (Table C-1.3-1). Background mean, median, and maximum concentrations of total dissolved chromium are 3.07 µg/L, 3.05 µg/L, and 7.20 µg/L, respectively, for the regional aquifer (LANL 2007, 095817). Dissolved concentrations of molybdenum ranged from 0.005 to 0.014 ppm (Table C-1.3-1) at well R-40 screen 2, which all six groundwater-screening samples exceeded the maximum background value of 4.4 µg/L for this trace metal in regional aquifer groundwater (LANL 2007, 095817). Background mean and median concentrations of molybdenum in filtered samples are 1.53 and 1.11 µg/L, respectively, for regional aquifer groundwater (LANL 2007, 095817).

C-2.0 REFERENCES

The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

LANL (Los Alamos National Laboratory), May 2007. "Groundwater Background Investigation Report, Revision 3," Los Alamos National Laboratory document LA-UR-07-2853, Los Alamos, New Mexico. (LANL 2007, 095817)

Table C-1.2-1
Well Development and Aquifer Test Volumes and
Field Water-Quality Parameter Measurements at Wells R-40 and R-40

Date	Time	pH	SP[a] (µS/cm)	T (°C)	Turbidity (NTU)	DO (mg/L)	End-of-Day Cumulative Purge Volume Screen 2 (gal.)
R-40 Screen 2 Well Development							
01/06/09	15:40	6.64	317	16.4	999	5.29	110
01/07/09	15:15	7.14	330	17.2	58	2.07	—[b]
01/07/09	15:35	7.32	335	16.9	34	1.43	—
01/07/09	15:50	7.34	332	16.7	19	4.95	—
01/07/09	16:05	7.28	4[c]	18.2	16	1.85	—
01/07/09	17:00	7.28	333	15.3	13	4.06	490
01/08/09	8:00	7.53	306	15.2	9	1.7	—
01/08/09	9:35	7.23	290	17.2	14	1.86	—
01/08/09	10:00	7.38	289	19.4	14	1.87	—
01/08/09	11:00	7.41	279	19.4	11	2.25	—
01/08/09	11:45	7.33	268	19.7	10	4.39	—
01/08/09	12:45	7.34	267	19.1	12	4.25	—
01/08/09	13:10	7.29	265	19.5	12	4.32	—
01/08/09	13:42	7.33	257	19.6	76	4.64	—
01/08/09	14:23	7.35	262	14.4	7	4.52	—
01/08/09	15:11	7.33	258	17.4	10	2.03	—
01/08/09	15:45	7.3	255	17.2	10	1.98	—
01/08/09	16:13	7.17	256	15.6	10	2.28	—
01/08/09	16:55	7.22	251	15.8	10	2.02	—
01/08/09	16:57	—	—	—	—	—	2352
01/09/09	7:55	7.47	256	19.2	12	4.32	—
01/09/09	8.24	7.36	250	15.8	21	1.35	—
01/09/09	9:58	6.66	25	15.8	18	—	—
01/09/09	11:30	7.68	247	16.6	13	1.68	—
01/09/09	13:42	7.49	243	18.4	12	1.82	—
01/09/09	14:38	7.38	235	19.2	14	1.49	—
01/09/09	15:20	—	—	—	10	—	—
01/09/09	15:26	6.8	216	17.6	6	5.06	—
01/09/09	16:15	6.97	214	18.2	7	2.52	—
01/09/09	16:41	7.24	210	17.6	6	2.69	—
01/09/09	17:00	7.21	207	18	6	2.19	—
01/09/09	17:01	—	—	—	—	—	4521
01/10/09	7:00	7.04	210	15.6	12	1.83	—
01/10/09	9:00	6.74	214	18.2	10	2.24	—
01/10/09	10:45	7.02	208	17.2	18	2.41	—

Table C-1.2-1 (continued)

Date	Time	pH	SP[a] (µS/cm)	T (°C)	Turbidity (NTU)	DO (mg/L)	End-of-Day Cumulative Purge Volume Screen 2 (gal.)
R-40 Screen 2 Well Development (continued)							
01/10/09	11:17	6.89	208	17.7	15	2.29	—
01/10/09	11:50	7.14	206	16.5	13	2.16	—
01/10/09	12:43	7.08	206	18.8	13	4.12	—
01/10/09	15:16	—	201	18.3	12	—	—
01/10/09	15:52	6.78	200	16.4	11	—	—
01/10/09	16:40	6.37	223	18.4	4	2.56	7145
01/10/09	17:00	6.44	206	17.6	3	2.71	—
01/13/09	8:55	7.33	205	20	10	1.69	—
01/13/09	12:55	6.92	227	19.2	24	1.57	8032
R-40 Screen 2 Aquifer Test (24 h)							
01/14/09	8:00	—	—	—	—	—	—
01/14/09	8:06	7.21	225	15	25	0.51	—
01/14/09	10:56	7.04	209	19.1	22	—	—
01/14/09	11:30	6.21	209	19.2	20	0.99	—
01/14/09	13:45	6.72	197	19.6	15	1	—
01/14/09	16:45	7.09	194	18.1	13	1.4	—
01/14/09	17:30	7.03	192	18.2	12	0.9	—
01/14/09	17:52	6.97	192	14.2	12	0.88	—
01/14/09	19:00	6.66	197	17.3	12	2.17	—
01/14/09	20:00	7.1	190	17.9	12	1.14	—
01/14/09	21:00	7.38	189	20.2	12	1.79	—
01/14/09	22:00	7.38	186	19.9	11	0.91	—
01/14/09	23:00	7.32	187	19.6	10	0.93	—
01/14/09	24:00	—	—	—	—	—	11296
01/15/09	0:00	7.29	184	19	10	0.93	—
01/15/09	1:00	7.24	186	21	9	0.73	—
01/15/09	2:00	7.22	182	19.3	9	1.23	—
01/15/09	3:00	7.09	181	19.2	9	1.23	—
01/15/09	4:00	7.26	181	18.9	10	1	—
01/15/09	5:00	7.28	181	20.8	8	1.33	—
01/15/09	6:00	7.34	181	19	8	1.44	—
01/15/09	7:00	7.39	179	20	8	0.81	—
01/15/09	7:45	7.29	180	19.8	8	0.81	—
01/15/09	8:00	—	—	—	—	—	12987
R-40i Well Development							
01/12/09	10:15	7.54	383	14.6	60	4.2	
01/25/09	17:25	6.37	421	19.4	23	0.3	100

Table C-1.2-1 (continued)

Date	Time	pH	SP[a] (µS/cm)	T (°C)	Turbidity (NTU)	DO (mg/L)	End-of-Day Cumulative Purge Volume Screen 2 (gal.)
R-40i Preaquifer Test (24 h)							
01/26/09	8:06	7.15	365	12.4	20	1.09	—
01/26/09	8:40	7.12	311	17.5	2	1.09	—
01/26/09	10:00	7.32	237	17.7	2	1.13	—
01/26/09	10:40	7.38	227	17.2	1	1.27	—
01/26/09	11:00	7.41	224	18.2	1	1.21	660.5
R-40i Aquifer Test (24 h)							
01/27/09	8:00	—	—	—	—	—	—
01/27/09	8:10	7.97	225	8.4	1	0.19	—
01/27/09	10:46	7.66	225	17	1	0.12	—
01/27/09	11:15	7.71	219	17.9	1	0.59	—
01/27/09	12:00	7.74	222	17.4	1	0.71	—
01/27/09	16:20	7.77	226	17.6	1	0.41	—
01/27/09	17:20	7.74	226	16.4	1	0.45	—
01/27/09	18:05	7.59	228	16.6	1	0.44	—
01/27/09	19:05	7.66	228	16.9	1	1.71	—
01/27/09	20:00	7.77	229	17.3	1	0.03	—
01/27/09	21:00	7.71	227	17	1	0.36	—
01/27/09	22:00	7.83	230	18.1	1	1.41	—
01/27/09	23:00	7.92	228	17.2	1	0.45	—
01/27/09	24:00	—	—	—	—	—	2708.4
01/28/09	0:00	7.92	230	17.5	1	0.43	—
01/28/09	1:00	8	230	17.4	1	0.58	—
01/28/09	2:00	7.96	202	17.2	1	0.47	—
01/28/09	3:00	8.17	230	16.9	1	1.39	—
01/28/09	4:00	8.04	229	17.4	1	0.39	—
01/28/09	5:03	8.02	232	17.2	1	1.47	—
01/28/09	6:05	7.95	231	17.3	1	0.42	—
01/28/09	7:21	7.8	231	11	1	0.51	—
01/28/09	8:00	—	—	—	—	—	3784.6

Table C-1.2-1 (continued)

Date	Time	pH	SP[a] (µS/cm)	T (°C)	Turbidity (NTU)	DO (mg/L)	End-of-Day Cumulative Purge Volume Screen 2 (gal.)
R-40i Continued Well Development							
03/05/09	10:45	7.19	320	17.1	9	0.08	—
03/05/09	11:27	7.39	253	18.2	3	0.26	—
03/05/09	11:50	7.46	246	19.2	2	0.12	—
03/05/09	13:00	7.25	225	19.7	1	0.46	—
03/05/09	14:19	7.22	218	18	1	0.05	—
03/05/09	15:17	7.45	218	17.8	1	1.55	—
03/05/09	16:40	7.46	217	17.4	0	0.01	—
03/05/09	17:00	7.59	218	17.1	1	0.35	4577.9
03/06/09	7:00	—	—	—	—	—	—
03/06/09	7:16	7.27	226	13.8	2	0.84	—
03/06/09	8:05	7.5	215	15.9	2	0.59	—
03/06/09	9:03	7.6	212	17.7	2	0.5	—
03/06/09	10:03	7.67	219	18.1	2	0.26	—
03/06/09	11:08	7.66	215	18.1	0	0.26	—
03/06/09	12:03	7.72	218	19.8	1	0.65	—
03/06/09	13:05	7.68	219	19.1	1	0.64	—
03/06/09	14:02	7.71	218	18.7	1	0.58	—
03/06/09	15:00	7.38	220	18	1	0.22	5569.4
03/09/09	7:40	—	—	—	—	—	—
03/09/09	8:08	7.75	246	16	1	0.97	—
03/09/09	9:23	7.48	215	18.2	0	0.9	—
03/09/09	16:15	7.44	214	19.4	0	0.42	—
03/09/09	17:30	7.61	213	19.4	0	0.67	—
03/09/09	17:45	7.55	214	17.9	0	0.3	6701.7
03/10/09	7:00	—	—	—	—	—	—
03/10/09	8:00	7.71	214	16.5	1	0.19	—
03/10/09	9:00	7.73	212	17.4	1	0.22	—
03/10/09	10:00	7.82	213	17.5	0	1.02	—
03/10/09	11:00	8.02	213	19.3	0	1.36	—
03/10/09	12:00	7.98	214	19.5	1	0.98	—
03/10/09	10:00	7.82	213	17.5	0	1.02	—
03/10/09	13:00	7.95	215	20	1	0.37	—
03/10/09	14:00	7.91	215	20	0	0.39	—
03/10/09	15:00	7.81	215	20	0	0.38	—
03/10/09	16:00	7.77	215	19.4	0	0.49	—
03/10/09	17:00	7.7	218	19.3	0	0.53	—
03/10/09	17:30	7.68	217	19.2	0	0.46	—

Table C-1.2-1 (continued)

Date	Time	pH	SP[a] (µS/cm)	T (°C)	Turbidity (NTU)	DO (mg/L)	End-of-Day Cumulative Purge Volume Screen 2 (gal.)
R-40i Continued Well Development (continued)							
03/10/09	17:45	7.76	218	19.3	0	0.47	7797.7
03/11/09	7:05	—	—	—	—	—	—
03/11/09	8:12	7.48	217	16.5	1	0.09	—
03/11/09	9:00	7.46	217	16.5	0	0.19	—
03/11/09	10:00	7.77	212	18.2	0	0.21	—
03/11/09	11:00	7.78	212	18.6	0	0.41	—
03/11/09	12:00	7.78	219	19.1	0	0.94	—
03/11/09	13:00	7.81	215	19.6	0	0.81	—
03/11/09	14:00	7.83	214	19.9	0	0.46	—
03/11/09	15:00	7.83	214	19.9	0	0.96	—
03/11/09	16:00	7.73	214	19.9	0	0.43	—
03/11/09	17:00	7.74	215	18.6	0	0.45	—
03/11/09	18:00	7.75	215	18.4	0	0.2	8737.2
03/12/09	10:20	—	—	—	—	—	—
03/12/09	10:30	7.75	226	16.6	1	0.42	—
03/12/09	11:30	7.75	224	17.2	0	0.33	—
03/12/09	12:30	7.7	210	18.6	0	0.18	—
03/12/09	13:30	7.7	214	19	0	0.08	—
03/12/09	14:30	7.72	213	19.6	0	0.01	—
03/12/09	15:50	7.74	217	19.9	0	0.01	—
03/12/09	16:50	7.67	215	19.4	0	-0.02	9603.2
03/13/09	7:00	7.75	214	17.6	0	-0.04	—
03/13/09	8:00	7.75	210	—	—	-0.01	—
03/13/09	9:00	7.76	1209	18.9	1	0.01	—
03/13/09	10:00	7.78	209	18.9	0	0.08	—
03/13/09	11:00	7.92	207	18.8	0	0.25	—
03/13/09	13:00	7.9	209	18.8	0	0.21	—
03/13/09	14:00	7.86	213	19.2	0	-0.06	—
03/13/09	15:00	7.86	213	19	0	0.02	—
03/13/09	16:00	7.88	216	18.7	0	0.03	—
03/13/09	16:30	7.88	214	17.9	0	0.05	10606.95
03/16/09	7:00	7.73	240	14.7	1	0.3	—
03/16/09	8:00	.767	213	18.2	0	0.38	—
03/16/09	9:00	7.78	210	18.7	0	0.23	—
03/16/09	10:00	7.8	205	19.3	0	0.012	—
03/16/09	11:00	7.88	205	19.4	0	0.18	—
03/16/09	12:00	7.9	206	19.4	0	0.3	—

Table C-1.2-1 (continued)

Date	Time	pH	SP[a] (µS/cm)	T (°C)	Turbidity (NTU)	DO (mg/L)	End-of-Day Cumulative Purge Volume Screen 2 (gal.)
R-40i Continued Well Development (continued)							
03/16/09	13:00	7.9	207	20	0	0.19	—
03/16/09	14:00	7.92	207	20.2	0	0.17	—
03/16/09	15:00	7.84	211	19.2	0	-0.04	—
03/16/09	16:00	7.94	216	20.2	0	-0.06	—
03/16/09	16:01	—	—	—	—	—	—
03/16/09	17:00	7.95	214	20.5	0	0.15	—
03/16/09	18:00	7.85	214	17	0	0.18	11755.2
03/17/09	7:00	7.92	218	11.4	0	0.04	—
03/17/09	8:00	7.85	208	18.1	0	0.08	—
03/17/09	8:50	—	—	—	—	—	—
03/17/09	9:32	—	—	—	—	—	—
03/17/09	10:30	7.87	204	17.4	0	-0.61	—
03/17/09	12:00	7.94	209	19.1	0	0.25	—
03/17/09	13:00	7.94	211	19.2	0	0.25	—
03/17/09	14:00	7.96	212	20.5	0	0.24	—
03/17/09	15:00	7.85	212	20.5	0	0.18	—
03/17/09	16:00	7.88	216	20.7	0	-0.13	—
03/17/09	17:20	7.8	216	20.4	0	0.24	—
03/17/09	18:00	7.65	217	19.5	0	-0.05	12976.8
03/18/09	7:00	—	—	—	—	—	—
03/18/09	8:00	7.72	211	17	0	0.08	—
03/18/09	9:00	7.76	211	17.1	0	0.02	—
03/18/09	10:00	7.82	205	17.8	0	0.07	—
03/18/09	11:00	7.99	212	18.7	0	0.13	—
03/18/09	12:00	7.99	215	—	0	0.07	—
03/18/09	13:00	7.98	219	19.3	0	-0.02	—
03/18/09	14:00	7.99	219	19.6	0	-0.03	—
03/18/09	15:00	8.04	218	19.7	0	-0.08	—
03/18/09	16:00	7.96	219	20.1	0	.018	—
03/18/09	17:45	8.02	220	20.1	0	0.12	14666.8
03/19/09	7:02	7.98	224	9.1	1	0.62	—
03/19/09	8:02	7.96	221	9.9	0	0.51	—
03/19/09	10:00	7.87	213	16.3	0	0.19	—
03/19/09	11:00	7.87	215	17.3	0	0.05	—
03/19/09	12:00	7.89	218	18.2	0	-0.04	—
03/19/09	13:00	7.89	218	18.8	0	-0.04	—
03/19/09	14:00	7.96	216	19.7	0	0.14	—

Table C-1.2-1 (continued)

Date	Time	pH	SP[a] (µS/cm)	T (°C)	Turbidity (NTU)	DO (mg/L)	End-of-Day Cumulative Purge Volume Screen 2 (gal.)
R-40i Continued Well Development (continued)							
03/19/09	15:00	7.94	221	20.1	1	-0.2	—
03/19/09	16:00	7.86	218	19.9	1	-0.36	—
03/19/09	16:45	7.83	222	19.8	0	-0.05	—
03/19/09	17:30	7.69	220	18.4	0	0.8	—
03/19/09	18:00	7.79	218	17.9	0	-0.06	14666.8
03/20/09	7:00	7.88	225	11.1	1	-0.15	—
03/20/09	8:00	7.84	221	15.4	0	-0.12	—
03/20/09	9:00	7.76	209	18.2	0	-0.08	—
03/20/09	10:02	7.81	216	18.7	0	-0.25	—
03/20/09	11:00	7.87	218	19.1	0	-0.46	—
03/20/09	12:00	7.95	218	19.1	0	-0.35	—
03/20/09	13:00	7.87	221	19.2	0	-0.28	—
03/20/09	14:00	7.92	221	19.4	0	-0.28	—
03/20/09	15:00	7.95	219	20.1	0	-0.22	—
03/20/09	15:45	7.95	219	20.3	0	0.01	17205.65
03/23/09	7:00	7.99	214	16	0	-0.37	—
03/23/09	8:00	8	212	—	0	-0.037	—
03/23/09	9:00	8.02	208	19.9	0	-.032	—
03/23/09	10:00	7.99	210	19.1	0	-.38	—
03/23/09	11:00	7.96	213	18.6	0	-0.45	—
03/23/09	12:00	7.98	213	18.7	0	-0.44	—
03/23/09	13:00	7.99	211	18.7	0	-0.41	—
03/23/09	14:00	7.92	213	18.8	0	0.42	—
03/23/09	15:00	7.8	—	—	0	0.36	—
03/23/09	17:30	7.89	219	19	0	-0.33	—
03/23/09	18:00	7.83	216	17.7	0	-0.22	18990.9
03/24/09	7:00	7.71	227	14.3	1	-0.17	—
03/24/09	8:00	7.89	218	16.3	0	-0.21	—
03/24/09	9:00	7.94	214	17	0	-0.26	—
03/24/09	10:00	7.96	215	17.6	0	-0.19	—
03/24/09	11:00	7.83	215	18.3	0	-0.23	—
03/24/09	12:00	7.83	218	17.4	0	-.024	—
03/24/09	13:00	7.84	220	18.9	0	-.021	—
03/24/09	14:00	7.92	218	19.2	0	-0.21	—
03/24/09	15:00	7.8	222	19.4	0	-0.29	—
03/24/09	16:00	7.96	216	18.1	0	-0.08	—
03/24/09	17:00	7.88	215	18.9	0	-0.23	—

Table C-1.2-1 (continued)

Date	Time	pH	SP[a] (µS/cm)	T (°C)	Turbidity (NTU)	DO (mg/L)	End-of-Day Cumulative Purge Volume Screen 2 (gal.)
R-40i Continued Well Development (continued)							
03/24/09	17:40	7.85	217	18.4	0	0.43	20726.8
03/25/09	7:30	7.69	218	13.2	1	-0.3	—
03/25/09	8:40	7.87	207	16.8	0	-0.18	—
03/25/09	10:00	7.82	213	15.9	0	-0.33	—
03/25/09	11:15	7.87	213	15.7	0	-0.4	—
03/25/09	13:30	7.95	210	15.4	0	-0.64	—
03/25/09	14:30	8.09	207	18.3	0	-0.17	—
03/25/09	15:30	7.96	213	18.9	0	-0.42	—
03/25/09	16:40	7.95	214	18.4	0	-0.24	21843.5
03/26/09	10:30	7.53	235	16.1	0	-0.01	—
03/26/09	12:00	7.84	204	18.1	0	-0.18	—
03/26/09	13:00	8.14	206	16.8	0	-0.2	—
03/26/09	14:30	7.93	208	15.7	0	-0.31	—
03/26/09	16:00	8.04	213	17.4	0	-0.19	22763.5
R-40 Screen 1 Well Development							
01/21/09	16:05	7.57	246	16.6	999	Bail	100
01/25/09	11:00	7.05	229	19.2	18	2.95	—
01/25/09	11:25	5.59	279	18.7	24	Bail	—
01/25/09	12:15	—	—	—	—	—	640
02/03/09	16:15	—	—	—	—	Bail	747
03/03/09	14:35	6.28	313	15.2	25	Pump on	—
03/03/09	14:42	6.56	26	17	2	—	—
03/03/09	14:49	6.8	258	17.6	1	—	—
03/03/09	14:56	7.06	256	16.5	1	—	—
03/03/09	15:01	7.13	257	16.7	2	—	—
03/03/09	15:04	7.16	259	17.8	3	—	—
03/03/09	15:09	7.21	259	17.3	3	—	—
03/03/09	15:15	7.25	263	17.5	3	Pump off	821
03/06/09	15:15	7.39	270	12.2	2	Pump on	—
03/06/09	15:30	7.38	267	14.2	4	—	—
03/06/09	15:45	—	—	—	—	Pump off	861.2
03/12/09	9:50	8.01	274	10.8	9	Pump on	—
03/12/09	10:00	7.78	256	12.8	15	—	—
03/12/09	10:07	7.73	243	15.2	1	—	—
03/12/09	10:12	7.69	235	15.4	1	—	—
03/12/09	10:13	7.65	235	16.1	1	—	—
03/12/09	10:17	7.63	235	16.1	1	—	—

Table C-1.2-1 (continued)

Date	Time	pH	SP[a] (µS/cm)	T (°C)	Turbidity (NTU)	DO (mg/L)	End-of-Day Cumulative Purge Volume Screen 2 (gal.)
R-40 Screen 1 Well Development (continued)							
03/12/09	10:18	—	—	—	—	Pump off	905.7
03/17/09	8:59	—	—	—	—	Pump on	—
03/17/09	9:02	7.95	250	10.2	1	—	—
03/17/09	9:06	7.81	249	12.3	25	—	—
03/17/09	9:08	7.89	244	13.5	11	—	—
03/17/09	9:12	7.81	248	12.7	7	—	—
03/17/09	9:17	7.72	235	15.5	3	—	—
03/17/09	9:20	7.7	233	14.2	2	—	—
03/17/09	9:22	7.68	232	16.1	1	—	—
03/17/09	9:24	7.67	233	14.7	2	Pump off	952.1
03/24/09	15:08	7.98	236	17.4	14	—	—
03/24/09	15:15	8.13	222	14.8	22	—	—
03/24/09	15:20	8.06	241	14.5	11	—	—
03/24/09	15:23	7.87	246	14.8	2	—	—
03/24/09	15:25	7.79	225	15.2	1	—	—
03/24/09	15:29	7.7	224	16.6	1	—	—
03/24/09	15:30	7.67	224	14.7	0	—	—
03/24/09	15:33	7.71	226	15.8	0	—	—
03/24/09	15:38	7.68	225	17	0	Pump off	1014.8

[a] SP = Specific conductivity.

[b] — = Analysis not conducted.

[c] Suspect value.

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	Depth (feet)	Well/Borehole	Activity-Phase	Ag rslt (ppm)	stdev (Ag)	Al rslt (ppm)	stdev (Al)	As rslt (ppm)	stdev (As)	B rslt (ppm)	stdev (B)
RC54-09-1031	11/10/2008	09-246	867	Borehole	Drilling	0.001	U	0.743	0.002	0.0005	0.0000	0.152	0.002
RC54-09-1032	11/10/2008	09-246	887	Borehole	Drilling	0.001	U	0.531	0.003	0.0003	0.0000	0.128	0.001
RC54-09-1033	11/10/2008	09-246	872	Borehole	Drilling	0.001	U	0.273	0.001	0.0002	U	0.107	0.002
RC54-09-1034	11/12/2008	09-278	910	Borehole	Drilling	0.001	U	0.086	0.001	0.0005	0.0000	0.083	0.001
RC54-09-1037	1/8/2009	09-591	853	R-40, screen 1	Pre-well development	0.001	U	0.003	0.000	0.0012	0.0000	0.030	0.000
RC54-09-1038	1/13/2009	09-615	641.7	R-40i	Pre-well development	0.001	U	0.015	0.000	0.0029	0.0001	0.043	0.000
GW40-08-14400	7/31/2008	08-1598	608.2	Borehole	Drilling	0.001	U	0.268	0.002	0.0005	0.0000	0.051	0.001
GW40-08-14401	10/31/2008	09-196	847	Borehole	Drilling	0.001	U	0.137	0.001	0.0002	0.0000	0.025	0.001
GW40-08-14402	10/29/2008	09-186	784	Borehole	Drilling	0.001	U	0.043	0.001	0.0003	0.0000	0.037	0.000
GW40-08-14404	10/30/2008	09-194	809	Borehole	Drilling	0.001	U	0.343	0.002	0.0002	0.0000	0.044	0.001
GW40-08-14405	10/30/2008	09-194	827	Borehole	Drilling	0.001	U	0.376	0.001	0.0003	0.0000	0.037	0.000
GW40-09-1617	1/21/2009	09-696	867.4	R-40, screen 2	Aquifer testing	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1618	1/26/2009	09-734	656.6	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1619	1/26/2009	09-734	656.6	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1620	2/5/2009	09-781	656.6	R-40i	Aquifer testing	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1621	3/5/2009	09-1086	829.93	R-40, screen 1	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1622	3/5/2009	09-1086	829.93	R-40, screen 1	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1623	3/10/2009	09-1117	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1624	3/10/2009	09-1117	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1625	3/10/2009	09-1143	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1626	3/9/2009	09-1138	834.89	R-40, screen 1	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1627	3/10/2009	09-1157	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1628	3/11/2009	09-1163	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1629	3/12/2009	09-1198	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1630	3/12/2009	09-1198	834.89	R-40, screen 1	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1631	3/12/2009	09-1198	834.89	R-40, screen 1	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1632	3/13/2009	09-1200	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1633	3/16/2009	09-1217	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1634	3/17/2009	09-1232	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1635	3/17/2009	09-1232	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5867	3/18/2009	09-1236	834.89	R-40, screen 1	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5868	3/18/2009	09-1236	834.89	R-40, screen 1	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5869	3/18/2009	09-1247	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5870	3/23/2009	09-1249	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5871	3/23/2009	09-1255	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5872	3/24/2009	09-1269	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5873	3/24/2009	09-1269	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5874	3/25/2009	09-1295	834.89	R-40, screen 1	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5875	3/25/2009	09-1295	834.89	R-40, screen 1	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5876	3/25/2009	09-1295	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5877	3/26/2009	09-1309	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5878	3/30/2009	09-1313	668.11	R-40i	Development	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-6937	4/7/2009	09-1393	834.99	R-40, screen 1	Aquifer testing	0.001	U	0.002	0.000	0.0005	0.0000	0.036	0.001
GW40-09-6938	4/7/2009	09-1393	834.99	R-40, screen 1	Aquifer testing	0.001	U	0.002	0.000	0.0005	0.0001	0.028	0.000
GW40-09-6939	4/7/2009	09-1393	668.11	R-40i	Development	0.001	U	0.002	0.000	0.0015	0.0000	0.026	0.000
GW40-09-6940	4/7/2009	09-1393	668.11	R-40i	Development	0.001	U	0.006	0.000	0.0009	0.0000	0.022	0.000
GW40-09-6941	4/7/2009	09-1393	668.11	R-40i	Development	0.001	U	0.007	0.000	0.0010	0.0000	0.021	0.000
GW40-09-6942	4/8/2009	09-1401	668.11	R-40i	Development	0.001	U	0.007	0.000	0.0010	0.0001	0.018	0.001
GW40-09-6943	4/8/2009	09-1404	668.11	R-40i	Development	0.001	U	0.006	0.000	0.0010	0.0000	0.018	0.000
GW40-09-6944	4/9/2009	09-1424	668.11	R-40i	Development	0.001	U	0.008	0.000	0.0009	0.0000	0.032	0.001
GW40-09-6945	4/9/2009	09-1424	668.11	R-40i	Development	0.001	U	0.009	0.002	0.0015	0.0000	0.026	0.001
GW40-09-6946	4/13/2009	09-1451	668.11	R-40i	Development	0.001	U	0.006	0.000	0.0009	0.0000	0.023	0.000

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	Depth (feet)	Well/Borehole	Activity-Phase	Ag rslt (ppm)	stdev (Ag)	Al rslt (ppm)	stdev (Al)	As rslt (ppm)	stdev (As)	B rslt (ppm)	stdev (B)
GW40-09-6947	4/13/2009	09-1451	668.11	R-40i	Development	0.001	U	0.006	0.001	0.0013	0.0000	0.022	0.000
GW40-09-6948	4/13/2009	09-1451	668.11	R-40i	Development	0.001	U	0.007	0.002	0.0009	0.0000	0.019	0.000
GW40-09-6949	4/13/2009	09-1451	834.99	R-40, screen 1	Development	0.001	U	0.004	0.000	0.0004	0.0000	0.019	0.000
GW40-09-6950	4/13/2009	09-1451	834.99	R-40, screen 1	Development	0.001	U	0.002	0.001	0.0005	0.0000	0.019	0.000
GW40-09-6951	4/13/2009	09-1451	668.11	R-40i	Development	0.001	U	0.011	0.000	0.0013	0.0000	0.018	0.000
GW40-09-6952	4/13/2009	09-1449	668.11	R-40i	Development	0.001	U	0.006	0.000	0.0008	0.0000	0.017	0.000
GW40-09-6953	4/13/2009	09-1449	668.11	R-40i	Development	0.001	U	0.051	0.000	0.0014	0.0000	0.051	0.001
GW40-09-6954	4/20/2009	09-1496	668.11	R-40i	Development	0.001	U	0.003	0.000	0.0009	0.0000	0.064	0.001
GW40-09-6955	4/20/2009	09-1496	668.11	R-40i	Development	0.001	U	0.004	0.000	0.0010	0.0000	0.038	0.001
GW40-09-6956	4/20/2009	09-1496	668.11	R-40i	Development	0.001	U	0.003	0.000	0.0009	0.0000	0.028	0.000
GW40-09-8320	4/23/2009	09-1549	668.11	R-40i	Development	0.001	U	0.004	0.000	0.0009	0.0000	0.022	0.000
GW40-09-8321	4/23/2009	09-1549	668.11	R-40i	Development	0.001	U	0.003	0.000	0.0008	0.0000	0.022	0.001
GW40-09-8322	4/23/2009	09-1549	668.11	R-40i	Development	0.001	U	0.006	0.000	0.0012	0.0000	0.019	0.000
GW40-09-8323	4/27/2009	09-1595	867.4	R-40 screen 2	Development	0.001	U	0.002	0.000	0.0009	0.0000	0.034	0.002
GW40-09-8324	4/27/2009	09-1595	867.4	R-40 screen 2	Development	0.001	U	0.003	0.000	0.0008	0.0000	0.042	0.001
GW40-09-8325	4/27/2009	09-1615	867.4	R-40 screen 2	Development	0.001	U	0.002	0.000	0.0012	0.0000	0.027	0.000
GW40-09-8326	4/27/2009	09-1615	668.11	R-40i	Development	0.001	U	0.003	0.000	0.0010	0.0000	0.025	0.000
GW40-09-8327	4/27/2009	09-1615	668.11	R-40i	Development	0.001	U	0.002	0.000	0.0009	0.0000	0.022	0.000
GW40-09-8328	4/27/2009	09-1615	867.4	R-40 screen 2	Development	0.001	U	0.002	0.000	0.0010	0.0000	0.020	0.000
GW40-09-8329	4/27/2009	09-1615	668.11	R-40i	Development	0.001	U	0.005	0.000	0.0008	0.0000	0.020	0.000
GW40-09-8330	4/30/2009	09-1647	668.11	R-40i	Development	0.001	U	0.003	0.000	0.0008	0.0000	0.018	0.000
GW40-09-8331	4/30/2009	09-1647	867.4	R-40 screen 2	Development	0.001	U	0.003	0.000	0.0009	0.0000	0.017	0.000
GW40-09-8332	4/30/2009	09-1647	668.11	R-40i	Development	0.001	U	0.005	0.000	0.0009	0.0000	0.016	0.001
GW40-09-8333	4/30/2009	09-1647	867.4	R-40 screen 2	Development	0.001	U	0.001	U	0.0008	0.0000	0.015	0.000

Note: During development at well R-40 and R-40i, only TOC was analyzed in some groundwater-screening samples to evaluate the presence of residual drilling fluid (AQF-2).

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	ClO4(-) (U)	Co rslt (ppm)	stdev (Co)	Alk-CO3 rslt (ppm)	ALK-CO3 (U)	Cr rslt (ppm)	stdev (Cr)	Cs rslt (ppm)	stdev (Cs)	Cu rslt (ppm)	stdev (Cu)	F(-) ppm
RC54-09-1031	11/10/2008	09-246	U	0.001	U	0.8	U	0.008	0.000	0.001	U	0.001	0.000	0.63
RC54-09-1032	11/10/2008	09-246	U	0.001	U	0.8	U	0.007	0.000	0.001	U	0.001	0.000	1.01
RC54-09-1033	11/10/2008	09-246	U	0.001	U	0.8	U	0.007	0.000	0.001	U	0.001	U	0.58
RC54-09-1034	11/12/2008	09-278	U	0.001	U	0.8	U	0.005	0.000	0.001	U	0.001	U	0.63
RC54-09-1037	1/8/2009	09-591	U	0.001	U	0.8	U	0.001	0.000	0.001	U	0.001	0.000	0.37
RC54-09-1038	1/13/2009	09-615	U	0.001	U	0.8	U	0.001	0.000	0.001	U	0.004	0.000	0.60
GW40-08-14400	7/31/2008	08-1598	U	0.001	U	8.19		0.006	0.000	0.001	U	0.002	0.000	0.78
GW40-08-14401	10/31/2008	09-196	U	0.001	U	0.8	U	0.001	U	0.001	U	0.002	0.000	0.59
GW40-08-14402	10/29/2008	09-186	U	0.001	U	0.8	U	0.001	0.000	0.001	U	0.001	0.000	0.48
GW40-08-14404	10/30/2008	09-194	U	0.001	U	0.8	U	0.001	0.000	0.001	U	0.001	0.000	0.44
GW40-08-14405	10/30/2008	09-194	U	0.001	U	0.8	U	0.001	0.000	0.001	U	0.002	0.000	0.43
GW40-09-1617	1/21/2009	09-696	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1618	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1619	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1620	2/5/2009	09-781	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1621	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1622	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1623	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1624	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1625	3/10/2009	09-1143	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1626	3/9/2009	09-1138	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1627	3/10/2009	09-1157	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1628	3/11/2009	09-1163	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1629	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1630	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1631	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1632	3/13/2009	09-1200	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1633	3/16/2009	09-1217	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1634	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1635	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5867	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5868	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5869	3/18/2009	09-1247	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5870	3/23/2009	09-1249	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5871	3/23/2009	09-1255	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5872	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5873	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5874	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5875	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5876	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5877	3/26/2009	09-1309	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5878	3/30/2009	09-1313	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-6937	4/7/2009	09-1393		0.001	U	0.8	U	0.002	0.000	0.001	U	0.002	0.000	0.47
GW40-09-6938	4/7/2009	09-1393		0.001	U	0.8	U	0.002	0.000	0.001	U	0.002	0.000	0.53
GW40-09-6939	4/7/2009	09-1393		0.001	U	0.8	U	0.004	0.000	0.001	U	0.001	0.000	0.52
GW40-09-6940	4/7/2009	09-1393		0.001	U	0.8	U	0.003	0.000	0.001	U	0.001	U	0.43
GW40-09-6941	4/7/2009	09-1393		0.001	U	0.8	U	0.002	0.000	0.001	U	0.001	U	0.50
GW40-09-6942	4/8/2009	09-1401		0.001	U	0.8	U	0.003	0.000	0.001	U	0.001	U	0.39
GW40-09-6943	4/8/2009	09-1404		0.001	U	0.8	U	0.002	0.000	0.001	U	0.001	U	0.39
GW40-09-6944	4/9/2009	09-1424		0.001	U	0.8	U	0.001	U	0.001	U	0.001	U	0.40
GW40-09-6945	4/9/2009	09-1424		0.001	U	0.8	U	0.001	U	0.001	U	0.001	U	0.36
GW40-09-6946	4/13/2009	09-1451		0.001	U	0.8	U	0.001	U	0.001	U	0.001	U	0.38

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	ClO4(-) (U)	Co rslt (ppm)	stdev (Co)	Alk-CO3 rslt (ppm	ALK-CO3 (U)	Cr rslt (ppm)	stdev (Cr)	Cs rslt (ppm)	stdev (Cs)	Cu rslt (ppm)	stdev (Cu)	F(-) ppm
GW40-09-6947	4/13/2009	09-1451		0.001	U	0.8	U	0.001	U	0.001	U	0.001	U	0.38
GW40-09-6948	4/13/2009	09-1451		0.001	U	0.8	U	0.001	U	0.001	U	0.001	U	0.38
GW40-09-6949	4/13/2009	09-1451		0.001	U	0.8	U	0.001	U	0.001	U	0.001	0.000	0.38
GW40-09-6950	4/13/2009	09-1451		0.001	U	0.8	U	0.001	U	0.001	U	0.002	0.000	0.38
GW40-09-6951	4/13/2009	09-1451		0.001	U	0.8	U	0.001	U	0.001	U	0.001	0.000	0.37
GW40-09-6952	4/13/2009	09-1449		0.001	U	0.8	U	0.001	U	0.001	U	0.001	U	0.39
GW40-09-6953	4/13/2009	09-1449		0.001	U	0.8	U	0.001	U	0.001	U	0.001	U	0.46
GW40-09-6954	4/20/2009	09-1496		0.001	U	0.8	U	0.001	U	0.001	U	0.001	U	0.35
GW40-09-6955	4/20/2009	09-1496		0.001	U	0.8	U	0.002	0.000	0.001	U	0.001	0.000	0.34
GW40-09-6956	4/20/2009	09-1496		0.001	U	0.8	U	0.001	0.000	0.001	U	0.001	U	0.35
GW40-09-8320	4/23/2009	09-1549		0.001	U	0.8	U	0.004	0.000	0.001	U	0.001	U	0.36
GW40-09-8321	4/23/2009	09-1549		0.001	U	0.8	U	0.003	0.000	0.001	U	0.001	U	0.37
GW40-09-8322	4/23/2009	09-1549		0.001	U	0.8	U	0.004	0.000	0.001	U	0.001	0.000	0.37
GW40-09-8323	4/27/2009	09-1595		0.001	U	0.8	U	0.005	0.000	0.001	U	0.003	0.000	0.27
GW40-09-8324	4/27/2009	09-1595		0.001	U	0.8	U	0.004	0.000	0.001	U	0.002	0.000	0.29
GW40-09-8325	4/27/2009	09-1615		0.001	U	0.8	U	0.005	0.001	0.001	U	0.001	U	0.27
GW40-09-8326	4/27/2009	09-1615		0.001	U	0.8	U	0.006	0.001	0.001	U	0.001	U	0.37
GW40-09-8327	4/27/2009	09-1615		0.001	U	0.8	U	0.005	0.000	0.001	U	0.001	U	0.38
GW40-09-8328	4/27/2009	09-1615		0.001	U	0.8	U	0.004	0.000	0.001	U	0.001	0.000	0.26
GW40-09-8329	4/27/2009	09-1615		0.001	U	0.8	U	0.003	0.000	0.001	U	0.001	U	0.39
GW40-09-8330	4/30/2009	09-1647		0.001	U	0.8	U	0.003	0.000	0.001	U	0.001	U	0.37
GW40-09-8331	4/30/2009	09-1647		0.001	U	0.8	U	0.003	0.000	0.001	U	0.001	U	0.27
GW40-09-8332	4/30/2009	09-1647		0.001	U	0.8	U	0.003	0.000	0.001	U	0.001	U	0.40
GW40-09-8333	4/30/2009	09-1647		0.001	U	0.8	U	0.003	0.000	0.001	U	0.001	U	0.27

Note: During development at well R-40 and R-40i, only TOC was analyzed in some groundwater-screening samples to evaluate the presence of residual drilling fluid (AQF-2).

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	Ba rslt (ppm)	stdev (Ba)	Be rslt (ppm)	stdev (Be)	Br(-) ppm	TOC rslt (ppm)	Ca rslt (ppm)	stdev (Ca)	Cd rslt (ppm)	stdev (Cd)	Cl(-) ppm	ClO4(-) ppm
RC54-09-1031	11/10/2008	09-246	0.388	0.001	0.001	U	0.06	Not applicable	13.69	0.1	0.001	U	4.77	0.005
RC54-09-1032	11/10/2008	09-246	0.464	0.002	0.001	U	0.05	Not applicable	13.66	0.0	0.001	U	7.18	0.005
RC54-09-1033	11/10/2008	09-246	0.283	0.002	0.001	U	0.07	Not applicable	15.35	0.1	0.001	U	4.71	0.005
RC54-09-1034	11/12/2008	09-278	0.298	0.001	0.001	U	0.03	Not applicable	10.22	0.1	0.001	U	2.91	0.002
RC54-09-1037	1/8/2009	09-591	0.034	0.000	0.001	U	0.09	Not applicable	13.21	0.1	0.001	U	3.93	0.005
RC54-09-1038	1/13/2009	09-615	0.031	0.001	0.001	U	0.13	Not applicable	13.36	0.2	0.001	U	8.56	0.005
GW40-08-14400	7/31/2008	08-1598	0.015	0.000	0.001	U	0.02	Not applicable	10.17	0.1	0.001	U	9.15	0.005
GW40-08-14401	10/31/2008	09-196	0.017	0.000	0.001	U	0.10	Not applicable	15.05	0.1	0.001	U	5.32	0.005
GW40-08-14402	10/29/2008	09-186	0.007	0.000	0.001	U	0.11	Not applicable	6.99	0.0	0.001	U	8.23	0.005
GW40-08-14404	10/30/2008	09-194	0.015	0.000	0.001	U	0.08	Not applicable	14.49	0.0	0.001	U	5.93	0.005
GW40-08-14405	10/30/2008	09-194	0.014	0.000	0.001	U	0.06	Not applicable	14.54	0.1	0.001	U	5.33	0.005
GW40-09-1617	1/21/2009	09-696	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	1.43	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1618	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	9.49	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1619	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	8.51	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1620	2/5/2009	09-781	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	11.2	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1621	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	12.5	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1622	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	4.9	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1623	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	9.2	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1624	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	13.9	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1625	3/10/2009	09-1143	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	10.0	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1626	3/9/2009	09-1138	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	7.7	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1627	3/10/2009	09-1157	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	6.6	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1628	3/11/2009	09-1163	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	5.1	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1629	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	6.9	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1630	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	5.1	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1631	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	5.1	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1632	3/13/2009	09-1200	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	5.9	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1633	3/16/2009	09-1217	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	5.0	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1634	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	4.4	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1635	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	6.0	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5867	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	4.3	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5868	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	4.3	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5869	3/18/2009	09-1247	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	5.4	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5870	3/23/2009	09-1249	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	6.1	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5871	3/23/2009	09-1255	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	4.4	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5872	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	4.1	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5873	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	5.0	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5874	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	3.4	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5875	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	3.2	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5876	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	5.8	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5877	3/26/2009	09-1309	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	3.9	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5878	3/30/2009	09-1313	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	3.8	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-6937	4/7/2009	09-1393	0.039	0.000	0.001	U	0.05	2.2	20.82	0.06	0.001	U	3.02	Pending
GW40-09-6938	4/7/2009	09-1393	0.036	0.001	0.001	U	0.05	2.3	20.93	0.05	0.001	U	2.97	Pending
GW40-09-6939	4/7/2009	09-1393	0.020	0.000	0.001	U	0.05	17.9	21.05	0.09	0.001	U	3.74	Pending
GW40-09-6940	4/7/2009	09-1393	0.016	0.000	0.001	U	0.05	2.9	15.65	0.10	0.001	U	3.71	Pending
GW40-09-6941	4/7/2009	09-1393	0.016	0.000	0.001	U	0.04	3.7	15.51	0.14	0.001	U	3.71	Pending
GW40-09-6942	4/8/2009	09-1401	0.016	0.000	0.001	U	0.05	3.8	16.21	0.04	0.001	U	3.62	Pending
GW40-09-6943	4/8/2009	09-1404	0.016	0.000	0.001	U	0.05	4.0	16.00	0.06	0.001	U	3.67	Pending
GW40-09-6944	4/9/2009	09-1424	0.017	0.001	0.001	U	0.05	4.0	16.96	0.04	0.001	U	3.63	Pending
GW40-09-6945	4/9/2009	09-1424	0.019	0.000	0.001	U	0.05	6.4	17.68	0.10	0.001	U	3.42	Pending
GW40-09-6946	4/13/2009	09-1451	0.018	0.000	0.001	U	0.05	3.9	17.22	0.11	0.001	U	3.52	Pending

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	Ba rslt (ppm)	stdev (Ba)	Be rslt (ppm)	stdev (Be)	Br(-) ppm	TOC rslt (ppm)	Ca rslt (ppm)	stdev (Ca)	Cd rslt (ppm)	stdev (Cd)	Cl(-) ppm	ClO4(-) ppm
GW40-09-6947	4/13/2009	09-1451	0.019	0.000	0.001	U	0.06	6.3	17.76	0.07	0.001	U	3.44	Pending
GW40-09-6948	4/13/2009	09-1451	0.018	0.000	0.001	U	0.05	4.1	17.28	0.04	0.001	U	3.52	Pending
GW40-09-6949	4/13/2009	09-1451	0.039	0.000	0.001	U	0.05	1.9	21.03	0.11	0.001	U	3.02	Pending
GW40-09-6950	4/13/2009	09-1451	0.038	0.001	0.001	U	0.05	1.8	21.04	0.05	0.001	U	3.16	Pending
GW40-09-6951	4/13/2009	09-1451	0.019	0.001	0.001	U	0.07	7.1	17.88	0.14	0.001	U	3.46	Pending
GW40-09-6952	4/13/2009	09-1449	0.017	0.000	0.001	U	0.05	3.2	16.81	0.03	0.001	U	3.59	Pending
GW40-09-6953	4/13/2009	09-1449	0.019	0.000	0.001	U	0.09	6.6	17.36	0.13	0.001	U	3.56	Pending
GW40-09-6954	4/20/2009	09-1496	0.019	0.000	0.001	U	0.10	2.8	15.96	0.09	0.001	U	3.78	Pending
GW40-09-6955	4/20/2009	09-1496	0.019	0.000	0.001	U	0.10	3.8	16.06	0.12	0.001	U	3.82	Pending
GW40-09-6956	4/20/2009	09-1496	0.018	0.000	0.001	U	0.10	2.1	15.90	0.09	0.001	U	3.79	Pending
GW40-09-8320	4/23/2009	09-1549	0.016	0.001	0.001	U	0.08	1.9	15.56	0.10	0.001	U	3.99	Pending
GW40-09-8321	4/23/2009	09-1549	0.017	0.001	0.001	U	0.06	1.7	15.93	0.08	0.001	U	3.95	Pending
GW40-09-8322	4/23/2009	09-1549	0.020	0.000	0.001	U	0.07	3.5	16.22	0.15	0.001	U	3.90	Pending
GW40-09-8323	4/27/2009	09-1595	0.018	0.001	0.001	U	0.08	0.7	11.89	0.03	0.001	U	3.69	Pending
GW40-09-8324	4/27/2009	09-1595	0.020	0.000	0.001	U	0.09	0.6	11.63	0.01	0.001	U	3.74	Pending
GW40-09-8325	4/27/2009	09-1615	0.026	0.001	0.001	U	0.08	0.5	11.44	0.11	0.001	U	3.50	Pending
GW40-09-8326	4/27/2009	09-1615	0.020	0.002	0.001	U	0.10	1.7	15.49	0.08	0.001	U	4.00	Pending
GW40-09-8327	4/27/2009	09-1615	0.018	0.001	0.001	U	0.10	1.4	15.79	0.06	0.001	U	4.02	Pending
GW40-09-8328	4/27/2009	09-1615	0.022	0.000	0.001	U	0.08	0.6	11.05	0.03	0.001	U	3.48	Pending
GW40-09-8329	4/27/2009	09-1615	0.017	0.000	0.001	U	0.09	1.8	15.66	0.08	0.001	U	4.10	Pending
GW40-09-8330	4/30/2009	09-1647	0.018	0.000	0.001	U	0.05	2.4	16.70	0.07	0.001	U	4.15	Pending
GW40-09-8331	4/30/2009	09-1647	0.023	0.000	0.001	U	0.04	0.4	11.38	0.06	0.001	U	3.64	Pending
GW40-09-8332	4/30/2009	09-1647	0.018	0.000	0.001	U	0.06	2.7	16.78	0.10	0.001	U	4.26	Pending
GW40-09-8333	4/30/2009	09-1647	0.021	0.000	0.001	U	0.04	0.5	10.90	0.02	0.001	U	3.64	Pending

Note: During development at well R-40 and R-40i, only TOC was analyzed in some groundwater-screening samples to evaluate the presence of residual drilling fluid (AQF-2).

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	Fe rslt (ppm)	stdev (Fe)	Alk-CO3+HCO3	Hg rslt (ppm)	stdev (Hg)	K rslt (ppm)	stdev (K)	Li rslt (ppm)	stdev (Li)	Mg rslt (ppm)	stdev (Mg)	Mn rslt (ppm)
RC54-09-1031	11/10/2008	09-246	0.483	0.003	106	0.00013	0.00001	2.49	0.01	0.021	0.000	4.95	0.03	0.078
RC54-09-1032	11/10/2008	09-246	0.346	0.000	111	0.00007	0.00000	3.87	0.00	0.044	0.001	4.59	0.01	0.196
RC54-09-1033	11/10/2008	09-246	0.243	0.001	115	0.00005	U	2.68	0.01	0.021	0.000	5.43	0.01	0.177
RC54-09-1034	11/12/2008	09-278	0.262	0.001	77	0.00006	0.00000	1.52	0.00	0.027	0.000	2.88	0.03	0.192
RC54-09-1037	1/8/2009	09-591	0.010	U	170	0.00005	U	2.18	0.02	0.029	0.000	3.84	0.02	0.304
RC54-09-1038	1/13/2009	09-615	0.013	0.000	171	0.00006	0.00001	2.22	0.01	0.047	0.000	3.33	0.01	0.396
GW40-08-14400	7/31/2008	08-1598	0.121	0.002	109	0.00005	U	2.97	0.03	0.014	0.000	5.34	0.06	0.023
GW40-08-14401	10/31/2008	09-196	0.261	0.001	114	0.00006	0.00000	2.35	0.01	0.016	0.000	6.44	0.07	0.101
GW40-08-14402	10/29/2008	09-186	0.010	U	89.2	0.00005	U	2.91	0.02	0.018	0.000	2.86	0.01	0.147
GW40-08-14404	10/30/2008	09-194	0.258	0.002	117	0.00014	0.00001	2.53	0.01	0.015	0.000	6.26	0.01	0.127
GW40-08-14405	10/30/2008	09-194	0.351	0.004	113	0.00011	0.00000	2.43	0.01	0.014	0.000	6.14	0.03	0.110
GW40-09-1617	1/21/2009	09-696	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1618	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1619	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1620	2/5/2009	09-781	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1621	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1622	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1623	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1624	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1625	3/10/2009	09-1143	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1626	3/9/2009	09-1138	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1627	3/10/2009	09-1157	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1628	3/11/2009	09-1163	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1629	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1630	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1631	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1632	3/13/2009	09-1200	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1633	3/16/2009	09-1217	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1634	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1635	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5867	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5868	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5869	3/18/2009	09-1247	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5870	3/23/2009	09-1249	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5871	3/23/2009	09-1255	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5872	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5873	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5874	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5875	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5876	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5877	3/26/2009	09-1309	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5878	3/30/2009	09-1313	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-6937	4/7/2009	09-1393	0.348	0.002	132	0.00005	U	1.78	0.01	0.03	0.00	6.35	0	0.101
GW40-09-6938	4/7/2009	09-1393	0.195	0.001	130	0.00005	U	1.70	0.01	0.03	0.00	6.23	0	0.081
GW40-09-6939	4/7/2009	09-1393	0.030	0.000	166	0.00005	U	3.63	0.02	0.02	0.00	8.98	0	0.165
GW40-09-6940	4/7/2009	09-1393	0.011	0.000	108	0.00005	U	2.13	0.00	0.01	0.00	6.56	0	0.054
GW40-09-6941	4/7/2009	09-1393	0.016	0.000	112	0.00005	U	1.90	0.01	0.01	0.00	6.33	0	0.100
GW40-09-6942	4/8/2009	09-1401	0.012	0.000	112	0.00020	0.00000	2.14	0.01	0.01	0.00	6.71	0	0.059
GW40-09-6943	4/8/2009	09-1404	0.013	0.000	112	0.00014	0.00001	2.05	0.01	0.01	0.00	6.51	0	0.076
GW40-09-6944	4/9/2009	09-1424	0.010	U	120	0.00007	0.00000	2.12	0.01	0.02	0.00	6.67	0	0.060
GW40-09-6945	4/9/2009	09-1424	0.019	0.000	123	0.00008	0.00001	2.18	0.03	0.02	0.00	6.88	0	0.088
GW40-09-6946	4/13/2009	09-1451	0.010	U	115	0.00006	0.00000	2.13	0.00	0.02	0.00	6.90	0	0.069

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	Fe rslt (ppm)	stdev (Fe)	Alk-CO3+HCO3 r	Hg rslt (ppm)	stdev (Hg)	K rslt (ppm)	stdev (K)	Li rslt (ppm)	stdev (Li)	Mg rslt (ppm)	stdev (Mg)	Mn rslt (ppm)
GW40-09-6947	4/13/2009	09-1451	0.011	0.000	124	0.00005	U	2.16	0.01	0.02	0.00	6.99	0	0.095
GW40-09-6948	4/13/2009	09-1451	0.010	U	115	0.00005	U	2.13	0.01	0.02	0.00	6.96	0	0.071
GW40-09-6949	4/13/2009	09-1451	0.174	0.000	125	0.00008	0.00000	1.62	0.01	0.03	0.00	5.96	0	0.079
GW40-09-6950	4/13/2009	09-1451	0.116	0.001	125	0.00000	U	1.67	0.01	0.03	0.00	6.10	0	0.069
GW40-09-6951	4/13/2009	09-1451	0.018	0.000	126	0.00008	0.00001	2.32	0.01	0.02	0.00	7.15	0	0.093
GW40-09-6952	4/13/2009	09-1449	0.010	U	112	0.00005	U	2.07	0.01	0.02	0.00	6.67	0	0.061
GW40-09-6953	4/13/2009	09-1449	0.084	0.001	125	0.00005	U	2.35	0.02	0.02	0.00	6.94	0	0.100
GW40-09-6954	4/20/2009	09-1496	0.010	U	112	0.00005	U	2.17	0.01	0.02	0.00	6.65	0	0.057
GW40-09-6955	4/20/2009	09-1496	0.010	U	116	0.00005	U	2.16	0.02	0.02	0.00	6.70	0	0.076
GW40-09-6956	4/20/2009	09-1496	0.010	U	110	0.00005	U	2.14	0.01	0.02	0.00	6.59	0	0.051
GW40-09-8320	4/23/2009	09-1549	0.010	U	119	0.00005	U	3.32	0.03	0.02	0.00	6.32	0	0.108
GW40-09-8321	4/23/2009	09-1549	0.010	U	111	0.00005	U	2.19	0.04	0.02	0.00	6.89	0	0.058
GW40-09-8322	4/23/2009	09-1549	0.011	0.000	118	0.00005	U	2.07	0.02	0.02	0.00	6.40	0	0.075
GW40-09-8323	4/27/2009	09-1595	0.010	U	93	0.00005	U	2.32	0.02	0.03	0.00	3.34	0	0.065
GW40-09-8324	4/27/2009	09-1595	0.010	U	98	0.00005	U	2.43	0.01	0.03	0.00	3.55	0	0.135
GW40-09-8325	4/27/2009	09-1615	0.010	U	86	0.00005	U	1.73	0.01	0.03	0.00	3.08	0	0.071
GW40-09-8326	4/27/2009	09-1615	0.010	U	113	0.00005	U	1.90	0.01	0.02	0.00	6.45	0	0.121
GW40-09-8327	4/27/2009	09-1615	0.010	U	108	0.00005	U	2.01	0.01	0.02	0.00	6.42	0	0.078
GW40-09-8328	4/27/2009	09-1615	0.012	0.001	86	0.00005	U	1.68	0.01	0.03	0.00	3.01	0	0.056
GW40-09-8329	4/27/2009	09-1615	0.068	0.001	108	0.00005	U	1.97	0.01	0.02	0.00	6.24	0	0.072
GW40-09-8330	4/30/2009	09-1647	0.010	U	116	0.00005	U	2.07	0.00	0.01	0.00	6.63	0	0.057
GW40-09-8331	4/30/2009	09-1647	0.010	0.001	83	0.00005	U	1.56	0.00	0.02	0.00	3.00	0	0.058
GW40-09-8332	4/30/2009	09-1647	0.010	0.000	112	0.00005	U	1.99	0.01	0.01	0.00	6.52	0	0.079
GW40-09-8333	4/30/2009	09-1647	0.010	U	89	0.00005	U	1.49	0.01	0.02	0.00	2.85	0	0.055

Note: During development at well R-40 and R-40i, only TOC was analyzed in some groundwater-screening samples to evaluate the presence of residual drilling fluid (AQF-2).

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	stdev (Mn)	Mo rslt (ppm)	stdev (Mo)	Na rslt (ppm)	stdev (Na)	Ni rslt (ppm)	stdev (Ni)	NO2(ppm)	NO2-N rslt	NO3 ppm	NO3-N rslt	C2O4 rslt (ppm	Pb rslt (ppm)
RC54-09-1031	11/10/2008	09-246	0.001	0.067	0.001	19.06	0.08	0.002	0.000	0.01	0.003, U	0.01	0.002, U	0.01, U	0.0005
RC54-09-1032	11/10/2008	09-246	0.001	0.164	0.001	21.01	0.12	0.003	0.000	0.01	0.003, U	0.01	0.002, U	0.37	0.0004
RC54-09-1033	11/10/2008	09-246	0.001	0.043	0.000	18.58	0.15	0.003	0.000	0.01	0.003, U	0.01	0.002, U	0.04	0.0002
RC54-09-1034	11/12/2008	09-278	0.000	0.016	0.000	11.72	0.01	0.002	0.000	0.01	0.003, U	0.85	0.191	0.05	0.0002
RC54-09-1037	1/8/2009	09-591	0.001	0.049	0.000	37.86	0.44	0.003	0.000	0.01	0.003, U	0.01	0.002, U	0.01, U	0.0002
RC54-09-1038	1/13/2009	09-615	0.004	0.052	0.001	59.73	0.47	0.004	0.000	0.01	0.003, U	0.01	0.002, U	0.01, U	0.0002
GW40-08-14400	7/31/2008	08-1598	0.000	0.032	0.000	23.21	0.22	0.003	0.000	1.13	0.344	2.67	0.604	0.23	0.0002
GW40-08-14401	10/31/2008	09-196	0.001	0.021	0.000	18.27	0.09	0.001	U	0.01	0.003, U	0.01	0.002, U	0.05	0.0002
GW40-08-14402	10/29/2008	09-186	0.005	0.060	0.000	27.03	0.11	0.001	0.000	0.01	0.003, U	0.16	0.036	0.16	0.0002
GW40-08-14404	10/30/2008	09-194	0.001	0.026	0.000	21.13	0.02	0.001	U	0.01	0.003, U	0.23	0.053	0.03	0.0002
GW40-08-14405	10/30/2008	09-194	0.001	0.022	0.000	20.07	0.23	0.001	U	0.01	0.003, U	0.20	0.045	0.03	0.0002
GW40-09-1617	1/21/2009	09-696	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1618	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1619	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1620	2/5/2009	09-781	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1621	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1622	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1623	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1624	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1625	3/10/2009	09-1143	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1626	3/9/2009	09-1138	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1627	3/10/2009	09-1157	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1628	3/11/2009	09-1163	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1629	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1630	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1631	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1632	3/13/2009	09-1200	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1633	3/16/2009	09-1217	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1634	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1635	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5867	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5868	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5869	3/18/2009	09-1247	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5870	3/23/2009	09-1249	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5871	3/23/2009	09-1255	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5872	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5873	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5874	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5875	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5876	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5877	3/26/2009	09-1309	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5878	3/30/2009	09-1313	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-6937	4/7/2009	09-1393	0.007	0.007	0.000	14.89	0.10	0.007	0.000	0.01	0.003, U	0.01	0.002, U	0.05	0.0012
GW40-09-6938	4/7/2009	09-1393	0.001	0.007	0.000	14.33	0.07	0.008	0.000	0.01	0.003, U	0.01	0.002, U	0.04	0.0013
GW40-09-6939	4/7/2009	09-1393	0.001	0.011	0.000	20.54	0.09	0.005	0.000	0.01	0.003, U	0.01	0.003	0.01, U	0.0002
GW40-09-6940	4/7/2009	09-1393	0.000	0.005	0.000	14.90	0.05	0.004	0.000	0.01	0.003, U	1.81	0.408	0.01, U	0.0002
GW40-09-6941	4/7/2009	09-1393	0.001	0.006	0.000	16.35	0.13	0.003	0.000	0.13	0.038	0.83	0.187	0.01, U	0.0002
GW40-09-6942	4/8/2009	09-1401	0.000	0.006	0.000	15.43	0.11	0.012	0.000	0.03	0.008	1.37	0.309	0.01, U	0.0002
GW40-09-6943	4/8/2009	09-1404	0.001	0.009	0.000	15.34	0.08	0.005	0.000	0.10	0.030	1.49	0.337	0.01, U	0.0002
GW40-09-6944	4/9/2009	09-1424	0.001	0.006	0.000	15.39	0.11	0.003	0.000	0.01	0.003, U	1.05	0.237	0.01, U	0.0002
GW40-09-6945	4/9/2009	09-1424	0.000	0.008	0.000	17.06	0.13	0.008	0.000	0.01	0.003, U	0.01	0.002, U	0.01, U	0.0002
GW40-09-6946	4/13/2009	09-1451	0.001	0.006	0.000	15.90	0.06	0.005	0.000	0.01	0.003, U	0.69	0.156	0.01, U	0.0002

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	stdev (Mn)	Mo rslt (ppm)	stdev (Mo)	Na rslt (ppm)	stdev (Na)	Ni rslt (ppm)	stdev (Ni)	NO2(ppm)	NO2-N rslt	NO3 ppm	NO3-N rslt	C2O4 rslt (ppm	Pb rslt (ppm)
GW40-09-6947	4/13/2009	09-1451	0.000	0.007	0.000	17.34	0.03	0.005	0.000	0.01	0.003, U	0.01	0.002, U	0.01, U	0.0002
GW40-09-6948	4/13/2009	09-1451	0.000	0.007	0.000	15.86	0.03	0.002	0.000	0.01	0.003, U	1.02	0.231	0.01, U	0.0002
GW40-09-6949	4/13/2009	09-1451	0.001	0.008	0.000	13.58	0.09	0.003	0.000	0.01	0.003, U	0.01	0.002, U	0.03	0.0004
GW40-09-6950	4/13/2009	09-1451	0.000	0.005	0.000	13.76	0.03	0.009	0.000	0.01	0.003, U	0.01	0.002, U	0.03	0.0004
GW40-09-6951	4/13/2009	09-1451	0.002	0.009	0.000	17.81	0.04	0.002	0.000	0.01	0.003, U	0.01	0.002, U	0.01, U	0.0002
GW40-09-6952	4/13/2009	09-1449	0.001	0.005	0.000	15.19	0.03	0.003	0.000	0.01	0.003, U	1.38	0.311	0.01, U	0.0002
GW40-09-6953	4/13/2009	09-1449	0.002	0.006	0.000	18.69	0.09	0.116	0.001	0.01	0.003, U	0.01	0.002, U	0.01, U	0.0002
GW40-09-6954	4/20/2009	09-1496	0.001	0.005	0.000	15.77	0.05	0.006	0.000	0.01	0.003, U	1.21	0.274	0.01, U	0.0002
GW40-09-6955	4/20/2009	09-1496	0.000	0.006	0.000	16.59	0.08	0.024	0.000	0.06	0.018	0.43	0.096	0.01, U	0.0002
GW40-09-6956	4/20/2009	09-1496	0.000	0.005	0.000	15.27	0.10	0.006	0.000	0.01	0.003, U	1.65	0.373	0.01, U	0.0002
GW40-09-8320	4/23/2009	09-1549	0.002	0.005	0.000	15.68	0.05	0.002	0.000	0.01	0.003, U	0.01	0.002, U	0.01, U	0.0002
GW40-09-8321	4/23/2009	09-1549	0.000	0.005	0.000	15.49	0.20	0.003	0.000	0.01	0.003, U	0.99	0.224	0.01, U	0.0002
GW40-09-8322	4/23/2009	09-1549	0.002	0.006	0.000	15.47	0.04	0.015	0.000	0.01	0.003, U	0.19	0.044	0.01, U	0.0002
GW40-09-8323	4/27/2009	09-1595	0.001	0.010	0.000	19.10	0.19	0.003	0.000	0.01	0.003, U	0.90	0.202	0.01, U	0.0002
GW40-09-8324	4/27/2009	09-1595	0.001	0.014	0.000	24.80	0.29	0.003	0.000	0.01	0.003, U	0.46	0.103	0.01, U	0.0002
GW40-09-8325	4/27/2009	09-1615	0.007	0.007	0.000	16.14	0.13	0.002	0.000	0.01	0.003, U	1.01	0.229	0.01, U	0.0002
GW40-09-8326	4/27/2009	09-1615	0.009	0.005	0.000	16.03	0.09	0.001	0.000	0.20	0.06	0.34	0.076	0.01, U	0.0002
GW40-09-8327	4/27/2009	09-1615	0.002	0.004	0.000	14.67	0.15	0.001	0.000	0.13	0.040	1.07	0.241	0.01, U	0.0002
GW40-09-8328	4/27/2009	09-1615	0.000	0.006	0.000	16.05	0.13	0.001	0.000	0.01	0.003, U	1.08	0.243	0.01, U	0.0002
GW40-09-8329	4/27/2009	09-1615	0.001	0.004	0.000	13.96	0.04	0.001	0.000	0.16	0.049	1.75	0.395	0.01, U	0.0002
GW40-09-8330	4/30/2009	09-1647	0.000	0.005	0.000	14.35	0.16	0.002	0.000	0.01	0.003, U	1.01	0.227	0.01, U	0.0002
GW40-09-8331	4/30/2009	09-1647	0.000	0.005	0.000	14.17	0.03	0.007	0.000	0.01	0.003, U	1.40	0.316	0.01, U	0.0002
GW40-09-8332	4/30/2009	09-1647	0.001	0.005	0.000	14.33	0.04	0.004	0.000	0.01	0.003, U	0.88	0.198	0.01, U	0.0002
GW40-09-8333	4/30/2009	09-1647	0.000	0.005	0.000	14.21	0.12	0.038	0.000	0.01	0.003, U	1.25	0.282	0.01, U	0.0002

Note: During development at well R-40 and R-40i, only TOC was analyzed in some groundwater-screening samples to evaluate the presence of residual drilling fluid (AQF-2).

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	stdev (Pb)	Lab pH	PO4(-3) rslt (pp	Rb rslt (ppm)	stdev (Rb)	Sb rslt (ppm)	stdev (Sb)	Se rslt (ppm)	stdev (Se)	Si rslt (ppm)	stdev (Si)	SiO2 rslt (ppm)
RC54-09-1031	11/10/2008	09-246	0.0000	7.88	0.12	0.003	0.000	0.001	U	0.001	U	20.6	0.2	44.1
RC54-09-1032	11/10/2008	09-246	0.0000	7.83	0.08	0.003	0.000	0.001	U	0.001	U	21.6	0.2	46.2
RC54-09-1033	11/10/2008	09-246	0.0000	7.81	0.07	0.002	0.000	0.001	U	0.001	U	22.6	0.1	48.3
RC54-09-1034	11/12/2008	09-278	U	7.84	0.09	0.001	U	0.001	U	0.001	U	33.4	0.2	71.4
RC54-09-1037	1/8/2009	09-591	U	7.10	0.01, U	0.004	0.000	0.001	U	0.001	U	15.5	0.1	33.1
RC54-09-1038	1/13/2009	09-615	U	8.00	0.11	0.002	0.000	0.001	U	0.001	U	15.9	0.1	34.0
GW40-08-14400	7/31/2008	08-1598	U	8.65	0.22	0.007	0.000	0.001	U	0.001	U	12.3	0.1	26.3
GW40-08-14401	10/31/2008	09-196	U	7.76	0.02	0.004	0.000	0.001	U	0.001	U	21.7	0.1	46.4
GW40-08-14402	10/29/2008	09-186	U	7.52	0.01, U	0.006	0.000	0.001	U	0.001	U	2.7	0.0	5.7
GW40-08-14404	10/30/2008	09-194	U	7.81	0.01, U	0.006	0.000	0.001	U	0.001	U	22.9	0.2	48.9
GW40-08-14405	10/30/2008	09-194	U	7.68	0.01, U	0.006	0.000	0.001	U	0.001	U	22.8	0.0	48.9
GW40-09-1617	1/21/2009	09-696	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1618	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1619	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1620	2/5/2009	09-781	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1621	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1622	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1623	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1624	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1625	3/10/2009	09-1143	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1626	3/9/2009	09-1138	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1627	3/10/2009	09-1157	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1628	3/11/2009	09-1163	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1629	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1630	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1631	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1632	3/13/2009	09-1200	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1633	3/16/2009	09-1217	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1634	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1635	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5867	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5868	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5869	3/18/2009	09-1247	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5870	3/23/2009	09-1249	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5871	3/23/2009	09-1255	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5872	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5873	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5874	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5875	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5876	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5877	3/26/2009	09-1309	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5878	3/30/2009	09-1313	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-6937	4/7/2009	09-1393	0.0000	7.46	0.01, U	0.002	0.000	0.001	U	0.001	U	30	0	63
GW40-09-6938	4/7/2009	09-1393	0.0000	7.27	0.01, U	0.002	0.000	0.001	U	0.001	U	29	0	62
GW40-09-6939	4/7/2009	09-1393	U	6.99	0.05	0.009	0.000	0.001	U	0.001	U	32	0	68
GW40-09-6940	4/7/2009	09-1393	U	7.24	0.02	0.003	0.000	0.001	U	0.001	U	31	0	66
GW40-09-6941	4/7/2009	09-1393	U	7.27	0.02	0.003	0.000	0.001	U	0.001	U	30	0	63
GW40-09-6942	4/8/2009	09-1401	U	7.22	0.06	0.003	0.000	0.001	U	0.001	U	30	0	65
GW40-09-6943	4/8/2009	09-1404	U	7.27	0.08	0.003	0.000	0.001	U	0.001	U	30	0	64
GW40-09-6944	4/9/2009	09-1424	U	7.40	0.01, U	0.003	0.000	0.001	U	0.001	U	29	0	63
GW40-09-6945	4/9/2009	09-1424	U	7.08	0.14	0.004	0.000	0.001	U	0.001	U	29	0	63
GW40-09-6946	4/13/2009	09-1451	U	6.97	0.01, U	0.003	0.000	0.001	U	0.001	U	30	0	65

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	stdev (Pb)	Lab pH	PO4(-3) rslt (pp	Rb rslt (ppm)	stdev (Rb)	Sb rslt (ppm)	stdev (Sb)	Se rslt (ppm)	stdev (Se)	Si rslt (ppm)	stdev (Si)	SiO2 rslt (ppm)
GW40-09-6947	4/13/2009	09-1451	U	7.05	0.11	0.004	0.000	0.001	U	0.001	U	30	0	63
GW40-09-6948	4/13/2009	09-1451	U	6.90	0.01, U	0.003	0.000	0.001	U	0.001	U	30	0	65
GW40-09-6949	4/13/2009	09-1451	0.0000	6.95	0.01, U	0.002	0.000	0.001	U	0.001	U	28	0	60
GW40-09-6950	4/13/2009	09-1451	0.0000	7.06	0.01, U	0.002	0.000	0.001	U	0.001	U	28	0	61
GW40-09-6951	4/13/2009	09-1451	U	7.08	0.13	0.004	0.000	0.001	U	0.001	U	30	0	64
GW40-09-6952	4/13/2009	09-1449	U	6.89	0.01, U	0.003	0.000	0.001	U	0.001	U	30	0	64
GW40-09-6953	4/13/2009	09-1449	0.0000	6.96	0.07	0.005	0.000	0.001	U	0.001	U	30	0	64
GW40-09-6954	4/20/2009	09-1496	U	6.98	0.01, U	0.003	0.000	0.001	U	0.001	U	30	0	64
GW40-09-6955	4/20/2009	09-1496	U	6.97	0.01, U	0.004	0.000	0.001	U	0.001	U	30	0	64
GW40-09-6956	4/20/2009	09-1496	U	7.07	0.01, U	0.003	0.000	0.001	U	0.001	U	30	0	64
GW40-09-8320	4/23/2009	09-1549	U	7.19	0.01, U	0.004	0.000	0.001	U	0.001	U	30	0	64
GW40-09-8321	4/23/2009	09-1549	U	7.03	0.01, U	0.004	0.000	0.001	U	0.001	U	32	0	69
GW40-09-8322	4/23/2009	09-1549	U	7.18	0.01	0.004	0.000	0.001	U	0.001	U	29	0	62
GW40-09-8323	4/27/2009	09-1595	U	7.37	0.01	0.004	0.000	0.001	U	0.001	U	32	0	69
GW40-09-8324	4/27/2009	09-1595	U	7.08	0.01, U	0.004	0.000	0.001	U	0.001	U	32	0	68
GW40-09-8325	4/27/2009	09-1615	U	7.21	0.01	0.003	0.000	0.001	U	0.001	U	32	0	68
GW40-09-8326	4/27/2009	09-1615	U	7.11	0.01, U	0.004	0.000	0.001	U	0.001	U	29	0	62
GW40-09-8327	4/27/2009	09-1615	U	7.12	0.01, U	0.003	0.000	0.001	U	0.001	U	30	0	64
GW40-09-8328	4/27/2009	09-1615	U	7.34	0.01	0.003	0.000	0.001	U	0.001	U	32	0	68
GW40-09-8329	4/27/2009	09-1615	U	7.23	0.01	0.003	0.000	0.001	U	0.001	U	29	0	62
GW40-09-8330	4/30/2009	09-1647	U	7.35	0.01, U	0.005	0.000	0.001	U	0.001	U	30	0	64
GW40-09-8331	4/30/2009	09-1647	U	7.17	0.01	0.004	0.000	0.001	U	0.001	U	32	0	68
GW40-09-8332	4/30/2009	09-1647	U	7.08	0.01	0.005	0.000	0.001	U	0.001	U	29	0	62
GW40-09-8333	4/30/2009	09-1647	U	7.17	0.01	0.004	0.000	0.001	U	0.001	U	31	0	65

Note: During development at well R-40 and R-40i, only TOC was analyzed in some groundwater-screening samples to evaluate the presence of residual drilling fluid (AQF-2).

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	stdev (SiO2)	Sn rslt (ppm)	stdev (Sn)	SO4(-2) rslt (ppm	Sr rslt (ppm)	stdev (Sr)	Th rslt (ppm)	stdev (Th)	Ti rslt (ppm)	stdev (Ti)	Tl rslt (ppm)	stdev (Tl)
RC54-09-1031	11/10/2008	09-246	0.4	0.001	U	6.59	0.074	0.000	0.001	U	0.058	0.001	0.001	U
RC54-09-1032	11/10/2008	09-246	0.3	0.001	U	5.45	0.068	0.001	0.001	U	0.045	0.000	0.001	U
RC54-09-1033	11/10/2008	09-246	0.2	0.001	U	6.17	0.081	0.002	0.001	U	0.027	0.000	0.001	U
RC54-09-1034	11/12/2008	09-278	0.3	0.001	U	2.34	0.044	0.001	0.001	U	0.005	0.000	0.001	U
RC54-09-1037	1/8/2009	09-591	0.3	0.001	U	10.47	0.105	0.001	0.001	U	0.002	U	0.001	U
RC54-09-1038	1/13/2009	09-615	0.1	0.001	U	42.64	0.118	0.004	0.001	U	0.002	U	0.001	U
GW40-08-14400	7/31/2008	08-1598	0.2	0.001	U	4.65	0.059	0.001	0.001	U	0.008	0.000	0.001	U
GW40-08-14401	10/31/2008	09-196	0.3	0.001	U	0.13	0.065	0.001	0.001	U	0.005	0.000	0.001	U
GW40-08-14402	10/29/2008	09-186	0.0	0.001	U	8.77	0.041	0.000	0.001	U	0.002	U	0.001	U
GW40-08-14404	10/30/2008	09-194	0.4	0.001	U	9.57	0.069	0.001	0.001	U	0.016	0.000	0.001	U
GW40-08-14405	10/30/2008	09-194	0.1	0.001	U	9.05	0.066	0.001	0.001	U	0.012	0.000	0.001	U
GW40-09-1617	1/21/2009	09-696	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1618	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1619	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1620	2/5/2009	09-781	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1621	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1622	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1623	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1624	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1625	3/10/2009	09-1143	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1626	3/9/2009	09-1138	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1627	3/10/2009	09-1157	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1628	3/11/2009	09-1163	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1629	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1630	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1631	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1632	3/13/2009	09-1200	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1633	3/16/2009	09-1217	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1634	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-1635	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5867	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5868	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5869	3/18/2009	09-1247	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5870	3/23/2009	09-1249	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5871	3/23/2009	09-1255	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5872	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5873	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5874	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5875	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5876	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5877	3/26/2009	09-1309	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-5878	3/30/2009	09-1313	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed
GW40-09-6937	4/7/2009	09-1393	1	0.001	U	4.84	0.102	0.001	0.001	U	0.002	U	0.001	U
GW40-09-6938	4/7/2009	09-1393	0	0.001	U	4.80	0.102	0.001	0.001	U	0.002	U	0.001	U
GW40-09-6939	4/7/2009	09-1393	0	0.001	U	1.20	0.107	0.000	0.001	U	0.002	U	0.001	U
GW40-09-6940	4/7/2009	09-1393	0	0.001	U	6.99	0.081	0.001	0.001	U	0.002	U	0.001	U
GW40-09-6941	4/7/2009	09-1393	0	0.001	U	6.52	0.080	0.000	0.001	U	0.002	U	0.001	U
GW40-09-6942	4/8/2009	09-1401	0	0.001	U	7.20	0.081	0.001	0.001	U	0.002	U	0.001	U
GW40-09-6943	4/8/2009	09-1404	0	0.001	U	6.88	0.079	0.000	0.001	U	0.002	U	0.001	U
GW40-09-6944	4/9/2009	09-1424	0	0.001	U	7.71	0.081	0.000	0.001	U	0.002	U	0.001	U
GW40-09-6945	4/9/2009	09-1424	1	0.001	U	7.64	0.085	0.000	0.001	U	0.002	U	0.001	U
GW40-09-6946	4/13/2009	09-1451	0	0.001	U	7.99	0.079	0.001	0.001	U	0.002	U	0.001	U

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	stdev (SiO2)	Sn rslt (ppm)	stdev (Sn)	SO4(-2) rslt (ppm	Sr rslt (ppm)	stdev (Sr)	Th rslt (ppm)	stdev (Th)	Ti rslt (ppm)	stdev (Ti)	Tl rslt (ppm)	stdev (Tl)
GW40-09-6947	4/13/2009	09-1451	0	0.001	U	7.84	0.081	0.001	0.001	U	0.002	U	0.001	U
GW40-09-6948	4/13/2009	09-1451	0	0.001	U	7.82	0.079	0.000	0.001	U	0.002	U	0.001	U
GW40-09-6949	4/13/2009	09-1451	1	0.001	U	5.15	0.088	0.000	0.001	U	0.002	U	0.001	U
GW40-09-6950	4/13/2009	09-1451	1	0.001	U	5.19	0.087	0.002	0.001	U	0.002	U	0.001	U
GW40-09-6951	4/13/2009	09-1451	0	0.001	U	7.96	0.078	0.001	0.001	U	0.002	U	0.001	U
GW40-09-6952	4/13/2009	09-1449	1	0.001	U	7.72	0.073	0.000	0.001	U	0.002	U	0.001	U
GW40-09-6953	4/13/2009	09-1449	0	0.001	U	7.67	0.076	0.001	0.001	U	0.002	U	0.001	U
GW40-09-6954	4/20/2009	09-1496	1	0.001	U	6.78	0.077	0.000	0.001	U	0.002	U	0.001	U
GW40-09-6955	4/20/2009	09-1496	0	0.001	U	6.93	0.073	0.000	0.001	U	0.002	U	0.001	U
GW40-09-6956	4/20/2009	09-1496	1	0.001	U	6.60	0.072	0.000	0.001	U	0.002	U	0.001	U
GW40-09-8320	4/23/2009	09-1549	1	0.001	U	6.39	0.079	0.001	0.001	U	0.002	U	0.001	U
GW40-09-8321	4/23/2009	09-1549	1	0.001	U	7.11	0.079	0.001	0.001	U	0.002	U	0.001	U
GW40-09-8322	4/23/2009	09-1549	1	0.001	U	6.82	0.075	0.001	0.001	U	0.002	U	0.001	U
GW40-09-8323	4/27/2009	09-1595	1	0.001	U	10.08	0.045	0.002	0.001	U	0.002	U	0.001	U
GW40-09-8324	4/27/2009	09-1595	1	0.001	U	16.42	0.044	0.001	0.001	U	0.002	U	0.001	U
GW40-09-8325	4/27/2009	09-1615	0	0.001	U	7.72	0.045	0.003	0.001	U	0.002	U	0.001	U
GW40-09-8326	4/27/2009	09-1615	0	0.001	U	6.68	0.068	0.006	0.001	U	0.002	U	0.001	U
GW40-09-8327	4/27/2009	09-1615	0	0.001	U	6.44	0.064	0.001	0.001	U	0.002	U	0.001	U
GW40-09-8328	4/27/2009	09-1615	0	0.001	U	6.86	0.040	0.000	0.001	U	0.002	U	0.001	U
GW40-09-8329	4/27/2009	09-1615	0	0.001	U	6.15	0.060	0.001	0.001	U	0.002	U	0.001	U
GW40-09-8330	4/30/2009	09-1647	0	0.001	U	7.55	0.092	0.001	0.001	U	0.002	U	0.001	U
GW40-09-8331	4/30/2009	09-1647	1	0.001	U	6.18	0.068	0.000	0.001	U	0.002	U	0.001	U
GW40-09-8332	4/30/2009	09-1647	0	0.001	U	7.54	0.091	0.000	0.001	U	0.002	U	0.001	U
GW40-09-8333	4/30/2009	09-1647	0	0.001	U	6.13	0.066	0.001	0.001	U	0.002	U	0.001	U

Note: During development at well R-40 and R-40i, only TOC was analyzed in some groundwater-screening samples to evaluate the presence of residual drilling fluid (AQF-2).

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	U rslt (ppm)	stdev (U)	V rslt (ppm)	stdev (V)	Zn rslt (ppm)	stdev (Zn)	TDS (ppm)	Cations	Anions	Balance
RC54-09-1031	11/10/2008	09-246	0.0007	0.0000	0.003	0.000	0.114	0.001	206	2.00	2.09	-0.02
RC54-09-1032	11/10/2008	09-246	0.0009	0.0000	0.003	0.000	0.101	0.001	217	2.10	2.23	-0.03
RC54-09-1033	11/10/2008	09-246	0.0007	0.0000	0.002	0.000	0.111	0.001	219	2.11	2.22	-0.02
RC54-09-1034	11/12/2008	09-278	0.0002	U	0.003	0.000	0.072	0.000	183	1.31	1.47	-0.06
RC54-09-1037	1/8/2009	09-591	0.0011	0.0000	0.002	0.000	0.008	0.000	276	2.70	3.16	-0.08
RC54-09-1038	1/13/2009	09-615	0.0008	0.0000	0.003	0.000	0.012	0.003	337	3.62	4.00	-0.05
GW40-08-14400	7/31/2008	08-1598	0.0017	0.0001	0.009	0.000	0.011	0.001	204	2.04	2.53	-0.11
GW40-08-14401	10/31/2008	09-196	0.0007	0.0000	0.001	0.000	0.022	0.001	210	2.14	2.08	0.02
GW40-08-14402	10/29/2008	09-186	0.0002	U	0.002	0.000	0.004	0.000	154	1.84	1.94	-0.02
GW40-08-14404	10/30/2008	09-194	0.0008	0.0001	0.002	0.000	0.001	U	228	2.23	2.35	-0.03
GW40-08-14405	10/30/2008	09-194	0.0008	0.0000	0.002	0.000	0.001	0.000	222	2.17	2.25	-0.02
GW40-09-1617	1/21/2009	09-696	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1618	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1619	1/26/2009	09-734	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1620	2/5/2009	09-781	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1621	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1622	3/5/2009	09-1086	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1623	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1624	3/10/2009	09-1117	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1625	3/10/2009	09-1143	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1626	3/9/2009	09-1138	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1627	3/10/2009	09-1157	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1628	3/11/2009	09-1163	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1629	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1630	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1631	3/12/2009	09-1198	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1632	3/13/2009	09-1200	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1633	3/16/2009	09-1217	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1634	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-1635	3/17/2009	09-1232	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5867	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5868	3/18/2009	09-1236	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5869	3/18/2009	09-1247	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5870	3/23/2009	09-1249	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5871	3/23/2009	09-1255	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5872	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5873	3/24/2009	09-1269	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5874	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5875	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5876	3/25/2009	09-1295	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5877	3/26/2009	09-1309	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-5878	3/30/2009	09-1313	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not analyzed	Not applicable	Not applicable	Not applicable
GW40-09-6937	4/7/2009	09-1393	0.0006	0.0000	0.001	0.000	1.316	0.004	250	2.3	2.4	-0.02
GW40-09-6938	4/7/2009	09-1393	0.0006	0.0000	0.001	0.000	0.934	0.001	246	2.3	2.4	-0.02
GW40-09-6939	4/7/2009	09-1393	0.0002	0.0000	0.001	0.000	1.514	0.005	296	2.8	2.9	-0.01
GW40-09-6940	4/7/2009	09-1393	0.0005	0.0000	0.002	0.000	0.421	0.002	228	2.0	2.1	-0.02
GW40-09-6941	4/7/2009	09-1393	0.0005	0.0000	0.001	0.000	0.524	0.006	229	2.1	2.2	-0.02
GW40-09-6942	4/8/2009	09-1401	0.0006	0.0000	0.002	0.000	0.331	0.003	232	2.1	2.2	-0.01
GW40-09-6943	4/8/2009	09-1404	0.0005	0.0000	0.001	0.000	0.427	0.001	230	2.1	2.2	-0.02
GW40-09-6944	4/9/2009	09-1424	0.0007	0.0000	0.002	0.000	0.276	0.002	238	2.1	2.3	-0.04
GW40-09-6945	4/9/2009	09-1424	0.0009	0.0000	0.002	0.000	0.715	0.009	243	2.3	2.3	-0.01
GW40-09-6946	4/13/2009	09-1451	0.0007	0.0000	0.003	0.000	0.277	0.001	236	2.2	2.2	-0.01

Table C-1.3-1
Analytical Results for Groundwater-Screening Samples Collected from R-40i and R-40 screens 1 and 2, Pajarito Canyon

Sample ID	Date Received	ER/RRES-WQH	U rslt (ppm)	stdev (U)	V rslt (ppm)	stdev (V)	Zn rslt (ppm)	stdev (Zn)	TDS (ppm)	Cations	Anions	Balance
GW40-09-6947	4/13/2009	09-1451	0.0008	0.0000	0.002	0.000	0.732	0.003	245	2.3	2.3	-0.01
GW40-09-6948	4/13/2009	09-1451	0.0007	0.0000	0.003	0.000	0.300	0.000	236	2.2	2.2	0.00
GW40-09-6949	4/13/2009	09-1451	0.0008	0.0000	0.002	0.000	1.179	0.004	238	2.2	2.3	-0.02
GW40-09-6950	4/13/2009	09-1451	0.0008	0.0000	0.002	0.000	1.026	0.005	240	2.2	2.3	-0.01
GW40-09-6951	4/13/2009	09-1451	0.0009	0.0000	0.002	0.000	0.815	0.003	249	2.3	2.4	-0.01
GW40-09-6952	4/13/2009	09-1449	0.0007	0.0000	0.003	0.000	0.297	0.002	231	2.1	2.2	-0.01
GW40-09-6953	4/13/2009	09-1449	0.0007	0.0000	0.001	0.000	0.865	0.009	248	2.3	2.4	0.00
GW40-09-6954	4/20/2009	09-1496	0.0007	0.0000	0.002	0.000	0.294	0.000	231	2.1	2.2	-0.01
GW40-09-6955	4/20/2009	09-1496	0.0007	0.0000	0.001	0.000	0.747	0.003	235	2.2	2.2	-0.01
GW40-09-6956	4/20/2009	09-1496	0.0006	0.0000	0.002	0.000	0.302	0.001	228	2.1	2.1	-0.01
GW40-09-8320	4/23/2009	09-1549	0.0006	0.0000	0.001	0.000	0.603	0.004	236	2.1	2.2	-0.04
GW40-09-8321	4/23/2009	09-1549	0.0006	0.0000	0.003	0.000	0.423	0.010	234	2.1	2.1	-0.01
GW40-09-8322	4/23/2009	09-1549	0.0006	0.0000	0.002	0.000	1.297	0.004	234	2.1	2.2	-0.03
GW40-09-8323	4/27/2009	09-1595	0.0003	0.0000	0.005	0.000	0.603	0.006	215	1.8	1.9	-0.03
GW40-09-8324	4/27/2009	09-1595	0.0003	0.0000	0.003	0.000	1.255	0.017	231	2.1	2.1	-0.01
GW40-09-8325	4/27/2009	09-1615	0.0004	0.0000	0.005	0.001	0.350	0.002	200	1.6	1.7	-0.04
GW40-09-8326	4/27/2009	09-1615	0.0006	0.0000	0.002	0.000	0.606	0.004	229	2.1	2.2	-0.02
GW40-09-8327	4/27/2009	09-1615	0.0006	0.0000	0.002	0.000	0.490	0.003	225	2.0	2.1	-0.01
GW40-09-8328	4/27/2009	09-1615	0.0003	0.0000	0.004	0.000	0.397	0.002	198	1.6	1.7	-0.04
GW40-09-8329	4/27/2009	09-1615	0.0006	0.0000	0.001	0.000	0.483	0.001	222	2.0	2.1	-0.03
GW40-09-8330	4/30/2009	09-1647	0.0006	0.0000	0.003	0.000	0.328	0.000	234	2.1	2.2	-0.04
GW40-09-8331	4/30/2009	09-1647	0.0003	0.0000	0.003	0.000	0.615	0.001	195	1.5	1.7	-0.05
GW40-09-8332	4/30/2009	09-1647	0.0006	0.0000	0.002	0.000	0.594	0.002	228	2.1	2.2	-0.02
GW40-09-8333	4/30/2009	09-1647	0.0003	0.0000	0.003	0.000	2.883	0.001	199	1.5	1.8	-0.07

Note: During development at well R-40 and R-40i, only TOC was analyzed in some groundwater-screening samples to evaluate the presence of residual drilling fluid (AQF-2).

Appendix D

Borehole Video Logging
(on DVD included with this document)

Appendix E

Schlumberger Geophysical Logging Report
(on CD included with this document)

Schlumberger Geophysical Report

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1.0 SUMMARY

Schlumberger performed geophysical logging in characterization well R-40 in November 2008 before well completion. The logging measurements were acquired from 8 to 905 ft below ground surface (bgs), when the borehole contained 10.75 in. inside diameter (I.D.) freestanding steel casing from ground surface to 910 ft, drilled with an approximately 12.25-in. diameter bit size.

The primary purpose of the geophysical logging was to characterize the geology and hydrogeology across the depth section where well screens were being considered, with emphasis on determining regional aquifer groundwater level, relative water saturation, depths of porous aquifer zones, and stratigraphy/lithology of geologic units. These objectives were accomplished by measuring, nearly continuously, along the length of the well (1) total water-filled porosity from which, in combination with lithologic composition estimated from the other logs, an indirect estimate of hydraulic conductivity (production capacity) is made; (2) bulk density (sensitive to total water plus air-filled porosity and grain density); (3) neutron-induced gamma ray spectroscopy, providing bulk concentrations of a number of important mineral-forming elements, as well as hydrogen; and (4) spectral natural gamma ray, including potassium, thorium, and uranium concentrations.

The following Schlumberger geophysical logging tools were used in the project (Table 1.1):

- Accelerator Porosity Sonde (APS∗)
- Triple Detector Litho-Density (TLD*) tool
- Elemental Capture Spectroscopy (ECS*) tool
- Hostile Natural Gamma Spectroscopy (HNGS*) and gamma ray (GR)

Table 1.1
Geophysical Logging Tool, Technology, Corresponding Measured Properties

Tool	Technology	Properties Measured
APS	Epithermal neutron porosity and neutron capture cross-section	Water/moisture content, lithologic variations
TLD	Gamma-gamma bulk density	Bulk density, total porosity, lithology
ECS	Neutron induced gamma ray spectroscopy	Formation matrix geochemistry, lithology and mineralogy, formation hydrogen content
HNGS and GR	Gross and spectral natural gamma ray, including potassium, thorium, and uranium concentrations	Formation matrix geochemistry, lithology and mineralogy

* Mark of Schlumberger.

Once the LATA well drilling project team provided Schlumberger final notification that R-40 was ready for geophysical well logging, the Schlumberger district in Farmington, New Mexico, mobilized a wireline logging truck, the appropriate wireline logging tools and associated equipment, and crew to the job site. Table 1.2 summarizes the geophysical logging runs performed in R-40.

Table 1.2
Geophysical Logging Services, Their Combined Tool Runs and Intervals Logged, as Performed by Schlumberger in Well R-40

Date of Logging	Run #	Tool 1 (bottom)	Tool 2 (top)	Depth Interval (ft bgs)
08-November-2008	1	ECS	GR	44-900
	2	APS	GR	293-900
	3	HNGS	GR	9-900
	4	TLD	GR	23-902

Preliminary results of these measurements were generated in the logging truck at the time the geophysical services were performed and are documented in field logs provided on-site. However, the measurements presented in the field results are not fully corrected for borehole conditions (particularly casing) and are provided as separate, individual logs. Schlumberger reprocessed the field results to (1) correct/improve the measurements, as best as possible, for borehole/formation environmental conditions; (2) perform an integrated analysis of the log measurements so that they are all coherent and provide consistent hydrogeologic and geologic results; and (3) combine the logs in a single presentation, enabling integrated interpretation. The reprocessed log results provide better quantitative property estimates that are consistent for all applicable measurements, as well as estimates of properties that otherwise could not be reliably estimated from the single measurements alone (e.g., total porosity inclusive of all water and air present, water saturation, relative hydraulic conductivity, lithology).

The geophysical log measurements from well R-40 provide overall, good quality results that are consistent with each other across the logged interval. However, the existence, extent, and effect on the geophysical logs of a water or air-filled annulus between the casing and the borehole wall (voids behind the casing) is difficult to determine and thus there is uncertainty about how well some of the log measurements represent true geologic formation conditions (unaffected by drilling). The distance between the logging tool sensor and formation is unknown and thus difficult to account or correct for. The measurements most affected by voids behind the casing were ones that have a shallow depth of investigation and that require close contact to the uncased borehole wall—the bulk density and the neutron porosity measurements (particularly the bulk density). One indicator that the bulk density is being adversely affected by voids behind the casing is when the computed density porosity is unrealistically high. Where the total porosity estimated from the processed logs reaches above 50%, the bulk density measurement is likely being affected by voids. This condition occurs across much of the logged section, indicating the presence of an annulus large enough to adversely affect the cased hole density measurement.

Important results from the processed geophysical logs in R-40 include the following.

1. The standing water level in R-40 was 853 ft bgs at the time of the ECS and APS logging runs and seems to have stayed consistently close to this depth during the other two logging runs.

2. The processed logs indicate very high water content below 866 ft bgs (mostly over 40% of total rock volume). The measured water content is a little lower in the interval from 844 to 866 ft (average around 30%), but it increases again to mostly over 40% from 830 to 844 ft. The measured water content does not drop below 30% until above 821 ft. Unfortunately, the total porosity estimate from the bulk density measurement is unrealistically high across most of this interval due to a large casing to formation annulus, making it difficult to estimate water saturation and the depth where below is fully saturated. The integrated log analysis does indicate full or very high water saturation below 848 ft, as well as 838–844 ft and at 831 ft. These results suggest the regional aquifer water-level (depth at which there is full water saturation) is likely no lower than 848 ft, more likely around 840 ft, and possibly as high as 831 ft.
3. Above 831 ft bgs, which the processed logs indicate as the likely highest possible top of the regional aquifer, the estimated water content decreases steadily to 20% of total rock volume at 808 ft. Above 808 ft the water content mostly varies between 10% and 30%. There are a number of zones where the water content and, correspondingly, water saturation increases (although not high enough to suggest 100% saturation and perched water).
    - 728–750 ft, where measured water content and total porosity ranges from 20% up to 32% at 746 ft . Water saturation is difficult to assess because of the bulk density reading unrealistically low because of large air-filled gap between the casing and formation, although at 746 ft the estimated water saturation sharply increases to near 100%.
    - 615–650 ft, measured water content is highly variable, but peaks to near 30% in several places. The log response suggests there are large, sharp washouts behind the casing that complicate the log interpretation.
    - 315–360 ft, water content rises smoothly to a high of 30% at 337 ft. This zone is within volcanic tuff.
4. The location of productive zones within the saturated section is difficult to determine because of the adverse cased well conditions. Higher porosity is not necessarily indicative of higher production capacity since fine-grained sediments often have higher porosity and lower productivity than coarser-grained sediments. The highest porosities are likely associated with washouts behind the casing. The predicted relative flow capacity profile generated from the integrated log analysis estimated permeability results suggest that the most productive intervals are 866–888 and 830–844 ft bgs, although the higher production potential in these zones is largely driven by higher water content (water-filled porosity).
5. The geophysical log results indicate overall basaltic rock composition below 442 ft bgs, characterized by high titanium, iron, and calcium content, although there are notable changes in the matrix geochemistry and mineralogy, as well as bulk density and porosity across this section. There is a significant consistent decrease in bulk density below 795 ft, likely marking transition from competent basalt lava above to reworked material of basaltic origin below. There appears to be a slight compositional change below 855 ft, with lower potassium, thorium, and calcium, and higher iron concentrations than in the section immediately above. In the interval from 442 to 720 ft, there is consistent chemical composition, with high titanium and calcium, and low potassium and thorium concentration—indicative of more mafic mineral pyroxene-rich basalt. Matrix chemical composition changes dramatically above 442 ft (increased potassium, thorium, and uranium; decreased titanium, iron, and calcium), marking a lithology change to rhyolite tuff above. Based on the bulk density log response (very low), it appears the Guaje Pumice Bed extends from 426 to 442 ft.

2.0 INTRODUCTION

Schlumberger performed geophysical logging services in regional characterization and monitoring well R-40 in November 2008 before initial well completion. The purpose of these services was to acquire in situ measurements to help characterize the near-borehole geologic formation environment. The primary objective of the geophysical logging was to provide in situ evaluation of formation properties (hydrogeology and geology) intersected by the well. This information was used by scientists, engineers, and project managers in the Los Alamos Characterization and Monitoring Well Project to help design the well completion, better understand subsurface site conditions, and assist in overall decision-making.

The primary geophysical logging tools used by Schlumberger in well R-40 were the following:

- APS, which measures, through casing and in water or air-filled hole, volumetric water content of the formation at several depths of investigation to evaluate moist/porous zones using a pulsed epithermal neutron measurement, as well as neutron capture cross section, which is sensitive to water and lithology;
- TLD tool, which measures formation bulk density through casing, used to estimate total porosity;
- HNGS tool, which measures gross natural gamma and spectral natural gamma ray activity, including potassium, thorium, and uranium concentrations, used to evaluate geology/lithology, particularly the amount of thorium and potassium-bearing minerals; and
- ECS tool, which measures neutron-induced spectral gamma ray activity; this determines elemental weight fraction concentrations of a number of key rock-forming elements used to characterize geochemistry, mineralogy, and lithology of the formation, as well as hydrogen content (closely related to water content).

In addition, calibrated gross GR was recorded with every service for the purpose of correlating depths between the different logging runs. Table 2.1 summarizes the geophysical logging runs performed in R-40.

Table 2.1
Geophysical Logging Services, Their Combined Tool Runs and Intervals Logged, as Performed by Schlumberger in Borehole R-40

Date of Logging	Borehole Status	Run #	Tool 1 (bottom)	Tool 2 (top)	Depth Interval (ft bgs)
08-November-2008	Steel free-tanding casing from surface to bottom. Single string of 10.75 in. I.D. casing (~1 in. thick) from surface to the bottom of the borehole at 910 ~12.25 in.	1	ECS	GR	37-900
	Same	2	APS	GR	290-900
	Same	3	HNGS	GR	9-900
	Same	4	TLD	GR	23-902

A more detailed description of these geophysical logging tools can be found on the Schlumberger website (http://www.slb.com/content/services/evaluation/index.asp?).

3.0 METHODOLOGY

This section describes the methods Schlumberger employed for geophysical logging of well R-40, including the following stages/tasks:

- measurement acquisition at the well site
- quality assessment of logs
- reprocessing of field data

3.1 Acquisition Procedure

Once the well drilling project team notified Schlumberger that R-40 was ready for geophysical well logging, the Schlumberger district in Farmington, New Mexico, mobilized a wireline logging truck, the appropriate wireline logging tools and associated equipment, and crew to the job site. Upon arriving at the Los Alamos National Laboratory (Laboratory) site, the crew completed site-entry paperwork and received a site-specific safety briefing.

After arriving at the well site, the crew proceeded to rig up the wireline logging system, including

- parking and stabilizing the logging truck in a position relative to the borehole that is best for performing the surveys,
- setting up a lower and an upper sheave wheel (the latter attached to, and hanging above, the borehole from the drilling rig/mast truck),
- threading the wireline cable through the sheaves, and
- attaching to the end of the cable the appropriate sonde(s) for the first run.

Next, prelogging checks and any required calibrations were performed on the logging sondes, and the tool string was lowered into the borehole. If any of the tools required active radioactive sources (in this case, a neutron and gamma source for the ECS and TLD, respectively), the sources were taken out of their carrying shields and placed in the appropriate tool source-holding locations using special source-handling tools just before lowering the tool string. The tool string was lowered to the bottom of the borehole and brought up at the appropriate logging speed as measurements were made. At least two logging runs (one main and one repeat) were made with each tool string.

Upon reaching the surface, any radioactive sources were removed from the tools and were returned to their appropriate storage shields, thus eliminating any radiation hazards. Any postlogging measurement checks were performed as part of log quality control (QC) and quality assurance (QA). The tool string was cleaned as it was pulled out of the hole, separated, and disconnected.

The second tool string was attached to the cable for another logging run, followed by subsequent tool strings and logging runs. After the final logging run was completed, the cable and sheave wheels were rigged down.

Before departure, the logging engineer printed field logs and created a compact disc containing the field log data for on-site distribution and sent the data via satellite to the Schlumberger data storage center. The Schlumberger data processing center was alerted that the data were ready for postacquisition processing.

3.2 Log QC and QA

Schlumberger has a thorough set of procedures and protocols for ensuring that the geophysical logging measurements are of very high quality. This includes full calibration of tools when they are first built, regular recalibrations and tool measurement/maintenance checks, and real-time monitoring of log quality as measurements are made. Indeed, one of the primary responsibilities of the logging engineer is to ensure, before and during acquisition, that the log measurements meet prescribed quality criteria.

A tool-specific base calibration that directly relates the tool response to the physical measurement using the designed measurement principle is performed on all Schlumberger logging tools when first assembled in the engineering production centers. This is accomplished through a combination of computer modeling and controlled measurements in calibration models with known chemical and physical properties.

The base calibration for most Schlumberger tools is augmented through regular “master calibrations” typically performed every 1 to 6 mo in local Schlumberger shops (such as Farmington, New Mexico), depending on tool design. Master calibrations consist of controlled measurements using specially designed calibration tanks/jigs and internal calibration devices that are built into the tools, both with known physical properties. The measurements are used to fine-tune the tool’s calibration parameters and to verify that the measurements are valid.

In addition, on every logging job, before and after on-site “calibrations” are executed for most Schlumberger tools directly before/after lowering/removing the tool string from the borehole. For most tools, these represent a measurement verification instead of an actual calibration used to confirm the validity of the measurements directly before acquisition and to ensure that they have not drifted or been corrupted during the logging job.

All Schlumberger logging measurements have a number of associated depth-dependent QC logs and flags to assist with identifying and determining the magnitude of log quality problems. These QC logs are monitored in real-time by the logging engineer during acquisition and are used in the postacquisition processing of the logs to determine the best processing approach for optimizing the overall validity of the property estimates derived from the logs.

Additional information on specific tool calibration procedures can be found on the Schlumberger website (http://www.slb.com/content/services/evaluation/index.asp).

3.3 Processing Procedure

After the geophysical logging job was completed in the field and the data was archived, the data were downloaded to the Schlumberger processing center. There, the data were processed in the following sequence: (1) the measurements were corrected for near-wellbore environmental conditions and the measurement field processing for certain tools (in this case, the HNGS, TLD, APS, and ECS) was redone using better processing algorithms and parameters; (2) the log curves from different logging runs were depth matched and spliced, if required; and (3) the near-wellbore substrate lithology/mineralogy and pore fluids were modeling through integrated log analysis. Afterwards, an integrated log montage was built to combine and compile all the processed log results.

3.3.1 Environmental Corrections and Raw Measurement Reprocessing

If required, the field log measurements were processed to correct for conditions in the well, including fluid type (water or air), presence of steel casing, and (to a much lesser extent) pressure, temperature, and fluid salinity. Basically, these environmental corrections entail subtracting from the measurement response the known influences of the set of prescribed borehole conditions. In R-40, the log measurements requiring these corrections are the APS porosity, TLD bulk formation density, ECS elemental concentrations, and HNGS spectral gamma ray logs.

Two neutron porosity measurements are available: one that measures thermal ("slow") neutrons and one that measures epithermal ("fast") neutrons (the APS tool). Measurement of epithermal neutrons is required to make neutron porosity measurements in air-filled holes. In water/mud-filled holes, both the epithermal and thermal neutron measurements are valid. Both measurements can be environmentally corrected for a single string of steel-casing. Epithermal neutron porosity measurements were made in R-40. The APS measurements were reprocessed for casing, borehole fluid type (air versus water), and other environmental conditions. The APS also makes a measurement of neutron capture cross section; this measurement was also corrected for well environmental conditions at the time of logging. For further processing and analysis (e.g., integrated log analysis), the reprocessed neutron porosity and neutron capture cross section logs were used.

The raw ECS elemental yield measurements include the contribution of iron from steel casing and hydrogen from fluid in the borehole. The processing consists of subtracting this unwanted contribution from the raw normalized yield, then performing the normal elemental yields-to-weight fraction processing. The contribution to subtract is a constant baseline amount (or zoned constant values if there are bit/casing size changes), usually determined by comparing the normalized raw yields in zones directly below/above the borehole casing/fluid change. Casing corrections were applied to the ECS logs across the entire log interval, attempting to account for one string of steel casing. At the time of the ECS logging in R-40, the borehole contained water from bottom to 853 ft; no hydrogen correction was required in the air-filled section above 853 ft and the difference between the hydrogen yield above and below this depth was used to determine the baseline borehole hydrogen correction to apply below.

The HNGS spectral gamma ray is affected by the material (fluid, air, and casing) in the borehole because different types and amounts of these materials have different gamma ray shielding properties; the HNGS measures incoming gamma rays emitted by radioactive elements in the formation surrounding the borehole. The processing algorithms try to correct for the damping influence of the borehole material. The HNGS logs from R-40 were reprocessed to account, as best as possible, for the environmental effects of the casing, borehole fluid (water below 853 ft and air above), and hole size.

The measurements cannot be fully corrected for borehole washouts or rugosity since the specific characteristics (e.g., geometry) of these features are unknown (especially in this scenario where they hidden by casing) and their effects on the measurements are often too significant to account for. Thus, the compromising effects of these conditions on the measurements should be accounted for in the interpretation of the log results.

3.3.2 Depth-Matching and Reference

Once the logs were environmentally corrected for the conditions in the borehole and the raw measurement reprocessing was completed, the logs from different tool runs were depth-matched to each, as needed, using the gross gamma ray log, acquired in all the logging runs, for depth correlation. The depth reference for field-print outs of logs was drill rig floor height, but the depth reference for all logs presented in this report is ground surface.

3.3.3 Integrated Log Analysis

An integrated log analysis, using as many of the processed logs as possible, was performed to model the near-wellbore substrate lithology/mineralogy and pore fluids. This analysis was performed using the Elemental Log Analysis (ELAN*) program (Mayer and Sibbit 1980, 103867; Quirein et al. 1986, 098043)—a petrophysical interpretation program designed for depth-by-depth quantitative formation evaluation from borehole geophysical logs. ELAN estimates the volumetric fractions of user-defined rock matrix and pore constituents at each depth based on the known log measurement responses to each individual constituent by itself[1]. ELAN requires an a priori specification of the volume components present within the formation, i.e., fluids, minerals, and rocks. For each component, the relevant response parameters for each measurement are also required. For example, if one assumes that quartz is a volume component within the formation and the bulk density tool is used, then the bulk density parameter for this mineral is well known to be 2.65 g/cc.

The logging tool measurements, volume components, and measurement response parameters used in the ELAN analysis for R-40 are provided in Table 3.1. The final results of the analysis—an optimized mineral-fluid volume model—are shown on the integrated log montage (see Attachment 1), 3rd track from the right (inclusive of the depth track). In addition, the ELAN program provides a direct comparison of the modeled versus the actual measured geophysical logs, as well as a composite log of all of the key ELAN-derived results, including geologic/hydrogeologic properties computed from the mineral-fluid volume model (see Attachment 2). To make best use of all the measurement data and to perform the analysis across as much of the well interval as possible (37 to 900 ft bgs), as many of the processed logs as possible were included in the analysis, with less weighting applied to less robust logs. Not all of the tool measurements shown in Table 3.1 and the ELAN modeled versus measured log display are used for the entire interval analyzed, as not all the measurements are available, or of good quality, across certain sections of the borehole. To accommodate fewer tool measurements, certain model constituents are removed from the analysis in some intervals.

The ELAN analysis was performed with as few constraints or prior assumptions as possible. A considerable effort was made to choose a set of minerals or mineral types for the model that is representative of Los Alamos area geology and its volcanic origins. For the ELAN analysis, the log interval from 37 to 452 ft bgs was assumed to be tuff or pumice, and a mineral suite considered representative of this volcanic tuff, based on Laboratory cuttings mineral analysis, was used (primary “minerals” silica glass/cristobalite/tridymite [indistinguishable from the log measurements], quartz, potassium feldspar, and augite, with accessory minerals calcite and pyrite). The results of laboratory analyses of Bandelier Tuff and Puye Formation samples from around the Laboratory site were also used to constrain the proportion of quartz versus the combination of glass/cristobalite/tridymite in the ELAN analysis. The log interval 452 to 900 ft bgs (bottom of log interval) was assumed be basaltic lava flows or material derived from such flows with a possible mineral suite of plagioclase and potassium feldspar, quartz, augite, hypersthene, and pyrite.

Because of the significant influence on the bulk density measurement from the annular space between the casing and formation, total porosity (which is determined primarily from the bulk density measurement) was constrained to 50% of total rock volume (a little higher in the pumice/tuff sequence) throughout the analysis interval. No prior assumption is made about water saturation—where the boundary between saturated and unsaturated zones lies (e.g., the depth to the top of the regional aquifer or perched zones).

*Mark of Schlumberger.

[1]Mathematically, this corresponds to an inverse problem—solving for constituent volume fractions from an (over)determined system of equations relating the measured log results to combinations of the tool measurement response to individual constituents.

Thus, the presence and amount of air in the pore space is unconstrained. Total porosity and water-filled porosity are also left unconstrained throughout the analysis interval, despite the obvious influence on the log response of borehole washouts and annular voids behind the casing. There is no way to objectively correct for the adverse effect on the log measurements from these borehole conditions; therefore, the decision was made to perform the ELAN analysis so as to honor the log measurements. Accordingly, interpretations should be made from the ELAN results with the understanding that the mineral-fluid model represents a mathematically optimized solution that is not necessarily a physically accurate representation of the native geologic formation. Within this context, the ELAN model is a robust estimate of the bulk mineral-fluid composition that accounts for the combined response from all the geophysical measurements.

Table 3.1
Tool Measurements, Volumes, and Respective Parameters
Used in the R-40 ELAN Analysis

Volume / Tool Measurement	Air	Water	Hypersthene	Labradorite	Silica Glass, Cristo., Tridy.	Augite	Pyrite	Orthoclase	Calcite	Quartz
Bulk density (g/cc)	–0.19	1.00	3.55	2.68	2.33	3.08	4.99	2.54	2.71	2.64
Epithermal neutron poro. (ft^3/ft^3)	0	1.00	0.012	-0.01	0.0	-0.01	0.165	-0.01	0.0	-0.05
Dry weight silicon (lbf/lbf)[a]	0.0	0.0	0.24	0.247	0.468	0.225	0.0	0.3	0.0	0.468
Dry weight calcium (lbf/lbf)	0.0	0.0	0.0	0.09	0.0	0.10	0.0	0.0	0.405	0.0
Dry weight iron (lbf/lbf)	0.0	0.0	0.20	0.023	0.0	0.112	0.466	0.015	0.0	0.0
Dry weight aluminum (lbf/lbf)	0.0	0.0	0.0	0.162	0.0	0.018	0.0	0.104	0.0	0.0
Dry weight sulfur (lbf/lbf)	0.0	0.0	0.0	0.0	0.0	0.0	0.535	0.0	0.0	0.0
Dry weight titanium (lbf/lbf)	0.0	0.0	0.01	0.0	0.0	0.048	0.0	0.0	0.0	0.0
Wet weight potassium (lbf/lbf)	0.0	0.0	0.0	0.0	0.0	0.003	0.0	0.12	0.0	0.0
Weight hydrogen (lbf/lbf)	0.0	0.111	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0
Neutron capture unit (cu)[b] cross-section	0	22.21	18.9	7.87	4	25.66	90	15.82	7.4	4.7

[a] lbf = Pound force.

[b] cu = Capture unit.

4.0 RESULTS

Preliminary results from the wireline geophysical logging measurements acquired by Schlumberger in R-40 were generated in the logging truck at the time the geophysical services were performed and were documented in the field logs provided on-site. However, the measurements presented in the field results are not fully corrected for undesirable influence (from a measurement standpoint) of borehole and geologic conditions and are provided as separate, individual logs. The field log results have been processed to (1) correct/improve the measurements, as best as possible, for borehole/formation environmental conditions; and (2) depth-match the logs from different tool runs in the well. Additional logs were generated from integrated analysis of processed measured logs, providing valuable estimates of key geologic and hydrologic properties.

The processed log results are presented as continuous curves of the processed measurement versus depth and are displayed as (1) a one-page, compressed summary log display for selected directly related sets of measurements (see Figures 4.1, 4.2, and 4.3); and (2) an integrated log montage that contains all the key processed log curves, on depth and side by side (see Attachment 1). The summary log displays address specific characterization needs, such as porosity, production capacity, moisture content, water saturation, and lithologic changes. The purpose of the integrated log montage is to present, side by side, all the most salient processed logs and log-derived models, depth-matched to each other, so that correlations and relationships between the logs can be identified.

Important results from the processed geophysical logs in R-40 are described below.

4.1 Well Fluid Level

The standing water level in R-40 (within the freestanding 11.75 in.-outside diameter casing) was 853 ft bgs at the time of the ECS and APS logging runs and seems to have stayed consistently close to this depth during the other two logging runs.

4.2 Regional Aquifer

The processed logs indicate very high water content below 866 ft bgs (mostly over 40% of total rock volume; see porosity summary display in Figure 4.1 or integrated log montage in Attachment 1). The measured water content is a little lower in the interval from 844 to 866 ft (average around 30%) but increases again to mostly over 40% from 830 to 844 ft. The measured water content does not drop below 30% until above 821 ft. Unfortunately, the total porosity estimate from the bulk density measurement is unrealistically high across most of this interval due to a large casing to formation annulus, making it difficult to estimate water saturation and the depth where below is fully saturated. The integrated log analysis does indicate full or very high water saturation below 848 ft, as well as 838–844 ft and at 831 ft.

Conclusions that can be drawn from these geophysical log results are that the regional aquifer water level (depth at which there is full water saturation) is likely no lower than 848 ft, more likely around 840 ft, and possibly as high as 831 ft.

The location of productive zones within the saturated section is difficult to determine because of the adverse cased well conditions. Higher porosity is not necessarily indicative of higher production capacity since fine-grained sediments often have higher porosity and lower productivity than coarser-grained sediments. The highest porosities are likely associated with washouts behind the casing. The predicted relative flow capacity profile generated from the integrated log analysis estimated permeability results suggest that the most productive intervals are 866–888 and 830–844 ft bgs, although the higher

production potential in these zones is largely driven by higher water content (see porosity summary display in Figure 4.1 or integrated log montage in Attachment 1).

4.3 Vadose Zone Perched Water

As mentioned above, the depth to the top of the regional aquifer and thus the extent of the vadose zone definitely extends above 831 ft bgs. Above this depth, the estimated water content decreases steadily to 20% of total rock volume at 808 ft (see porosity summary display in Figure 4.1 or integrated log montage in Attachment 1). Above 808 ft, the water content mostly varies between 10% and 30%. There are a number of zones where the water content and, correspondingly, water saturation increases (although not high enough to suggest 100% saturation and significant perched water).

- 728–750 ft, where measured water content and total porosity ranges from 20% up to 32% at 746 ft . Water saturation is difficult to assess because of the bulk density reading unrealistically low because of large air-filled gap between the casing and formation, although at 746 ft the estimated water saturation sharply increases to near 100%.
- 615–650 ft, measured water content is highly variable, but peaks to near 30% in several places. The log response suggests there are large, sharp washouts behind the casing that complicate the log interpretation.
- 315–360 ft, water content rises smoothly to a high of 30% at 337 ft. This zone is within volcanic tuff

4.4 Geology

The processed geophysical log results, particularly the matrix geochemistry logs, provide information on lithology and potential formation contacts intersected by R-40 across the log interval (from 605 to 842 f bgs). The generalized geologic stratigraphy observed from the logs across the measured interval is as follows (depth below ground surface):

- **9–40 ft bgs (top of log interval):** Relatively low uranium, thorium, potassium material with unknown porosity (possible surface alluvium or volcanic tuff)
- **40–149 ft bgs: Silicon-, iron-, gadolinium-, uranium-, thorium-, and potassium-rich volcanic tuff—**characterized by high silica glass/tridymite/cristobalite content; minor to moderate amounts of quartz, potassium feldspar, and augite (or similar minerals); and trace amounts of calcite (or other calcium-bearing mineral); unknown porosity
- **149–160 ft bgs: Silicon-rich volcanic tuff—**characterized by high silica glass/tridymite/cristobalite content; minor to moderate amounts of quartz, potassium feldspar, and augite (or similar minerals); and trace amounts of calcite (or other calcium-bearing mineral); unknown porosity
- **160–167 ft bgs: Silicon-, iron-, gadolinium-, uranium-, thorium-, and potassium-rich volcanic tuff—**characterized by high silica glass/tridymite/cristobalite content; minor to moderate amounts of quartz, potassium feldspar, and augite (or similar minerals); and trace amounts of calcite (or other calcium-bearing mineral); unknown porosity

- **167–277 ft bgs: Silicon- and potassium-rich volcanic tuff—**characterized by high silica glass/tridymite/cristobalite content; minor to moderate amounts of quartz, potassium feldspar, and augite (or similar minerals); and trace amounts of calcite (or other calcium-bearing mineral); unknown porosity

- **277–291 ft bgs: Silicon-rich material with very high uranium and thorium peak (likely volcanic tuff**)—characterized by high silica glass/tridymite/cristobalite content; minor to moderate amounts of quartz and potassium feldspar; moderate to high augite content (or mineral with similar composition); and trace amounts of calcite (or other calcium-bearing mineral); unknown porosity

- **291–359 ft bgs: Silicon-, uranium-, thorium-, and potassium-rich volcanic tuff—** characterized by high silica glass/tridymite/cristobalite content; minor to moderate amounts of quartz, potassium feldspar, and augite (or similar minerals); and trace amounts of calcite (or other calcium-bearing mineral); unknown porosity

- **359–418 ft bgs: Very high porosity silicon-, uranium-, thorium-, and potassium-rich volcanic tuff—**characterized by very high total porosity (48%–55% of total rock volume), high silica glass/tridymite/cristobalite content; minor to moderate amounts of quartz, potassium feldspar, and augite (or similar minerals); and trace amounts of calcite (or other calcium-bearing mineral); unknown porosity

- **418–425 ft bgs: Silicon-, uranium-, thorium-, and potassium-rich volcanic tuff—** characterized by high silica glass/tridymite/cristobalite content; minor to moderate amounts of quartz, potassium feldspar, and augite (or similar minerals); and trace amounts of calcite (or other calcium-bearing mineral); unknown porosity

- **425–442 ft bgs: Silicon-, uranium-, and thorium-rich volcanic tuff/pumice (likely Guaje Pumice Bed)—**characterized by high silica glass/tridymite/cristobalite content; moderate amounts of quartz, potassium feldspar, and augite (or similar minerals); and minor amounts of calcite (or other calcium-bearing mineral); unknown porosity

- 442–720 ft bgs: Titanium-, calcium-, and iron-rich, and potassium, thorium, and uranium deficient volcanics (likely basalt lava)—characterized by high augite (or similar mineral) content; variably moderate to high amounts of plagioclase and quartz; and variably small amounts of alkali feldspars; unknown porosity

- **720–753 ft bgs: Titanium- and calcium-rich volcanics (likely basalt lava, slightly less mafic than overlying basalt)—**characterized by moderate augite (or similar mineral) content; variably moderate to high amounts of plagioclase and quartz; and variably minor to small amounts of alkali feldspars and hypersthene (or similar minerals)

- **753–795 ft bgs**: Low to moderate porosity, titanium- and calcium-rich volcanics (likely basalt lava, slightly less mafic than overlying basalt)—characterized by low to moderate total porosity (20%–35%, higher porosities likely a result of annular voids); moderate augite (or similar mineral) content; variably moderate to high amounts of plagioclase and quartz; and variably minor to small amounts of alkali feldspars and hypersthene (or similar minerals)

- **795–854 ft bgs**: High porosity, titanium- and calcium-rich material of volcanic origin (likely volcanoclastics derived from basalt)—characterized by high total porosity (highly elevated porosities likely a result of annular voids); variably moderate to high amounts of plagioclase and quartz; variably minor to moderate augite (or similar mineral) content; and variably minor to small amounts of alkali feldspars

- **854–900 ft bgs(bottom of log interval)**: High porosity, iron-rich material of volcanic origin (likely volcanoclastics derived from mafic-rich basalt)—characterized by high total porosity (highly elevated porosities likely a result of annular voids); moderate to high amounts of augite and hypersthene (or similar minerals); variably moderate to high amounts of plagioclase and quartz; and variably minor to small amounts of alkali feldspars

4.5 Summary Logs

Three summary log displays have been generated for R-40 to highlight the key hydrogeologic and geologic information provided by the processed geophysical log results:

- **Porosity and hydrogeologic properties summary log** showing continuous hydrogeologic property logs, including total porosity (water and air), water-filled porosity, water saturation, estimated hydraulic conductivity, transmissivity, and relative producibility (production capacity); highlights key derived hydrologic information obtained from the integrated log results, including (Figure 4.1)

- **Density and clay content summary** showing a continuous logs of formation bulk density and estimated grain density, as well as estimated clay volume, highlights key geologic rock matrix information obtained from the log results (Figure 4.2)

- **Spectral natural gamma ray and lithology** summary showing a high vertical resolution, continuous volumetric analysis of formation mineral and pore fluid composition (based on an integrated analysis of the logs), and key lithologic/stratigraphic correlation logs from the spectral gamma ray measurement (concentrations of gamma-emitting elements); highlights the geologic lithology, stratigraphy, and correlation information obtained from the log results (Figure 4.3)

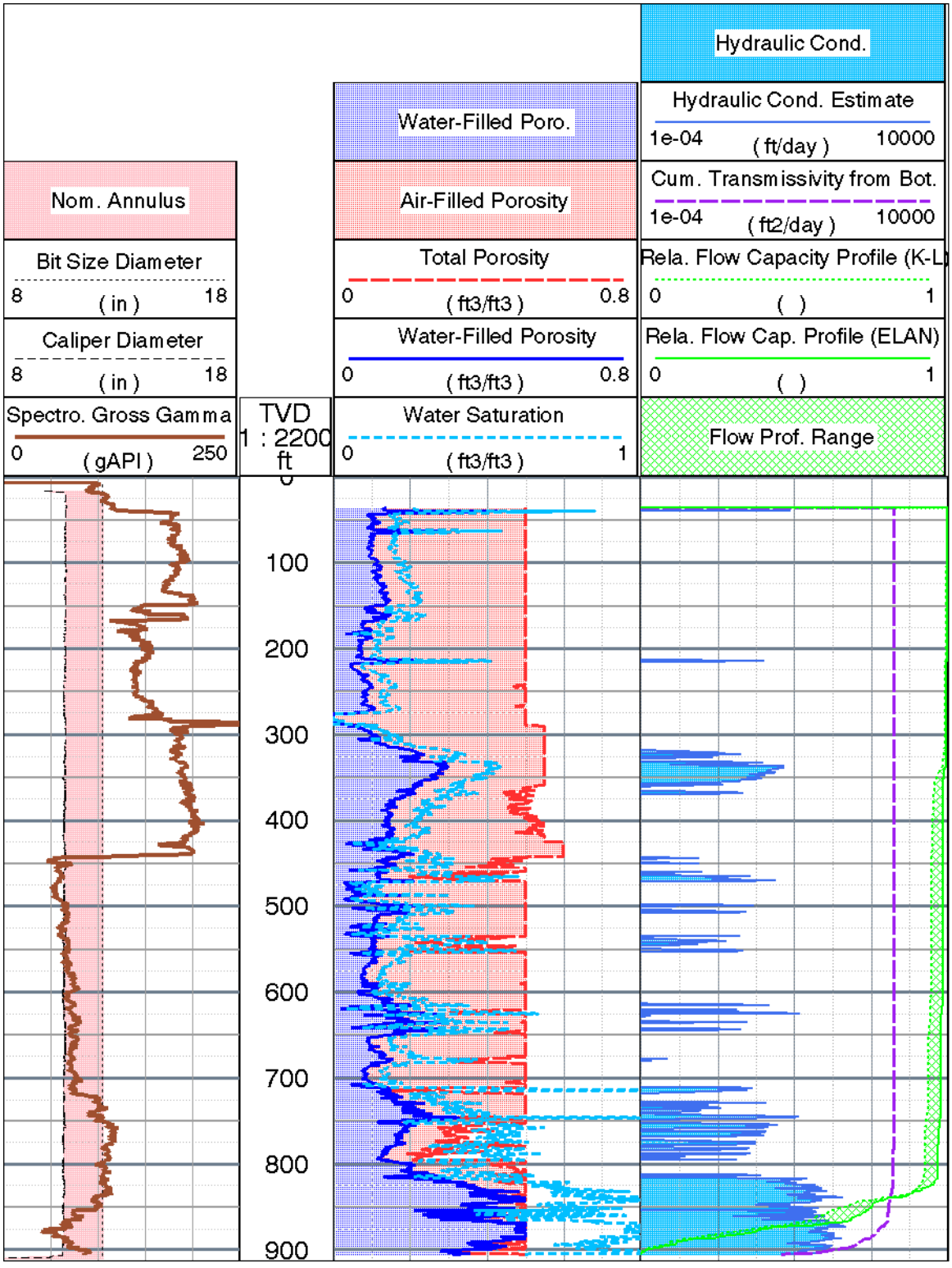

Figure 4.1 **Summary of porosity logs in R-40 borehole from processed geophysical logs, interval of 37 to 900 ft bgs, with caliper, gross gamma, water saturation, estimated relative flow capacity profile, hydraulic conductivity, and transmissivity logs also displayed. Porosity, water saturation, and hydraulic conductivity logs are derived from the ELAN-integrated log analysis.**

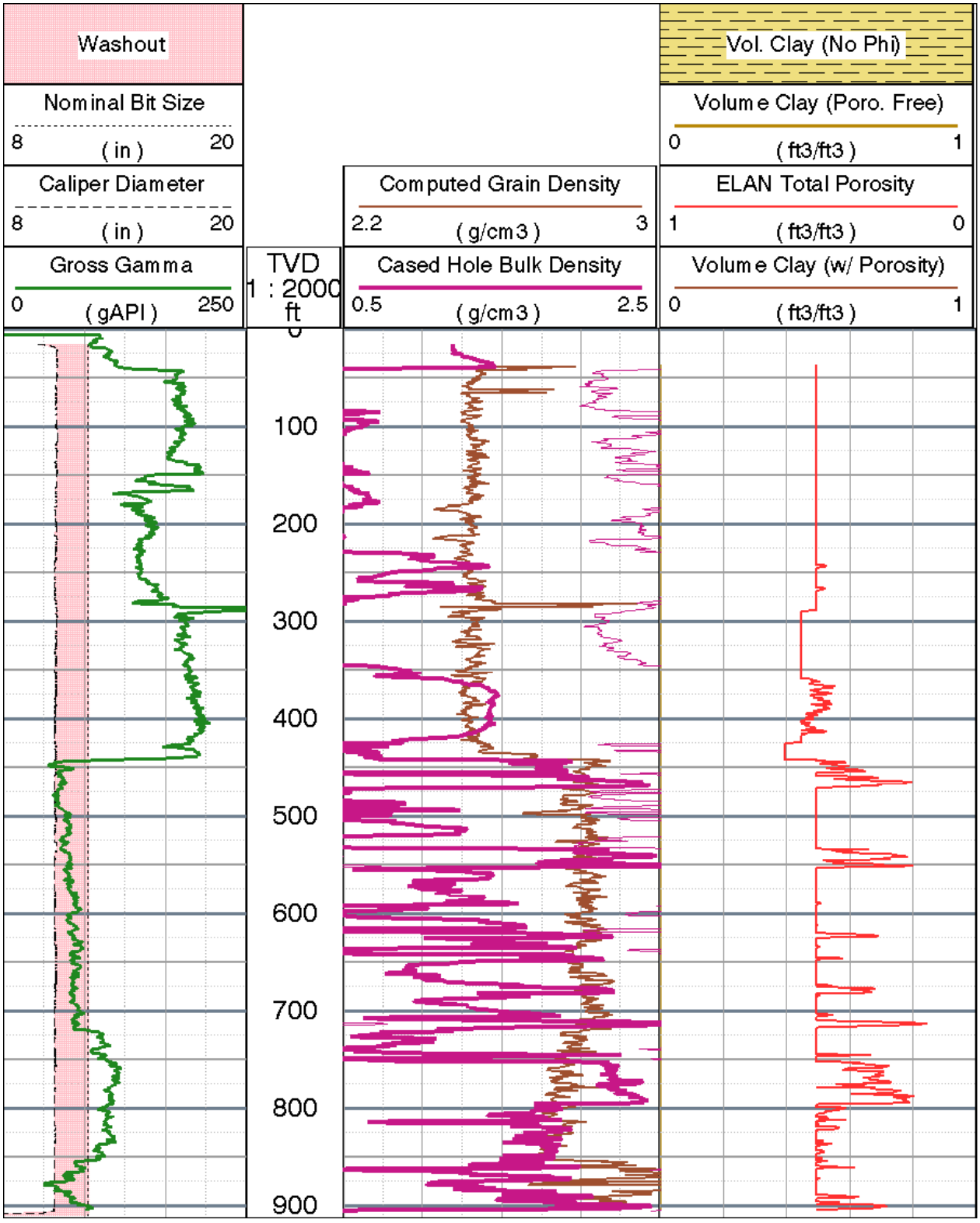

Figure 4.2 **Summary of bulk density and apparent grain density logs in R-40 borehole from processed geophysical logs, interval of 23 to 902 ft bgs. Also shown are caliper, gross gamma, volume of clay, and total porosity logs. (The latter two were derived from the ELAN analysis. Note that clay was not solved for.)**

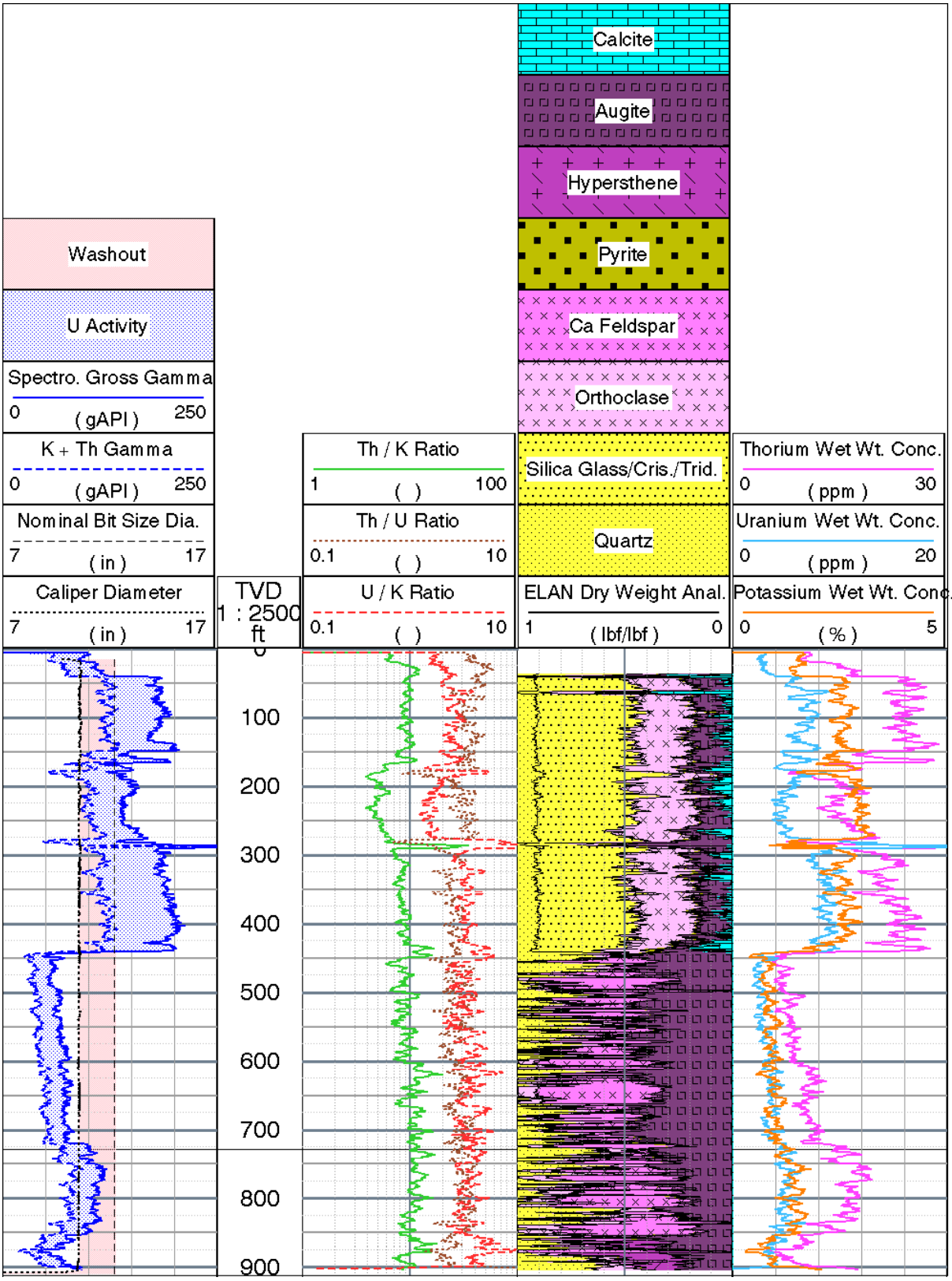

Figure 4.3 **Summary of spectral natural gamma ray logs and ELAN mineralogy/lithology and pore fluid model volumes derived from the ELAN-integrated log analysis for R-40 borehole, interval 10 to 900 ft bgs. Caliper log is also shown.**

4.6 Integrated Log Montage

This section summarizes the integrated geophysical log montage for R-40. The montage is provided in Appendix 1. A description of each log curve in the montage follows, organized under the heading of each track, starting from track 1 on the left-hand side of the montage. Note that the descriptions in this section focus on what the curves are and how they are displayed; the specific characteristics and interpretations of the R-40 geophysical logs are provided in the previous section

4.6.1 Track 1—Depth

The first track on the left contains the depth below ground surface in units of feet, as measured by the geophysical logging system during the ECS logging runs. All the geophysical logs are depth-matched to the gross gamma log acquired with this logging run.

4.6.2 Track 2—Basic Logs

The second track on the left (inclusive of the depth track) presents basic curves:

- gamma ray (thick black), recorded in American Petroleum Institute gamma ray (gAPI) standard units and displayed on a scale of 0 to 250 gAPI units;
- single arm caliper from the TLD (thin solid pink) with nominal maximum bit size as a reference (dashed-dotted black) to show nominal annular distance between inside of inner casing to borehole wall (pink shading), recorded as hole diameter in inches and displayed on a scale of 8 to 18 in.

Two gamma ray curves from the HNGS are displayed:

- total gross gamma (thick solid black curve)
- gross gamma minus the contribution of uranium (dotted black)
- yellow shading between the two curves to show uranium contribution to the total gamma ray response.

4.6.3 Track 3—Porosity

The third track displays the primary porosity log results. All the porosity logs are recorded in units of volumetric fraction and are displayed on a linear scale of 0.75 (left side) to -0.1 (right side). Specifically, these logs consist of

- APS epithermal neutron porosity derived from near-far detector pairing (bold solid dark blue curve)—deepest reading epithermal neutron porosity from APS tool, processed for zoned air-filled and water-filled cased hole;
- APS epithermal neutron porosity derived from near-array detector pairing (solid sky blue curve)—medium depth of investigation epithermal neutron porosity from APS tool, processed for zoned air-filled and water-filled cased hole;
- APS slowing down time porosity derived from pulsed neutron time series in the array detectors (thin dotted green curve)—shallowest reading epithermal neutron porosity from APS tool, processed for zoned air-filled and water-filled cased hole;

- ECS bulk volumetric water content derived from hydrogen weight concentration measurement, corrected for water in casing and converted to volume fraction (short-dashed violet);
- Total porosity derived from bulk density and ELAN water-filled porosity using a grain density of 2.45/2.65 g/cc (dashed red curve), 2.55/2.75 g/cc (long-dashed red curve), and 2.65/2.85 g/cc (dotted red curve), with red shading between the 2.45/2.65 and 2.65/2.85 g/cc porosity curves to show the range (the lowest grain-density range used across the tuff/pumice interval [37–442 ft] and the highest range used across the basalt lava and basalt-derived alluvium interval [442–900 ft]); and
- ELAN water-filled porosity (bold dashed-dotted cyan with dark blue shading to right)—derived from the ELAN-integrated analysis of all log curves to estimate optimized matrix and pore volume constituents.

4.6.4 Track 4—Density

The fourth track displays the

- bulk density, corrected for single string of steel casing (thick solid maroon curve) on a wrapping scale of 1 to 3 g/cc; and
- apparent grain density (dashed brown curve), derived from the ELAN analysis, on a scale of 2.4 to 3.2 g/cc.

4.6.5 Track 5—HNGS Spectral Gamma

The fifth track from the left displays the spectral components of the HNGS measurement results as wet weight concentrations, corrected as best as possible for casing and borehole size and fluid:

- potassium (solid green curve) in units of percent weight fraction and on a scale of –5% to 5%;
- thorium (dashed brown) in units of parts per million and on a scale of 50 to –50 ppm; and
- uranium (dotted blue) in units of parts per million and on a scale of 20 to 0 ppm.

4.6.6 Tracks 6 to 11—Geochemical Elemental Measurements

The narrow tracks 6 to 11 present the geochemical measurements, along with their estimated one standard deviation uncertainty range: iron (Fe) and silicon (Si), sulfur (S) and calcium (Ca), estimated aluminum (Al) and potassium (K), titanium (Ti) and gadolinium (Gd), hydrogen (H) and apparent relative bulk chlorinity (Rela. Cl), and uranium (U) and carbon yield (C Yield)—from left to right respectively, in units of dry matrix weight fraction (except K and H in wet-weight fraction, Rela. Cl in ppk, U in wet-weight ppm, and C Yield in relative yield units).

4.6.7 Track 12—ELAN Mineralogy Model Results (Dry-Weight Fraction)

Track 12 displays the results from the ELAN-integrated log analysis (the matrix portion)–presented as dry-weight fraction of mineral types chosen in the model:

- quartz (yellow with closely spaced small black dots)
- combined silica glass, tridymite, and cristobalite (yellow with widely spaced large black dots)

- orthoclase or other potassium feldspar (lavender)
- labradorite or similar plagioclase feldspar (pink)
- pyrite (orange-tan with black squares)
- hypersthene (purple)
- augite (maroon)
- calcite (cyan)

4.6.8 Track 13—ELAN Mineralogy and Pore Space Model Results (Wet-Volume Fraction)

Track 13 displays the results from the ELAN-integrated log analysis–presented as wet mineral and pore fluid volume fractions:

- quartz (yellow with closely spaced small black dots)
- combined silica glass, tridymite, and cristobalite (yellow with widely spaced large black dots)
- orthoclase or other potassium feldspar (lavender)
- labradorite or similar plagioclase feldspar (pink)
- pyrite (orange-tan with black squares)
- hypersthene (purple)
- augite (maroon)
- calcite (cyan)
- air (red)
- water (white)
- moved air (orange)
- moved water (blue)

4.6.9 Track 14—Water Saturation

Track 14 displays the continuous-in-depth water saturation logs estimated from the processed logs, recorded in units of volumetric fraction of pore space filled with water (ratio of cubic feet per cubic feet) and presented on a scale of 0 to 1 ft^3/ft^3 (left to right:

- optimized estimate of water saturation (volumetric fraction of pore space filled with water) from the ELAN analysis (bold dashed-dotted purple curve with blue shading to the right and red shading to the left, corresponding to water-filled and air-filled pore space, respectively)

- water saturation as calculated directly from the bulk density and ELAN-estimated porosity using a grain density of 2.45/2.65 g/cc (dashed cyan curve), 2.55/2.75 g/cc (solid cyan curve), and 2.65/2.85 g/cc (dotted cyan curve)—with stippled cyan shading between the 2.45/2.65 and 2.65/2.85 g/cc water-saturation curves to show the range (the lowest grain-density range used across the tuff/pumice interval [37–442 ft] and the highest grain-density range used across the basalt lava and basalt-derived alluvium interval [442–900 ft]).

4.6.11 Track 15—Hydraulic Conductivity

Track 15 displays several estimates of hydraulic conductivity (K) derived from the ELAN-integrated log analysis (sensitive to the estimated porosities and mineral composition), presented on a logarithmic scale of 10^{-5} to 10^{5} ft/day:

- a K-versus-depth estimate derived from using the ELAN permeability equation with water-filled porosity and matrix mineral weight fraction values derived from the ELAN analysis, converted to hydraulic conductivity (bold solid blue curve with gradational coloring to represent the range of hydraulic conductivity relative to standard unconsolidated clastic sediments);

- an intrinsic K-versus-depth estimate (assuming full saturation) using the ELAN total porosity and mineral-based permeability equation with total porosity and matrix mineral weight fraction values derived from the ELAN analysis, converted to hydraulic conductivity (dotted purple).

In addition, an estimate of cumulative transmissivity from the bottom of the log interval is displayed for the ELAN mineral-based estimator (dashed dark green curve)—computed by integrating from bottom to top the hydraulic conductivity estimates, presented on a logarithmic scale of 10^{-5} to 10^{5} ft^2/d.

4.6.12 Track 16—Predicted Flow (Production Potential) Profile

Track 16 displays the integrated predicted relative flow (production potential) profile from the permeability (hydraulic conductivity) logs that mimics a flow meter (spinner) acquired under flowing conditions:

- predicted relative water-flow profile derived from the k-Lambda water permeability log (bold solid blue curve), displayed on a unitless linear scale of 0 to 1 relative volumetric flow rate (ratio of flow rate to flow rate);

- predicted relative water-flow profile derived from the ELAN water permeability log (long-dashed blue curve), displayed on a unitless linear scale of 0 to 1 relative volumetric flow rate;

- relative integrated intrinsic permeability profile derived by integrating the k-Lambda intrinsic permeability log (dashed-dotted red), displayed on a unitless linear scale of 0 to 1;

- relative integrated intrinsic permeability profile derived by integrating the ELAN intrinsic permeability log (dashed red), displayed on a unitless linear scale of 0 to 1;

- predicted hypothetical well water flow versus depth profile for the entire log interval (dotted green), assuming a well radius of 4 in., entirely open to flow, and pumping is occurring under steady-state conditions with a drawdown of 25 ft (incremental flow computed using the Thiem steady-state flow equation)—derived from the k-Lambda water permeability log (bold solid blue), displayed on a scale of 0 to 1,000,000 gpd.

4.6.13 Track 17—Summary Logs

Track 17, the second track from the right, displays several summary logs that describe the fluid and air-filled volume measured by the geophysical tools:

- optimized estimate of total volume fraction water from the ELAN analysis (solid blue curve and blue plus cyan area shading)
- optimized estimate of volume fraction intergranular water (non-pore throat bound water-filled porosity) from the ELAN analysis (dashed cyan curve and cyan area shading);
- optimized estimate of total volume fraction of air-filled porosity from the ELAN analysis (solid red curve and dotted red area shading)
- estimate of bulk volumetric water content from the ECS tool (thin dashed dark blue curve)

The porosity and volumetric water content scales are from 0 to 0.6 total volume fraction, left to right.

4.6.14 Track 18—Depth

The final track on the right, the same as the first track on the left, displays the depth below ground surface in units of feet, as measured by the geophysical logging system during the ECS logging run.

5.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

Mayer, C., and A. Sibbit, September 21–24, 1980. "Global, A New Approach to Computer-Processed Log Interpretation," 55th Annual Fall Technical Conference and Exhibition of the Society of Petroleum Engineers of AIME, September 21–24, 1980, Dallas, Texas. (Mayer and Sibbit 1980, 103867)

Quirein, J., S. Kimminau, J. LaVigne, J. Singer, and F. Wendel, June 9–13, 1986. "A Coherent Framework for Developing and Applying Multiple Formation Evaluation Models," SPWLA 27th Annual Logging Symposium, June 9–13, 1986, Schlumberger Well Services, Houston, Texas. (Quirein et al. 1986, 098043)

ATTACHMENT 1: MONITORING WELL AND BOREHOLE ABANDONMENT INFORMATION

5034-1

Monitoring Well and Borehole Abandonment Information

Records Use only

Los Alamos NATIONAL LABORATORY EST.1943

Date/Time: 01/08/2009 - 16:36	**Sheet 1 of 1**
Technical Area: 54	**Focus Area (if applicable, or other location details): LWSP**
Borehole ID: R-40	**Well Type (monitoring, etc.): Monitoring**
Site Work Plan: Drilling Work Plan for Regional and Intermediate Wells at Technical Area 54	
Depth from Surface to Bottom of Hole: 0 to 630 ft.	
Grout Depth/Location: NA	
Bentonite Depth/Location: NA	
Other Fill Material Depth/Location: Base-course gravel 0 to 2 ft. Neat cement 2 ft to 40 ft. Concrete 40 ft to 630 ft.	
Surface Construction: No surface construction	
Grout/Backfill Composition: Neat cement is 95 % portland cement, 5% bentonite gel. Concrete is 4000 psi.	
Additional Comments/Details: Drilling start date: 07/11/2008; drilling end date: 09/23/2008; borehole located 20 ft SW of completed R-40 well; stratigraphy identical to completed R-40 borehole (see R-40 well completion report, Figure 3.1-1).	
Attach "Borehole/Well Completion Information Form" or the original "as-completed" drawings for the abandoned hole.	

GEOFRAME
PROCESSED
INTERPRETATION

Integrated Wireline Log Well Montage

Processed Advanced Cased Hole Geophysical Logs

A Mark of Schlumberger

Using the following logs: APS*, TLD*
HNGS*, SGT*
ECS*

COMPANY:	LATA (Drilling Contractor for LANL)		
WELL:	R-40		
FIELD:	LANL		
STATE:	New Mexico		
COUNTRY:	U.S.		
Date Logged:	8-Nov-2008	Date Processed: April-2008	
Well Location:	NA		
Elevations:	K.B. 6731 ft	D.F. 6730 ft	G.L. 6724 ft
API Number:		Job Number:	

Remarks:

Depth reference displayed is ground surface.
Well contained one or more strings of casing (casing advanced) during logging.
Water saturation calculated using Archie equation.
ELAN* performed with max. porosity constraints to account for large annular space.
Interpretation should account for well conditions.

FOLD HERE

GP Vers. : WDS-147 Process Date: April-2008 Center: BWS Stoneworks Baseline: GP-4.2 Log Analyst: Ned Crayton

Mud and Borehole Measurements:

Rm @ Measured Temperature: NA	BHT: NA	Bitsize: 12.25 in	
Rmf @ Measured Temperature: NA	Type Fluid in Hole: Air/Mist	FGM:	
Rmc @ Measured Temperature: NA	Mud density: GB-3/4 Bar/gal	FGM:	

Schlumberger

ELAN* Geophysical Log Integrated Analysis

Optimized Mineral + Pore Volume Model

COMPANY: LATA (Drilling Contractor for LANL)

WELL: R-40

FIELD: LANL

State: New Mexico

COUNTRY:

*Elemental Log Analysis, Mark of Schlumberger

Date Processed:	April-2008	Date Logged:	8-Nov-2008
Job Number:		Processed at:	SWS Sacramento
Well Location:	NA		
Latitude:		Longitude:	
Elevations:	KB: 2051.61m	DF: 2051.3m	GL: 2049.48m

Depth ref. is ground surface. Results are affected by cased hole conditions.

The well name, location and borehole reference data were furnished by the customer.

FOLD HERE

All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretations made by any of our officers, agents or employees. These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.

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Subject: 1) SUBMITTAL OF THE COMPLETION REPORT FOR REGIONAL AQUIFER WELL R-40, 2) COMPLETION REPORT, 3) ATTACHED CD EP 2009-0256, LA-UR-09-3067

☐ **Filed in RPF**