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Date: February 27, 2009
Refer To: EP2009-0106

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 Drilling Work Plan for Intermediate Aquifer Well PCI-2

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the Drilling Work Plan for Intermediate Aquifer Well PCI-2. This work plan is a revision to the plan submitted on November 13, 2007, and subsequently approved by the New Mexico Environment Department NMED) on December 7, 2007. The revision to the work plan reflects recent discussions with your staff to move PCI-2 from its originally planned location in lower Pajarito Canyon to the location where perched-intermediate monitoring well R-17i was planned. In the original work plan, drilling PCI-2 was considered contingent on the observations of perched-intermediate groundwater from wells in the vicinity, especially PCI-1. The proposed change in location is based on the original objective of PCI-2 (to characterize perched-intermediate groundwater with respect to potential sources upgradient in Pajarito Canyon) having been accomplished in part with the installation of a perched-intermediate screen at 650–670 ft below ground surface in well R-40. Additionally, a review of existing video and geophysical logs and driller's observations from drilling at R-39, R-32, and R-20 (east of R-40) suggest a low probability of encountering perched-intermediate groundwater at the original planned location.

The new location of PCI-2 will accomplish the objectives of R-17i, which is a requirement of NMED's Notice of Disapproval on the Pajarito Canyon Investigation Report, dated November 21, 2008. As described in the attached drilling work plan, drilling activities will include a separate core hole to characterize potential tritium contamination in pore water of the upper vadose zone beneath Pajarito Canyon. Timing of installation of PCI-2 at the new location will allow inclusion of key geologic and hydrologic information in the revised Pajarito Canyon investigation report scheduled for submittal to NMED on August 31, 2009, and should also provide time to obtain a single round of analytical data.

Demonstration of completion of monitoring well PCI-2 is a stipulated-penalty requirement for fiscal year 2009, as set in NMED's letter dated July 15, 2008. The Laboratory will meet that requirement by installing PCI-2 at the new location by the required date of May 30, 2009.

If you have any questions, please contact Mark Everett at (505) 667-5931 (meverett@lanl.gov) or Suzy Schulman at (505) 606-1962 (sschulman@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

MG/DG/PH/DK/ME:sm

Enclosures: Two hard copies with electronic files – Drilling Work Plan for Intermediate Aquifer Well PCI-2 (LA-UR-09-1014)

Cy: (w/enc.)
Neil Weber, San Ildefonso Pueblo
Suzy Schulman, 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
Dave Broxton, EES-16, MS T003
Danny Katzman, EP-LWSP, MS M992
Kristine Smeltz, WES-DO, 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, WES-DO, MS M992
Paul Huber, EP-LWSP, MS M992
IRM-RMMSO, MS A150 (date-stamped letter emailed)

Drilling Work Plan for Perched Intermediate Monitoring Well PCI-2

Primary Purpose	The primary purpose of monitoring well PCI-2 is to investigate potential contamination in perched intermediate groundwater identified during drilling of regional well R-17. An additional objective is to verify results of tritium data collected from pore water in core obtained during drilling at R-17 in 2005. To accomplish these objectives, two boreholes will be drilled at the existing R-17 regional well site. A new core hole will be drilled into the upper vadose zone beneath Pajarito Canyon to obtain pore water for analysis. A second borehole, not cored, will be drilled to install intermediate well PCI-2 to monitor perched intermediate groundwater. The site for PCI-2 is on the existing drill pad for R-17 (Figure 1). During drilling of the R-17 regional well, perched groundwater was collected from within the borehole at 850–857 ft depth, but subsequent borehole video and induction logs indicate that perched water actually entered the hole between 518 and 585 ft. Schlumberger integrated log analysis suggests that the perching horizon could be at 665–681 ft in dense dacite lavas. PCI-2 is expected to penetrate the uppermost perched zone of saturation at approximately 518-ft depth. The final screen position and length will be recommended based on observations. Figure 2 shows the stratigraphy and a conceptual well design for PCI-2. Because the actual depth of perching is uncertain, the borehole will be advanced to 670 ft and rested; if the depth to perched water does not stabilize, a series of bentonite plugs will be used working from the bottom upwards to seal off the perching horizon and reach a stable water level. Actual screen length and position will be based on data acquired during drilling and possible video and induction logging. Figure 3 is a geologic cross-section that shows the distribution of hydrostratigraphic units in the vicinity of PCI-2.
Conceptual Model	Perched groundwater at PCI-2 could have contaminants from upper Pajarito Canyon and its tributaries, principally from Technical Area 09 (TA-09) and TA-22. Contaminants from TA-09 and TA-22 include high explosives (HE) compounds, perchlorate, nitrate, chlorinated solvents, tritium, and other radionuclides. During the R-17 drilling campaign, cores from a separate borehole indicated that the upper vadose zone contained exceptionally high tritium values, ranging from 70,600 to 236,000 pCi/L (LANL 2008, 104909). These high tritium results are considered suspect because there are no known tritium release sites in the watershed that had liquid discharges that contained such high tritium concentrations. New core-hole samples are needed to determine if the original R-17 core hole tritium results are representative or are in error (possibly the result of sample contamination at the analytical laboratory or unit conversion problems with the pore-water analyses). Borehole water samples collected from the perched groundwater zone at R-17 during drilling show little or no contamination; however, tritium was not included in the analytical suite. Water samples collected from the regional aquifer in the completed well at R-17 are noncontaminated, including for tritium. Surface-water flow along Pajarito Canyon fed by snowmelt and seasonal rainfall extends to the flood-retention structure near R-17/PCI-2 and beyond, with larger and longer flow events reaching the Los Alamos National Laboratory (the Laboratory) boundary. The hydrogeologic conceptual model suggests that canyon-bottom recharge supplies the perched zone that will be sampled by the screen at PCI-2, possibly enhanced by ponding behind the flood retention structure that was constructed following the Cerro Grande fire in May 2000 (Figure 3).

Drilling Approach	Drilling will be conducted with methods selected to optimize the potential for completing the well without the use of any drilling additives in the perched water zone. The following is a summary of the proposed methods by depth interval: **Core Hole:** • A 10-in. surface casing will be advanced approximately 20 ft to near the base of alluvium. This casing will allow the auger rig to collect a core sample at the base of alluvium while avoiding the difficulties of potential cobbles and boulders above. • The core hole will be advanced without using fluids, to the extent possible, through the lower Tshirege Member, Cerro Toledo interval, and upper part of the Otowi Member to a total depth (TD) of 165 ft with 4 ¼ in.-inside diameter augers. • Core will be collected in Lexan sleeves with a split spoon at the target intervals. **PCI-2:** • A 16-in. surface casing will be advanced using fluid-assisted air-rotary methods through the alluvium and into the upper part of the Bandelier Tuff to 60 ft below ground surface (bgs). • A 15-in. open borehole will be advanced using fluid-assisted air-rotary methods to 470 ft bgs near the base of the Otowi Member. No drilling fluids will be used below this depth. Continue open hole to 510 ft (into the top of the upper Puye Formation), trip out, and run borehole video and geophysical logs (natural gamma and conductivity) to look for perched water. If no perched water is found, continue to 565 ft (top of dacite lava), trip out, and run borehole video and geophysical logs. If no perched water is found, continue to TD = 670 ft. • If perched water is present, water levels will be observed to see if they stabilize before the well is completed. Bentonite plugs will be emplaced as needed to prevent leakage of water beneath perching horizons, allowing a stable water level to be determined. • Municipal water may be added to cool the drill bit as needed.
Potential Drilling Fluids, Composition, and Use	The following fluids and additives that may be used are consistent with those previously used in the drilling program at the Laboratory and have been characterized geochemically. No drilling fluids will be used within 100 ft of the perched saturated zone at PCI-2 except potable municipal water. If the perched zone cannot be reached without adding drilling fluid additives, the situation will be discussed with the New Mexico Environment Department (NMED). No chemicals will be added without prior approval from NMED. • potable water, municipal water supply, to aid in delivery of other drilling additives and cool the drill bit • QUIK-FOAM, a blend of alcohol ethoxy sulfates, used as a foaming agent • AQF-2, an anionic surfactant, used as a foaming agent
Hydrogeologic and Geochemical Objectives	• The objectives are to install a perched intermediate well at the R-17 location to characterize the groundwater chemistry, including major ions, trace metals, perchlorate, HE compounds, chlorinated solvents, tritium, and other chemicals and to enhance the hydrologic conceptual model for recharge.
Potential Groundwater Occurrence and Detection	• *Perched:* 518–585 ft, perched water was encountered in the lower part of the Puye Formation overlying dacitic lavas at adjacent well R-17. The perching horizon is believed to be dense dacite lavas. • Methods for groundwater detection may include driller's observations, water-level measurements, borehole video, and borehole geophysics.

Core Sampling	In the core hole, moisture-protected samples will be collected at depths of 23, 30, 39, 53, 63, 83, 93, 100, 120, 140, and 163 ft to correspond with sample depths in the original R-17 core hole. The depth overlap between the original R-17 samples and the new proposed core samples are used to validate the original R-17 tritium results or show they are in error. Moisture extracted from the core will be analyzed for tritium, anions, and volatile organic compounds (VOCs). Each sample will consist of three 6-in. lengths of core preserved in Lexan and moisture-protecting wrap, one for each analysis.
Groundwater Screening Sampling	At PCI-2, a screening water sample will be collected, using a temporary pump, at the end of development. Screening samples of groundwater will be analyzed for cations/metals (dissolved and total) and anions (dissolved) by the Earth and Environmental Sciences chemistry laboratory.
Groundwater Characterization Sampling	• Groundwater samples will be collected from the completed PCI-2 well between 10 and 60 d after well development, in accordance with the Compliance Order on Consent. These samples will be analyzed for the full suite of constituents, including radionuclides; metals/cations; general inorganic chemicals; VOCs; perchlorate; HE compounds; and stable isotopes of hydrogen, oxygen, and nitrogen. • Subsequent groundwater samples will be collected under the "Interim Facility-Wide Groundwater Monitoring Plan."
Geophysical Testing	At PCI-2, the Laboratory's borehole video camera, natural gamma, and induction tools will be used in the 15-in.open borehole before the 12-in. casing is lowered in, if conditions allow.
Well Completion Design	At PCI-2, one well screen will be placed within the upper part of the perched groundwater.
Well Development	The well may be developed by mechanical and chemical means, including swabbing, bailing, and pumping. • After initial swabbing and bailing, a submersible pump will be used to complete the development process. • Water-quality parameters to be monitored: pH, dissolved oxygen, specific conductance, temperature, turbidity,and total organic carbon (TOC). • If the Laboratory is unable to bring the water-quality parameters within the limits specified below, the use of chemical well development may be discussed with NMED. No chemicals will be added without approval from NMED. Chemical means include the use of sodium acid pyrophosphate or AQUA-CLEAR PFD to remove natural and added clays and/or chlorination to kill bacteria introduced during well completion. Target water-quality parameters: turbidity <5 nephelometric turbidity units, TOC <2 ppm, other parameters stable.
Hydraulic Testing	No aquifer tests are planned. Because of the limited areal extent of perched water and the hydrologic variability within the system, an aquifer test would provide little value in an intermediate depth well.

Investigation Derived Waste Management	Investigation-derived waste (IDW) will be managed in accordance with EP-ERSS-SOP-5022, Characterization and Management of Environmental Restoration Project Waste (http://int.lanl.gov/environment/all/docs/qa/ep_qa/EP-ERSS-SOP-5022.pdf). This standard operating procedure incorporates the requirements of applicable U.S. Environmental Protection Agency and NMED regulations, U.S. Department of Energy orders, and Laboratory requirements. The primary waste streams include drill cuttings, drilling water, purge water, development water, contact waste, and decontamination water. Drill cuttings will be managed in accordance with the NMED-approved Notice of Intent (NOI) Decision Tree for Land Application of IDW Solids from Construction of Wells and Boreholes (November 2007). Drilling, purge, and development waters will be managed in accordance with the NMED-approved NOI Decision Tree for Drilling, Development, Rehabilitation, and Sampling Purge Water (November 2006). Drill cuttings, drilling water, and purge water will initially be stored in aboveground- or belowground-lined pits The pit contents will be characterized with direct sampling following completion of drilling activities, and waste determinations will be made from validated data. If validated analytical data show these wastes cannot be land-applied, they will be removed from the pit, containerized, and placed in accumulation areas appropriate to the type of waste. Cuttings and drilling water that cannot be land-applied and are designated as hazardous waste will be sent to an authorized treatment, storage, or disposal facility within 90 d of containerization. Development water and decontamination water will be containerized separately at their point of generation, placed into an accumulation area appropriate to the type of waste, and directly sampled. Contact waste will be containerized at the point of generation, placed into an appropriate accumulation area, and characterized based on the waste determination of the drill cuttings and water.

REFERENCE

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.

LANL (Los Alamos National Laboratory), September 2008. "Pajarito Canyon Investigation Report," Los Alamos National Laboratory document LA-UR-08-5852, Los Alamos, New Mexico. (LANL 2008, 104909)

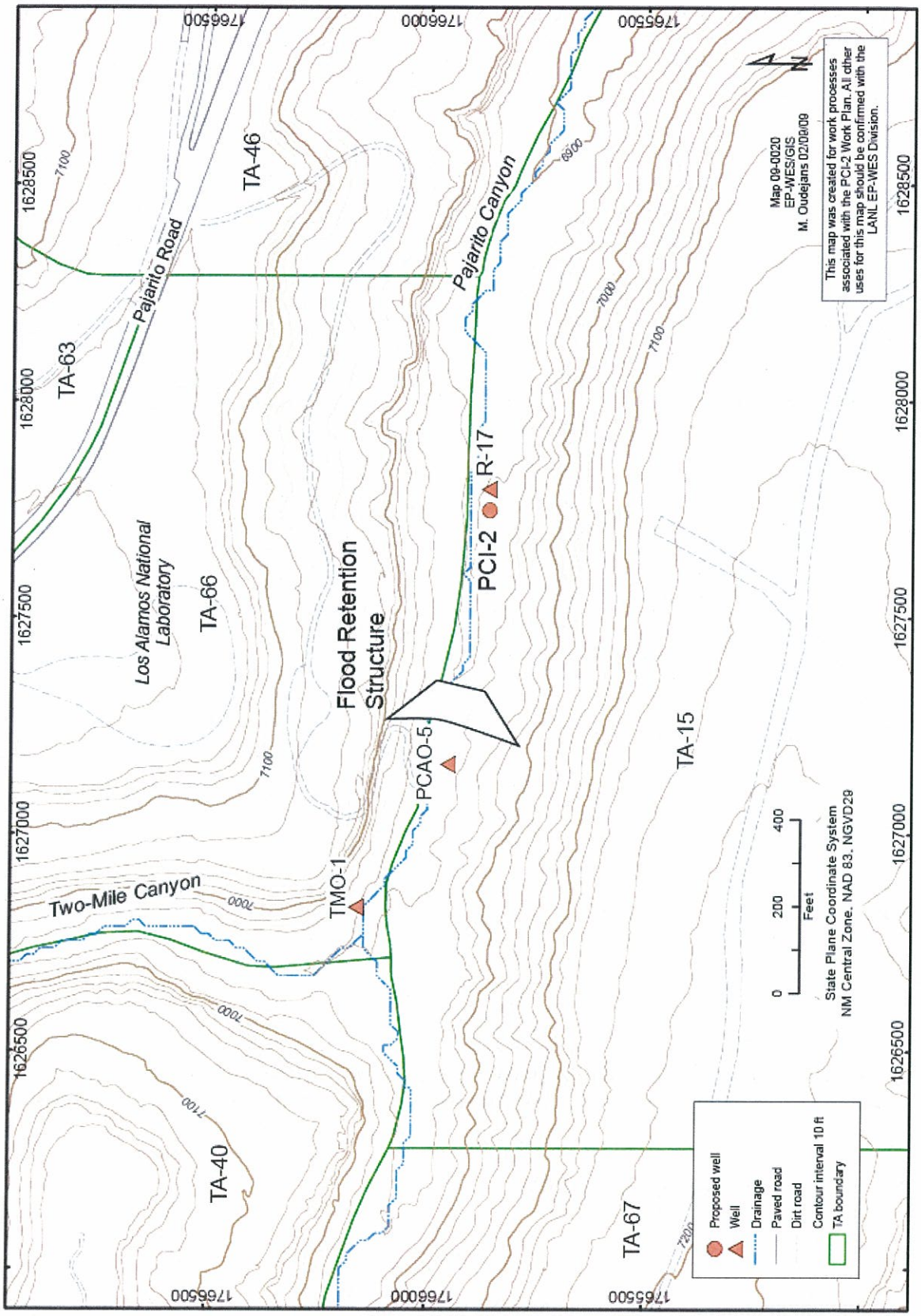
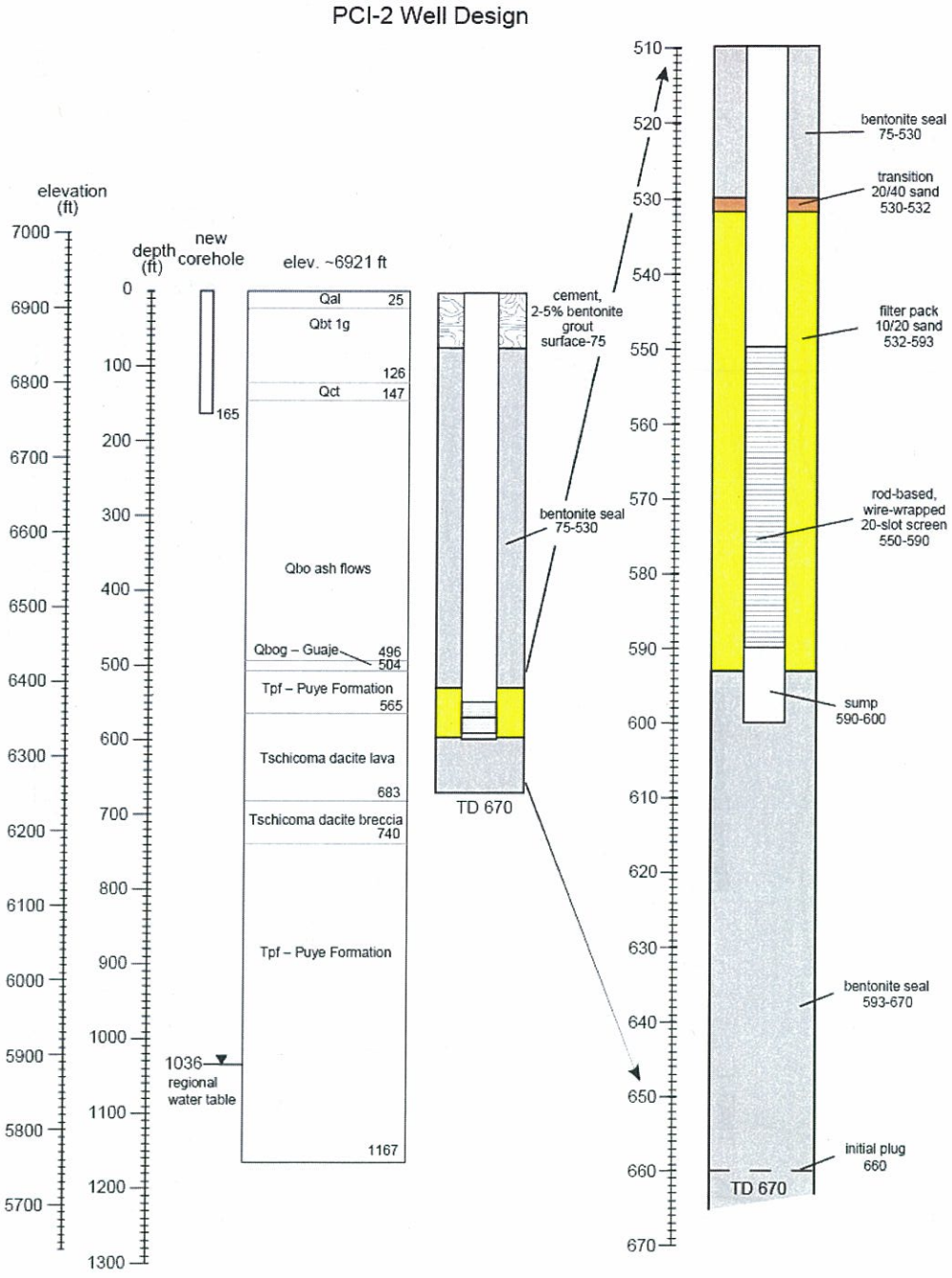


Figure 1 Proposed monitoring well PCI-2



Note: Qal = alluvium, Qbt 1g = unit 1g of the Tshirege Member of the Bandelier Tuff; Qct = Cerro Toledo Interval; Qbo = Otowi Member of the Bandelier Tuff; Qbog = Guaje Pumice Bed of the Otowi Member of the Bandelier Tuff; Tpf = Puye Formation.

Figure 2 Proposed well design for PCI-2

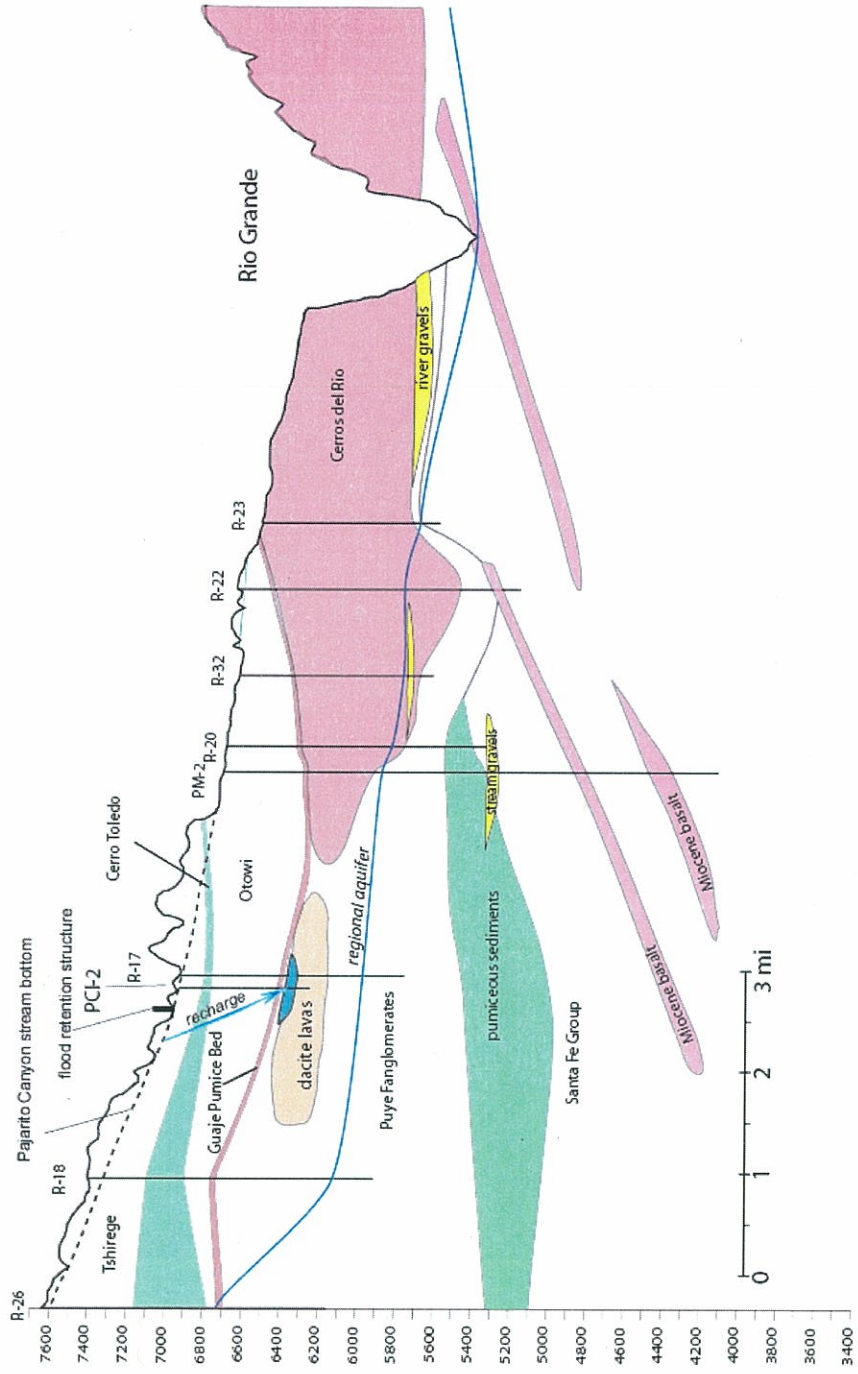


Figure 3 **Direct-line borehole-to-borehole cross-section (crossing mesas and canyons) from R-26 through R-18, R-17/PCI-2, PM-2, R-20, R-32, R-22, and R-23 to a point on the east side of the Rio Grande. Proposed location of PCI-2 is shown (extending from the bottom of Pajarito Canyon), with hypothetical recharge.**

PCI-2 Tentative Drill Schedule
Proposed Start of Field Preparations: April 1, 2009

Activity	Duration (d)
Drilling and Completion of Borehole (includes mob and site prep)	41
Collect Borehole Geophysics	1
Development of PCI-2	5
Characterization Sampling of PCI-2	10–60 following development
Site Restoration at PCI-2	7