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SEP 2010
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*Date*: SEP 30 2010
*Refer To*: EP2010-0382

James 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 Well R-59**

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the Drilling Work Plan for Well R-59. Because of parking lot construction and the necessity of water level data from nearby well R-60, the Laboratory proposes to submit a map with the final well location marked by November 15, 2010.

If you have any questions, please contact Ted Ball at (505) 665-3996 (tedball@lanl.gov) or Tom Whitacre at (505) 665-5042 (twhitacre@doeal.gov).

Sincerely,

Bruce Schappell, Executive Director
Environmental Programs – Recovery Act Projects
Los Alamos National Laboratory

Sincerely,

Everett Trollinger, Federal Project Director
Environmental Projects – ARRA
Los Alamos Site Office

BS/ET/TB/ME:sm

Enclosures: Two hard copies with electronic files – Drilling Work Plan for Well R-59 (LA-UR-10-6502)

Cy: (w/enc.)
Neil Weber, San Ildefonso Pueblo
Hai Shen, DOE-LASO, MS A316
Mark Everett, EP-ET, MS M992
Stefani Fuller, EP-CAP, MS M992
RPF, MS M707 (w/ two CDs)
Public Reading Room, MS M992

Cy: (Letter and CD and/or DVD only)
Laurie King, EPA Region 6, Dallas, TX
Steve Yanicak, NMED-DOE-OB, MS M894
Kristine Smeltz, EP-BPS, MS M992

Cy: (w/o enc.)
Tom Skibitski, NMED-OB, Santa Fe, NM
Annette Russell, DOE-LASO (date-stamped letter emailed)
Ted Ball, EP-ARRA Project, MS C348
Dave McInroy, EP-CAP, MS M992
Michael J. Graham, ADEP, MS M991

# Drilling Work Plan for Regional Aquifer Well R-59

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| **Primary Purpose** | Regional Aquifer Well R-59 is being installed to satisfy a requirement by the New Mexico Environment Department (NMED) to install two regional groundwater-monitoring wells downgradient of Material Disposal Area (MDA) C within Technical Area 50 (TA-50). The first of the two wells, R-60, is currently under construction and will be completed by October 31, 2010. The potential locations for well R-59 and the actual location for R-60 are shown in Figure 1. Because of pending parking lot construction, the original location for R-59 is not viable. The two alternative locations identified on Figure 1 provide options for monitoring groundwater to the north or to the east of the original location. Los Alamos National Laboratory (the Laboratory) proposes the evaluation of water-level measurements collected from R-60 in the context of the local regional aquifer monitoring network and selection of a final location by November 15, 2010. Wells R-59 and R-60 will supplement groundwater monitoring for MDA C provided by well R-46 (Figure 1).<br><br>The R-59 borehole is expected to penetrate the top of regional saturation at a depth of approximately 1339 ft within sedimentary deposits of the Puye Formation. The target borehole total depth (TD) is set at approximately 1410 ft. The well will be completed with a single screen set near the top of regional saturation (Figure 2). Well screen length and position will be based on data acquired during drilling, including information from lithological logs of cuttings, water-level measurements, video logs, geophysical logs, and driller's observations.<br><br>Figure 2 shows the predicted geology and proposed well design for well R-59. A final well design will be based on hydrogeological conditions encountered during drilling, and a revised well design document will be submitted to NMED for approval. |
| **Conceptual Model** | MDA C is located on a mesa top above thick, unsaturated units of the Bandelier Tuff, and present-day aqueous-phase transport is generally believed to be minimal. Because of the low expected infiltration rates, travel times for nonadsorbing aqueous-phase contaminants from the disposal area to the regional aquifer are expected to be greater than several hundred years and significantly longer for sorbing constituents. However, pore-gas sampling shows that vapor-phase transport of contaminants occurs in the upper portion of the unsaturated zone. The primary vapor-phase contaminants at MDA C are tritium, trichloroethene, and tetrachloroethene.<br><br>A thick (~330 ft) series of dacitic lavas, probably derived from western Tschicoma sources, underlie the Bandelier Tuff. The top of the lava sequence may exert strong control over travel times and directions for liquid transport. The dacitic lavas have very low permeability and will inhibit downward transport. The dip of the top of the unsaturated dacite lava is also important because pore water percolating to depth may accumulate in the Guaje Pumice Bed above the dacite and move laterally downdip to the south before infiltrating into fractures.<br><br>Groundwater flow in the regional aquifer is expected to be dominantly toward the east beneath TA-50. The water table beneath TA-50 occurs primarily within the lower Puye Formation or the upper pumiceous deposits of the Santa Fe Group. Contamination, if present at the R-59 location, is likely to be derived from MDA C and would be the result of contact with vapor-phase constituents. |
| **Drilling Approach** | Drilling will be conducted with methods selected to optimize the potential of completing the well without the use of drilling additives in, or immediately above, the target zone of saturation. A combination of open-hole and casing-advance methods will be employed. Each interval of open-hole or casing-advance will be optimized to meet well objectives. Casing will be used to protect open-hole intervals above, to advance the borehole when open-hole drilling is not possible, and to secure the borehole through unstable zones or through significant perched groundwater intervals. |

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| **Potential Drilling Fluids, Composition, and Use** | Fluids and additives that may be used to facilitate drilling are consistent with those currently used in the drilling program at the Laboratory and have been characterized geochemically. Fluids and additives authorized for use by NMED include<br>• potable water, municipal water supply, to aid in delivery of other drilling additives and cool the drill bit;<br>• QUIK-FOAM, a blend of alcohol ethoxy sulfates, used as a foaming agent; and<br>• AQF-2, an anionic surfactant, used as a foaming agent.<br>Complete records will be maintained detailing the type, amount, and volume of drilling fluid used, depth of drilling fluid added to the borehole, amount in storage in the borehole, and recovery volume of drilling fluid. No drilling fluids will be used within 100 ft of the regional aquifer, except potable municipal water. If the regional aquifer cannot be reached without the addition of drilling fluids, the situation will be discussed with NMED. No chemicals, other than those listed above, will be added without approval from NMED. |
| **Hydrogeologic and Geochemical Objectives** | The primary objective is to monitor water quality in the regional aquifer downgradient of potential hazardous- or radioactive-chemical releases from MDA C.<br>A secondary objective is to establish water levels in the regional aquifer in this area for water-table maps. |
| **Potential Groundwater Occurrence & Detection** | *Potential Perched Water:* In Pajarito Canyon, located south of MDA C, perched groundwater was found in the Puye Formation overlying the dacite lavas at wells R-17 and PCI-2. Small pockets of saturation may occur above the dacite lavas near MDA C, but perched groundwater was not found in five deep mesa-top boreholes near MDA C (R-46, R-60, 50-24813, 50-603470, and DSC-1B). Perched groundwater may be encountered above permeability barriers within the stratified deposits of the Puye Formation but this is unlikely based on information from the nearby wells referenced above.<br>*Regional:* Encountering regional groundwater is expected to occur at a depth of 1339 ft within sedimentary deposits of the Puye Formation.<br>Methods for groundwater detection may include driller's observations, water-level measurements, borehole video, and borehole geophysics. |
| **Core Sampling** | No core collection is planned. |
| **Groundwater Screening Sampling** | Groundwater screening samples will be collected during drilling at any perched groundwater zones producing sufficient water for sampling.<br>Screening samples of groundwater will be analyzed for cations/metals (dissolved and total) and anions (dissolved) by the Earth and Environmental Sciences Division's Geochemistry and Geomaterials Research Laboratories and for tritium and volatile organic compounds (VOCs) by off-site laboratories. |
| **Groundwater Characterization Sampling** | Groundwater samples will be collected from the completed 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, high explosives, VOCs, and stable isotopes.<br>Subsequent groundwater samples will be collected under the Interim Facility-Wide Groundwater Monitoring Plan. |

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| **Geophysical Testing** | The Laboratory's borehole video camera and natural gamma and induction tools will be used in the open borehole if conditions allow.<br><br>A full suite of geophysical logs will be run, if required, for proper placement of the screen. The logs will be collected by Schlumberger, Inc., and for open-hole conditions will include accelerator porosity sonde (neutron porosity), array induction, combined magnetic resonance, natural and spectral gamma, and formation micro-imager logs. In cased portions of the borehole, neutron porosity, triple lithodensity, elemental capture, natural gamma, and spectral gamma logs will be collected. These logs will be used to characterize the hydraulic properties of saturated rocks in the regional aquifer.<br><br>The suites run and timing of geophysical logging will depend on borehole conditions. |
| **Well Completion Design** | The well screen will be placed within volcaniclastic deposits of the Puye Formation near the top of the regional aquifer.<br><br>Figure 2 shows the proposed well design and predicted geology for well R-59. |
| **Well Development** | The well may be developed by both mechanical and chemical means. Mechanical means include swabbing, bailing, and pumping. Chemical means include the use of additives to remove clays and/or chlorination to kill bacteria introduced during well completion.<br><br>After initial swabbing and bailing, a submersible pump will be used to complete the development process.<br><br>Water-quality parameters will be measured in a flow-through cell. The parameters to be monitored are pH, specific conductance, dissolved oxygen, temperature, turbidity, oxidation-reduction potential, and total organic carbon (TOC).<br><br>If the Laboratory is unable to bring the water-quality parameters within measurement limits specified below, the use of chemical well development may be discussed with NMED. No chemicals will be added without approval from NMED.<br><br>Chemical means that may be used include the addition of sodium acid pyrophosphate and AQUACLEAR PFD to remove clays and/or chlorination to kill bacteria introduced during well completion.<br><br>Well development will be considered complete when target water-quality parameters are met. The target water-quality parameters are turbidity <5 nephelometric turbidity units, TOC <2 ppm, and other parameters stable. |
| **Hydraulic Testing** | Hydraulic testing will be considered if significant water-producing horizons are encountered.<br><br>The most likely test will be a 24-h, constant-rate test. |
| **Investigation Derived Waste Management** | Investigation-derived waste (IDW) will be managed in accordance with Standard Operating Procedure (SOP) EP-SOP-5238, Characterization and Management of Environmental Program Waste (http://www.lanl.gov/environment/all/qa/adep.shtml). This SOP 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 will include drill cuttings, drilling water, development water, purge water, decontamination water, and contact waste. Where Resource Conservation and Recovery Act constituents are detected and duplicate samples are collected during the same sampling event and one is a nondetect and the other is detected, the Laboratory assumes the detection is the result of laboratory or field contamination. The detection will not be used for waste determination and/or land application. |

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| **Investigation Derived Waste Management (continued)** | Drill cuttings will be managed in accordance with the NMED-approved "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" (March 2010). Initially, drill cuttings and drilling water will be stored in lined pits. The cuttings may or may not contain residue of drilling/well completion additives (e.g., drilling foam and bentonite clay). The contents of the pits 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 for the type of waste. Cuttings, drilling water, development water, and purge 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.<br><br>Development water, purge water, and decontamination water will be containerized separately at their point of generation, placed in an accumulation area appropriate to the type of waste, and directly sampled. Contact waste will be containerized at the point of generation, placed in an appropriate accumulation area, and characterized using acceptable knowledge of the media with which it came in contact. |
| **Schedule** | Well R-59 is proposed for completion by February 28, 2011, in accordance with NMED's letter dated July 16, 2010, "Approval, Proposed Date for Submittal of the Corrective Measures Evaluation Report for Material Disposal Area C and Request for Extension of Date for Submittal of Material Disposal Area C Remedy Completion Report" (NMED 2010, 110418).<br><br>Monitoring conducted subsequent to installation of R-59 will be implemented under the Interim Facility-Wide Groundwater Monitoring Plan and will support investigations and potential corrective actions at MDA C and other sites in the vicinity as applicable. |

## REFERENCE

*The following list includes all documents cited in this plan. 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.*

NMED (New Mexico Environment Department), July 16, 2010. "Approval, Proposed Date for Submittal of the Corrective Measures Evaluation Report for Material Disposal Area C and Request for Extension of Date for Submittal of Material Disposal Area C Remedy Completion Report," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2010, 110418)

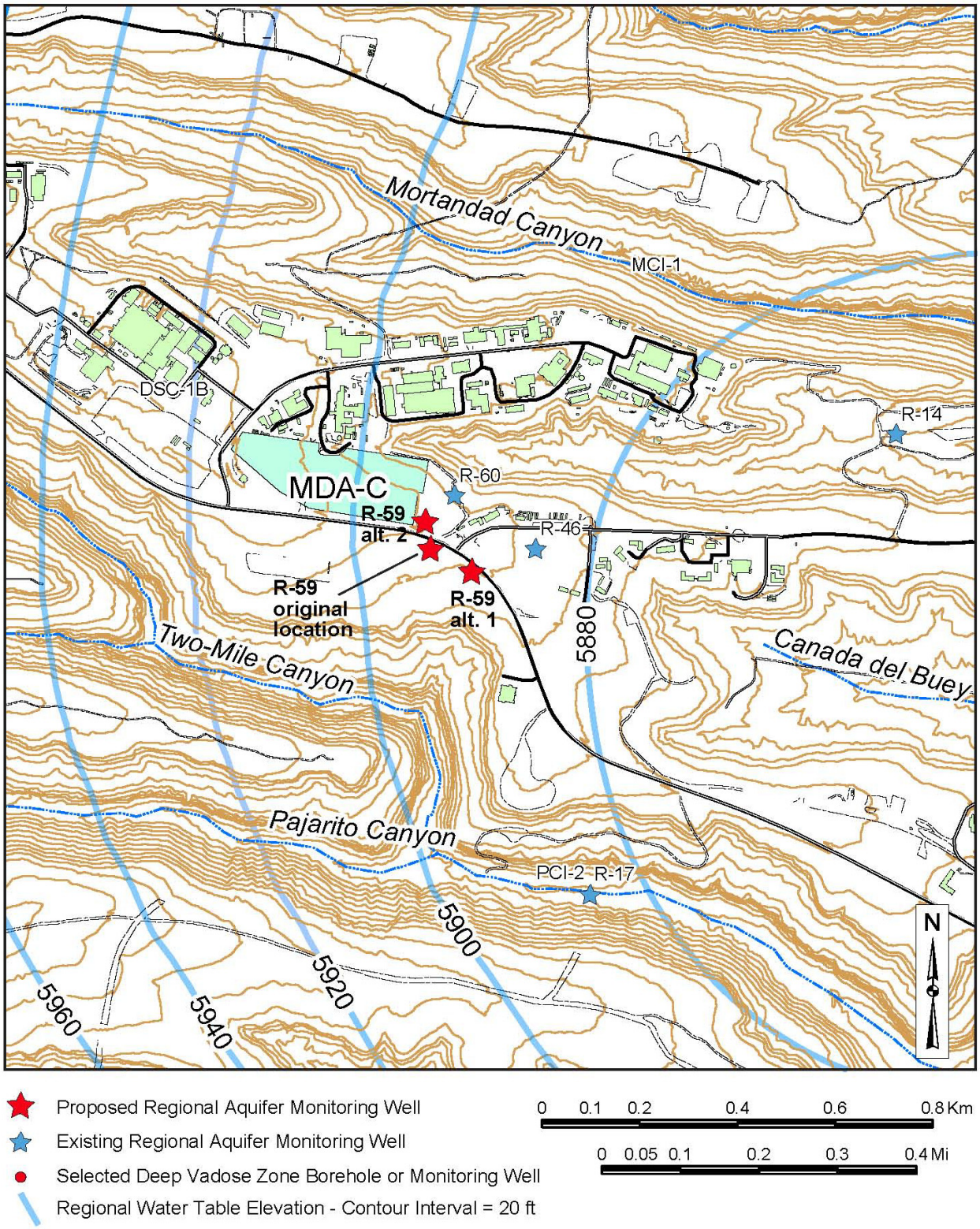


**Figure 1 Proposed location for well R-59**

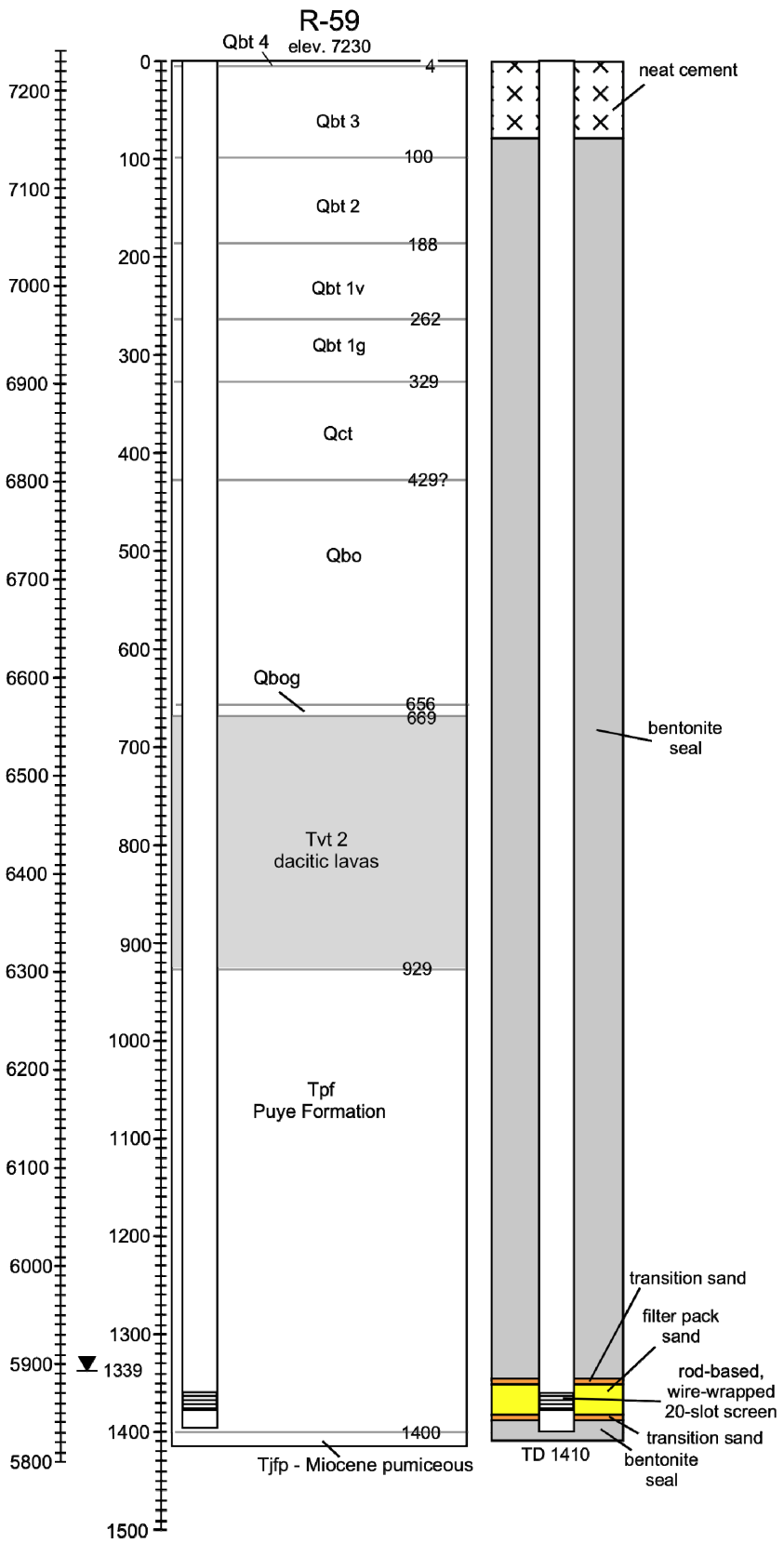


**Figure 2 Predicted geology and proposed well design for well R-59**