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Date: June 15, 2004
Refer to: ER2004-0310

Mr. John Young, Project Leader
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NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East
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Santa Fe, NM 87505-6303



**SUBJECT: CROSSWALK OF DRAFT CONSENT ORDER AND LANL INVESTIGATION
WORK PLAN REQUIREMENTS FOR INTERMEDIATE AND REGIONAL
AQUIFER WELLS IN LOS ALAMOS CANYON AND PUEBLO CANYON**

Dear Mr. Young:

The purpose of this letter is to amend the scope of work proposed in the Los Alamos Canyon and Pueblo Canyon Intermediate and Regional Aquifer Groundwater Work Plan submitted to the New Mexico Environment Department (NMED) on December 30, 2003. After submittal of the above work plan, subsequent discussions with the NMED clarified the expectation that a crosswalk between the draft Consent Order requirements and the work plan be provided by LANL. The attached table provides the crosswalk of the Order and the LANL work plan requirements for installation of intermediate and regional aquifer wells in Los Alamos and Pueblo Canyons.

The crosswalk references the June 2004, compiled draft Consent Order, the Los Alamos Canyon and Pueblo Canyon work plan (November 1995), the hydrogeologic work plan (May 1998), and the Los Alamos and Pueblo Canyons intermediate and regional aquifer groundwater work plan (December 2003) as amended by this letter. Also attached is a report on the status of the intermediate and regional wells in Los Alamos and Pueblo Canyons required under these work plans.

The proposed changes to the December work plan include relocating and constructing regional well R-6 (NMED letter dated May 20, 2004), constructing intermediate well LAOI-3.2, and collecting core at the proposed LAOI-1.5 work plan location. The updated scope also includes plugging and abandoning test wells TW-1, TW-1A, TW-2, TW-2A, TW-3, and TW-4.



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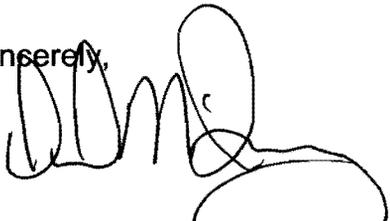


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Upon NMED approval of the crosswalk and updated scope to the December work plan, LANL will submit a revised work plan that will include the scope of work for all remaining intermediate and regional aquifer wells to be installed in Los Alamos and Pueblo Canyons.

If you have any questions, please contact Kent Rich at (505) 665-4272 or Tom Whitacre at (505) 665-5042.

Sincerely,



David McInroy, Deputy Project Director
Remediation Services
Los Alamos National Laboratory

Sincerely,



Mathew Johansen
Groundwater Program Compliance Manager
National Nuclear Security Administration
Los Alamos Site Operations

CN/MJ/KR/th

- Enclosure: 1) Crosswalk of Compiled Draft Consent Order and LANL Work Plan Requirements
2) Status of Intermediate and Regional Aquifer Wells Proposed for Los Alamos and Pueblo Canyons

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Crosswalk of Complied Draft Consent Order and LANL Work Plan Requirements

Compiled Draft Consent Order (June 2004)	Los Alamos Canyon and Pueblo Canyon Work Plan (November 1995) as amended	Hydrogeologic Workplan (May 1998)	Los Alamos Canyon and Pueblo Canyon Intermediate and Regional Aquifer Groundwater Work Plan (December 2003) as amended	Status (see attached discussion)
Los Alamos Canyon				
1 intermediate well located between LAO-4.5 and LAO-6 (Draft Order IV.B.1.b.ii)	LAOI-7	-	LAOI-7	Construct LAOI-7 under 2003 work plan. Original location moved upstream between wells LAO-4.5 and LAO-6.
1 regional background well (Draft Order V.B.1.b.iii)	-	R-6	-	Original requirements for R-6 to serve as a background well was met by the installation of R-7 and R-26.
1 regional well located north of the canyon floor and east of TA-53 (Draft Order IV.B.1.b.iii)	-	-	R-6	Previously constructed R-8 and R-9 substantially met this Order requirement. Construct newly located R-6 under 2003 work plan to complete the Order requirement.
Plug and abandon TW-3 (Draft Order V.B.1.b.iv)	-	-	Plug and abandon TW-3	Plug and abandon TW-3 under 2003 work plan
-	LAOI-3.2	-	LAOI-3.2	Construct well LAOI-3.2 under 2003 work plan to complete the requirement.
-	LAOI-1.5	-	LAOI-1.5 (core 350 ft)	Installation of R-7 substantially met the 1995 work plan requirement. Collect core at original LAOI-1.5 location to complete the requirement.
-	LAOI(B)-1.1	-	-	1995 work plan requirements met by installation of well R-7.
-	LAOI-B	-	-	Installation of LAOI(A)-1.1 fulfilled this 1995 work plan requirement.
-	-	R-7	-	Installation of well R-7 was completed in March 2001.
-	-	R-8	-	Installation of well R-8 was completed in January 2002.
-	-	R-9/R-9i	-	Installation of well R-9/R-9i was completed in 2000.

Compiled Draft Consent Order (June 2004)	Los Alamos Canyon and Pueblo Canyon Work Plan (November 1995) as amended	Hydrogeologic Workplan (May 1998)	Los Alamos Canyon and Pueblo Canyon Intermediate and Regional Aquifer Groundwater Work Plan (December 2003) as amended	Status (see attached discussion)
Pueblo Canyon				
-	POI-2	-	-	Installation of two piezometers at well R-4 met the 1995 work plan requirement.
-	POI-4	-	-	Installation of POI-4 was completed in May 1996.
-	-	R-2	-	Regional well R-2 was installed upstream of TW-2A in December 2003.
-	-	R-3	R-3	Original location for R-3 in hydrogeologic work plan moved to lower Pueblo Canyon near O-1. Well R-3 will be constructed under the 2003 work plan.
-	-	R-4	-	R-4 installed in October 2003 at 1995 work plan location for well POI-2.
-	-	R-5	-	R-5 was installed in May 2001 on the southern side of Pueblo Canyon.
-	-	-	Plug and abandon TW-1, -1A, -2, -2A, -4	Plug and abandon TW-1, -1A, -2, -2A, -4.

Status of Intermediate and Regional Aquifer Wells Proposed for Los Alamos and Pueblo Canyons

Los Alamos Canyon Intermediate Wells

LAOI-7

Installation of intermediate well LAOI-7 was proposed in the Los Alamos and Pueblo Canyons work plan (LANL 1995, 50290, pp. 7-50–7-51). Well LAOI-7 was originally sited near the eastern Laboratory boundary and was designed to investigate whether intermediate perched groundwater in Los Alamos Canyon is connected to the discharge at Basalt Spring. Basalt Spring contains contaminants that indicate a connection to sewage sources in Pueblo Canyon, but elevated concentrations of tritium and strontium-90 observed at the spring could indicate a contribution of groundwater from Los Alamos Canyon.

Wells R-9 and R-9i were installed in October 1999 and March 2000, respectively, at the original proposed location for LAOI-7 (Figure 1). Installation of these wells satisfies the original work plan requirement for well LAOI-7. Three perched systems were encountered at well R-9: (1) in the central part of the Cerros del Rio basalt (199 ft below ground surface [bgs]), (2) in the basal part of the Cerros del Rio basalt (279 ft bgs), and (3) in pumice-rich deposits in the lower part of the Puye Formation (579 ft bgs). Four rounds of characterization sampling were conducted at well R-9, and tritium was detected at concentrations ranging from 4.84 to 14.68 pCi/L (Longmire 2002, 72713).

The characterization objectives and location for LAOI-7 were updated in the Los Alamos and Pueblo Canyons intermediate and regional aquifer groundwater work plan (LANL 2003, 82612). Well LAOI-7 was moved upstream from its original location to determine the nature and extent of contamination in intermediate-perched groundwater zones within the Cerros del Rio basalt between wells R-8 and R-9i. Well LAOI-7 had an original total depth (TD) of 150 ft (LANL 1995, 50290) but was revised to 300–400 ft within the Cerros del Rio basalt (LANL 2003, 82612). Well LAOI-7 is planned for construction and will be located between alluvial wells LAO-4.5 and LAO-6 (Figure 1).

LAOI-3.2

Installation of intermediate well LAOI-3.2 was proposed in the Los Alamos and Pueblo Canyons work plan (LANL 1995, 50290, pp. 7-54–7-57) and is located near test well (TW)-3 (see Figure 1). This well was designed to identify whether an intermediate perched zone exists in Los Alamos Canyon between DP Canyon and State Road 4 and if the zone is contaminated. In 1990, a video of O-4 near DP Canyon recorded groundwater cascading into the borehole at a depth of 253 ft bgs within the Puye fanlomerate. Well LAOI-3.2 was to be installed downcanyon of O-4 to confirm the presence of this intermediate perched zone.

Well R-8 was originally sited at the LAOI-3.2 location (LANL 1998, 59599, p. 4-53) but was moved 3500 ft downstream to provide a better monitoring point for contaminants entering Los Alamos Canyon via DP Canyon and infiltrating along the canyon floor (see discussion of well R-8 below). The extent of saturation and contaminant concentrations within perched groundwater between the mouth of DP Canyon and State Road 4 was not fully characterized with the data obtained from well R-8. The location for well LAOI-3.2 near LAO-2, between O-4 and TW-3, will target the perched zone observed at 253 ft depth in O-4. Core samples will be collected and analyzed for radionuclides, metals, and anions, including perchlorate, to a depth of 300 ft. Installation of well LAOI-7 (2500 ft downstream of well R-8) will also assist in determining the nature and extent of contamination in the intermediate perched zone between DP Canyon and State Road 4.

LAOI-1.5

Installation of intermediate well LAOI-1.5 was proposed in the Los Alamos and Pueblo Canyons work plan (LANL 1995, 50290 p. 7-57). Well LAOI-1.5 was originally located approximately midway between wells LAOI(A)-1.1 and LADP-3 to determine contaminant pathways between the canyon floor and the intermediate perched zone within the Guaje Pumice Bed east of Technical Area (TA)-2 and TA-41 in Los Alamos Canyon. Perched groundwater occurs in intermediate depth wells LAOI(A)-1.1 and LADP-3 within the Guaje Pumice Bed 320-400 ft beneath Los Alamos Canyon. Well LAOI(A)-1.1 was free of Laboratory contamination, but well LADP-3, located 3600 ft downstream, contained up to 6000 pCi/L tritium. The objective of well LAOI-1.5 was to determine the contaminant pathway between the alluvium and the intermediate perched zone between these two wells.

Well R-7 was installed in March 2001 at the proposed location for well LAOI-1.5 (Figure 1). Water chemistry data collected from the upper perched zone (378 ft bgs) at well R-7 suggest that contaminants discharged from TA-2 and TA-41 are diverted eastward (primarily in the alluvial groundwater and possibly along bedrock bedding) and that contaminant-bearing infiltration reaches the uppermost perched groundwater zone east of well R-7.

Installation of well R-7 substantially met the investigation requirements identified in the Los Alamos and Pueblo Canyons work plan for well LAOI-1.5. However, the information collected at R-7 was not sufficient to assess contaminant-bearing infiltration containing tritium and strontium-90. Therefore, core will be collected at the well R-7 site to a depth of 350 ft and analyzed for radionuclides, metals, and anions, including perchlorate. Contaminant profiles from the core will help to determine distributions of contaminants, if they are present in the subsurface at the LAOI-1.5 site.

LAOI(B)-1.1

Installation of intermediate well LAOI(B)-1.1 was proposed in the Los Alamos and Pueblo Canyons work plan to examine the possible mechanisms for perched groundwater accumulation in the Puye Formation in Los Alamos Canyon (LANL 1995, 50290, p. 7-60). Well LAOI(B)-1.1 was to be installed at a greater depth than LAOI(A)-1.1 (323 ft bgs) to gain a better understanding of the hydrologic relationships in

this area of Los Alamos Canyon and to examine the significance of potential fault/fracture zones as a mechanism of downward water movement. During the installation of well LAOI(A)-1.1, it appeared that saturation in the Guaje Pumice Bed (at 323 ft bgs) might extend into underlying Puye fanglomerate. Core was collected at borehole LAOI(A)-1.1 and analyzed for contaminant (metals and radionuclides).

Well R-7 was installed near the proposed location for well LAOI(B)-1.1 (Figure 1). Geophysical and borehole video logs from R-7 suggested generally wet conditions throughout the Puye Formation above the regional aquifer. In addition to a well screen at the top of the regional aquifer (895.5 to 937.4 ft), two well screens were installed at depths of 363.2 to 379.2 ft bgs and 730.4 to 746.2 ft bgs to sample perched groundwater. During subsequent characterization sampling, the upper perched zone in well R-7 produced water, but the lower screen was dry. Water quality data for the upper screen show no evidence of Laboratory contamination after four rounds of characterization sampling (Longmire and Goff 2002, 75905). Well R-7 met the work plan requirements proposed for LAOI(B)-1.1.

LAOI-B

Installation of intermediate well LAOI-B was proposed in the Los Alamos and Pueblo Canyons work plan to determine the source of recharge for the intermediated perched zone in upper Los Alamos Canyon east of the Pajarito Fault Zone (LANL 1995, 50290, p. 7-60). Well LAOI-B was to be located near the western boundary of the Laboratory (Figure 1) and was intended to confirm the presence of perched groundwater in the Guaje Pumice Bed reported in the now-abandoned well H-19 and to provide baseline geochemical data for groundwater quality trends in the Guaje Pumice Bed farther downgradient in Los Alamos Canyon.

Well LAOI(A)-1.1, drilled to the east of proposed well LAOI-B, serves as a background well for the perched groundwater in the Guaje Pumice Bed. Well LAOI-B is no longer needed as a background well in upper Los Alamos Canyon since the construction and sampling of LAOI(A)-1.1 satisfied this requirement.

Pueblo Canyon Intermediate Wells

POI-2

Installation of intermediate well POI-2 was originally proposed in the Los Alamos and Pueblo Canyons work plan to determine whether an intermediate perched zone exists east of well TW-2A in Pueblo Canyon and, if so, how it is recharged (LANL 1995, 50290, p. 7-60). Perched groundwater containing Laboratory contaminants was found in the Puye Formation in central Pueblo Canyon at TW-2A. Well R-4 was installed in October 2003 at the proposed location for well POI-2 (Figure 1). Shallow perched zones of limited thickness were detected during drilling at depths of 125 and 226 ft bgs and piezometers were installed in both zones. No significant perched water was found in deeper parts of the vadose zone. Water level measurements and groundwater sampling will be conducted at the piezometers during characterization sampling. The two

piezometers installed at well R-4 fulfilled the investigation work plan requirements of well POI-2.

POI-4

Installation of intermediate well POI-4 was proposed in the Los Alamos Canyon and Pueblo Canyon Work Plan to examine how and to what extent contaminants are transported from surface water and alluvial groundwater to the intermediate perched zone in lower Pueblo Canyon and to Basalt Spring in lower Los Alamos Canyon (LANL 1995, 50290 p. 7-51). This well was installed in May 1996 in accordance with the requirements of the work plan and is located north of supply well O-1 (Figure 1).

Los Alamos Canyon Regional Aquifer Wells

R-6

Installation of regional aquifer well R-6 was proposed in the hydrogeologic work plan to provide background water quality information on intermediate perched zones and the regional aquifer (LANL 1998, 59599, p. 4-52). Well R-6 was proposed to be drilled upgradient of any known contaminant sources on the western boundary of the Laboratory in upper Los Alamos Canyon.

The requirements for R-6 were met by the installation of regional aquifer wells R-7 and R-26. Wells R-7 (see discussion below) and R-26 provide background water chemistry data for regional groundwater beneath the Laboratory. Concentrations of tritium in the perched zone and regional aquifer in well R-7 ranged from 2.55 to 3.38 pCi/L and from 1.34 to 2.52 pCi/L, respectively, during characterization sampling (Longmire and Goff 2002, 75905). Well R-7 has not been impacted by past tritium releases from former TA-2 that are described in the work plan (LANL 1995, 50290). Concentrations of cesium-137, strontium-90, plutonium isotopes, americium-241, and perchlorate were less than detection at well R-7 (Longmire and Goff 2002, 75905). Well R-26 is located at the western boundary of the Laboratory in TA-16. Concentrations of tritium at R-26 were less than detection (1 pCi/L).

Well R-6 will be moved to a new location at the east end of TA-21 near the water supply well O-4. The R-6 investigation will include a mesa-top regional aquifer well and core will be collected in the canyon-bottom as part of the installation of well LAIO-3.2. The regional aquifer well will meet multiple objectives, including investigating radionuclide and hazardous waste constituents, particularly those associated with releases from TA-21, TA-53, and TA-2. Another primary objective of well R-6 is to replace TW-3 which is an old well that lacks a sufficient annulus seal. R-6 will be completed with a screen placed near the top of the regional zone of saturation. The core hole will provide information about infiltration rates in lower DP Canyon by characterizing contaminant profiles through the vadose zone. The core hole will also investigate the possible presence of perched groundwater in the upper part of the Puye Formation near O-4. The data needs and characterization activities for well R-6 were provided to New Mexico Environment Department in the May 20, 2004, letter (LANL 2004, 86553).

R-7

Installation of regional aquifer well R-7 was proposed in the hydrogeologic work plan to identify possible infiltration pathways connecting overlying alluvial groundwater with known intermediate perched zones (LANL 1998, 59599, p. 4-53). Well R-7 was installed in upper Los Alamos Canyon east of TA-2 (Figure 1). Geophysical and borehole video logs from R-7 suggested generally wet conditions throughout the Puye Formation above the regional aquifer. In addition to a well screen at the top of the regional aquifer (895.5 to 937.4 ft bgs), two well screens set at depths of 363.2 to 379.2 ft and 730.4 to 746.2 ft bgs were installed in well R-7 to sample perched groundwater. During subsequent characterization sampling events, the upper perched zone in well R-7 produced water, but the lower screen was dry. Water quality data for the upper screen show no evidence of Laboratory contamination after four rounds of characterization sampling (Longmire and Goff 2002, 75905). Sampling at well R-7 also provided background water chemistry data for Los Alamos Canyon as discussed above.

R-8

Installation of regional aquifer well R-8 was proposed in the hydrogeologic work plan to monitor possible contaminants in the regional aquifer in the vicinity of well O-4 and to verify possible intermediate perched zones (LANL 1998, 59599, p. 4-53). Well R-8 was originally sited at the LAOI-3.2 location but was moved 3500 ft downstream to provide a better monitoring point for contaminants entering Los Alamos Canyon via DP Canyon and infiltrating along the canyon floor. Borehole R-8 encountered clay-rich sections within both the Otowi Member of the Bandelier Tuff and the Guaje Pumice Bed. Saturation was encountered in the Guaje Pumice Bed, but the borehole drained before a water sample could be collected. Core samples collected from this clay-rich interval contain groundwater with several thousand pCi/L tritium. Borehole R-8 was abandoned after difficulties with drilling were encountered. Well R-8 was re-drilled next to the original abandoned borehole in January 2002. Well R-8 was constructed with two screens with sampling ports set at depths of 711.1 and 825 ft bgs in the regional aquifer.

R-9 and R-9i

Installation of regional aquifer well R-9 was proposed in the hydrogeologic work plan to help define the downcanyon extent and flow directions of known intermediate perched zones in lower Los Alamos Canyon (LANL 1998, 59599, p. 4-53). Regional aquifer well R-9 was installed in 1999, followed by emplacement of intermediate well R-9i in 2000. These two wells are located near the eastern boundary of TA-72 (Figure 1). Well R-9 has a single screen at the top of the regional aquifer, which is within Miocene basaltic lava. Well R-9i has two screens within perched saturated zones, one at the base of the Cerros del Rio lavas and one located approximately one third of the distance from the base to the top of the lavas. Geochemical analysis of groundwater from these wells is summarized in Longmire (2002, 72713). R-9 and R-9i were installed at the original LAOI-7 location proposed in the Los Alamos Canyon and Pueblo Canyon work plan (LANL 1995, 50290).

Pueblo Canyon Regional Aquifer Wells

R-2

Installation of regional aquifer well R-2 was proposed in the hydrogeologic work plan to determine the nature and extent of contaminants within the regional aquifer east of the confluence of Acid Canyon and Pueblo Canyon (LANL 1998, 59599, p. 4-46). Regional aquifer well R-2 was installed upstream of TW-2A (Figure 1) and contains a single screen at a depth of 906.4 to 929.6 ft bgs. Perched groundwater was not encountered at well R-2.

R-3

Installation of regional aquifer well R-3 was proposed in the hydrogeologic work plan to investigate the continuity, water quality, and hydraulic characteristics of the intermediate perched zone known to exist at TW-2A (LANL 1998, 59599, p. 4-46). Well R-3 is proposed to be moved from upper Pueblo Canyon to the vicinity east of supply well O-1 (Figure 1), as described in the Los Alamos and Pueblo Canyons intermediate and regional aquifer groundwater work plan (LANL 2003, 82612). This well is designed to provide additional contaminant information on the distributions of tritium, nitrate, perchlorate, and uranium observed near the vicinity of O-1 and TW-1. Well R-3 will replace TW-1.

R-4

Installation of regional aquifer well R-4 was proposed in the hydrogeologic work plan to determine the nature and extent of contaminants within the regional aquifer in central Pueblo Canyon (LANL 1998, 59599, p. 4-46). Well R-4 is located north of TA-73 (Figure 1) at the well POI-2 location proposed in the Los Alamos and Pueblo Canyons work plan (LANL 1995, 50290, p. 7-60) and contains a single screen. Two piezometers were installed in perched zones at depths of 125 to 226 ft bgs.

R-5

Installation of regional aquifer well R-5 was proposed in the hydrogeologic work plan to further define the western limit of the intermediate perched zone in Pueblo Canyon (LANL 1998, 59599, p. 4-46). Well R-5 was installed on the southern side of Pueblo Canyon about 3000 ft west-northwest of supply well O-1 (Figure 1). Well R-5 has four screens, two in possible perched zones within the Puye Formation, one at the top of the regional aquifer in Santa Fe Group sediments, and one deeper in the zone of regional saturation, within Miocene basalt.

References

LANL (Los Alamos National Laboratory), November 1995. "Task/Site Work Plan for Operable Unit 1049: Los Alamos Canyon and Pueblo Canyon," Los Alamos National Laboratory document LA-UR-95-2053, Los Alamos, New Mexico. (LANL 1995, 50290)

LANL (Los Alamos National Laboratory), May 22, 1998. "Hydrogeologic Workplan," Los Alamos, New Mexico. (LANL 1998, 59599)

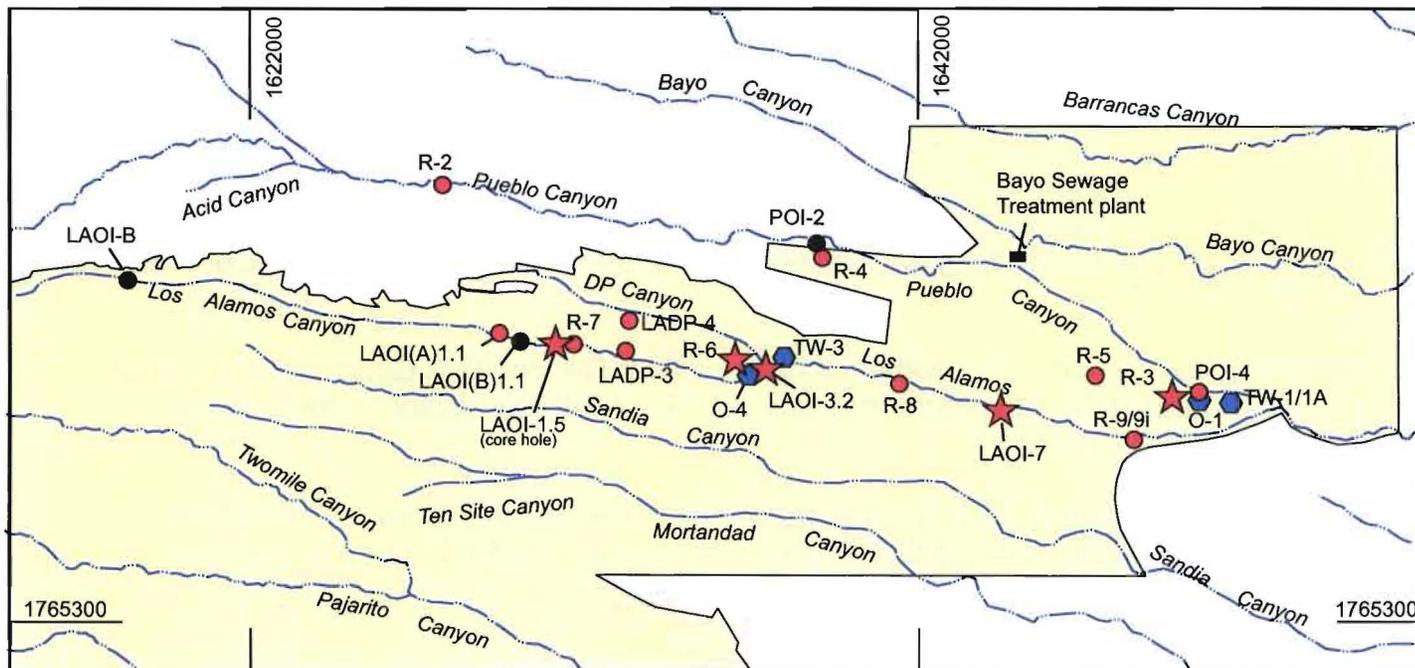
LANL (Los Alamos National Laboratory), December 23, 2003. "Los Alamos Canyon and Pueblo Canyon Intermediate and Regional Aquifer Groundwater Work Plan" Los Alamos National Laboratory document LA-UR-03-9191, Los Alamos, New Mexico. (LANL 2003, 82612)

LANL (Los Alamos National Laboratory), May 20, 2004. "Delay in Implementing the Mortandad Groundwater Work Plan and Accelerating the Drilling of Regional Aquifer Wells R-6 and R-18," Los Alamos National Laboratory letter (ER2004-0268) to J. Young (NMED/HWB) from D. McInroy (Deputy Project Director RRES-RS) and M. Johansen (NNSA Groundwater Program Compliance Manager), Los Alamos, New Mexico. (LANL 2004, 86553)

Longmire, P., April 2002. "Characterization Wells R-9 and R-9i Geochemistry Report," Los Alamos National Laboratory report LA-13927-MS, Los Alamos, New Mexico. (Longmire 2002, 72713)

Longmire, P. and F. Goff, December 2002. "Characterization Well R-7 Geochemistry Report," Los Alamos National Laboratory report LA-14004-MS, Los Alamos, New Mexico. (Longmire and Goff 2002, 75905)

Figure 1. Proposed and Installed Intermediate and Regional Aquifer Well Locations in Los Alamos Canyon and Pueblo Canyon



Coordinates are NM State Plane NAD 83



- Laboratory boundary
- Canyon drainages
- Perched and regional wells installed as part of the Hydrogeologic Work Plan (May 1998), Los Alamos Canyon and Pueblo Canyon work plan (November 1995) and other former ER Project investigations
- Wells/coreholes proposed for completion as part of the Los Alamos Canyon and Pueblo Canyon Intermediate and Regional Aquifer Groundwater Work Plan (December 2003) and this letter.
- Intermediate wells proposed in the Los Alamos Canyon and Pueblo Canyon work plan (November 1995) that requirements were met by installation of existing wells.
- Test and supply wells