General

ENTERED

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: MAY 2 7 2010
Refer To: EP2010-0233

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

RECEIVED
MAY 2010
NMED Hazardous Waste Bureau

Subject: Submittal of the Work Plan to Conduct Reliability Assessment of Multi-Screened West Bay Wells

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the Work Plan to Conduct Reliability Assessment of Multi-Screened West Bay Wells.

If you have any questions, please contact Steve Paris at (505) 606-0915 (smparis@lanl.gov) or Hai Shen at (505) 665-5046 (hshen@doeal.gov).

Sincerely,

for MJG

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

Sincerely,

for

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

33619

MG/DG/DM/SP/DK:sm

Enclosures: Two hard copies with electronic files – Work Plan to Conduct Reliability Assessment of Multi-Screened West Bay Wells (LA-UR-10-1422)

Cy: (w/enc.)
Neil Weber, San Ildefonso Pueblo
Hai Shen, DOE-LASO, MS A316
Woody Woodworth, DOE-LASO, MS A316
Steve Paris, EP-CAP, MS M992
John McCann, 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
Danny Katzman, EP-ET-DO, MS M992 (w/ MS Word files on CD)
Kristine Smeltz, EP-WES, MS M992

Cy: (w/o enc.)
Tom Skibitski, NMED-OB, Santa Fe, NM
Annette Russell, DOE-LASO (date-stamped letter emailed)
Craig Douglass, EP-CAP, MS M992
Michael J. Graham, ADEP, MS M991
IRM-RMMSO, MS A150 (date-stamped letter emailed)

LA-UR-10-1422
May 2010
EP2010-0233

Work Plan to Conduct Reliability Assessment of MultiScreened Westbay Wells

Los Alamos
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Prepared by the Environmental Programs Directorate

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LA-UR-10-1422
EP2010-0233

Work Plan to Conduct Reliability Assessment of MultiScreened Westbay Wells

May 2010

Responsible project manager:

Printed Name	Signature	Title	Organization	Date
Steve Paris		Project Manager	Environmental Programs	5/26/10

Responsible LANS representative:

Printed Name	Signature	Title	Organization	Date
Michael J. Graham	for MJG	Associate Director	Environmental Programs	5/26/10

Responsible DOE representative:

Printed Name	Signature	Title	Organization	Date
David R. Gregory	for	Project Director	DOE-LASO	5/27/2010

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1.0 INTRODUCTION

This work plan has been developed in response to a February 11, 2010, letter from the New Mexico Environment Department (NMED) requiring a reliability assessment of multiscreened Westbay wells by Los Alamos National Laboratory (LANL or the Laboratory) (NMED 2010, 108877). The NMED letter raised concerns regarding the reliability of water-quality data generated from multiscreened no-purge Westbay monitoring wells at the Laboratory and, specifically, whether multiscreened Westbay wells are capable of producing representative samples suitable for contaminant detection and monitoring. In order to determine if the remaining Westbay wells are yielding sample data suitable for monitoring purposes and decision support, NMED requested that a reliability study be conducted of Westbay wells by comparing water-quality data from groundwater samples collected from the same screen intervals in the wells both before and after purging. The NMED letter directed that the Laboratory use the hydrobooster system at specific wells. On April 1, 2010, the Laboratory submitted a letter requesting that NMED reconsider the technical approach and allow the Laboratory to provide an alternate proposal in this work plan. On April 16, 2010, NMED approved the Laboratory's request. This work plan presents a technical approach for addressing these issues.

2.0 OBJECTIVES

The primary objective of the study is to evaluate whether data collected with Westbay sampling systems in select wells are comparable with data collected using conventional purging and sampling techniques in those same wells. Data obtained during the study will be used to evaluate comparability of data derived from nonpurging and purging sampling approaches. This evaluation will provide insights into whether Westbay sampling systems are a reliable means to collect samples in the particular hydrogeologic environment where they are deployed.

A secondary objective is to compare data collected from select screens, after redevelopment, with historical Westbay data and with data collected with a purgeable sampling system before redevelopment. The results will also be used to provide recommendations to NMED for the final configuration of the wells addressed in this study and sampling systems for these wells. Recommendations for final configuration and sampling systems will be based on monitoring network objectives, the conceptual model for groundwater flow and transport in the study area, and the data confirming the nature and extent of contaminants, particularly from the deepest screens in each well.

The study will focus on three wells in the Technical Area 16 (TA-16) -260 Outfall area (Solid Waste Management Unit 16-021(c)-99) that currently use Westbay sampling systems. The three wells, R-26, CdV-R-37-2, and CdV-R-15-3, are shown in Figure 2.0-1. These wells are selected to facilitate and advance a review of the groundwater monitoring data and network supporting the 260 Outfall investigation pending revision to the corrective measures evaluation report. These wells are currently configured with Westbay sampling systems to enable monitoring in multiple zones, although some screen intervals do not yield groundwater either because of absence of groundwater following installation or because of construction problems. Details of well-drilling methodologies and construction chronology are provided in Table 2.0-1. Details related to well screens, groundwater occurrences, and monitoring data for these three wells are provided in Table 2.0-2. Well-construction details are provided in Table 2.0-3.

3.0 CONCEPTUAL MODEL

The conceptual model being tested with this study is whether analytical data for samples collected by purging from well screens following removal of the Westbay systems are comparable with analytical data for samples collected using the Westbay no-purge approach. The Westbay no-purge approach assumes that ambient groundwater flow around the well screen and Westbay intake port provides a constant environment of representative groundwater available for sampling.

The assessment may consider more than just differences in concentrations of either contaminants or indicator constituents, which may be due in part to natural and analytical variability. A review of multiple constituents or groups of constituents, along with applicable statistical approaches, is expected to be invoked to determine whether the data from purging are comparable with Westbay data.

4.0 STUDY DESIGN

The following activities will be implemented at each of the three wells in this study. Many of the specific field activities necessary to implement the study are not described in this work plan but will be documented in the report on this study.

4.1 Collection of No-Purge Westbay Samples

At the start of the study, samples will be collected from each Westbay port in each well. Samples will be analyzed at the Laboratory's Geochemistry and Geomaterials Research Laboratory (GGRL) for the list of constituents shown in Table 4.1-1. The proposed analytical suite is representative of the key groundwater contaminants related to the 260 Outfall and other key constituents used to assess general groundwater chemistry. The suite will consist of high explosives (HE) and associated degradation products, volatile organic compounds (VOCs), target analyte list (TAL) metals (specifically barium), general inorganic compounds (including nitrate), and common cations and anions and total organic carbon. This analytical suite includes more than is currently collected for some of the well screens in this study because those screens are being monitored only for a limited suite to assess temporal changes in residual effects of drilling fluids as described in the 2009 Interim Facility-Wide Groundwater Monitoring Plan (LANL 2009, 106115). For example, screen 5 in well CdV-R-15-3 is not currently being monitored for VOCs because of concerns about the reliability of VOC data from that screen. The purpose of including constituents that are not currently in the suite for Westbay monitoring is so that data will be available for comparison to purged groundwater data as described below in section 4.4.

4.2 Removal of Westbay Sampling Systems

The Westbay sampling system will be removed from each of the three wells. The activity involves deflation of packers and removal of the Westbay casing. This activity requires that Westbay representatives be on site to support the work. In the event that the Westbay casing is difficult to remove, additional measures will be used to dislodge and remove the system. Removal of the Westbay casing will expose the stainless-steel well casing, allowing conventional purging of each screen using submersible pumps and straddle packers where appropriate. Following removal of the Westbay casing, a video log will be run in each well to interrogate and document the condition of the well casing and screens.

4.3 Installation of Temporary Packer Strings

Following the Westbay sampling systems' removal and the video logging, temporary inflatable packer strings will be set to isolate each well screen, including screens that appear to be nonproductive based on Westbay transducer records. These packer strings will be installed as soon as possible after removal of the Westbay systems to minimize cross-flow between screens.

4.4 Purging and Sampling

Sampling activities will use a straddle packer and pump assembly capable of pumping up to 3–5 gal. per minute (gpm). Adjustments in pumping rate may need to be made depending on the hydraulic yield of each screen. This purging and sampling rate is generally consistent with rates used in many of the Laboratory's single-screen or dual-screen wells completed in the regional aquifer. The packers will be set at a spacing which is greater than the length of each screen but which also minimizes the volume of water contained in the casing between packers. Purging and sampling will be conducted beginning with the lowest screen in the well and proceeding upward. This purging and sampling process inherently results in some cross-flow between screens, but the approach should minimize the amount of cross-flow that might progress into deeper screens. Estimates will be made of the anticipated cross-flow between screens, and those estimates will be the basis for determining how much water will be purged before initiating sample collection in each screen. Because of downward head gradient in each well, no cross-flow is anticipated in the uppermost screen. Detailed hydraulic data are not available for many of the screened intervals in these wells, so conservative estimates will be made of the amount of potential cross-flow that will be removed to ensure that samples collected from each screen are representative of that zone.

Following removal of the purge volume calculated for each well screen, samples will be collected in each well screen. Field personnel will collect real-time field-parameter data using a flow-through cell during purging and sampling. The goal will be to collect samples at four distinct times during purging as described in Table 4.1-1. The first samples will be collected at the estimated purge volume necessary to remove cross-flow, assuming key field parameters (e.g., dissolved oxygen, pH, temperature, and conductivity) are stable. The samples will not be collected until field parameters are stable. Three more samples will be collected at an additional 3, 6, and 10 casing volumes.

This analyte suite is more comprehensive than that currently collected for some of the well screens in this study because those screens are being monitored only for a limited suite as described in the 2009 Interim Facility-Wide Groundwater Monitoring Plan (LANL 2009, 106115). For example, screen 5 in well CdV-R-15-3 is not currently being monitored for VOCs because of concerns about the reliability of VOC data from that screen.

4.5 Redevelopment

In addition to the purging and sampling described above, two well screens, CdV-R-15-3, screen 4 and CdV-R-37-2, screen 2, are proposed for subsequent redevelopment followed by additional comparative sampling. These screens are located near the water table and represent locations that may be useful for the overall groundwater monitoring network for TA-16. Additionally, each of these two screens provides an opportunity for comparison of post-redevelopment data: first, from a screen that has historically provided data that appear to be of good quality (CdV-R-15-3, screen 4) and second, from a screen that has historically provided compromised data because of the presence of residual drilling effects in the surrounding aquifer (CdV-R-37-2, screen 2).

Redevelopment will involve swabbing and pumping of screens bounded by packers. Field parameters will be collected during redevelopment. Redevelopment of each screen may require up to 40 h of pumping at a rate of 5 to 10 gpm. Water-quality samples will be collected at the midpoint and at the end of development and submitted for the same analytical suite presented in Table 4.1-1. These data will be part of the overall assessment of the purging conducted as part of this study.

4.6 Redeployment of Temporary Packer String

Following completion of the sampling program for each well and redevelopment of select screens, a temporary packer string will be deployed in each well. Each screened interval that historically produces water will be isolated. Any additional screens that have historically been dry with the Westbay sampling system, but produce water after removal of the Westbay system, will also be isolated. These packer strings will consist of a series of inflatable packers that will be set up to ensure adequate pressurization while the well is in this configuration. The wells are anticipated to be under this configuration during the period awaiting receipt of the analytical data, evaluation of the results, and submittal of a work plan (or plans) for final disposition and configuration of the sampling system for each well.

4.7 Data Assessment

A report will be prepared that provides a summary of the sampling activities and an evaluation of the data derived from the test. The methodology to comparatively assess the data collected by each method (purge vs no-purge) will include a review of multiple constituents or groups of constituents along with applicable statistical approaches to evaluate comparability of the data. The report will also specifically present and discuss analytical data from screens that may be proposed for abandonment as part of reconfiguration of the wells. Recommendations for each sampling system will be based on the number of screens proposed to be retained and the hydraulic properties of those same screens.

5.0 SCHEDULE

This study will be conducted following NMED approval of the work plan. The proposed start date for implementation is August 1, 2010. A report that presents the results of the study and recommendations for future actions at the three wells used for the study will be submitted to NMED by April 11, 2011.

6.0 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.

Kleinfelder, January 25, 2005. "Final Well R-26 Completion Report, Revision No. 1," report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 087846)

Koch, R.J., and S. Schmeer, March 2010. "Groundwater Level Status Report for 2009, Los Alamos National Laboratory," Los Alamos National Laboratory report LA-14416-PR, Los Alamos, New Mexico. (Koch and Schmeer 2010, 108926)

Kopp, B., A. Crowder, M. Everett, D. Vaniman, D. Hickmott, W. Stone, N. Clayton, S. Pearson, and D. Larssen, April 2002. "Well CdV-R-15-3 Completion Report," Los Alamos National Laboratory report LA-13906-MS, Los Alamos, New Mexico. (Kopp et al. 2002, 073179)

Kopp, B., M. Everett, J.R. Lawrence, G. WoldeGabriel, D. Vaniman, J. Heikoop, W. Stone, S. McLin, N. Clayton, and D. Larssen, April 2003. "Well CdV-R-37-2 Completion Report," Los Alamos National Laboratory report LA-14023-MS, Los Alamos, New Mexico. (Kopp et al. 2003, 088803)

LANL (Los Alamos National Laboratory), May 2009. "2009 Interim Facility-Wide Groundwater Monitoring Plan," Los Alamos National Laboratory document LA-UR-09-1340, Los Alamos, New Mexico. (LANL 2009, 106115)

NMED (New Mexico Environment Department), February 11, 2010. "Requirement to Conduct Reliability Assessment of Multi-Screened Westbay Wells," 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, 108877)

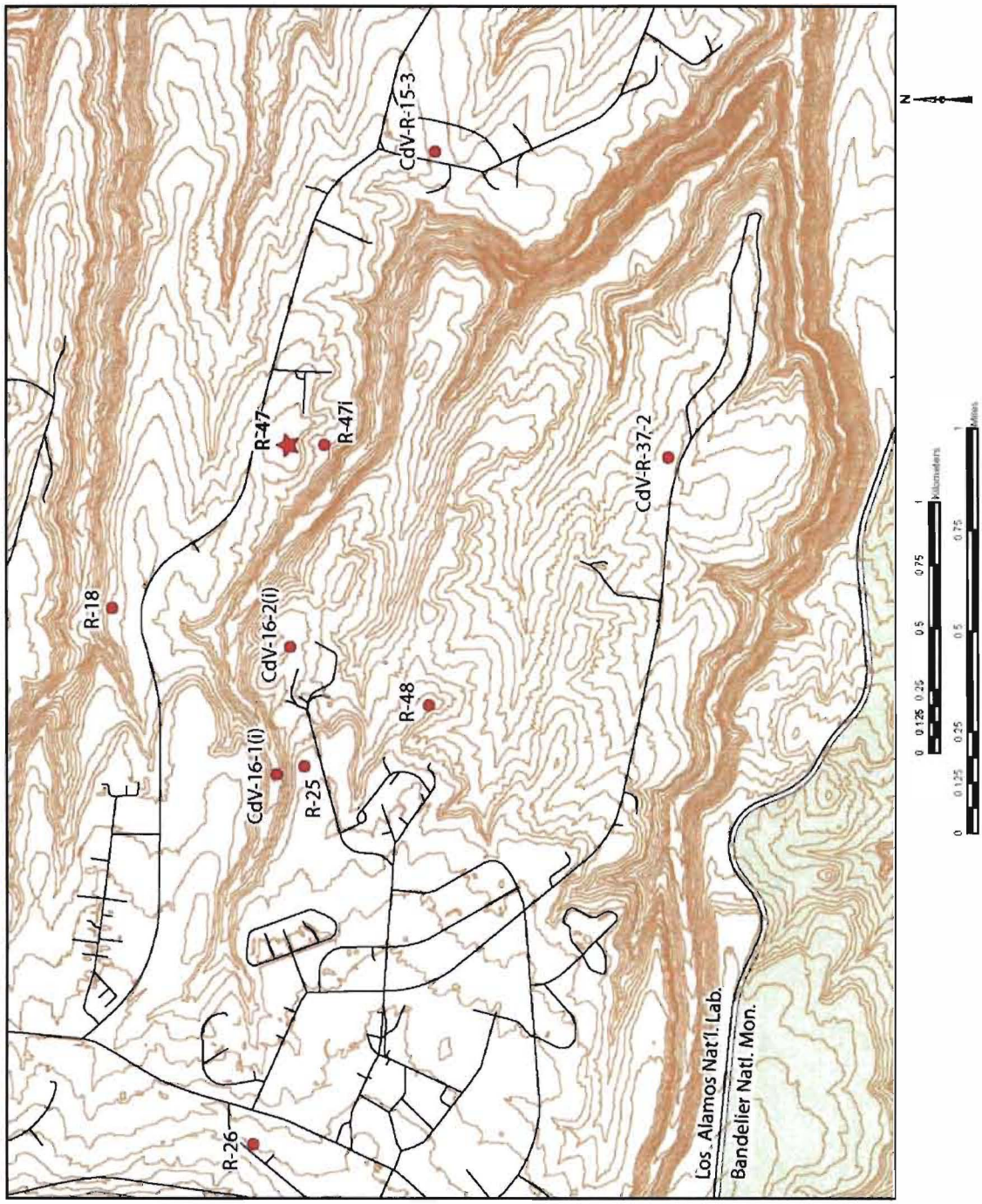

Figure 2.0-1 Locations of R-26, CdV-R-37-2, CdV-R-15-3, and other monitoring wells at TA-16

Table 2.0-1
Well-Drilling Methods and Construction Chronologies for Wells Selected for Westbay Study

Drilling Method and Additives	R-26	CdV-R-15-3	CdV-R-37-2
	Fluid-assisted air-rotary methods Open-hole drilling through interval Drilling fluids consisted of air with a mixture of potable water, QUIK-FOAM, and EZ-MUD (205–1000 ft).	Fluid-assisted air-rotary methods Open-hole drilling through sediments (152–534 ft) Formation instability required casing advance for interval 534–870 ft Drilling fluids consisted of air with a mixture of municipal water, QUIK-FOAM, and EZ-MUD.	Fluid-assisted air-rotary methods Open-hole drilling from 824 to total depth (1664 ft) Drilling fluids consisted of air with a mixture of municipal water, QUIK-FOAM, and EZ-MUD.
Completion of Drilling	October 17, 2003	May 20, 2001	August 5, 2001
Completion of Well Construction	October 21, 2003	May 31, 2001	August 17, 2001
Completion of Well Development	November 16, 2003	June 21, 2001	September 21, 2001
Westbay Sampling System Installed	July 16, 2004	July 19, 2001	October 8, 2001

Table 2.0-2
Hydrogeologic and Water-Quality Characteristics of Screened Intervals Selected for Study

Well Screen and Port Depth →	R-26 Screen 1 (659 ft bgs)	CdV-R-37-2 Screen 2 (1200 ft bgs)	CdV-R-37-2 Screen 3 (1359 ft bgs)	CdV-R-37-2 Screen 4 (1551 ft bgs)	CdV-R-15-3 Screen 4 (1254 ft bgs)	CdV-R-15-3 Screen 5 (1350 ft bgs)	CdV-R-15-3 Screen 6 (1640 ft bgs)
Screen Length (ft)	18	25.1	23.4	6.7	43.8	6.9	6.9
Hydrologic Zone	Intermediate perched zone (top of screen submerged 44 ft)	Regional aquifer (straddles water table)	Regional aquifer (top of screen submerged 159 ft)	Regional aquifer (top of screen submerged 354 ft)	Regional aquifer (straddles water table)	Regional aquifer (top of screen submerged 109 ft)	Regional aquifer (top of screen submerged 362 ft)
Drilling Impacts	None observed	Highly impacted by residual drilling fluids. Residual organics; strongly reducing.	None observed	Still shows effects from drilling. Slightly to moderately reducing; no residual organics.	None observed	Still shows effects from drilling. Moderately reducing. Residual organics.	Still shows effects from drilling. Slightly to moderately reducing.
Geochemical Trends	Stable, oxidizing	Does not appear to be cleaning up significantly with time. Significant changes to iron mineralogy in vicinity of screen are highly probable as result of extended period of strongly reducing conditions.	Stable, oxidizing	Mostly re-equilibrated	Stable, oxidizing	Does not appear to be cleaning up significantly with time. Changes to iron mineralogy in vicinity of screen are possible as result of extended period of reducing conditions.	Improving
Contaminants Present	No contaminants known to be present. Location is upgradient of any known Laboratory sources.	No contaminants known to be present.	No contaminants known to be present.	No contaminants known to be present.	No contaminants known to be present.	No contaminants known to be present.	No contaminants known to be present.

Table 2.0-2 (continued)

Well Screen and Port Depth →	R-26 Screen 1 (659 ft bgs)	CdV-R-37-2 Screen 2 (1200 ft bgs)	CdV-R-37-2 Screen 3 (1359 ft bgs)	CdV-R-37-2 Screen 4 (1551 ft bgs)	CdV-R-15-3 Screen 4 (1254 ft bgs)	CdV-R-15-3 Screen 5 (1350 ft bgs)	CdV-R-15-3 Screen 6 (1640 ft bgs)
Lithology of Screened Interval	Volcaniclastic sediments of the Cerro Toledo interval. Sediments in interval are stratified silty to clayey sands and minor gravels.	Dacitic lava and interflow siltstones of Tschicoma Formation	Dacitic lava of Tschicoma Formation	Dacitic lava of Tschicoma Formation	Puye Formation, lower fanglomerate sequence. Gravel and fine to coarse sand.	Puye Formation, lower fanglomerate sequence. Gravel and coarse sand.	Puye Formation, lower fanglomerate sequence. Gravel and coarse sand with vitric pumice.
Permeability of Screened Interval	Moderate to high	Moderate to high porosity and free water above 1205 ft depth; marked decline in free water in interval from 1205–1270 ft depth.	Moderate to high; highly porous zone.	Highly porous zone	Screen includes zone of notably high pore saturation at 1250–1254 ft.	Screen straddles transition into zone of high pore saturation at 1354–1360 ft.	High porosity typical of this interval
Hydraulic Conductivity (ft/d)	1.7	Not tested	7.0	11.4	Not tested	0.25	0.10
Issues Related to Screen Development	Screen 1 probably not isolated during pumping.	Located in tight dacites and could not be pumped during well development.	Pumping performed adjacent to screens 3 and 4 but did not include packers to isolate the screens.		Pumping performed adjacent to each screen but did not include packers to isolate the screens. Screen 5 partially covered with bentonite.		

Sources: Well completion reports (Kopp et al. 2002, 073179; Kopp et al. 2003, 088803; Kleinfelder 2005, 087846); well screen assessments from Appendix F of the 2009 Interim Plan (LANL 2009, 106115).

Table 2.0-3
Construction Attributes of Well Screens in the Westbay Study

Well Screen →	Units	R-26 Screen 1	CdV-R-37-2 Screen 2	CdV-R-37-2 Screen 3	CdV-R-37-2 Screen 4	CdV-R-15-3 Screen 4	CdV-R-15-3 Screen 5	CdV-R-15-3 Screen 6
Surface Elevation	ft msl[a]	7641.69	7330.60	7330.60	7330.60	7258.90	7258.90	7258.90
Port Data								
Port ID[b]	n/a[c]	MP1A	MP2A	MP3A	MP4A	MP4A	MP5A	MP6A
Port Depth	ft bgs	659.3	1200.3	1359.3	1550.6	1254.4	1350.1	1640.1
Port Elevation	ft msl	6982.4	6130.3	5971.3	5780.0	6004.5	5908.8	5618.8
Screen and Borehole Data								
Groundwater Elevation (ft msl)	ft msl	7034.44	6136.62	6135.74	6135.11	6019.07	6019.37	5982.48
Measurement Date	n/a	10/19/09	04/16/10	04/16/10	04/16/10	04/30/10	04/30/10	04/30/10
Screen Depth (top)	ft bgs	651.8	1188.7	1353.7	1549.3	1235.1	1348.4	1637.9
Screen Depth (bottom)	ft bgs	669.9	1213.8	1377.1	1556.0	1278.9	1355.3	1644.8
Screen Length	ft	18.1	25.1	23.4	6.7	43.8	6.9	6.9
Saturated Screen Length	ft	18.1	19.8	23.4	6.7	39.1	6.9	6.9
Borehole Diameter	in.	12.25	12.25	12.25	12.25	12.25	12.25	12.25
Well-Casing Diameter (I.D./O.D.)[d]	in.	4.5/5.0	4.5/5.0	4.5/5.0	4.5/5.0	4.5/5.0	4.5/5.0	4.5/5.0

Source: Groundwater Level Status Report for 2009 (Koch and Schmeer 2010, 108926).

[a] msl = mean sea level.

[b] ID = identification.

[c] n/a = not applicable.

[d] I.D./O.D. = inside diameter / outside diameter.

Table 4.1-1
Analytical Tests for Water-Quality Samples Collected during Purging

Monitoring Well	Field Parameters[a]	General Inorganics[b]	Metals[c]	Semivolatile Organic Compounds[d]	VOCs[d]	HEXP[e]
R-26, Screen 1	X	X	X	X	X	X
CdV-R-15, Screen 4	X	X	X	X	X	X
CdV-R-15, Screen 5	X	X	X	X	X	X
CdV-R-15, Screen 6	X	X	X	X	X	X
CdV-R-37-2, Screen 2	X	X	X	X	X	X
CdV-R-37-2, Screen 3	X	X	X	X	X	X
CdV-R-37-2, Screen 4	X	X	X	X	X	X

[a] Field parameters will be collected during purging at 10-min intervals until collection of the first sample, then at 30-min intervals thereafter. Field parameters will be measured through a flow-through cell and will include pH, turbidity, specific conductance, dissolved oxygen, oxidation-reduction potential, and temperature.

[b] General inorganic analyses will be conducted at LANL's GGRL laboratory and at an off-site laboratory. The GGRL laboratory analysis will include inorganic anions (filtered) (bromide, chloride, fluoride, sulfate, phosphate, nitrate, oxalate), major cations (filtered and nonfiltered) (calcium, magnesium, sodium, potassium), ammonia (filtered and nonfiltered), total organic carbon (nonfiltered), carbonate alkalinity (filtered and nonfiltered), and pH. Off-site laboratory analyses of general inorganics will include the preceding combinations of constituents and field preparation, as well as total Kjeldahl nitrogen (filtered), total dissolved solids (filtered), and specific conductance (filtered and nonfiltered).

[c] Metals analyses will be conducted at LANL's GGRL laboratory and at an off-site laboratory. Metals analyses will be on filtered and nonfiltered samples, and will include TAL metals (those not already included in the general inorganic analytical suite), plus boron, molybdenum, silicon dioxide, strontium, and uranium.

[d] Analysis for organic constituents will be on nonfiltered samples only and will be analyzed only at an off-site laboratory.

[e] HE analyses will be conducted on nonfiltered samples at an off-site laboratory. The HEXP analytical suite includes 20 HE analytes analyzed by Environmental Protection Agency (EPA) method SW-846:8321A (modified) plus three RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) degradation products analyzed by EPA method SW-846:8330. Analytes measured by method SW-846:8321A (modified) include the following: 2,4-diamino-6-nitrotoluene; 2,6-diamino-4-nitrotoluene; 3,5-dinitroaniline; 2-amino-4,6-dinitrotoluene; 4-amino-2,6-dinitrotoluene; 1,3-dinitrobenzene; 2,4-dinitrobenzene; 2,6-dinitrobenzene; HMX (1,3,5,7-tetranitro-1,3,5,7-tetrazocane); nitrobenzene; 2-nitrotoluene; 3-nitrotoluene; 4-nitrotoluene; RDX; PETN (pentaerythritol tetranitrate); tetryl; TATB (triaminotrinitrobenzene); 1,3,5-trinitrobenzene; TNT (2,4,6-trinitrotoluene); and TOCP (tris(o-cresyl) phosphate). Method SW-846:8330 analytes include MNX (hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine); DNX (hexahydro-1,3-dinitroso-5-dinitro-1,3,5-triazine); and TNX (hexahydro-1,3,5-trinitroso-1,3,5-triazine).