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Well Reconfiguration of CdV-R-37-2 Field Summary Report



Prepared by the Environmental Programs Directorate

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September 2013

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Acronyms and Abbreviations

amsl	above mean sea level
bgs	below ground surface
Consent Order	Compliance Order on Consent
GGRL	Geochemistry and Geomaterials Research Laboratory (LANL)
gpm	gallons per minute
hp	horsepower
I.D.	inside diameter
IDW	investigation-derived waste
LANL	Los Alamos National Laboratory
NAD	North American Datum
NMED	New Mexico Environment Department
O.D.	outside diameter
PVC	polyvinyl chloride
RPF	Records Processing Facility
SOP	standard operating procedure
TA	technical area
WCSF	waste characterization strategy form

1.0 INTRODUCTION

This report provides a summary of field activities associated with the reconfiguration of monitoring well CdV-R-37-2 at Los Alamos National Laboratory (LANL or the Laboratory). The report is written in accordance with the requirements for well completion reports in Section IV.A.3.e.iv of the March 1, 2005 (revised 2012) Compliance Order on Consent (Consent Order). Plans for the well reconfiguration were presented in the "Work Plan to Reconfigure Well CdV-R-37-2" (LANL 2012, 232345) that was approved by the New Mexico Environment Department (NMED) in an approval with modifications letter dated January 11, 2013 (NMED 2013, 521802).

The primary objective of the work was to reconfigure CdV-R-37-2 from a multiscreen well into a single-screen well equipped for sampling. One dry well screen interval remains above the retained screen 2 interval.

Field activities for the reconfiguration of CdV-R-37-2 occurred between August 9 and August 29, 2013. The field activities performed as part of the reconfiguration included removing two packers isolating the lower screen intervals, abandoning the lower well screen, redeveloping screen 2, purging and sampling, and installing a dedicated sampling system.

The information presented in this report was 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 field activities and supporting figures, and tables associated with the well reconfiguration.

2.0 WELL RECONFIGURATION

Well CdV-R-37-2 is located on the mesa between Cañon de Valle and Water Canyon in Technical Area 37 (TA-37) (Figure 2.0-1). The well was installed to evaluate transport pathways, including the deep perched and regional saturated zones that potentially carry contamination from Consolidated Unit 16-021(c)-99 at TA-16 (LANL 2012, 213573). The borehole was drilled using standard air-rotary drilling methods to a total depth of 1644 ft below ground surface (bgs) (Kopp et al. 2003, 088803). Four pipe-based, wire-wrapped screens were installed in the borehole. Pertinent well information is as follows:

- 4.5-in.–inside diameter (I.D.) stainless-steel casing
- Screen 1, 914.4–939.5 ft bgs (dry)
- Screen 2, 1188.7–1213.8 ft bgs
- Screen 3, 1353.7–1377.1 ft bgs
- Screen 4, 1549.3–1556.0 ft bgs
- Depth to water for screen 2 is 1194 ft bgs, standing approximately 5 ft below the top of the screen

Figure 2.0-2 presents the CdV-R-37-2 monitoring well construction and disposition before reconfiguration activities started.

Testing of screen 2 indicates a specific capacity of 2.23 gallons per minute (gpm)/ft (LANL 2011, 205233).

2.1 Packer Removal

Two inflatable packers had been installed on 2-in. drop pipe between screens 2 and 3 and between screens 3 and 4 to prevent cross-flow between the screen intervals. The packers were located at depths of 1229 and 1406 ft bgs, respectively. The packers were in place and inflated as required. They were deflated and removed from the well on August 10.

2.2 Lower Well Screen Abandonment

After the packers were removed, a hybrid tremie pipe consisting of 180 ft of 2-in. schedule 40 polyvinyl chloride (PVC) pipe on the bottom and 1405 ft of steel BQ-size core pipe (above the PVC) was installed in the well on August 11, 2013. (Note: BQ is a specific core rod diameter.) A cross-over coupling was used to join the compositionally different pipes. A 45-degree bevel was cut on the leading edge of the PVC, and one stainless-steel centralizer was installed on the bottom of the PVC section. A total of 117 gal. of neat cement was installed through the tremie pipe. A total of 44 gal. of chase water was pumped through the tremie pipe to clear the upper (steel) portion of the pipe. The volume of chase water was determined as the volume of the tremie pipe over the distance between the top of cement target (1445 ft bgs) and the measured static water level in the well (1198.12 ft bgs). The volume of chase water used ensures the PVC is full of cement. The cement interval was installed on August 11, 2013.

The technical approach for the cementing work at CdV-R-37-2 included cementing the lower PVC section of the tremie pipe in place. This approach resulted in the least possible amount of time the well screens were in open communication. This approach also minimized the upper screen's exposure to fugitive cement grout because the tremie pipe had not been separated or removed until the work shift following cement curing.

The cement was allowed to cure for 24 h before the tremie pipe was rotated clockwise to cause the PVC to fail and break off. A total of 10 ft of PVC was recovered after the tremie pipe was removed, and 170 ft of PVC remains embedded in the cement. The tremie pipe was broken off and the top of the cement interval was measured at 1451.2 ft bgs on August 12, 2013. The top of the separated section of PVC was located at 1413 ft bgs.

Because of location of the top of the PVC at approximately 38.1 ft above the top of the cement, a submersible pump could not be installed to purge from immediately above the cement. Filter sand was installed before pumping. The tremie pipe was installed in the well, and 10/20 filter-grade sand was emplaced above the cement from 1451.2 to 1414 ft bgs on August 14 and 15, 2013. A submersible pump was installed in the well to purge any cement-impacted water before the remainder of the sand backfill was emplaced. Pumping from a depth of 1410 ft bgs was conducted for 35 min at 6.7 gpm. Approximately 235 gal. of water was purged before the pump was removed on August 16, 2013. One sample was collected for analysis at LANL's Geochemistry and Geomaterials Research Laboratory (GGRL). Table 2.2-1 presents a summary of samples collected during the well reconfiguration at CdV-R-37-2. Appendix A presents analytical results for the samples collected.

The tremie pipe was installed in the well, and 10/20 filter-grade sand was emplaced from 1414.6 to 1399.6 ft bgs, and the tremie pipe was removed from the well on August 17, 2013. A k-packer constructed of stainless-steel and Viton was installed above the sand backfill. The top of the k-packer was measured at 1397.4 ft bgs. The k-packer was installed on August 17, 2013.

The cement was mixed and the sand backfill was emplaced with potable water from the Los Alamos County municipal supply source near the Los Alamos County Eco Station on East Jemez Road.

On August 18, 2013, a Tam single-set packer was installed between screens 2 and 3 at a depth of 1236.9 ft bgs. Following packer inflation, a temporary transducer was installed in the well on a dedicated cable, and real-time water levels were monitored for 24 h to ensure proper packer inflation and isolation of the screen 2 interval. The transducer was removed and a stainless-steel and Viton k-packer was installed above the single-set packer at a depth of 1233.3 ft bgs on August 20, 2013.

Well reconfiguration details and the final disposition of CdV-R-37-2 are presented on Figure 2.2.1. Backfill material volumes for the respective intervals are presented in Table 2.2-2.

The previously installed packers were deflated at 15:10 on August 10, 2013, and the cement installation above screen 4 was completed at 13:53 on August 11, 2013. The duration between packer deflation and cement installation was 1363 min. Previous combined cross-flow estimates from screens 2 and 3 into screen 4 were on the order of 1.95 gpm. This estimated volume would result in a maximum total cross-flow volume into screen 4 of 2658 gal. Cross-flow from screen 2 into screen 3 is considered negligible, based on previous estimates.

2.3 Redevelopment, Purging, and Sampling Activities

Following reconfiguration, redevelopment of screen 2 was performed per the work plan and approval with modifications between August 20 and August 24, 2013 (LANL 2012, 232345; NMED 2013, 521802). Redevelopment activities consisted of swabbing and bailing and then pumping throughout the screened interval with a submersible pump.

The swabbing tool employed was a 4.25-in. outside diameter (O.D.), 1-in.-thick nylon disc attached to a weighted steel rod. The wireline conveyed tool was drawn repeatedly across the screened interval, causing a surging action across the screen interval and filter pack. The bailing tool used was a 4.0-in.-O.D. by 21.0-ft-long carbon steel bailer with a total capacity of 12 gal. The bailer was lowered by wireline and repeatedly filled, withdrawn from the well, and emptied into a container. Approximately 180 gal. of groundwater was removed during bailing activities. Approximately 2 h of swabbing and bailing took place on August 20, 2013. Water-quality parameters were not recorded during swabbing and bailing.

After swabbing and bailing, a 5 horsepower (hp) submersible pump inside a pump shroud was installed in the well. The work plan prescribed 40 h of pump development for the retained screen 2 interval. The pump was raised throughout the screen interval in multiple trips from bottom to static water level in 2 ft increments for 20-min intervals between the screen bottom at 1213 ft bgs and static water level at 1198 ft bgs. The pump was repositioned in the sump space daily at 1231 ft bgs. The duration of development was extended an additional 4.5 h on August 24, 2013, for a total of 44.5 h of purging to achieve a longer record of stable water-quality parameters.

Table 2.3-1 presents a summary of volumes purged and water-quality parameters collected during the pump development. Approximately 18,740 gal. of groundwater was purged with the submersible pump during pump development activities.

3.0 DEDICATED SAMPLING SYSTEM INSTALLATION

The dedicated sampling system for CdV-R-37-2 was installed between August 25 and August 27, 2013. The pumping system utilizes an environmentally retrofitted 4-in. 5 hp Grundfos submersible pump installed in a stainless-steel pump shroud. The bottom of the pump shroud (the pump intake) is set below the screened interval at 1225.1 ft bgs. The pump column is constructed of 1-in. threaded/coupled schedule 80 passivated stainless-steel pipe. A weep hole was installed at the bottom of the uppermost

pipe joint to protect the pump column from freezing. To measure water levels in the well, two 1-in.-I.D. schedule 80 flush-threaded PVC pipes are installed to sufficient depth to set a dedicated transducer and to provide access for manual water-level measurements. The PVC transducer tubes are equipped with 0.75-ft sections of 0.010-in. slot screen with a threaded end cap on the bottom of each tube. An In-Situ Level Troll 500 30-psig transducer is installed in one of the PVC tubes to monitor the water level in the well's screened interval.

Sampling system details for CdV-R-37-2 are presented in Figures 3.0-1 and 3.0-2.

4.0 GEODETIC SURVEY

A New Mexico licensed professional land surveyor conducted a geodetic survey on July 15, 2013 (Table 4.0-1). The survey data collected 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 relative to the New Mexico State Plane Coordinate System Central Zone (North American Datum [NAD] 83); elevation is expressed relative to feet above mean sea level (amsl) using the National Geodetic Vertical Datum of 1929. Survey points include ground-surface elevation near the concrete pad, the top of the brass cap in the concrete pad, the top of the well casing, and the top of the protective casing for the CdV-R-37-2 monitoring well.

5.0 DEVIATIONS FROM WORK PLAN

The in situ abandonment of a 170-ft section of PVC tremie pipe, 131 ft within the cement seal and 39 ft above the cement, was not part of the work plan NMED approved (LANL 2012, 232345; NMED 2013, 521802). Since the PVC is inert and located within the cement seal and sand filter pack, it will not impart any undesirable effects.

The work plan approval with modifications specified installation of cement from the bottom of the well to a depth of 1445 ft bgs. The volume of cement added was based on a target depth of 1445 ft bgs, but after it cured, the actual depth to the top of the cement was determined to be 1451.2 ft bgs, approximately 6 ft below the target depth. The length of the cement seal is 136.1 ft, and this deviation will not affect the performance of the well.

6.0 WASTE MANAGEMENT

All investigation-derived waste (IDW) generated during well reconfiguration activities will be managed in accordance with the applicable standard operating procedures (SOP). The SOP incorporates the requirements of all applicable U.S. Environmental Protection Agency and NMED regulations, U.S. Department of Energy orders, and LANL requirements. The SOP applicable to the characterization and management of IDW is

- SOP-10021, Characterization and Management of Environmental Program Waste.

A waste characterization strategy form (WCSF) has been prepared and approved per requirements of SOP-10021. The WCSF provides detailed information on IDW characterization methods, management, containerization, and potential volumes.

Fluids (i.e., redevelopment and decontamination waters) and contact waste (e.g., gloves, paper towels, plastic, and/or glass sample bottles) were the primary waste streams generated during well reconfiguration activities. The fluids produced will be sampled and analyzed for the suite of constituents listed in the WCSF.

Fluids produced during well reconfiguration activities were containerized, and the fluids will be sampled and evaluated for compliance with New Mexico Water Quality Control Commission Regulation 3103 groundwater standards and applicable Resource Conservation and Recovery Act regulatory limits before any release of water occurs. Decisions regarding the release of water will be made in accordance with the 2006 notice of intent decision tree for drilling, development, rehabilitation, and sampling purge water. The decontamination water, contact waste, and any other IDW will be managed in accordance with the approved WCSF.

7.0 REFERENCES AND MAP DATA SOURCES

7.1 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.

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), August 2011. "Reliability Assessment of Multiscreened Westbay Wells," Los Alamos National Laboratory document LA-UR-11-4445, Los Alamos, New Mexico. (LANL 2011, 205233)

LANL (Los Alamos National Laboratory), March 2012. "Technical Area 16 Well Network Evaluation and Recommendations," Los Alamos National Laboratory document LA-UR-12-1082, Los Alamos, New Mexico. (LANL 2012, 213573)

LANL (Los Alamos National Laboratory), November 2012. "Work Plan to Reconfigure Well CdV-R-37-2," Los Alamos National Laboratory document LA-UR-12-26361, EP2012-0257, Los Alamos National Laboratory (LANL 2012, 232345).

NMED (New Mexico Environment Department), January 11, 2013. "Approval with Modifications, Work Plan to Reconfigure Well CdV-R-37-2," New Mexico Environment Department letter to P. Maggiore (DOE-LASO) and J.D. Mousseau (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2013, 521802).

7.2 Map Data Sources

Point Feature Locations of the Environmental Restoration Project Database; Los Alamos National Laboratory, Waste and Environmental Services Division, EP2008-0109; 14 March 2012.

Hypsography, 100 and 20 Foot Contour Interval; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1991.

Surface Drainages, 1991; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2002-0591; 1:24,000 Scale Data; Unknown publication date.

Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Division; 4 December 2009.

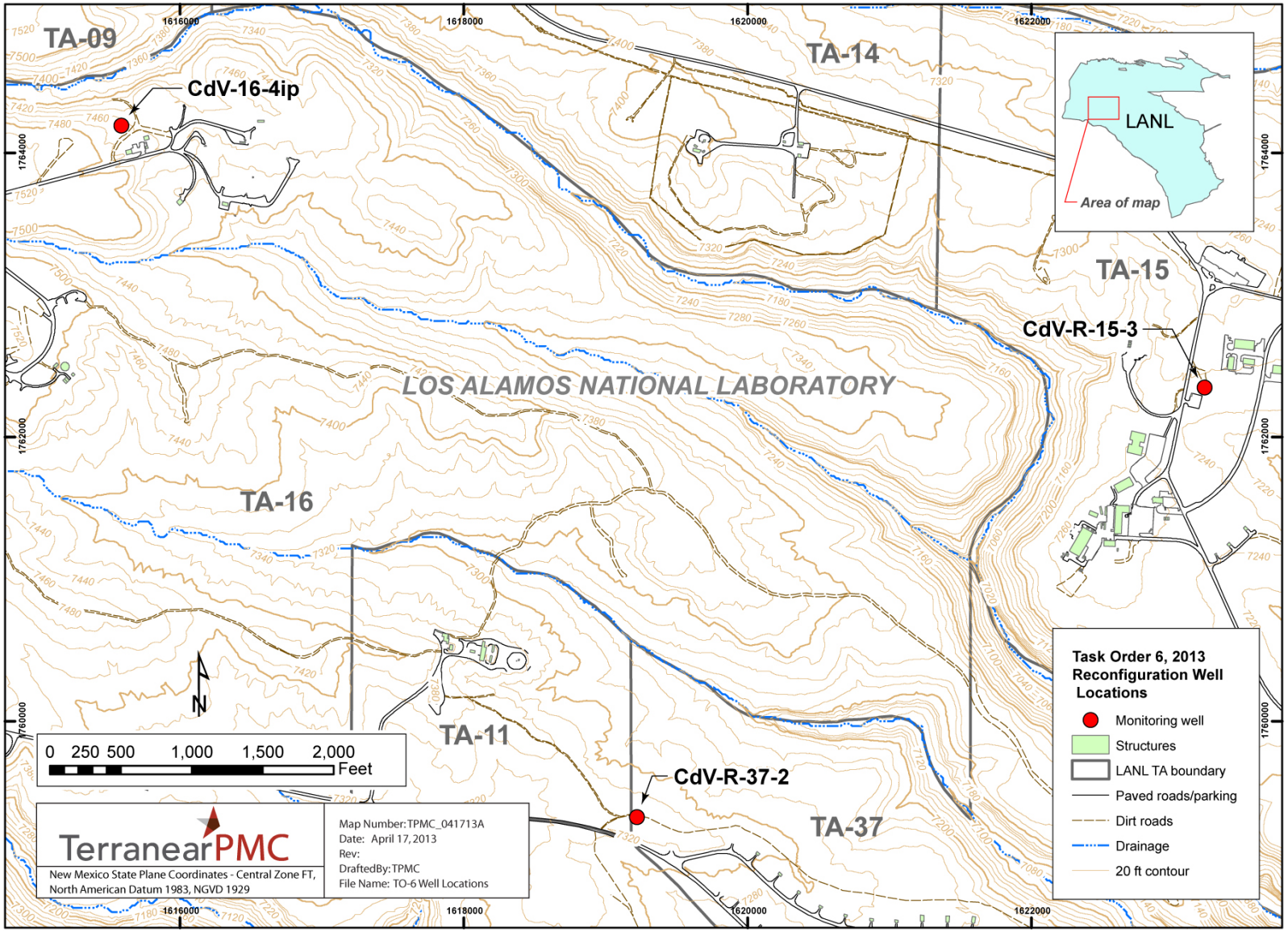


Figure 2.0-1 Location of well CdV-R-37-2

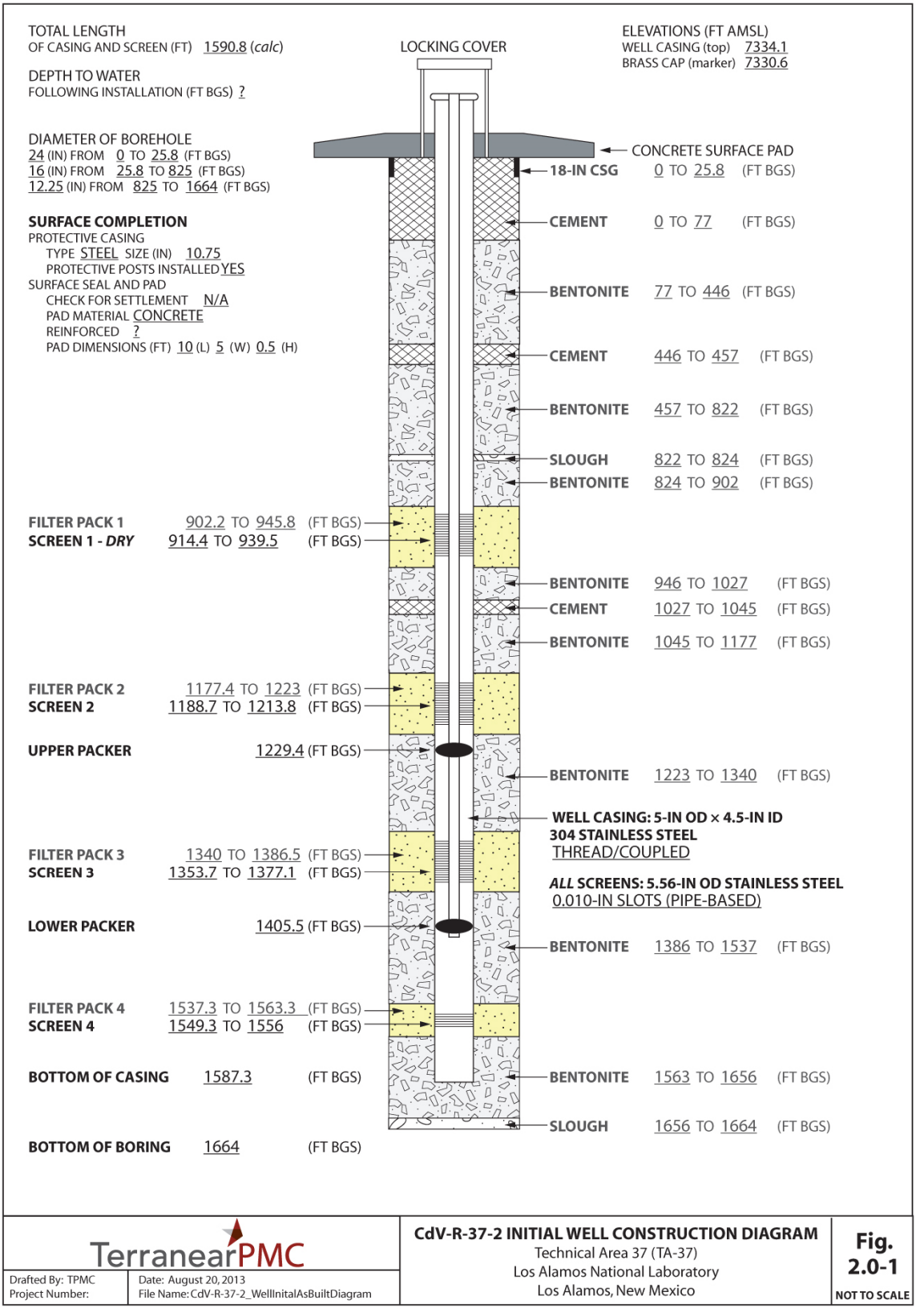


Figure 2.0-2 Initial well construction diagram of monitoring well CdV-R-37-2

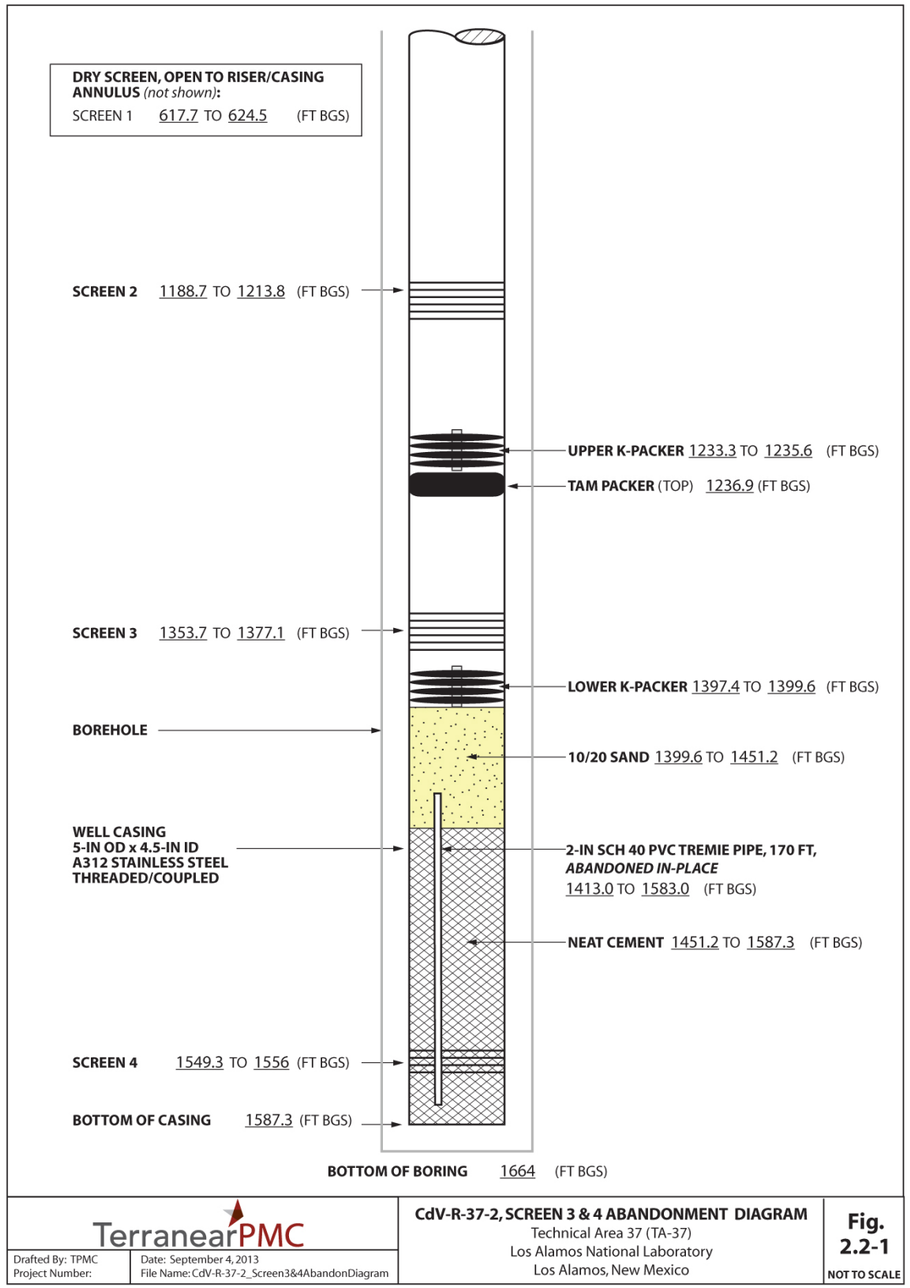


Figure 2.2-1 Backfill diagram of monitoring well CdV-R-37-2

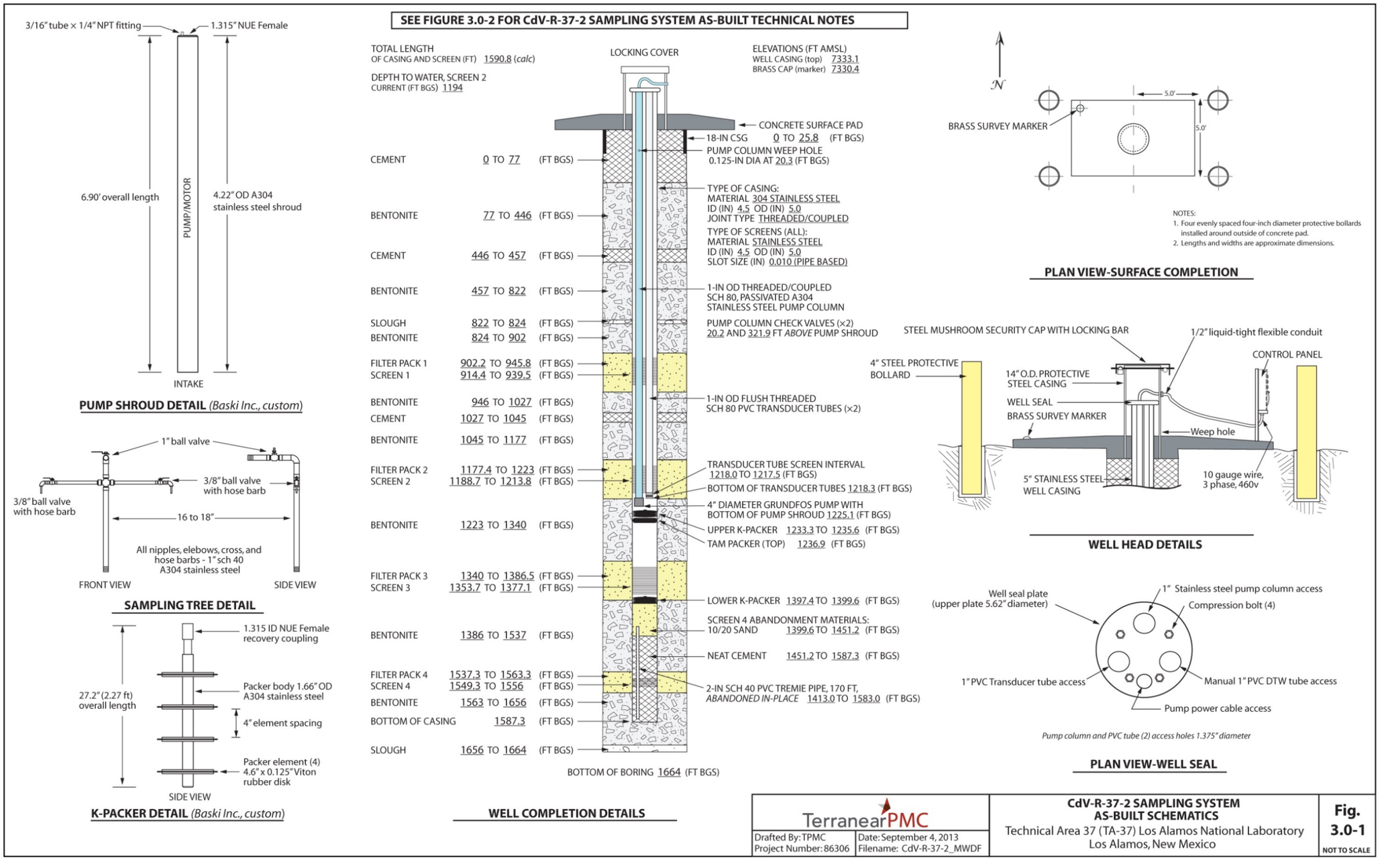


Figure 3.0-1 As-built schematics of monitoring well CdV-R-37-2 sampling system

CdV-R-37-2 SAMPLING SYSTEM AS-BUILT TECHNICAL NOTES:

SURVEY INFORMATION*

Brass Marker

Northing: 1759388.27 ft
Easting: 1619252.47 ft
Elevation: 7330.4 ft AMSL

Well Casing (top of stainless steel)

Northing: 1759381.42 ft
Easting: 1619254.27 ft
Elevation: 7333.1 ft AMSL

SAMPLING SYSTEM MATERIALS AND PRODUCT LIST

Pump: Grundfos, 10S50-930CBM, environmental retrofit

Pump motor: Franklin Electric, 5HP, 3-phase, 460V

Motor cable: 10g, 3 lead with ground, double jacket

Discharge column: 1-in, threaded and coupled, sch 80, pickled and passivated A304 stainless steel

Check valves (x2): Flomatic, 1-in female x female, 303 stainless steel, mod. 4201LSS2, 400 psi

Couplings: A304 stainless steel deep well couplings

Gauge tubes (x2): 1-in, flush-threaded, sch 80 PVC, each with 0.50–0.75-ft (long), 0.010-in slot screens, female bottom caps

Banding: 5/8-in or 3/4-in 201 stainless steel with 201 stainless steel buckles

Well seal: Maas Midwest Manufacturing 5.0-in dia top plate x 1/2 inch steel, 4 access holes, custom

Thread compound: Jet Lube, V2

Sampling Tree: A304 sch 40 stainless steel 1-in nipples, elbows, cross, bushings, hose barbs, and Apollo ball valves 1-in (76-105-01A) and (x2) 3/8-in (76-102-01A)

AQUIFER TESTING

Constant Rate Pumping Test
Specific Capacity: 2.23 gpm/ft
Performed on: 04/24/2011

DEDICATED SAMPLING SYSTEM

Pump (Shrouded)

Make: Grundfos
Model: 10S50-48
S/N: B09110849-P11309407
Environmental retrofit

Motor

Make: Franklin Electric
Model: 2343278902
S/N: 11A14-25-00615C 337610908
5 hp, 3-phase, 460V

Pump Shroud

A304 stainless steel, 4.22-in x 0.0120-in wall tube, Baski Inc. custom

Pump Column

1-in threaded/coupled sch 80, pickled and passivated A304 stainless steel tubing

Transducer Tubes

2 × 1-in flush threaded sch 80 PVC tubing, each with 0.75-ft (long), 0.010-in slot screens located above the pump shroud

Transducer

Make: In-Situ, Inc.
Model: Level TROLL 500
30 psig range (vented)
S/N: 347170

NOTES:

* NEW (8/15/13) Coordinates based on New Mexico State Plane Grid Coordinates, Central Zone (NAD83); Elevation expressed in feet amsl using the National Geodetic Vertical Datum of 1929.

TerranearPMC	CdV-R-37-2 SAMPLING SYSTEM AS-BUILT TECHNICAL NOTES	Fig. 3.0-2
Drafted By: TPMC Project Number: 86306	Date: August 28, 2013 Filename: CdV-R-37-2_SampSysTechnicalNotes	NOT TO SCALE

Figure 3.0-2 Technical notes for as-built sampling system for monitoring well CdV-R-37-2

Table 2.2-1
Summary of Groundwater Samples Collected during Reconfiguration of Well CdV-R-37-2

Location ID	Sample ID	Date/Time Collected	Screen	Analysis
Chase Water Purge after Cementing				
CdV-R-37-2	CAWA-13-36228	8/16/13; 1155h	1410.16 ft	HEXP, ALK, ANIONS, TOC
CdV-R-37-2	CAWA-13-36233	8/16/13; 1155h	1410.16 ft	MET
40-h Redevelopment Samples (1293.9 ft bgs)				
CdV-R-37-2	CAWA-13-36229	8/21/2013; 1830h	Screen 2	HEXP, ALK, ANIONS, TOC
CdV-R-37-2	CAWA-13-36234	8/21/2013; 1830h	Screen 2	MET
CdV-R-37-2	CAWA-13-36230	8/22/2013; 1830h	Screen 2	HEXP, ALK, ANIONS, TOC
CdV-R-37-2	CAWA-13-36235	8/22/2013; 1830h	Screen 2	MET
CdV-R-37-2	CAWA-13-36231	8/23/2013; 1745h	Screen 2	HEXP, ALK, ANIONS, TOC
CdV-R-37-2	CAWA-13-36236	8/23/2013; 1745h	Screen 2	MET
CdV-R-37-2	CAWA-13-36232	8/24/2013; 1830h	Screen 2	HEXP, ALK, ANIONS, TOC
CdV-R-37-2	CAWA-13-36237	8/24/2013; 1830h	Screen 2	MET
Sampling System Rinsate Samples (Equipment Blank)				
CdV-R-37-2	CAWA-13-36238	8/25/2013; 1300h	Pump	VOC, SVOC
CdV-R-37-2	CAWA-13-36239	8/25/2013; 1300h	Pump Shroud	VOC, SVOC
CdV-R-37-2	CAWA-13-36240	8/25/2013; 1300h	Pipe String	VOC, SVOC
CdV-R-37-2	CAWA-13-36241	8/29/2013; 1653h	First Water	VOC, SVOC

Analysis abbreviations: ALK = alkalinity, ANIONS = positive (+) ions, CATIONS = negative (–) ions, HEXP = high explosives, MET = metals, SVOC = semi-volatile organics, TOC = total organic carbon, VOC = volatile organics.

Table 2.2-2
CdV-R-37-2 Monitoring Well Screen 4 Abandonment Materials

Material	Interval (ft bgs)	Emplaced Volume (ft^3)	Calculated Volume (ft^3)
Cement interval	1587.2–1451.2	15.7	15.0
10/20 filter sand interval	1451.2–1399.7	5.9	5.7

Table 2.3-1
Purge Volumes and Field Parameters during Well Redevelopment at CdV-R-37-2

Date	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	Eh (mV)	Specific Conductivity (µS/cm)	Turbidity (NTU[a])	Purge Volume between Samples (gal.)	Cumulative Purge Volume (gal.)
Well Redevelopment									
8/21/13	6.88	21.85	3.06	30	233.9	104	0.0	145.1	145
	6.64	22.33	3.01	167	370.9	104	0.0	145.1	290
	6.69	22.31	3.16	193	396.9	104	0.0	145.1	435
	6.53	21.73	3.31	177	380.9	104	0.0	145.1	580
	6.47	21.80	3.33	125	328.9	104	0.0	145.1	726
	6.56	21.80	3.36	125	328.9	104	0.0	145.1	871
	6.67	21.85	3.46	92	295.9	104	0.0	145.1	1016
	6.64	21.95	3.45	112	315.9	104	0.0	145.1	1161
	6.56	21.97	3.54	120	323.9	104	0.0	145.1	1306
	6.31	22.21	3.26	106	309.9	101	0.0	145.1	1451
	6.28	20.84	3.05	246	449.9	103	0.0	145.1	1596
	6.32	21.64	2.80	242	445.9	104	0.0	145.1	1741
	6.69	22.10	3.14	234	437.9	104	0.0	145.1	1886
	6.76	22.06	3.28	167	370.9	104	0.0	145.1	2031
	6.79	21.94	3.43	111	314.9	104	0.0	145.1	2177
	6.64	22.04	3.58	76	279.9	104	0.0	145.1	2322
	6.77	22.64	3.65	199	397.5	104	0.0	145.1	2467
	6.77	22.41	5.04	235	438.9	104	0.0	145.1	2612
	6.87	22.77	4.13	236	434.5	104	0.0	145.1	2757
	6.88	22.51	3.76	261	459.5	104	0.0	145.1	2902
	6.83	22.44	3.77	277	480.9	104	0.0	145.1	3047
	6.96	22.50	3.78	298	501.9	103	0.0	145.1	3192
	6.77	22.66	3.77	339	537.5	104	0.0	145.1	3337
	6.87	22.98	3.80	377	575.5	104	0.0	145.1	3482
	6.97	22.84	3.83	383	581.5	103	0.0	145.1	3628
	6.82	22.48	3.85	394	597.9	103	0.0	145.1	3773
	6.94	22.05	3.88	410	613.9	103	0.0	145.1	3918
	6.98	21.98	3.89	429	632.9	103	0.0	145.1	4063
	7.09	21.70	3.99	351	554.9	103	0.0	145.1	4208

Table 2.3-1 (continued)

Date	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	Eh (mV)	Specific Conductivity (µS/cm)	Turbidity (NTU[a])	Purge Volume between Samples (gal.)	Cumulative Purge Volume (gal.)
	6.89	21.07	5.60	110	313.9	179	0.0	117.2	4325
	7.62	21.21	2.45	12	215.9	105	0.0	117.2	4442
	7.62	21.31	2.74	-24	179.9	104	0.0	117.2	4560
	7.61	21.37	2.95	-35	168.9	104	0.0	117.2	4677
	7.52	21.51	3.10	-31	172.9	103	0.0	117.2	4794
	7.42	21.58	3.26	-9	194.9	103	0.0	117.2	4911
	7.28	21.66	3.23	8	211.9	103	0.0	117.2	5029
	6.95	21.33	5.01	102	305.9	103	0.0	117.2	5146
	6.71	21.62	5.62	182	385.9	103	0.0	117.2	5263
	6.45	21.79	3.96	237	440.9	103	0.0	117.2	5380
	6.21	21.87	3.85	289	492.9	103	0.0	117.2	5498
	6.16	22.05	3.87	334	537.9	103	0.0	117.2	5615
	6.11	22.41	3.80	395	598.9	103	0.0	117.2	5732
	5.92	22.62	3.80	443	641.5	103	0.0	117.2	5849
	5.79	22.74	3.83	447	645.5	103	0.0	117.2	5966
	5.66	22.82	3.80	459	657.5	103	0.0	117.2	6084
	5.64	22.88	3.79	473	671.5	103	0.0	117.2	6201
	5.54	23.13	3.78	481	679.5	103	0.0	117.2	6318
	5.52	22.22	3.80	472	675.9	103	0.0	117.2	6435
8/22/13[b]	7.48	26.33	3.91	213	411.5	109	0.0	117.2	6553
	7.10	23.20	3.81	401	599.5	102	0.0	117.2	6670
	7.24	24.86	3.85	449	647.5	102	0.0	117.2	6787
	6.90	22.36	4.11	426	629.9	103	0.0	117.2	6904
	7.16	23.07	7.18	53	251.5	124	11.70	117.2	7022
	7.47	22.80	3.97	63	261.5	115	0.70	117.2	7139
	7.45	23.07	3.99	57	255.5	116	1.30	117.2	7256
	7.58	23.39	4.01	56	254.5	115	0.50	117.2	7373
	7.47	23.47	4.03	62	260.5	115	0.40	117.2	7490
	7.48	23.55	4.02	69	267.5	115	0.30	117.2	7608
	7.46	23.18	4.02	70	268.5	114	0.50	117.2	7725
	7.39	22.84	3.99	81	279.5	115	0.40	117.2	7842
	7.31	22.54	4.07	90	288.5	114	0.60	117.2	7959
	7.56	23.01	4.00	6	204.5	115	0.0	117.2	8077
	7.08	20.62	3.22	92	295.9	113	3.00	117.2	8194
	7.29	21.59	3.30	77	280.9	115	1.50	117.2	8311
	7.31	21.92	3.28	61	264.9	115	0.80	117.2	8428
	7.37	21.81	3.48	63	266.9	114	0.60	117.2	8546
	7.34	21.78	3.69	74	277.9	114	0.50	117.2	8663
	7.42	22.03	3.71	76	279.9	114	0.40	117.2	8780

Table 2.3-1 (continued)

Date	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	Eh (mV)	Specific Conductivity (µS/cm)	Turbidity (NTU[a])	Purge Volume between Samples (gal.)	Cumulative Purge Volume (gal.)
8/23/13	7.26	21.11	2.38	49	252.9	116	0.70	125.0	8905
	7.40	21.14	2.69	81	284.9	115	0.60	125.0	9030
	7.32	21.21	2.82	79	282.9	115	0.40	125.0	9155
	7.35	21.31	3.02	78	281.9	115	0.60	125.0	9280
	7.31	21.43	3.19	76	279.9	115	0.50	125.0	9405
	7.28	21.53	3.20	76	279.9	114	0.50	125.0	9530
	7.34	22.47	3.26	54	257.9	114	0.50	125.0	9655
	7.38	22.90	3.34	67	265.5	115	0.40	125.0	9780
	7.28	22.09	3.72	52	255.9	114	0.50	125.0	9905
	7.27	22.16	3.66	54	257.9	114	0.60	125.0	10,030
	7.27	22.27	3.80	56	259.9	114	0.40	125.0	10,156
	7.30	22.96	3.91	56	254.5	114	0.70	125.0	10,281
	7.30	22.98	3.97	62	260.5	114	0.50	125.0	10,406
	7.29	23.24	3.93	57	255.5	114	0.40	125.0	10,531
	7.29	23.41	3.95	55	253.5	114	0.30	125.0	10,656
	7.30	23.69	4.23	63	261.5	114	0.30	125.0	10,781
	7.29	23.65	4.05	58	256.5	114	0.40	125.0	10,906
	7.31	23.67	4.02	63	261.5	114	0.40	125.0	11,031
	7.31	24.22	4.05	60	258.5	114	0.70	125.0	11,156
	7.33	24.06	4.06	64	262.5	114	0.50	125.0	11,281
	7.32	24.34	4.07	63	261.5	115	0.60	125.0	11,406
	7.34	24.73	4.08	61	259.5	115	0.90	125.0	11,531
	7.32	25.04	4.10	61	259.5	114	0.50	125.0	11,656
	7.34	24.45	3.98	75	273.5	115	0.50	125.0	11,781
	7.27	24.58	4.18	76	274.5	114	0.80	125.0	11,906
	7.28	24.84	4.06	68	266.5	115	0.70	125.0	12,031
	7.30	24.79	4.06	71	269.5	115	0.70	125.0	12,156
	7.29	24.16	4.19	55	253.5	114	0.80	125.0	12,281
	7.27	23.98	4.00	72	270.5	114	0.60	125.0	12,406
	7.24	24.02	3.97	68	266.5	114	0.70	125.0	12,531
	7.23	23.78	3.97	74	272.5	114	0.40	125.0	12,656
	7.24	23.80	3.96	78	276.5	114	0.50	125.0	12,782
	7.24	23.75	3.96	85	283.5	114	0.30	125.0	12,907
	7.25	23.70	3.96	86	284.5	114	0.40	125.0	13,032
	7.25	23.76	3.97	83	281.5	114	0.40	125.0	13,157
	7.22	23.17	3.96	85	283.5	114	0.50	125.0	13,282
	7.19	22.97	3.96	83	281.5	114	0.30	125.0	13,407
	7.23	23.31	3.95	73	271.5	114	0.40	125.0	13,532

Table 2.3-1 (continued)

Date	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	Eh (mV)	Specific Conductivity (µS/cm)	Turbidity (NTU[a])	Purge Volume between Samples (gal.)	Cumulative Purge Volume (gal.)
8/23/13 (cont.)	7.13	22.26	4.00	83	286.9	114	0.30	125.0	13,657
	7.14	21.88	3.99	83	286.9	114	0.30	125.0	13,782
	7.14	22.08	4.06	69	272.9	114	0.30	125.0	13,907
	7.18	22.47	4.09	68	271.9	114	0.30	125.0	14,032
8/24/13	6.90	19.40	3.03	86	289.9	119	0.90	114.8	14,147
	7.12	19.25	3.02	97	300.9	121	0.90	114.8	14,262
	7.19	19.14	2.99	103	306.9	122	0.90	114.8	14,376
	7.30	19.14	2.97	109	312.9	122	1.00	114.8	14,491
	7.29	19.15	2.97	115	318.9	122	1.00	114.8	14,606
	7.31	19.63	4.08	118	321.9	123	1.30	114.8	14,721
	7.41	20.06	4.53	117	320.9	118	1.20	114.8	14,836
	7.45	20.30	4.86	118	321.9	118	1.10	114.8	14,951
	7.30	21.82	3.80	97	300.9	115	0.70	114.8	15,065
	7.28	21.98	3.64	69	272.9	114	0.60	114.8	15,180
	7.30	22.01	3.63	59	262.9	114	0.40	114.8	15,295
	7.23	22.05	3.62	53	256.9	114	0.40	114.8	15,410
	7.32	21.99	3.64	52	255.9	114	0.40	114.8	15,525
	7.27	22.05	3.66	52	255.9	114	0.30	114.8	15,640
	7.26	22.17	3.72	40	243.9	114	0.50	114.8	15,754
	7.24	22.08	3.73	61	264.9	114	0.40	114.8	15,869
	7.21	22.33	3.73	65	268.9	114	0.50	114.8	15,984
	7.26	22.48	3.76	71	274.9	114	0.40	114.8	16,099
	7.18	22.69	3.81	70	268.5	114	0.70	114.8	16,214
	7.20	23.18	3.82	65	263.5	114	0.20	114.8	16,329
	7.20	23.83	3.82	73	271.5	114	0.40	114.8	16,443
	7.17	23.22	3.88	105	303.5	114	0.30	114.8	16,558
	7.14	23.42	3.90	122	320.5	114	0.30	114.8	16,673
	7.15	23.08	3.92	123	321.5	114	0.30	114.8	16,788
	7.12	22.71	3.94	94	292.5	114	0.30	114.8	16,903
	7.21	22.92	3.99	63	261.5	114	0.40	114.8	17,018
	7.20	22.83	3.99	52	250.5	114	0.20	114.8	17,132
	7.19	23.44	4.00	43	241.5	114	0.10	114.8	17,247
	7.27	22.86	4.04	69	267.5	114	0.30	114.8	17,362
	7.23	22.38	4.11	79	282.9	114	0.30	114.8	17,477
	7.29	22.85	4.26	72	270.5	114	0.30	114.8	17,592
	7.22	23.76	4.27	61	259.5	114	0.30	114.8	17,707
	7.18	22.31	3.92	57	260.9	114	0.30	114.8	17,821
	7.17	22.06	3.92	55	258.9	114	0.30	114.8	17,936

Table 2.3-1 (continued)

Date	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	Eh (mV)	Specific Conductivity (µS/cm)	Turbidity (NTU[a])	Purge Volume between Samples (gal.)	Cumulative Purge Volume (gal.)
8/24/13	7.21	22.27	3.93	60	263.9	114	0.30	114.8	18,051
	7.21	21.97	3.93	61	264.9	113	0.30	114.8	18,166
	7.17	21.79	3.95	61	264.9	114	0.30	114.8	18,281
	7.24	21.57	3.95	60	263.9	113	0.30	114.8	18,396
	7.24	21.56	3.96	59	262.9	113	0.30	114.8	18,510
	7.21	21.47	3.97	59	262.9	113	0.30	114.8	18,625
	7.20	21.20	3.94	55	258.9	113	0.30	114.8	18,740

[a] NTU = Nephelometric turbidity unit.

[b] The pH probe is suspected of providing questionable pH values on August 22, 2013. A different probe was used after 14:20.

Table 4.0-1
CdV-R-37-2 Survey Coordinates

Identification	Northing	Easting	Elevation
CdV-R-37-2 brass cap embedded in pad	1759388.27	1619252.47	7330.39
CdV-R-37-2 ground surface near pad	1759389.60	1619251.49	7330.19
CdV-R-37-2 top of stainless-steel well casing	1759381.42	1619254.27	7333.08
CdV-R-37-2 top of 14-in. protective casing	1759381.52	1619254.00	7334.35

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

Appendix A

CdV-R-37-2 Indicator Suite and Dedicated Sampling System Equipment Blank Analytical Results