May 2023
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Well R-49 Maintenance Report

N3B Los Alamos

EM2023-0243

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Acronyms and Abbreviations

APV	access port valve
bgs	below ground surface
CV	casing volume
DO	dissolved oxygen
gpm	gallons per minute
I.D.	inside diameter
LANL	Los Alamos National Laboratory
LIC	liquid inflation chamber
NTU	nephelometric turbidity unit
ORP	oxidation-reduction potential
PVC	polyvinyl chloride
TA	technical area

1.0 INTRODUCTION

This report presents the well maintenance activities performed from January to February 2023 at well R-49. The primary objective of the report is to document the well maintenance activities and the current sampling system configuration in well R-49. This work was conducted as prescribed in the "Field Implementation Plan for Repair of Wells R-40, R-44, R-49, R-58 and CdV-16-1(i)" of October 2022 (Appendix A). The R-49 sampling system details are presented in Figure 1.0-1 of this report. Figure 1.0-2 indicates the approximate location of R-49.

Planned repairs at well R-49 focused on resolving the downhole pressure leak in the sampling system. No exceptions to the field implementation plan occurred.

1.1 Background

Well R-49 is located in Pajarito Canyon, Technical Area 36 (TA-36), of Los Alamos National Laboratory (LANL or the Laboratory), Los Alamos County, New Mexico. The original purpose of R-49 was to characterize the presence and nature of a potential perched groundwater zone, and if groundwater was present, to provide detection monitoring of potential impacts to perched intermediate-depth groundwater from sources at adjacent Material Disposal Area G at TA-54. Because the targeted perched water was absent, the decision was made to drill deeper to the regional aquifer, rather than abandon the borehole. A detailed description of the well installation is in "Completion Report for Regional Aquifer Well R-49" (LANL 2009).

The R-49 borehole was drilled to a total depth of 977.5 ft below ground surface (bgs). Groundwater was first recognized in the regional aquifer at approximately 901 ft bgs. After this zone was sampled and evaluated, the borehole was drilled deeper and another, more productive, groundwater zone was encountered at 953 ft bgs before total depth was achieved.

A 5-in.-inside-diameter (I.D.) stainless-steel well casing with two screened intervals was constructed in the borehole during May to June 2009. The upper screened interval (screen 1) is 10 ft long at a depth of 845 to 855 ft bgs. The lower screened interval (screen 2) is 20.8 ft long at a depth of 905.6 to 926.4 ft bgs. The well screens are separated by an inflatable packer as part of the permanent sampling system to ensure isolation of each screen interval. The composite depth to water after well installation and well development was 832.4 ft bgs.

The well was outfitted with a Baski, Inc., dual-screen sampling system to monitor both screened intervals. The sampling system was configured with a shrouded submersible Grundfos 5S20-39DS pump, one access port valve (APV) for the upper screened interval, and one APV for the lower screened interval. The submersible pump column consisted of threaded and coupled 1-in.-I.D. stainless-steel pipe. A weep valve was installed at the bottom of the uppermost 20-ft pipe joint to protect the pump column from freezing. The system included a liquid inflation chamber (LIC) and one viton-wrapped isolation packer between the screened intervals. To measure water levels in the well, two 1-in.-I.D. schedule 80 polyvinyl chloride (PVC) tubes were banded to the pump column for dedicated transducers.

Although well R-49 has remained functional, the sampling system was unable to maintain pressure without the use of nitrogen tanks supplying supplemental pressure at the wellhead and preventing crossflow between screen 1 and screen 2. The objectives of the maintenance activities described in this report were to evaluate the cause of sampling system pressure loss, to replace or repair any failed system components, and to reinstall and test the functionality of the sampling system.

This report describes the activities associated with removing, repairing, and reinstalling the R-49 sampling system during January to February 2023.

2.0 REMOVAL OF DUAL-SCREEN SAMPLING SYSTEM

Transducers were removed from the R-49 well by Groundwater Monitoring Program personnel before January 23, 2023, when mobilization occurred. On January 23 and 24, 2023, a hoist rig was used to remove the dual-screen sampling system, which appeared to be in good condition.

Visual tests using Swagelok Snoop applied to component Swagelok fittings and pressure gauge tests of the R-49 sampling system inflation lines were conducted at the wellhead prior to system removal and as the system was removed. Pressure gauge tests confirmed an apparent leak in the lower APV of the sampling system. The lower APV was removed from the sampling system on January 25, 2023, and returned to the manufacturer for repairs on January 26, 2023.

A video log of the 5-in. well casing was performed following sampling system removal. Screens appeared clean with exception of a thin film, with no buildup, on one side of the upper screen, and a coating of very fine sediment on the lower screen. A summary of the video logging run is in Table 2.0-1. DVD recordings of the logging runs are included as Appendix B.

3.0 WELL REDEVELOPMENT

On January 24, 2023, the lower screened interval was brushed to remove the thin bacterial growth and sediment observed in the camera survey. The brushing tool consisted of 5-in.-diameter nylon brushes attached to a cable sand-line. The brush was raised and lowered rapidly through the well screens to remove the bacterial growth and sediment. The follow-up downhole camera survey was performed on January 25, 2023, and indicated no film present on the upper screen and removal of about 80 percent of fine sediment buildup previously observed.

Final well redevelopment was performed using the permanent 4-in. Grundfos, 2-horsepower, submersible pump. The submersible pump was reinstalled in the well on February 3, 2023. The well was pumped for a total of 168.5 hr from February 4 to February 24, 2023. Approximately 22,800 gal. of groundwater was purged using the submersible pump during well redevelopment.

4.0 REINSTALLATION OF DUAL-SCREEN SAMPLING SYSTEM

The repaired lower APV was returned to the site on February 1, 2023, and the R-49 sampling system was reinstalled between February 1 and February 3, 2023. Installation activities were conducted in accordance with “Groundwater Monitoring Well Dual-Screen Sampling System installation and Testing” (N3B 2020a), and “Pneumatic Leak Testing of Groundwater Sampling and Packer Pressurization Equipment” (N3B 2020b).

The 1/4-in. stainless-steel actuation and packer tubing was replaced with new 1/4-in. stainless-steel tubing. The 1/4-in. nylon pump vent tubing was replaced with new 1/4-in. nylon tubing. Fittings were replaced as needed. The lower depth-to-water inlet was modified by adding a 1/4-in.-diameter, 12-in.-long stainless-steel screen to the stainless-steel tubing below the packer and within the PVC above the pump shroud. A new splice was made between the 12-gauge electrical cable and pump pigtail. The brass bleeder orifice was replaced with a stainless-steel bleeder orifice.

Upon reinstallation, the upper and lower APVs, LIC, and packer were pressure tested. Pressure tests were performed after nitrogen lines were attached into any fitting that either actuated the APVs or pressurized the LIC, packer, and closed sides of the APVs. The LIC, packer, and closed sides of the APVs were tested at approximately 240 psi. The upper and lower APV actuation lines were pressure tested at 400 psi. Pressure tests were within the range expected to be applied to the system during operation. No leaks were identified during testing. The 7-day continuous pressure test was conducted from February 3–10, 2023, and confirmed no detectable sampling system pressure leaks.

The pump shroud was set from 860.3 to 864.9 ft bgs. The upper APV screen midpoint was set at 873.0 ft bgs. The LIC was set from 874.7 to 879.4 ft bgs, and the packer was set from 887.4 to 892.2 ft bgs. The lower APV screen midpoint was set at 904.2 ft bgs.

Water level measurements for each screen are accessed via two 1-in.-I.D. schedule 80 PVC transducer gauge tubes. The gauge tubes were installed to a depth of 857.6 ft bgs. The upper transducer gauge tube is fitted with a 6-in. section of 0.020-in. slot screen and bottom cap, providing upper screen water level measurements. The lower transducer gauge tube bottom cap is fitted to stainless-steel tubing that extends to 894.7 ft bgs through the pump shroud, LIC, and packer providing lower screen water level measurements.

Table 4.0-1 provides R-49 well and sampling system component details.

Appendix D of N3B-GDE-ER-6011, “Groundwater Monitoring Well Dual-Screen Sampling System Installation and Testing,” outlines the packer and APV pressure requirements (N3B 2020a). The pressure requirement calculations are presented in sections 4.1 and 4.2 of this report.

4.1 Minimum Packer Pressure Requirements

The formula used to determine the minimum packer inflation pressure is as follows:

$$R_{\min} = 50 + M\left(50, 0.2h\right) + \frac{d_p - d_{hswl}}{2.31} \qquad \textbf{Equation 1}$$

where R_{min} = minimum packer inflation pressure required, in psi

$M(a,b)$ = the maximum of a (50) or b (0.2h)

h = head difference above and below packer, in feet

d_p = depth to packer, in feet

d_{hswl} = depth to the higher static water level of the two zones above and below the packer (usually that of the upper zone), in feet

Using the information for the R-49 sampling system configuration of

a = 50

b = 0.2 × 23.47 = 4.69

h = 23.47

d_p = 887

d_{hswl} = 819

the minimum packer inflation pressure is 129 psi.

4.2 Maximum Packer Pressure Allowable

The formula used to estimate the maximum safe packer pressure is as follows:

$$R_{\max} = 300 + \frac{M(-27, d_p - d_{lpwl})}{2.31}$$

Equation 2

where R_{max} = maximum allowable packer inflation pressure, in psi

$M(a,b)$ = the maximum of a (−27) or b (d_p-d_{lpwl})

d_p = depth to packer, in feet

d_{lpwl} = depth to lower pumping water level of the two zones, in feet

Using the information for the R-49 sampling system configuration of

d_p = 887

d_{lpwl} = 819

the maximum packer inflation pressure is 329 psi.

The manufacturer, Baski, Inc., proof-tested the packer to 300 psi in a 5-in.-I.D. pipe without apparent leakage or damage. Baski should be contacted for information about operating the packer at inflation pressures in excess of 300 psi.

4.3 Target and Action Packer Pressures

The target packer pressure is the pressure for which the packer operates and is set at halfway between the minimum and maximum packer pressures. The target packer pressure at R-49 is 229 psi.

The action packer pressure is the pressure below which the packer pressure should not be allowed to drop and is set at halfway between the minimum and target pressures. The action packer pressure at R-49 is 179 psi.

4.4 System Test

After the sampling system was reinstalled, the packer was inflated to approximately 247 psi and remained stable within 2 psi with no trend for a period of 7 days, indicating a successful pressure test. Table 4.4-1 presents the pressure test dates, times, and measured packer pressures.

5.0 CROSS-FLOW ESTIMATES

The volume of water that flowed from the upper screened interval to the lower screened interval was estimated using specific capacity and hydraulic head data. This estimate of cross-flow volume is needed to determine the amount of cross-flow water to be purged from the well. The cross-flow rate can be computed using the following formula:

$$Q = h\frac{c_1 c_2}{c_1 + c_2}$$

Equation 3

where Q = cross-flow rate, in gallons per minute (gpm)

c_1 = specific capacity of screen 1, in gpm/ft

c_2 = specific capacity of screen -2, in gpm/ft

h = head difference between screens 1 and 2

Specific capacity of screen 1 is 0.075 gpm/ft and specific capacity of screen 2 is 3.34 gpm/ft, as indicated in "Completion Report for Regional Aquifer Well R-49," (LANL 2009), Appendix C-8.4 and Appendix C-9.5, respectively. The head difference between screen 1 and screen 2 is approximately 23.47 ft, as indicated in Appendix C-1.0 of the referenced report. Applying this formula yields a cross-flow rate of approximately 1.72 gpm at R-49.

When the sampling system was removed, the packer was deflated at 8:40 a.m. on January 23, 2023. At 4:55 p.m. on January 25, 2023, the packer was temporarily reinstalled and inflated while the lower APV was being repaired. Upon receipt of the rebuilt lower APV, the packer was deflated at 9:25 a.m. on February 1, 2023. Following reinstallation, the permanent packer was inflated at 2:45 p.m. on February 3, 2023. Thus, cross-flow occurred for 6,573 minutes during system maintenance activities.

The estimated cross-flow volume is calculated by multiplying the cross-flow period duration by the cross-flow rate, yielding 11,306 gal. Two hundred percent of the estimated cross-flow volume yields a lower screen purge volume of 22,612 gal.

Approximately 22,797 gal. of water was purged from the lower screen zone between February 4 and 24, 2023.

6.0 PURGE VOLUME REQUIREMENTS

One casing volume (CV) of water from the screen 1, based on a groundwater elevation of 819 ft bgs and a water column of 68.4 ft above the packer in the 5-in.-I.D. stainless-steel casing (1.02 gal./ft), is approximately 69.8 gal. The 1-in. stainless-steel drop pipe from surface to the top of the upper APV screen contains approximately 35.9 gal., for a single CV plus drop pipe volume of 105.7 gal. Three CVs plus drop pipe is about 245.3 gal. At a pumping rate of 2.5 gpm, the time to purge 3 CVs plus drop pipe from the lower screen section is about 1.6 hr.

One CV of water from screen 2 is about 58.2 gal., based on a water column from below the packer at 892.2 ft bgs to the bottom of the well at 949.3 ft bgs or 57.1 ft in the 5-in.-I.D. casing. The 1-in. stainless-steel drop pipe from surface to the top of the lower APV screen contains approximately 37.2 gal., for a single CV plus drop pipe volume of 95.4 gal. Three CVs plus drop pipe is approximately 211.8 gal. At a pumping rate of 2.5 gpm, the time to purge 3 CVs plus drop pipe from the lower screen section is about 1.4 hr.

Table 6.0-1 lists the parameters associated with calculation of the purge volumes at each screen.

7.0 GROUNDWATER QUALITY PARAMETERS

During the pumping stage of well redevelopment, groundwater turbidity, temperature, pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), and specific conductance were measured using a flow-through cell connected to the well discharge pipe. During well redevelopment, pH ranged from 7.66 to

8.30 and temperature ranged from 12.6 to 22.6°C. DO concentrations varied from 5.03 to 6.66 mg/L. ORP values varied from 87.3 mV to 305.4 mV. The pH/ORP sensor used to determine ORP values consisted of a silver/silver chloride reference electrode and platinum reference junction. Specific conductance ranged from 132.7 µS/cm to 162.0 µS/cm, and turbidity values varied from 0.08 to 4.51 nephelometric turbidity units (NTU). Suspended solids concentration as measured by the Imhoff cone, was 0 ml/L.

The final parameters at the end of well development were pH of 8.23, temperature of 21.5ºC, DO of 6.18 mg/L, ORP of 157.6 mV, specific conductance of 142.5 µS/cm, and turbidity of 0.14 NTU. Table 7.0-1 shows groundwater quality parameters and purge volumes measured during well development.

8.0 SUMMARY

A pressure leak in the lower APV was identified during diagnostic testing of the sampling system. The APV was removed and returned to the manufacturer for repairs. Following the repair of the system, visual and pressure gauge tests, including the 7-day continuous pressure test, confirmed that the system was holding pressure. Overall, the testing of the R-49 dual-screen sampling system demonstrated that the system functions properly following repairs.

The 2023 well maintenance event at well R-49 was successful and the well was returned to service on March 22, 2023, as part of the Interim Facility-Wide Groundwater Monitoring Program at the Laboratory. The as-built schematic of the sampling system presented in Figure 1.0-1 should be used as a reference for future groundwater monitoring activities at well R-49.

9.0 REFERENCES

LANL (Los Alamos National Laboratory), October 2009, “Completion Report for Regional Aquifer Well R-49,” Los Alamos National Laboratory document LA-UR-09-6564, Los Alamos, New Mexico. (LANL 2009)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), November, 30, 2020. “Groundwater Monitoring Well Dual-Screen Sampling System Installation and Testing,” Newport News Nuclear BWXT-Los Alamos, LLC, document N3B-GDE-ER-6011, Revision 0, Los Alamos, New Mexico. (N3B 2020a)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), December 17, 2020. “Pneumatic Leak Testing of Groundwater Sampling and Packer Pressurization Equipment,” N3B Newport News Nuclear BWXT-Los Alamos, LLC, document N3B-SOP-ER-6003, Revision 0, Los Alamos, New Mexico. (N3B 2020b)

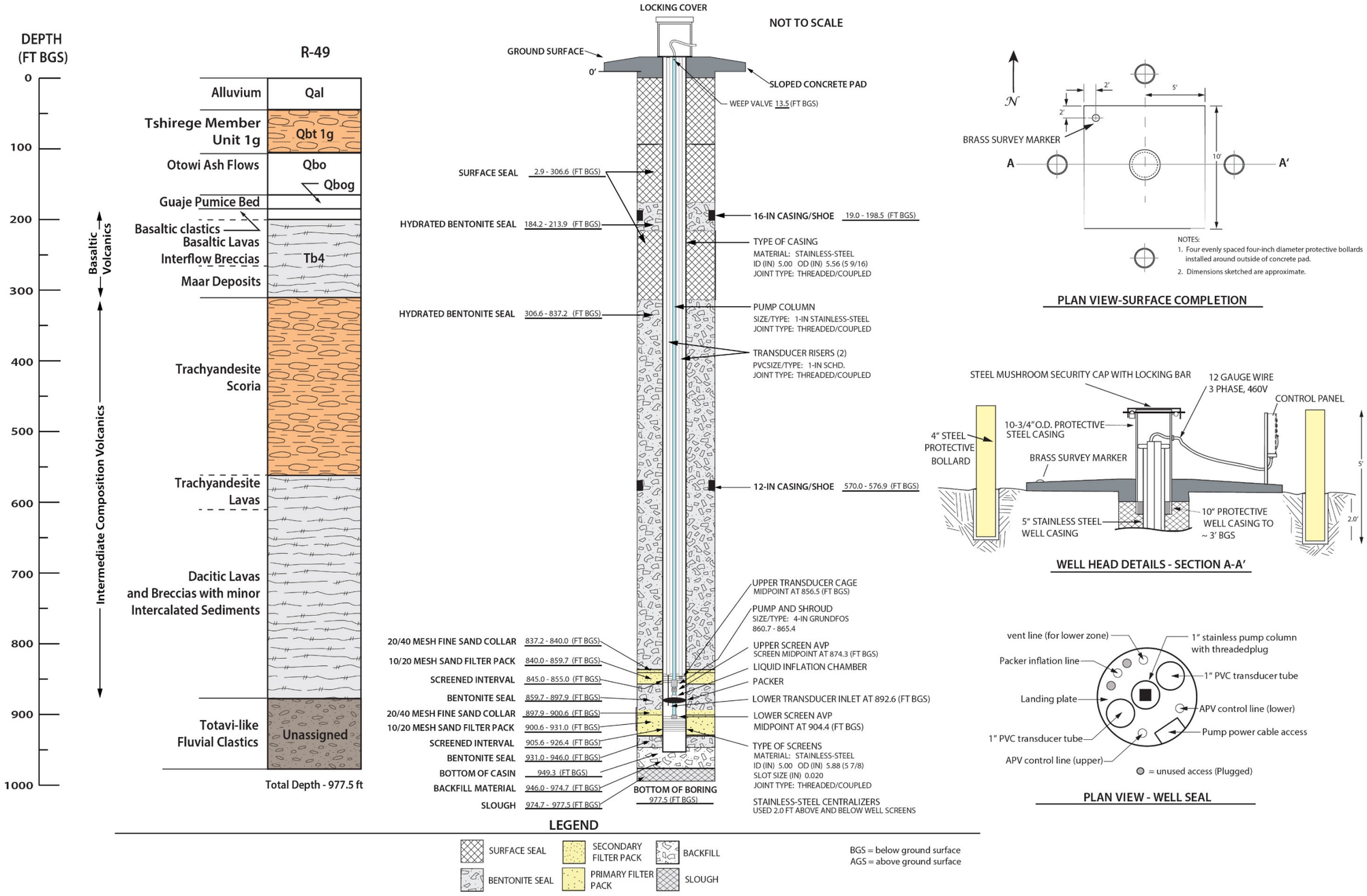

Figure 1.0-1 Monitoring well R-49 as-built diagram with borehole lithology and technical well completion details

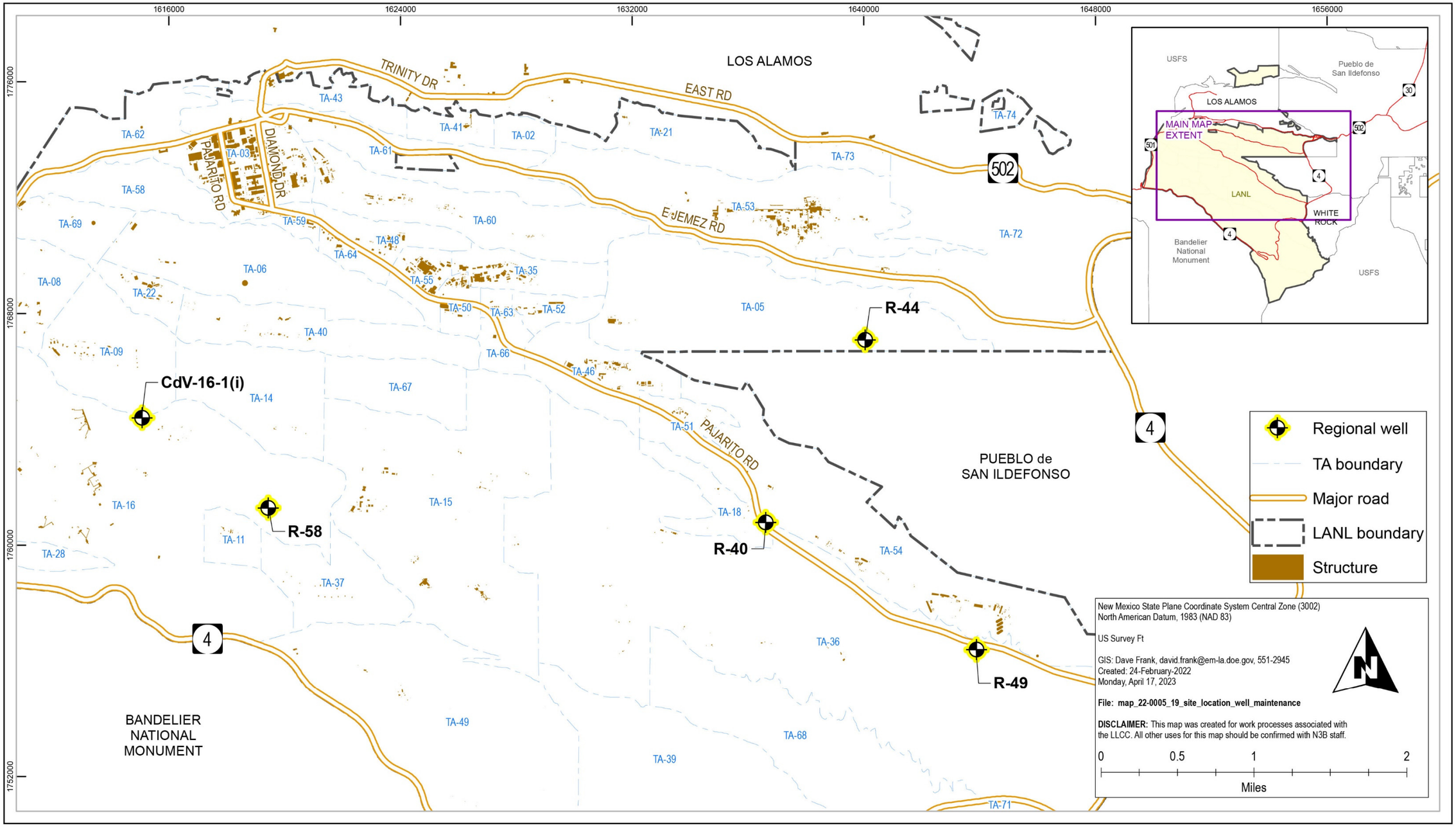

Figure 1.0-2 Location of Well R-49

Table 2.0-1
R-49 Video Logging Run

Date	Logging Interval	Description
1/24/2023	Ground surface to 950 ft bgs	Video log run in the completed well casing. DVD included as Appendix B.
1/25/2023	Ground surface to 930 ft bgs	Video log run in the completed well casing. DVD included as Appendix B.

Table 4.0-1
R-49 Well and Sampling System Details

	Upper Screen (ft bgs)	Lower Screen (ft bgs)	Sump (ft bgs)*	Upper Gauge Tube Screen (ft bgs)	Pump Shroud (ft bgs)	Upper APV Screen (ft bgs)	LIC (ft bgs)	Packer (ft bgs)	Lower Gauge Tube Intake (ft bgs)	Lower APV Screen (ft bgs)
Top	845.0	905.6	887.4	857.0	860.3	872.9	874.7	887.4	893.7	904.1
Bottom	855.0	926.4	949.3	857.5	864.9	873.2	879.4	892.2	894.7	904.4

* The sump at 887.4 ft bgs is the top of the packer. The sump at 949.3 ft bgs is the bottom of the well casing.

Table 4.4-1
R-49 Packer Pressure Monitoring

Date	Time	Packer Pressure (psi)
2/4/2023	02:40 PM	247 (Lower APV open)
2/5/2023	02:30 PM	247 (Lower APV open)
2/6/2023	02:30 PM	247 (Lower APV open)
2/7/2023	02:30 PM	249 (Lower APV open)
2/8/2023	03:00 PM	249 (Lower APV open)
2/9/2023	03:00 PM	249 (Lower APV open)
2/14/2023	06:00 PM	247 (Lower APV open)

Table 6.0-1
R-49 Purge Volume Parameters

Screen	Top of Purge Zone (ft bgs)	Bottom of Purge Zone (ft bgs)	Length of Purge Zone (ft)	5-in. SS* Casing Volume (gal./ft)	1 CV (gal.)	1-in. SS Drop Pipe Volume (gal.)	1 CV + Drop pipe (gal.)	3 CV + Drop Pipe (gal.)	Purge Rate (gpm)	Purge Time (min)	Purge Time (hr)
Upper	819	887.4	68.4	1.02	69.8	35.9	105.7	245.3	2.5	98.1	1.6
Lower	892.2	949.3	57.1	1.02	58.2	37.2	95.4	211.8	2.5	84.7	1.4

* SS = Stainless steel.

Table 7.0-1
R-49 Purge Volumes and Groundwater Quality Parameters During Well Development

Date	pH	Temp (°C)	DO (mg/L)	ORP (mV)	Specific Conductivity (µS/cm)	Turbidity (NTU)	Purge Volume between Samples (gal.)	Cumulative Purge Volume (gal.)
2/4/2023	8.15	16.3	6.23	184.4	147.2	3.92	28	28
	8.17	18.6	6.07	183.4	160.5	1.57	14	42
	8.18	20.4	5.81	191.1	161.7	0.97	14	56
	8.23	20.4	5.71	204.4	162.0	0.68	14	70
	8.18	21.2	5.51	225.2	161.7	1.00	56	126
	8.17	21.4	5.69	255.9	159.7	0.51	70	196
	8.14	21.4	5.67	277.9	157.2	0.51	84	280
	8.11	21.7	5.44	179.9	154.4	0.48	84	364
	8.17	22.1	5.58	262.8	152.5	0.35	168	532
	8.18	22.4	5.55	298.1	151.8	0.27	168	700
	8.21	22.4	5.57	198.1	151.7	0.43	168	868
	8.15	22.2	5.63	201.7	151.4	0.37	168	1036
	8.14	22.2	5.53	199.5	151.3	0.68	168	1204
	8.16	22.1	5.69	305.4	151.2	0.57	168	1372
	8.12	21.5	5.70	199.4	150.1	0.31	168	1540
	8.12	21.3	5.86	212.2	150.3	0.38	168	1708
2/5/2023	7.72	21.8	5.63	246.1	153.6	0.37	252	1960
	7.71	22.2	5.49	195.2	153.1	0.20	168	2128
	7.74	22.3	5.64	182.1	157.8	0.28	168	2296
	7.77	22.4	5.64	173.3	149.4	0.15	168	2464
	7.77	22.6	5.69	174.4	148.3	0.13	168	2632
	7.73	22.4	5.74	175.5	147.6	0.09	168	2800
	7.72	22.3	5.71	188.8	147.0	0.10	168	2968
	7.73	22.2	5.72	176.4	146.1	0.12	168	3136
	7.68	22.2	5.77	177.5	146.1	0.15	168	3304
	7.66	22.0	5.80	182.7	145.4	0.10	168	3472
2/6/2023	7.76	21.4	6.16	154.6	148.7	0.22	224	3696
	8.04	21.9	5.75	173.7	148.6	0.11	168	3864
	8.04	21.9	5.76	180.4	148.0	0.10	168	4032
	8.06	22.3	5.77	174.4	146.6	0.09	168	4200
	7.94	22.0	5.77	184.6	144.9	0.10	168	4368
	7.98	21.7	5.84	188.2	144.1	0.09	168	4536
	8.04	22.1	5.84	245.6	144.0	0.11	168	4704
	7.86	21.3	5.83	202.9	143.0	0.09	168	4872
	7.89	21.6	5.86	198.4	142.9	0.10	168	5040

Table 7.0-1 (continued)

Date	pH	Temp (°C)	DO (mg/L)	ORP (mV)	Specific Conductivity (µS/cm)	Turbidity (NTU)	Purge Volume between Samples (gal.)	Cumulative Purge Volume (gal.)
	7.90	21.6	5.89	200.7	142.5	0.08	168	5208
2/7/2023	7.96	21.9	5.88	219.3	142.5	0.11	168	5376
	7.90	20.4	6.41	210.6	148.2	4.51	145.6	5521.6
	8.18	21.1	5.89	180.7	148.0	0.85	168	5689.6
	8.22	21.5	5.73	178.8	146.6	0.69	168	5857.6
	8.15	21.7	6.02	181.5	144.2	0.43	168	6025.6
	8.13	21.6	6.09	179.0	143.1	0.36	168	6193.6
	8.08	21.9	6.07	175.9	142.6	0.27	168	6361.6
	8.12	21.6	6.09	178.9	142.0	0.43	168	6529.6
	8.09	21.6	6.06	181.3	141.0	0.35	168	6697.6
	8.08	21.5	6.12	182.9	141.0	0.42	168	6865.6
	8.06	21.5	6.14	184.4	139.9	0.31	168	7033.6
	8.06	21.3	6.14	188.3	140.7	0.26	168	7201.6
2/8/2023	8.20	19.5	6.23	164.1	146.1	0.40	66	7267.6
	8.20	20.9	5.85	162.0	146.7	0.26	132	7399.6
	8.16	20.9	5.77	167.8	148.3	0.21	132	7531.6
	8.09	21.1	5.68	162.4	148.3	0.42	132	7663.6
	8.11	21.1	5.60	165.0	147.8	0.60	132	7795.6
	8.02	21.0	5.61	166.2	145.6	0.36	132	7927.6
	8.04	21.0	5.61	173.3	132.7	0.79	132	8059.6
	7.99	20.9	5.71	170.2	142.6	0.65	132	8191.6
	7.99	20.9	5.59	171.5	141.6	0.58	132	8323.6
	7.95	20.4	5.74	173.5	140.7	0.55	132	8455.6
2/9/2023	7.95	20.0	6.31	208.3	145.5	0.26	120	8575.6
	8.09	20.8	5.81	177.1	145.7	0.86	150	8725.6
	8.02	20.8	5.88	172.0	144.9	0.30	120	8845.6
	8.02	21.1	5.74	170.3	143.6	0.26	120	8965.6
	8.08	21.3	5.77	164.4	141.7	0.32	120	9085.6
	8.02	21.5	5.70	167.9	140.4	0.26	120	9205.6
	7.97	19.0	6.13	165.9	138.5	0.23	120	9325.6
	7.94	18.9	6.03	163.4	138.1	0.17	120	9445.6
	7.91	18.5	6.01	168.8	137.3	0.20	120	9565.6
	8.00	21.1	5.87	164.2	137.7	0.58	120	9685.6
	8.03	21.3	5.76	171.3	137.0	0.46	120	9805.6
2/10/2023	No parameters logged						330	10,135.6

Table 7.0-1 (continued)

Date	pH	Temp (°C)	DO (mg/L)	ORP (mV)	Specific Conductivity (µS/cm)	Turbidity (NTU)	Purge Volume between Samples (gal.)	Cumulative Purge Volume (gal.)
2/14/2023	7.87	13.1	5.03	152.3	142.9	0.52	98.7	10,234.3
	8.10	18.0	6.08	123.2	144.5	0.17	126	10,360.3
	8.10	18.4	5.97	87.3	144.3	0.15	126	10,486.3
	8.08	18.3	5.91	133.0	143.8	0.18	126	10,612.3
	8.08	18.1	5.95	132.1	143.4	0.26	126	10,738.3
	8.08	19.5	5.80	139.5	143.1	0.27	126	10,864.3
2/16/2023	8.17	20.4	6.28	192.4	145.4	0.12	157.5	11,021.8
	8.15	18.6	6.14	175.4	144.7	0.20	126	11,147.8
	8.13	18.8	6.00	176.1	144.6	0.14	126	11,273.8
	8.14	18.3	6.01	171.2	144.7	0.20	126	11,399.8
	8.13	19.2	6.01	173.0	144.6	0.12	126	11,525.8
	8.14	19.5	6.20	139.5	144.1	0.32	126	11,651.8
	8.15	19.6	6.06	172.6	143.1	0.22	126	11,777.8
	8.15	19.7	5.98	172.6	141.9	0.14	126	11,903.8
	8.16	19.8	6.10	176.5	141.4	0.26	126	12,029.8
	8.16	20.3	6.18	147.8	140.2	0.13	126	12,155.8
	8.17	19.7	6.25	150.3	139.5	0.13	126	12,281.8
2/17/2023	8.11	14.2	6.00	206.3	141.8	0.22	63	12,344.8
	8.18	17.3	6.33	189.4	144.5	0.15	126	12,470.8
	8.16	17.7	6.09	178.6	144.1	0.15	126	12,596.8
	8.15	18.9	5.97	170.4	144.1	0.15	126	12,722.8
	8.15	19.1	6.00	169.6	142.0	0.14	126	12,848.8
	8.14	20.0	5.94	156.1	140.9	0.13	126	12,974.8
	8.14	20.5	5.91	159.8	138.6	0.14	126	13,100.8
	8.15	20.2	5.92	167.3	137.1	0.12	126	13,226.8
	8.15	20.1	6.03	167.2	137.9	0.15	126	13,352.8
	8.15	20.7	6.00	169.9	139.3	0.14	126	13,478.8
	8.15	20.2	5.99	176.2	138.3	0.12	126	13,604.8
	8.15	19.6	6.07	181.9	137.2	0.13	126	13,730.8
2/18/2023	8.15	14.9	6.37	113.8	143.0	0.22	63	13,793.8
	8.14	16.6	6.38	176.0	144.0	0.15	126	13,919.8
	8.11	19.2	6.24	159.0	144.6	0.16	126	14,045.8
	8.12	18.0	6.16	130.5	142.8	0.15	126	14,171.8
	8.11	19.0	6.21	141.9	141.7	0.14	126	14,297.8
	8.10	20.0	6.17	128.5	140.9	0.11	126	14,423.8

Table 7.0-1 (continued)

Date	pH	Temp (°C)	DO (mg/L)	ORP (mV)	Specific Conductivity (µS/cm)	Turbidity (NTU)	Purge Volume between Samples (gal.)	Cumulative Purge Volume (gal.)
	8.10	20.5	6.17	129.6	139.5	0.14	126	14,549.8
	8.11	20.1	6.18	143.9	138.2	0.17	126	14,675.8
	8.12	20.3	6.18	155.1	137.5	0.19	126	14,801.8
	8.11	20.1	6.20	164.1	137.4	0.11	126	14,927.8
	8.12	20.0	6.10	172.2	137.2	0.12	126	15,053.8
	8.14	19.2	6.16	181.0	136.7	0.12	126	15,179.8
2/19/2023	8.12	13.3	6.25	250.1	134.5	0.14	63	15,242.8
	8.16	18.7	6.25	211.3	139.3	0.12	126	15,368.8
	8.13	20.3	6.10	197.4	142.6	0.15	126	15,494.8
	8.14	20.7	6.06	184.2	142.7	0.11	126	15,620.8
	8.14	20.7	6.11	187.1	140.2	0.13	126	15,746.8
	8.16	20.6	6.16	172.0	138.9	0.13	126	15,872.8
	8.14	20.7	6.16	180.8	137.7	0.14	126	15,998.8
	8.14	20.4	6.19	191.4	136.4	0.15	126	16,124.8
	8.18	19.6	6.16	193.3	135.4	0.14	126	16,250.8
	8.14	20.2	6.33	199.8	136.0	0.11	126	16,376.8
	8.15	20.0	6.22	205.7	135.2	0.12	126	16,502.8
	8.15	20.0	6.34	216.4	135.1	0.13	126	16,628.8
2/20/2023	8.10	15.8	6.01	101.9	138.4	1.13	63	16,691.8
	8.13	19.3	6.24	163.8	144.3	0.33	126	16,817.8
	8.11	19.8	6.17	168.1	143.8	0.16	126	16,943.8
	8.11	19.9	6.12	152.5	142.5	0.18	126	17,069.8
	8.10	20.9	6.09	140.2	140.9	0.14	126	17,195.8
	8.10	21.1	6.02	134.9	138.6	0.14	126	17,321.8
	8.09	21.1	6.14	140.0	137.7	0.15	126	17,447.8
	8.09	20.7	6.14	160.4	136.3	0.18	126	17,573.8
	8.09	20.9	6.20	169.5	136.1	0.12	126	17,699.8
	8.09	20.6	6.18	178.8	135.6	0.14	126	17,825.8
	8.10	20.5	6.30	186.5	135.0	0.11	126	17,951.8
	8.10	20.2	6.23	199.3	134.6	0.13	126	18,077.8
2/21/2023	8.08	14.4	6.55	261.8	134.0	0.19	63	18,140.8
	8.14	20.6	6.15	199.1	146.1	0.23	126	18,266.8
	8.12	21.0	6.17	190.4	144.6	0.18	126	18,392.8
	8.11	21.5	6.27	180.5	143.2	0.13	126	18,518.8
	8.10	21.1	6.24	174.4	141.5	0.16	126	18,644.8

Table 7.0-1 (continued)

Date	pH	Temp (°C)	DO (mg/L)	ORP (mV)	Specific Conductivity (µS/cm)	Turbidity (NTU)	Purge Volume between Samples (gal.)	Cumulative Purge Volume (gal.)
	8.11	21.3	6.27	171.8	139.5	0.33	126	18,770.8
	8.12	21.6	6.23	166.7	137.6	0.21	126	18,896.8
	8.13	20.8	6.43	187.9	135.6	0.16	126	19,022.8
	8.14	20.2	6.41	199.9	134.5	0.17	126	19,148.8
	8.14	20.2	6.38	205.4	135.5	0.18	126	19,274.8
	8.13	20.2	6.36	212.9	135.0	0.14	126	19,400.8
	8.12	20.3	6.39	216.8	134.7	0.10	126	19,526.8
2/22/2023	7.86	12.6	6.43	224.4	134.9	0.16	60	19,586.8
	8.21	18.1	6.32	179.3	145.2	0.13	120	19,706.8
	8.22	18.0	6.24	181.6	143.7	0.14	120	19,826.8
	8.21	18.8	6.19	181.6	141.8	0.13	120	19,946.8
	8.21	18.7	6.22	188.9	139.9	0.12	120	20,066.8
	8.22	18.7	6.30	188.6	137.9	0.13	120	20,186.8
	8.24	18.6	6.34	193.0	135.8	0.11	120	20,306.8
	8.22	18.0	6.39	197.6	135.5	0.17	120	20,426.8
	8.23	17.1	6.43	196.1	134.2	0.13	120	20,546.8
	8.22	17.5	6.38	198.4	134.9	0.18	120	20,666.8
	8.22	17.2	6.42	203.6	133.6	0.16	120	20,786.8
	8.22	17.4	6.42	211.9	133.7	0.12	120	20,906.8
2/23/2023	8.22	14.8	6.66	161.6	134.7	0.69	60	20,966.8
	8.27	18.8	6.44	176.9	145.2	0.23	120	21,086.8
	8.25	19.2	6.31	183.5	143.7	0.23	120	21,206.8
	8.24	19.6	6.35	176.5	142.9	0.42	120	21,326.8
	8.24	20.1	6.30	173.5	139.4	0.20	120	21,446.8
	8.23	20.0	6.49	176.9	138.2	0.11	120	21,566.8
	8.23	20.5	6.37	175.1	137.0	0.10	120	21,686.8
	8.23	20.1	6.43	185.4	135.2	0.08	120	21,806.8
	8.25	20.4	6.40	188.8	135.0	0.11	120	21,926.8
	8.23	20.8	6.50	195.4	134.6	0.17	120	22,046.8
	8.23	20.1	6.46	204.2	133.8	0.11	120	22,166.8
	8.23	20.4	6.42	212.2	134.5	0.10	120	22,286.8
2/24/2023	8.19	14.8	6.15	152.6	133.4	0.25	60	22,346.8
	8.30	19.8	6.19	157.0	145.4	0.17	120	22,466.8
	8.26	20.7	6.12	157.8	144.9	0.13	120	22,586.8
	8.24	21.1	6.16	152.4	143.1	0.14	120	22,706.8
	8.23	21.5	6.18	157.6	142.5	0.14	90	22,796.8

Appendix A

Field Implementation Plan for Repair of
Wells R-40, R-44, R-49, R-58 and CdV-16-1(i)

Field Implementation Plan for Repair of Wells R-40, R-44, R-49, R-58 and CdV-16-1(i)

October 2022

Primary N3B Representative:

Printed Name	Signature	Title	Organization	Date
Sherry Gaddy	Sherry Gaddy	Program Manager	N3B	10/11/2022

Layne Christensen Company Representative

Printed Name	Signature	Title	Organization	Date
Alex Gustafson		Project Manager	Layne	10/20/2022

October 2022

Field Implementation Plan for Repair of Wells R-40, R-44, R-49, R-58 and CdV-16-1(i)

N3B Los Alamos

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Tables

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ACRONYM LIST

DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ER	Environmental Remediation
ES&H	Environment, Safety and Health
FIP	field implementation plan
FTL	field team leader
IDW	Investigation derived waste
IWCP	integrated work control process
LANL	Los Alamos National Laboratory
LIC	liquid inflation chamber
NMED	New Mexico Environmental Department
N3B	Newport News Nuclear BWXT-Los Alamos, LLC
OM	operations manager
PLY	Pajarito Laydown Yard
POD	plan of the day
PPRR	Project Plan and Readiness Review
PVC	polyvinyl chloride
QA	quality assurance
RCT	radiological control technician
RLM	responsible line manager
SMO	sample management office
SOM	shift operations manager
SOP	standard operating procedure
SSEH&SP	site-specific environmental health and safety plan
SWPPP	Stormwater Pollution Prevention Plan
STR	subcontract technical representative
T&E	threatened and endangered
T2S	Tech2Solutions
VFD	Variable Frequency Drive
WCSF	Waste Characterization Strategy Form

1.0 INTRODUCTION

1.1 Background

Newport News Nuclear BWXT – Los Alamos, LLC (N3B) via Tech2Solutions (T2S) has contracted with Layne Christensen Company (Layne) to perform well repair activities of existing monitoring wells at Los Alamos National Laboratory (LANL), Los Alamos County, New Mexico (Figure 1). All work will be performed in accordance with the following:

- The IWCP for Well Repair of R-40, R-44, R-49, R-58 and CdV-16-1(i)
- The statement of work and technical specifications for Well Repair (Statement of Work)

This Field Implementation Plan (FIP) provides technical guidance for field activities associated with the Los Alamos National Laboratory (LANL) well repair project at monitoring wells R-40, R-44, R-49, R-58 and CdV-16-1(i), located in Los Alamos, New Mexico, as shown in Figure 1, Well Location Map.

The activities associated with the project include mobilization/demobilization of equipment, decontamination of equipment/tools, pressure leak testing, removal/assembly of plumbing between wellhead and manifold, pump system removal, packer removal/installation, swabbing/bailing, aquifer testing, collection of water quality parameters and water samples, video logging, reinstallation and testing of pump system.

As-built well diagrams and technical notes for the referenced wells are presented in Figures 2 through 10.

Project staff, health and safety are also discussed in this document.

1.2 Objectives

This FIP outlines the objectives for evaluation of nitrogen leaks and rehabilitation of Baski sampling systems in wells R-40, R-44 and R-49 and removal and replacement of pumping systems in wells R-58 and CdV-16-1(i) and well redevelopment at each well.

2.0 ORGANIZATIONAL STRUCTURE

This project is a joint effort of Newport News Nuclear BWXT (N3B), its subcontractor Tech2 Solutions and second-tier subcontractor Layne Christensen Company (Layne). An organizational chart is presented in Table 1.

2.1 N3B Project Management Team

The management team includes the Water Program Director, Program Manager, Project Manager, Environmental, Safety and Health (ES&H) Manager, Quality Assurance (QA) Manager, Procurement Manager, and ancillary staff to support and assist in all areas of the project. The management team will provide project management, prepare reports and deliverables, provide field support and oversight of repair tasks, and manage waste streams and sample analyses.

The ES&H Manager will provide ES&H assistance in accordance with Exhibit F of the request for proposal and the integrated work control process documents (IWCPs) and site-specific environmental, health and safety plan (SSEH&SP). Water Program field team leaders (FTLs) are trained as ES&H and QA representatives to provide ES&H and QA field oversight.

2.2 N3B Field Team

During the repair activities, there will be one full-time, on-site, Field Team Lead (FTL), who will act as site manager, ES&H representative, and QA representative. The FTL will maintain field notes detailing daily site activities including standby and documenting sample system installation. The FTL will also be responsible for, but not limited to, conducting daily safety meetings, compiling and submitting daily field reports, review and approval of Layne daily field reports, and collecting/documenting groundwater samples. A list of relevant standard operating procedures (SOPs) for the field project is presented in Table 2. The FTL will serve as a point of contact in conjunction with other field staff. Other on-site support personnel may be added to the field team as needed.

2.3 Well Repair Subcontractor

The Layne field team shall include a qualified pump hoist operator and additional personnel needed to safely and efficiently carry out planned activities. Other qualified staff or subcontracted service providers may be added as necessary to ensure all project requirements are met.

Layne personnel must be U.S. citizens, badged and trained before being approved for field work. Training has been outlined in a training matrix and supplied to Layne. Work crews must be of sufficient size to safely and effectively conduct the planned work, or the FTL on duty will pause/stop work until adequate manpower is present.

As the well repair subcontractor, Layne will support N3B with site safety and quality assurance at all times. All field staff are empowered to pause/stop work in accordance with N3B procedures.

Layne will ensure that equipment is appropriate for the goals of the field project and in proper working order, and that daily logs are maintained. In addition, Layne will support Water Program staff in video logging of the wells, as specified below.

3.0 FIELD ACTIVITIES

Field activities typically will include the following:

- Mobilization/demobilization
- pressure leak testing of packer inflation system
- removal/assembly of plumbing between wellhead and manifold
- pump system or Baski packer removal and reinstallation of new equipment
- video logging
- well redevelopment activities
- reinstallation and testing of the pumping system

The table below indicates the general tasks to be completed at each well site:

Well Number	Repair Tasks
R-40	Evaluate Baski sampling system and replace Baski packer, as needed
R-44	Evaluate Baski sampling system and replace Baski packer, as needed
R-49	Evaluate Baski sampling system and replace Baski packer, as needed
R-58	Replace sampling system pump
CdV-16-1(i)	Replace sampling system pump

The Exhibit A, statement of work, for well repair tasks will be used to guide field operations and ensure all objectives are met.

3.1 Readiness

N3B will coordinate readiness activities.

N3B will coordinate or be responsible for the following:

- Quality Management – Provide review of Layne's Quality Program for compliance and train field personnel to T2S 512.00.01, Rev. 0 "Project Quality Implementation Plan" before field operations.
- ES&H – Coordinate with Layne for their assistance in preparing the IWCP and in reviewing the SSEH&SP. Review training records for health and safety needs.
- Waste Characterization Strategy Form (WCSF) – Prepare plan, acquire required containers, and provide waste sampling criteria.
- Training Requirements – Define requirements and review all field staff records for completeness.
- Stormwater Pollution Prevention Plan (SWPPP) – Prepare or review SWPPP, if applicable, and implement engineered features to minimize impacts from storm water at drill site.
- Project Plan & Readiness Review (PPRR) – Compile all relevant documentation and determine resolutions for issues associated with the National Environmental Policy Act cultural resources and threatened and endangered (T&E) species.
- Spark and Flame Permit – Obtain and verify permit before all spark and flame producing operations.
- Training and Badges – Provide training and badges for all proposed field staff.
- Location of Potable Water Source – Define source, see 3.4 Mobilization
- Requests for Plan of the Day (POD) – Coordinate with Environmental Remediation (ER Ops) Operations staff regarding schedule of activities.
- Access Keys and Radios – Obtain keys and radios for field team.
- Inspections – Define items/tasks to be inspected and coordinate schedule for qualified inspections (e.g., rig inspection, electrical systems, sampling and pumping system assembly).
- Radiological Services – Coordinate schedule with radiological control technicians (RCTs) for the documentation and screening of incoming equipment and at final demobilization of equipment.
- Water Hauling – Provide potable water from J-stand, to be transported to sites by Layne for decontamination, as needed. Contaminated water to be stored temporarily in poly tanks at the site for WCSF sampling, waste characterization and disposition.

Layne will coordinate, or cooperate with the following:

- Assure that all personnel are U.S. citizens and are trained to applicable corporate ES&H and QA standards
- Assist N3B staff with IWCP and SSEH&SP preparation and review, and make all personnel available for LANL/N3B-required training and badging

- Provide hoist rig maintenance records and conduct a robust equipment inspection before delivery to LANL
- Assist N3B in inspection of rig and equipment at the Pajarito Laydown Yard, and provide decontamination of rig and equipment, before mobilization to well sites
- Assist N3B in inspection of rig and equipment at rig up inspection at each well site

3.2 Equipment

Well repair tasks will be facilitated with a pump hoist rig provided by Layne, with suitable auxiliary equipment including, but not limited to, air compressors, water truck/rig tender, forklifts, and manlift, as needed. Light plants will be provided by Layne, in case of work during night shifts, and be sufficient for adequate well pad lighting as verified by N3B light surveys.

This pump hoist will perform well redevelopment, installation of temporary pump systems for aquifer testing, and installation of the dedicated sampling system.

Material approvals and receipt inspections will be conducted by both Layne and N3B for all items, including initial inspection of rig and equipment when mobilized to LANL, any new wire rope and other hoist rigging delivered to site after mobilization.

Layne will be responsible for delivery of all fuel necessary for equipment operation to the well sites for R-40, R-44 and R-49 and to the Pajarito Laydown Yard (PLY). Fuel deliveries to wells R-58 and CdV-16-1(i), both of which are located in the Weapons Facility Operations (WFO) at Technical Area TA-16, will be coordinated with Triad. The placement of an aboveground storage tank on-site is allowed, with placement on secondary containment. No more than 1320 gals of fuel will be allowed at well sites R-40, R-44 and R-49 site at any time, excluding vehicle fuel tanks, to avoid application of spill prevention control and countermeasure (SPCC) rules.

3.3 Waste Collection

Investigation-derived waste (IDW) will be managed in accordance with standard operating procedure (SOP) N3B-EP-SOP-10021, “Characterization and Management of Environmental Program Waste.” This SOP incorporates the requirements of applicable U.S. Environmental Protection Agency (EPA) and New Mexico Environmental Department (NMED) regulations, Department of Energy (DOE) orders, and N3B requirements. The primary waste streams will include development water, purge water generated during redevelopment, decontamination water, and contact waste. Details are located in the WCSFs for the individual wells.

3.4 Mobilization

Equipment and supplies for the completion of the project will be staged at each work site in an organized and secure manner. Surplus and/or inactive equipment and supplies may be stored at the PLY located at the northwest corner of Pajarito Road and New Mexico State Road 4. Access to the laydown yard is through a locked gate and is limited to the hours of 7 a.m. to 7 p.m. unless prior authorization is granted.

Mobilization to each site will consist of transporting and setting up equipment at the well site and will include the following:

- Mobilize pump hoist rig, trailers, support vehicles, materials, and tools to the well site.
- Set up pump hoist rig, trailers, support vehicles and tools at the location.
- Complete pump hoist rig up inspection.

- Review scope of work and project-specific health and safety issues with crew.
- Complete all required training for all personnel.
- Obtain Environmental Remediation (ER) Responsible Line Manager (RLM)/ Operations Manager's (OM) authorization through the Plan-of the-Day (POD), including rig inspection and Integrated Work Control Process form (IWCP) review.

Site access routes have been established for all sites. The water source for the project will be the J-stand located on Eniwetok Drive, adjacent to building number 60-0287.

Since no soil disturbance exceeding one acre per site is expected, no SWPPP is required. In the event pad repairs or snow removal are required during repair operations, Layne will support N3B ER Crafts crews in these operations. If snow removal is necessary, N3B will maintain access to the well pad, and Layne will be responsible for clearing snow from the pad. Layne will ensure that work areas will always be kept free of ice to maintain safe working conditions.

Decontamination of any pumping system components that will be placed downhole during well repair and redevelopment (including packer, drop pipe, APVs, pump, pump shroud, liquid inflation chamber (LIC), etc.) will be hot water/steam pressure rinsed, washed with non-phosphatic Alconox® or Liquinox® detergent, hot water/pressure rinsed again, then wrapped in plastic after air drying prior to the start of repair and redevelopment activities. Decontamination water will be containerized in 55-gal drums or poly-tanks, properly labeled, and stored on-site for characterization and disposal. For water quality testing, it is anticipated that samples would be collected directly from a spigot mounted at the wellhead.

Decontamination of sample tools will be performed with a wire brush followed by spraying with Fantastik® and wiping clean with paper towels. If bailers are used for collecting groundwater samples, they will be washed with Liquinox® detergent and potable water and rinsed with deionized water before sample collection. The deionized water would be provided by N3B.

3.5 Planned Repair Tasks at Well Sites

Wells R-40, R-44 and R-49 - Baski Sampling System Evaluation and Packer Replacement

At each of these wells, all of which are 5-inch inside diameter (ID) dual-screen monitoring wells with Baski sampling and pumping systems in place, Layne Christensen will perform pressurized leak tests with nitrogen and troubleshoot pneumatic fittings for inflation lines for the inflatable packer, and upper and lower access port valves at the wellhead.

Upon confirmation that the apparent pressure leak is downhole, Layne will begin removing the sampling system from the well, performing pressure testing of all fittings at each stage. If it is determined that the existing packer is the source of the leak, a new packer will be prepared for installation in the well. The packer is provided by N3B.

Upon removal of the complete sampling system, Layne will provide access and assist T2S crew for video logging.

Layne will reinstall the sampling system, consisting of the existing pump, pump shroud, upper and lower access port valves (APVs), liquid inflation chamber (LIC), new packer, 1-inch diameter pump column pipe and two 1-inch PVC gauge tubes. Existing PVC gauge tubes and 1-inch-diameter stainless steel pump column will be evaluated and reinstalled or replaced, depending on condition .Layne, under FTL

oversight, will assist with inspection of the existing drop pipe for wear, erosion, thread damage, etc. Damaged pipe will be replaced as-needed prior to re-installation

Replacement PVC gauge tubes and pump column pipe will be provided by N3B.

The existing pump power cable will be evaluated by Layne, under FTL oversight, and replaced, depending on condition. N3B will provide the replacement cable. Electrical terminations/splices to the pump motor will be made by N3B craft electricians or by Subcontractor's N3B-approved licensed electricians offsite. Electrical terminations in the electrical panel will be made by N3B craft electricians.

With reinstallation of the system, Layne will install new stainless steel inflation/actuation lines and new nylon tubing line for pump shroud air vent, all secured with new stainless steel banding and buckles, and new stainless steel screens for lower zone gauge tube modification. The inflation/action lines, tubing, banding, buckles and stainless steel screens will be provided by N3B.

Layne will conduct pressure leak tests at all inflation line fittings as re-installation of the system proceeds, including at surface prior to start of installation.

Once the sampling system is installed, 200% of the calculated cross flow volume may be pumped from the affected screen. The cross flow times include from the time the packer was deflated after the last aquifer test was completed until the temporary packer is installed, and from the time the temporary packer is deflated until the permanent packer is inflated.

All waste water from deconning, purging, bailing and surging during repair and redevelopment activities must be collected in poly-tanks stored at the sites.

Well R-58 – Pump Replacement

At well R-58, a 5-inch ID monitoring well with a 4-inch pumping system in place, Layne will remove the existing pumping system and assist with video logging of well by T2S. Expect potential separation of the pump from the motor, broken shaft, etc.

Layne will then perform brushing of screen interval followed by surging and will bail the well until visible clarity of water improves. If requested, Layne will assist in collection of water samples during the bailing period. Layne will then redevelop the screen interval with jetting as directed by T2S.

Layne will then reinstall the sampling system with new environmentally retrofitted 5 HP pump and motor, including shroud and two 1-inch PVC gauge tubes. Existing PVC gauge tubes and 1-inch-diameter stainless steel pump column will be evaluated and reinstalled or replaced, depending on condition. Layne, under FTL oversight, will assist with inspection of the existing drop pipe for wear, erosion, thread damage, etc. Damaged pipe will be replaced as-needed prior to re-installation

The existing pump power cable will be evaluated by Layne, under oversight of the FTL, and replaced, depending on condition. N3B will provide the replacement cable. Electrical terminations/splices to the pump motor will be made by N3B craft electricians or by Subcontractor's N3B-approved licensed electricians offsite. Electrical terminations in the electrical panel will be made by N3B craft electricians.

Layne will then perform functional testing of the pump. The pump, pump motor, shroud and replacement PVC gauge tubes and pump column pipe will be provided by N3B.

All waste water from deconning, purging, bailing and surging during repair and redevelopment activities must be collected in poly-tanks stored at the site.

Well CdV-16-1(i) – Pump Replacement

At well CdV-16-1(i), a 4.5-inch ID monitoring well with a 4-inch pumping system in place, Layne will remove the existing pumping system and assist with video logging of well by T2S. Foot valve is holding so the pull will be wet. Take precautions based on ambient temperature to protect crew and work area (footing, collection of water as required).

Layne will then perform brushing of screen interval followed by surging and will bail the well until visible clarity of water improves. If requested, Layne will assist in collection of water samples during the bailing period. Layne will then redevelop the screen interval with jetting as directed by T2S.

Layne will then reinstall the sampling system with new environmentally retrofitted 5 HP pump and motor, including shroud and two 1-inch PVC gauge tubes. Existing PVC gauge tubes and 1-inch-diameter stainless steel pump column will be evaluated and reinstalled or replaced, depending on condition. Layne, under FTL oversight, will assist with inspection of the existing drop pipe for wear, erosion, thread damage, etc. Damaged pipe will be replaced as-needed prior to re-installation.

The existing pump power cable will be evaluated by Layne, under FTL oversight, and replaced, depending on condition. N3B will provide the replacement cable. Electrical terminations/splices to the pump motor will be made by N3B craft electricians or by Subcontractor's N3B-approved licensed electricians offsite. Electrical terminations in the electrical panel will be made by N3B craft electricians.

Layne will then perform functional testing of the pump. The pump, pump motor, shroud and replacement PVC gauge tubes and pump column pipe will be provided by N3B.

All waste water from deconning, purging, bailing and surging during repair and redevelopment activities must be collected in poly-tanks stored at the site.

3.6 Demobilization

Demobilization activities will include:

- Loading and removal of the equipment.
- Removal of the pump hoist rig and support vehicles from the site.
- Staging and securing of IDW for future disposition.
- Removal of municipal waste (e.g. materials packaging).
- Final site cleanup of all materials used during well repair activities.

The N3B subcontract technical representative (STR) and shift operations manager (SOM) will inspect the sites prior to final demobilization of the drill crew. Final demobilization of the drill crew will not be permitted until the condition of the sites are acceptable to the STR and SOM.

4.0 REPORTING

Updated as-built diagram and technical notes will be prepared within 30 calendar days of project completion. Technical notes will include dates and descriptions of project activities.

Table 1
Key Team Personnel Roles and Responsibilities

Name	Role	Responsibilities
Ryan Flynn	Water Program Director	Responsible for the successful execution of the project
Amanda White	Water Program Deputy Director	Responsible for the successful execution of the project in support of the Director
Sherry Gaddy	Drilling Program Manager (PgM)	Leadership for overall drilling and well repair program
Phil Walkup	Project Manager (PM)	Responsible for monitoring and documenting the subcontractor's day-to-day performance, providing day-to-day oversight, and assuring work is performed in a safe manner. Project and field management, N3B interaction, subcontractor coordination, IWCP and ES&H compliance
Thomas Klepfer	Back-up Project Manager (PM)	Responsible as above as needed
Jeffrey Richeson	Subcontract Technical Representative (STR)	Responsible to the Project Manager for monitoring and documenting the subcontractor's day-to-day performance, communications, procurement support, providing day-to-day oversight, IWCP and ES&H compliance
Christina Rampley	N3B/T2S Procurement Manager	Responsible for solicitation, negotiation, award, and administration of subcontracts and has overall commercial responsibility for subcontracts
Kenneth Hoffman	ES&H Oversight	Primary contact for ES&H oversight, ESH Professional
Al Medina	Quality Control Manager	Primary contact for N3B QA oversight
Ken Wright Karen Warren Chris Harper Isaiah Sedillo Alicia Lopez	FTL/PIC	Field management, subcontractor coordination, IWCP and ES&H compliance, ESH & QA site Representative
Adam Zimmerman	Waste Coordinator	Lead for waste generation and management oversight
Charles Smith	Layne Drilling Manager	Project and field management, N3B interaction, budget, resource commitments, subcontractor coordination, IWCP and ES&H compliance
Alex Gustafson	Layne Project Manager	Project and field management, budget and resource commitments, subcontractor coordination and ES&H compliance
Joshua Walsh Jody Woods	Layne Field Supervisors	Project and field management, N3B interaction, subcontractor coordination, IWCP and ES&H compliance
Hunter Clement	Layne Safety Specialist	Responsible for Layne corporate ES&H programs, site visits and 24/7 on-call oversight
Steve Maze	N3B Operations Manager	Facility Operations and Security Management/Coordination. Authorizes and approves project work release
Ralph Rupp	N3B Shift Operations Manager (SOM)	Responsible for authorization and coordination of field operations

Table 2
Project-Specific Procedures, Standing Orders, and SOPs

Procedure #	Title
N3B-AP-ER-1002	Environmental Remediation (ER) Field Work Requirements
N3B-P101-1	Ergonomics
N3B-P101-4	Forklifts and Powered Industrial Trucks
N3B-P101-6	Personal Protection Equipment
N3B-P101-7	Vehicle and Pedestrian Safety
N3B-P101-13	Electrical Safety Program
N3B-P101-18	Procedure for Pause/Stop Work
N3B-P101-26	Welding, Cutting, and Other Spark- or Flame-Producing Operations
N3B-P101-34	Pressure Safety
N3B-P330-9	Suspect/Counterfeit Items
N3B-SO-ER-0006	Access Restrictions in Canada del Buey
N3B-SO-ER-0024	ER Protocols During Migratory Bird Season
N3B-SO-ER-0026	ER Requirements for Opening New Empty Metal Drums
N3B-SO-ER-0032	Event or Injury Reporting Requirements for Pre-Job Briefing and Tailgate Meeting Forms
N3B-SOP-ER-2002	Field Decontamination of Equipment
N3B-SOP-ER-3001	Manual Groundwater Level Measurements
N3B-SOP-ER-3003	Groundwater Sampling
N3B-SOP-ER-6001	Pressure Transducer Installation, Removal and Maintenance
N3B-SOP-ER-6002	Well Development
N3B-SOP-ER-6003	Pneumatic Leak Testing of Packer - GW Water Sampling Equip
N3B-SOP-ER-6004	Borehole Camera and Geophysical Logging System Use
N3B-SOP-ER-6007	Packer Pressure Monitoring and Maintenance
N3B-GDE-ER-6011	GW Well Double Screen Sampling System - Install-Test
N3B-SOP-SDM-1100	Sample Containers, Preservation, and Field Quality Control
N3B-SOP-SDM-1101	Sample Control and Field Documentation
N3B-SOP-SDM-1102	Sample Receiving and Shipping by the N3B Sample Management Office
UI-PROC-64-00-125-R4	Fire Hydrant Operation and Non-emergency Use

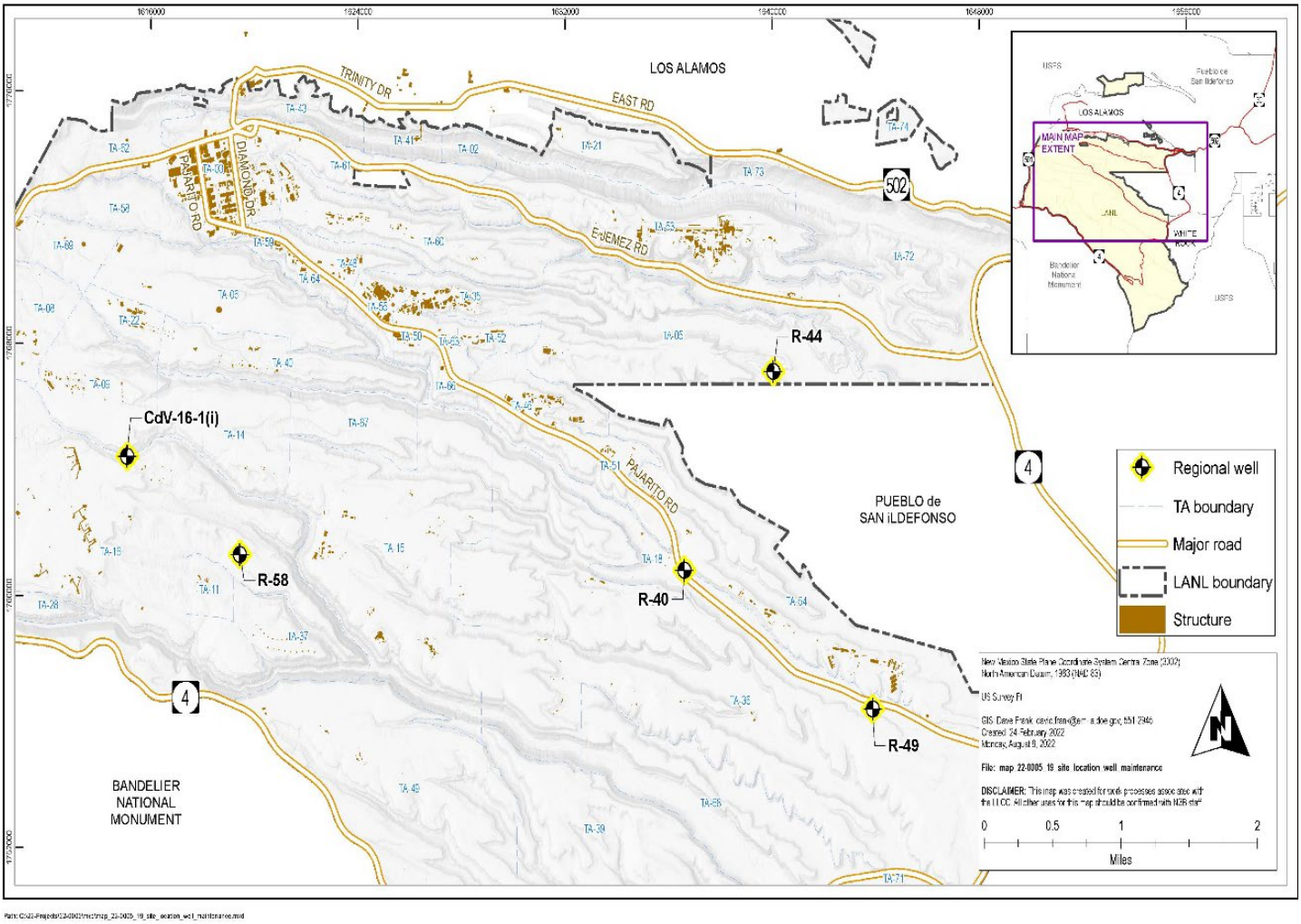


Figure 1 - Well Location Map

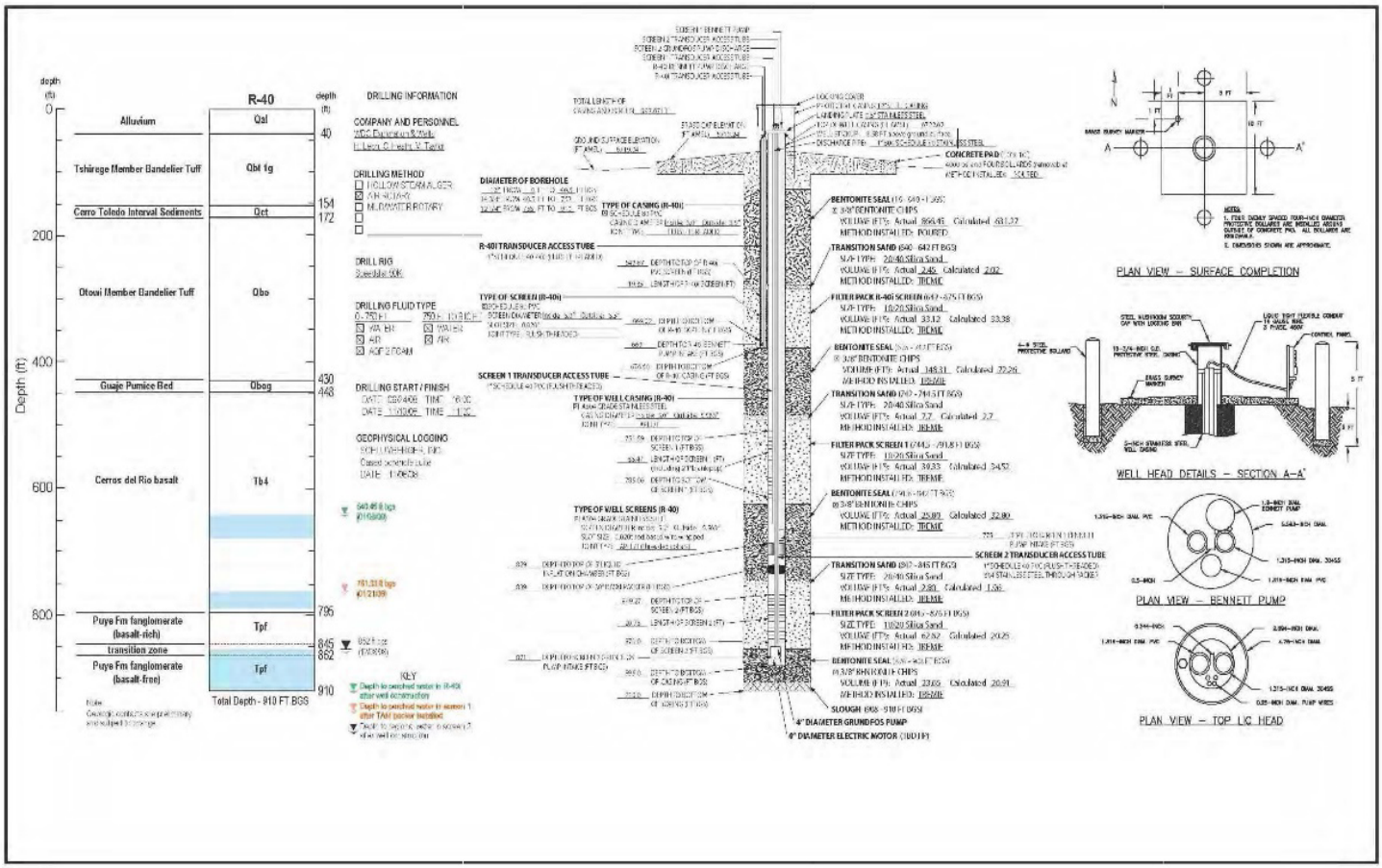


Figure 2 - R-40 As-Built Completion Schematic

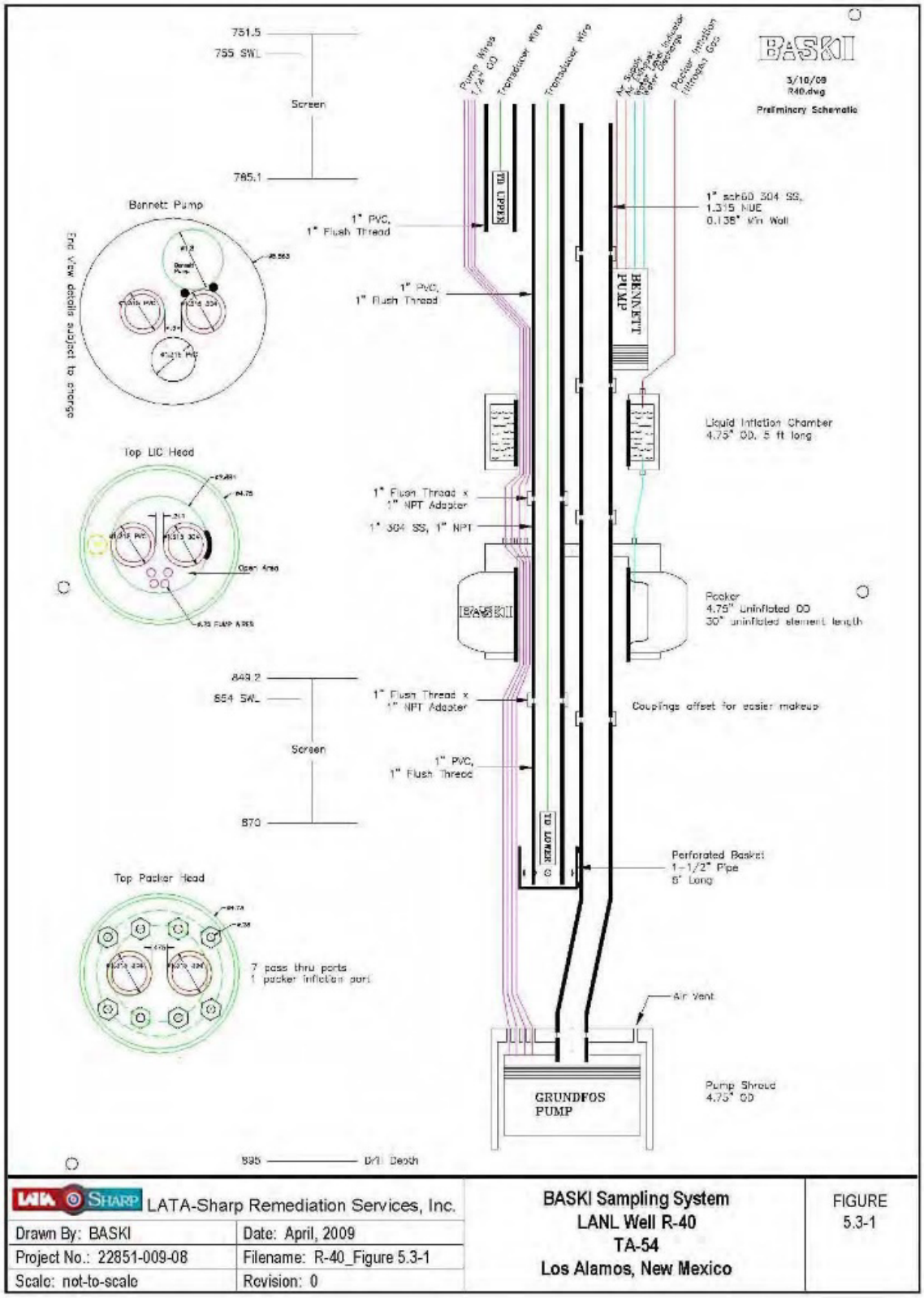


Figure 3 - R-40 Baski Sampling System

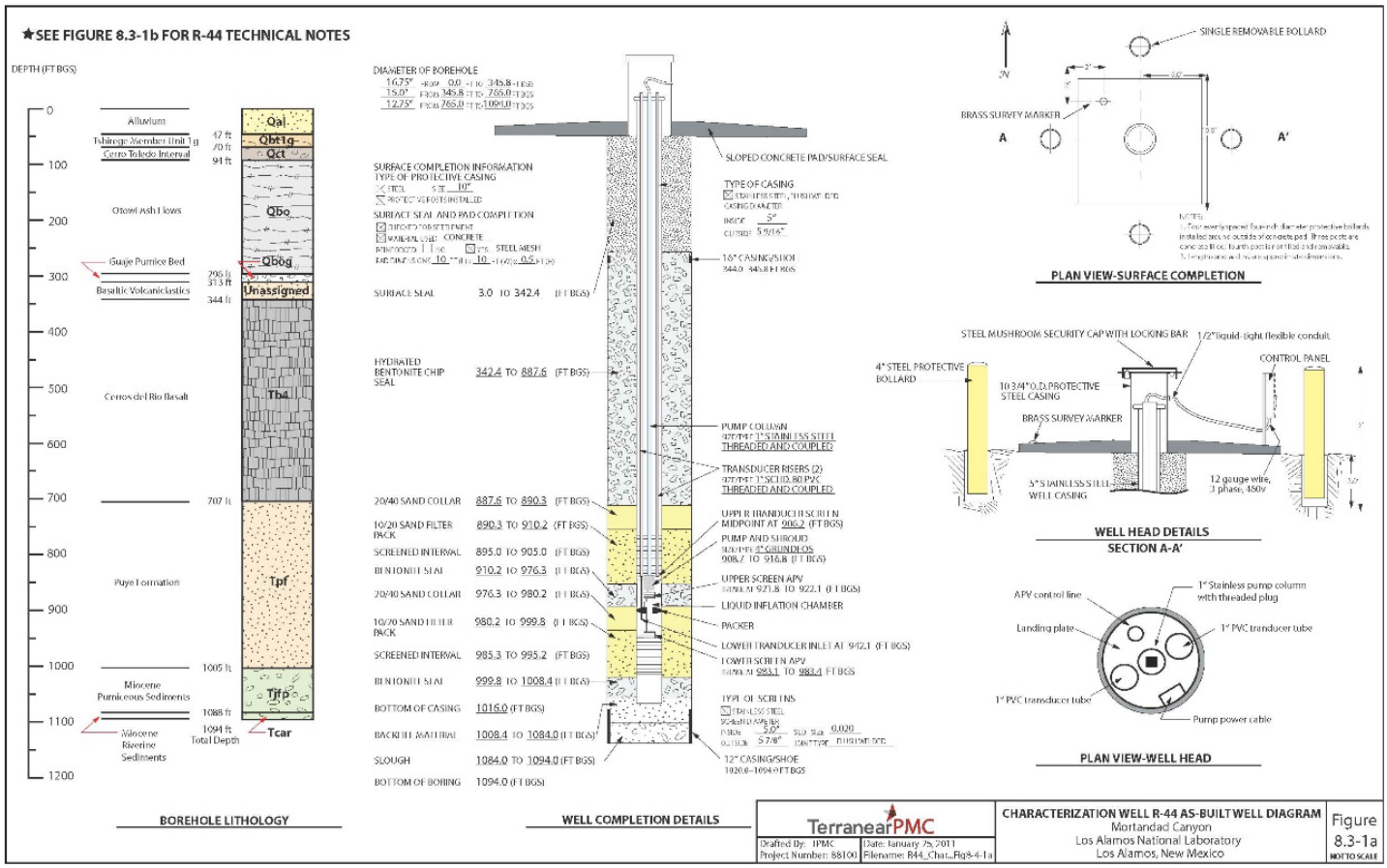
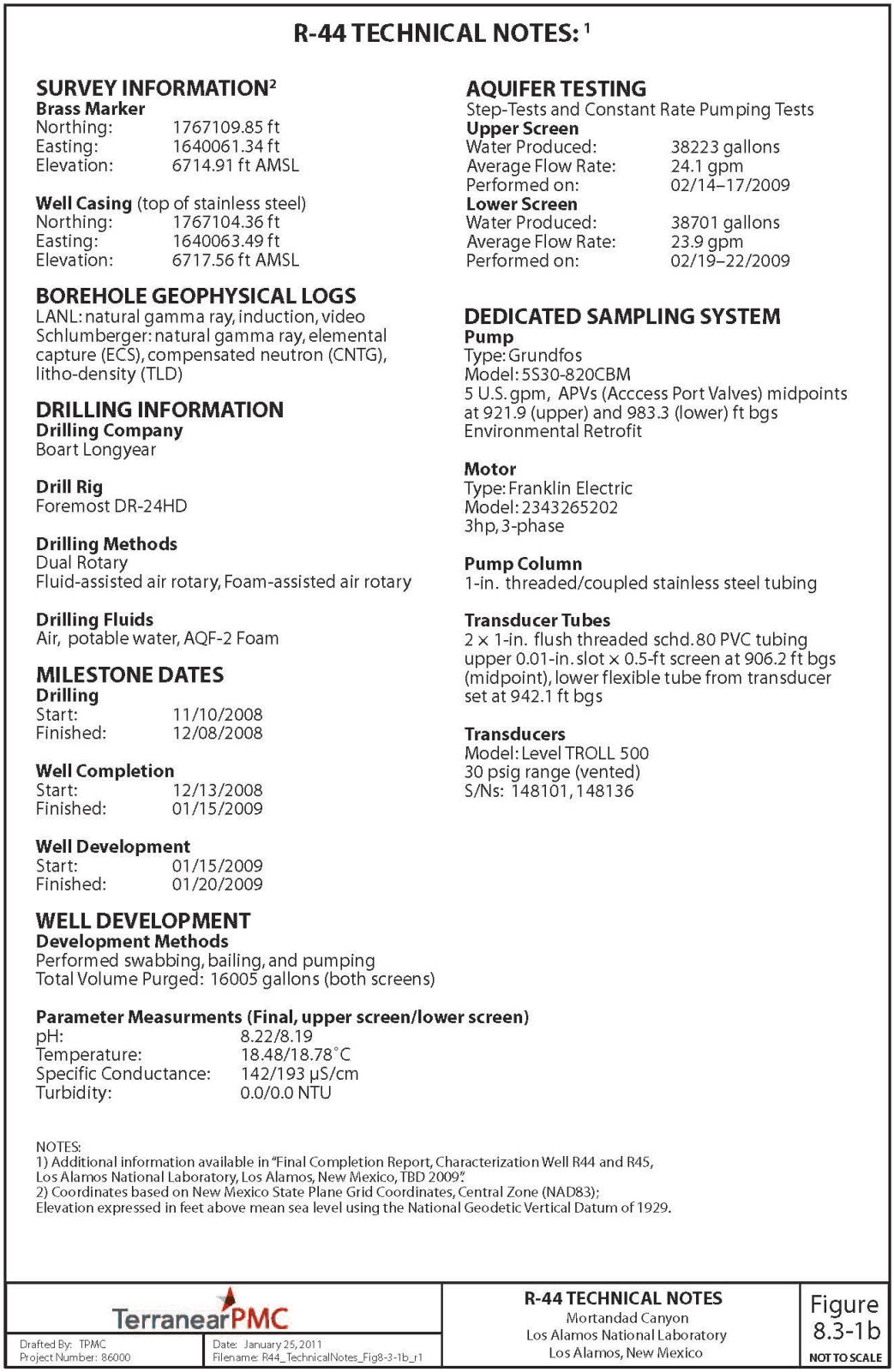


Figure 4 - R-44 As-Built Well Diagram



R-44 TECHNICAL NOTES: [1]

SURVEY INFORMATION[2]

Brass Marker

Northing:	1767109.85 ft
Easting:	1640061.34 ft
Elevation:	6714.91 ft AMSL

Well Casing (top of stainless steel)

Northing:	1767104.36 ft
Easting:	1640063.49 ft
Elevation:	6717.56 ft AMSL

BOREHOLE GEOPHYSICAL LOGS

LANL: natural gamma ray, induction, video
Schlumberger: natural gamma ray, elemental capture (ECS), compensated neutron (CNTG), litho-density (TLD)

DRILLING INFORMATION

Drilling Company
Boart Longyear

Drill Rig
Foremost DR-24HD

Drilling Methods
Dual Rotary
Fluid-assisted air rotary, Foam-assisted air rotary

Drilling Fluids
Air, potable water, AQF-2 Foam

MILESTONE DATES

Drilling

Start:	11/10/2008
Finished:	12/08/2008

Well Completion

Start:	12/13/2008
Finished:	01/15/2009

Well Development

Start:	01/15/2009
Finished:	01/20/2009

WELL DEVELOPMENT

Development Methods
Performed swabbing, bailing, and pumping
Total Volume Purged: 16005 gallons (both screens)

Parameter Measurments (Final, upper screen/lower screen)

pH:	8.22/8.19
Temperature:	18.48/18.78°C
Specific Conductance:	142/193 µS/cm
Turbidity:	0.0/0.0 NTU

AQUIFER TESTING

Step-Tests and Constant Rate Pumping Tests

Upper Screen

Water Produced:	38223 gallons
Average Flow Rate:	24.1 gpm
Performed on:	02/14–17/2009

Lower Screen

Water Produced:	38701 gallons
Average Flow Rate:	23.9 gpm
Performed on:	02/19–22/2009

DEDICATED SAMPLING SYSTEM

Pump
Type: Grundfos
Model: 5S30-820CBM
5 U.S. gpm, APVs (Acccess Port Valves) midpoints at 921.9 (upper) and 983.3 (lower) ft bgs
Environmental Retrofit

Motor
Type: Franklin Electric
Model: 2343265202
3hp, 3-phase

Pump Column
1-in. threaded/coupled stainless steel tubing

Transducer Tubes
2 x 1-in. flush threaded schd. 80 PVC tubing upper 0.01-in. slot x 0.5-ft screen at 906.2 ft bgs (midpoint), lower flexible tube from transducer set at 942.1 ft bgs

Transducers
Model: Level TROLL 500
30 psig range (vented)
S/Ns: 148101, 148136

NOTES:
1) Additional information available in "Final Completion Report, Characterization Well R44 and R45, Los Alamos National Laboratory, Los Alamos, New Mexico, TBD 2009".
2) Coordinates based on New Mexico State Plane Grid Coordinates, Central Zone (NAD83); Elevation expressed in feet above mean sea level using the National Geodetic Vertical Datum of 1929.

Figure 5 - R-44 Technical Notes

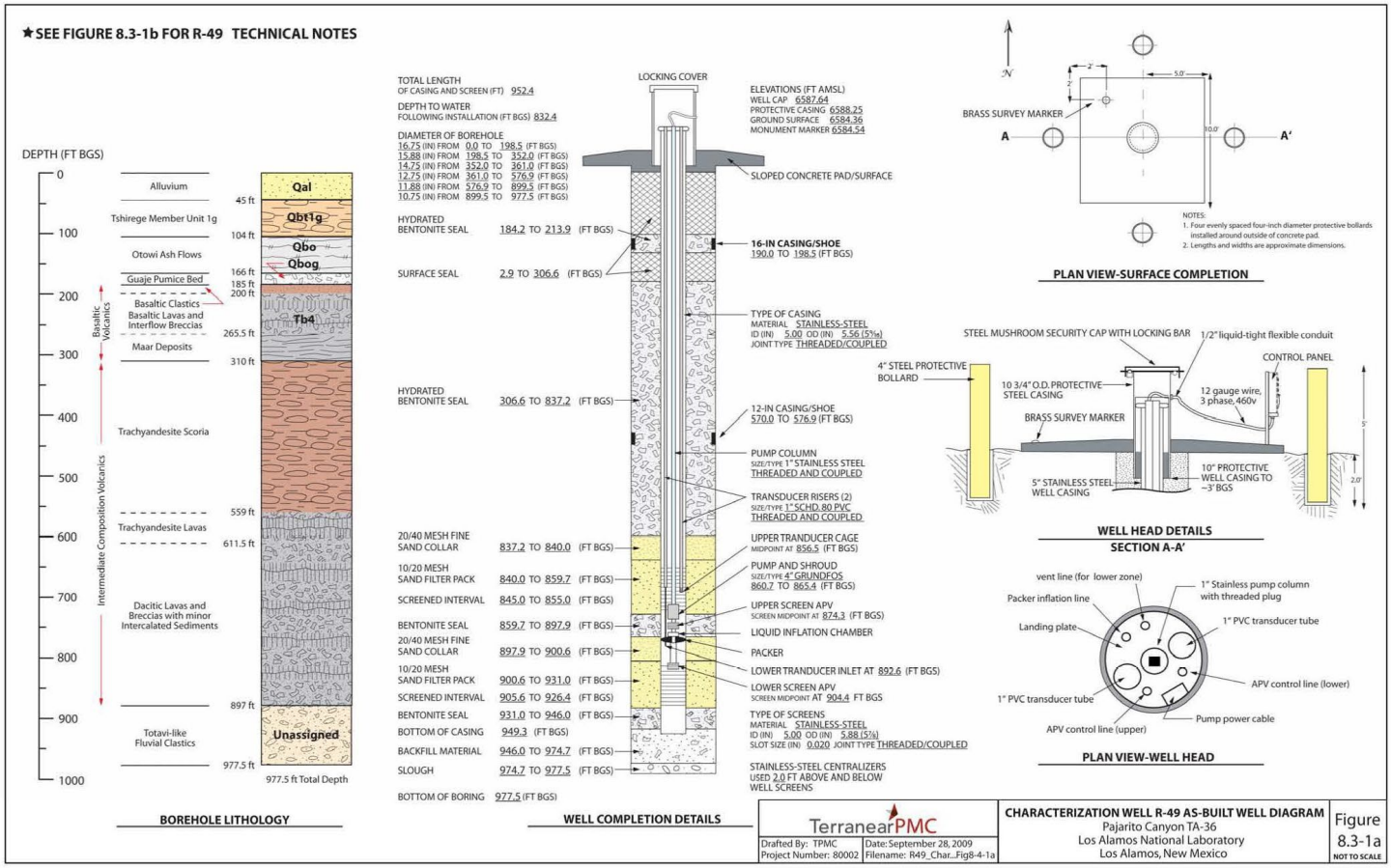
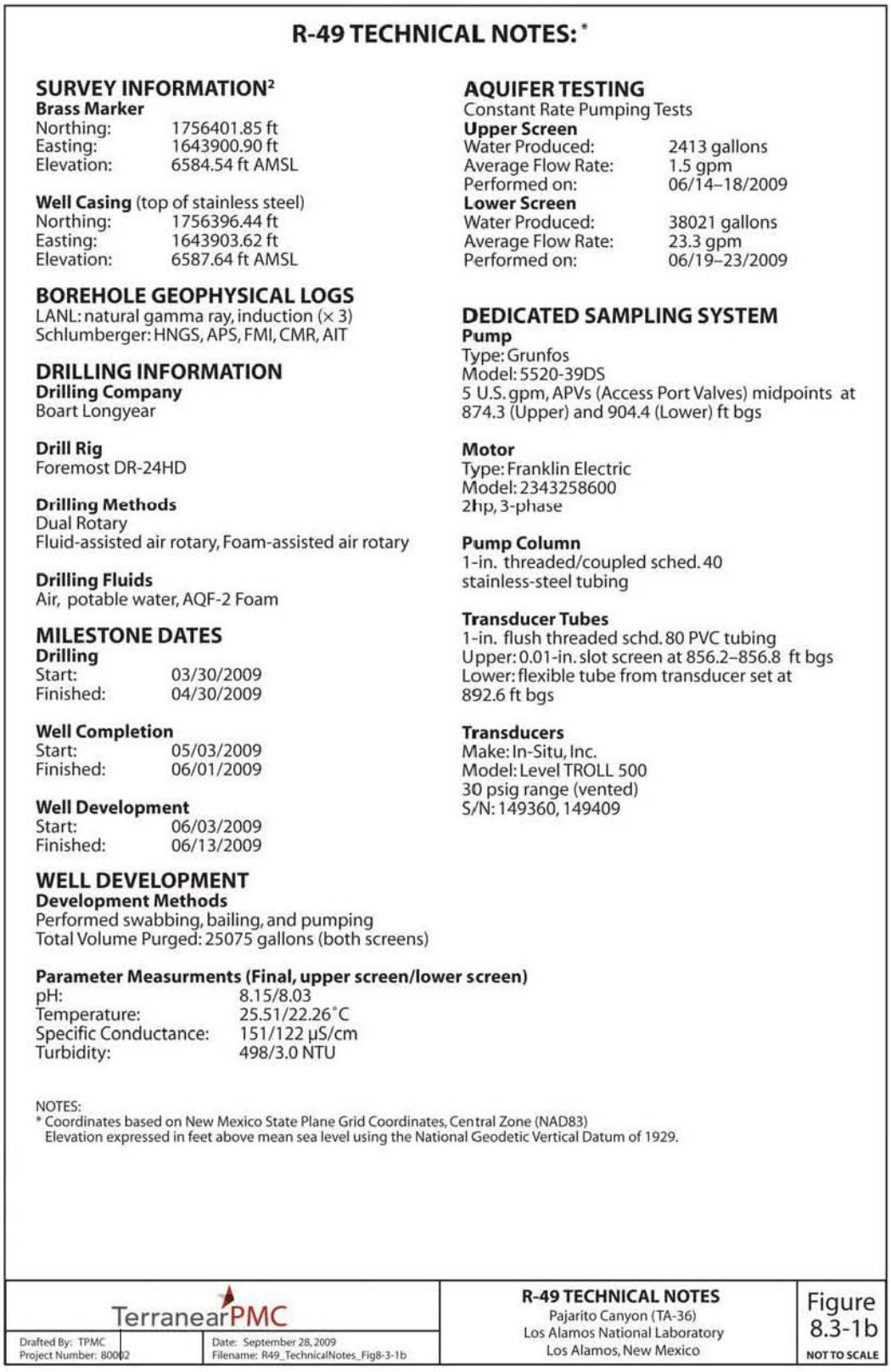


Figure 6 - R-49 As-Built Well Diagram



R-49 TECHNICAL NOTES: *

SURVEY INFORMATION[2]

Brass Marker

Northing:	1756401.85 ft
Easting:	1643900.90 ft
Elevation:	6584.54 ft AMSL

Well Casing (top of stainless steel)

Northing:	1756396.44 ft
Easting:	1643903.62 ft
Elevation:	6587.64 ft AMSL

BOREHOLE GEOPHYSICAL LOGS

LANL: natural gamma ray, induction (× 3)
Schlumberger: HNGS, APS, FMI, CMR, AIT

DRILLING INFORMATION

Drilling Company
Boart Longyear

Drill Rig
Foremost DR-24HD

Drilling Methods
Dual Rotary
Fluid-assisted air rotary, Foam-assisted air rotary

Drilling Fluids
Air, potable water, AQF-2 Foam

MILESTONE DATES

Drilling

Start:	03/30/2009
Finished:	04/30/2009

Well Completion

Start:	05/03/2009
Finished:	06/01/2009

Well Development

Start:	06/03/2009
Finished:	06/13/2009

WELL DEVELOPMENT

Development Methods
Performed swabbing, bailing, and pumping
Total Volume Purged: 25075 gallons (both screens)

Parameter Measurments (Final, upper screen/lower screen)

pH:	8.15/8.03
Temperature:	25.51/22.26°C
Specific Conductance:	151/122 µS/cm
Turbidity:	498/3.0 NTU

AQUIFER TESTING

Constant Rate Pumping Tests

Upper Screen

Water Produced:	2413 gallons
Average Flow Rate:	1.5 gpm
Performed on:	06/14–18/2009

Lower Screen

Water Produced:	38021 gallons
Average Flow Rate:	23.3 gpm
Performed on:	06/19–23/2009

DEDICATED SAMPLING SYSTEM

Pump
Type: Grunfos
Model: 5520-39DS
5 U.S. gpm, APVs (Access Port Valves) midpoints at 874.3 (Upper) and 904.4 (Lower) ft bgs

Motor
Type: Franklin Electric
Model: 2343258600
2hp, 3-phase

Pump Column
1-in. threaded/coupled sched. 40 stainless-steel tubing

Transducer Tubes
1-in. flush threaded schd. 80 PVC tubing
Upper: 0.01-in. slot screen at 856.2–856.8 ft bgs
Lower: flexible tube from transducer set at 892.6 ft bgs

Transducers
Make: In-Situ, Inc.
Model: Level TROLL 500
30 psig range (vented)
S/N: 149360, 149409

NOTES:
* Coordinates based on New Mexico State Plane Grid Coordinates, Central Zone (NAD83)
Elevation expressed in feet above mean sea level using the National Geodetic Vertical Datum of 1929.

TerranearPMC
Drafted By: TPMC
Project Number: 80002
Date: September 28, 2009
Filename: R49_TechnicalNotes_Fig8-3-1b

R-49 TECHNICAL NOTES
Pajarito Canyon (TA-36)
Los Alamos National Laboratory
Los Alamos, New Mexico

Figure 8.3-1b
NOT TO SCALE

Figure 7 - R-49 Technical Notes

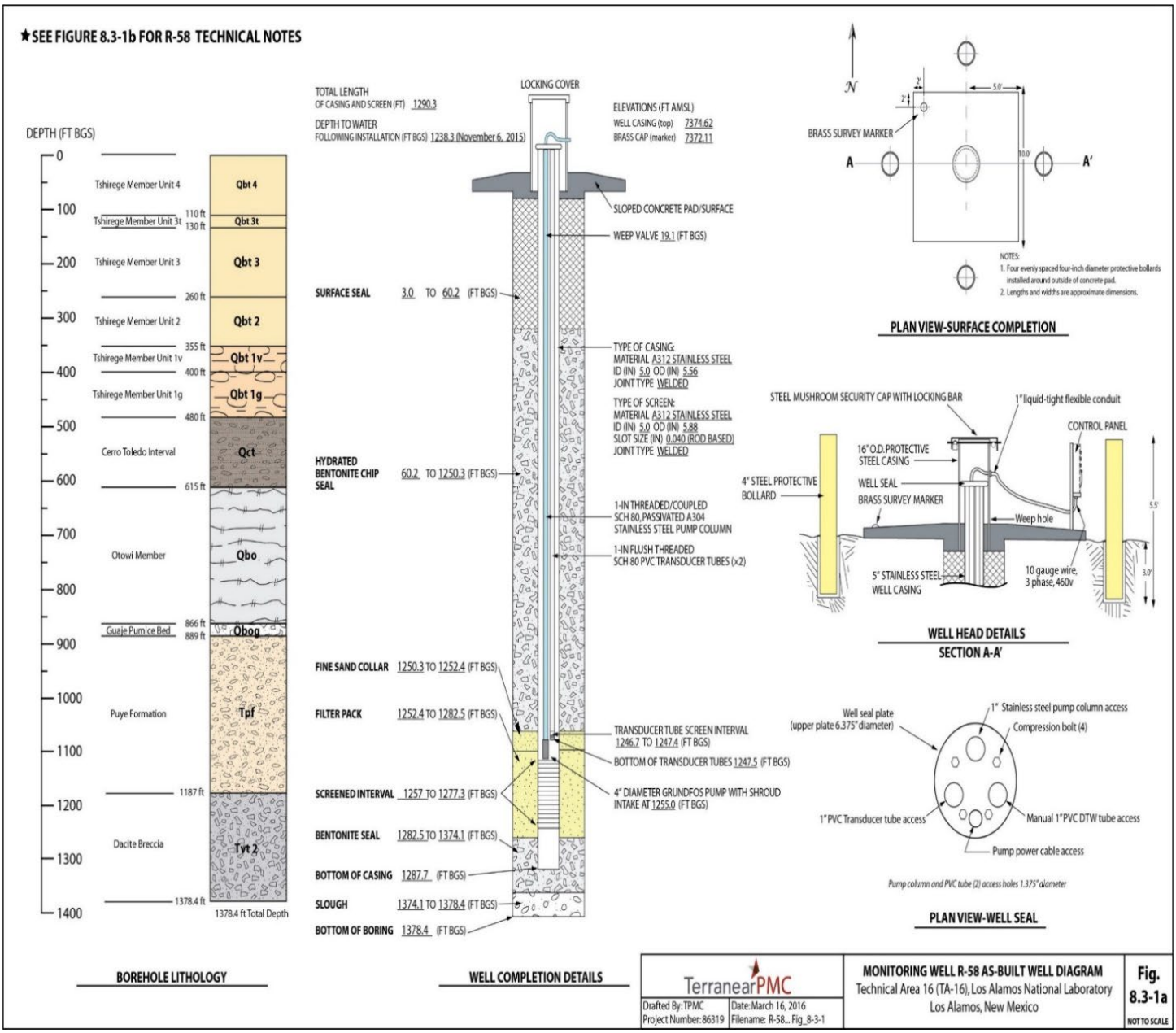
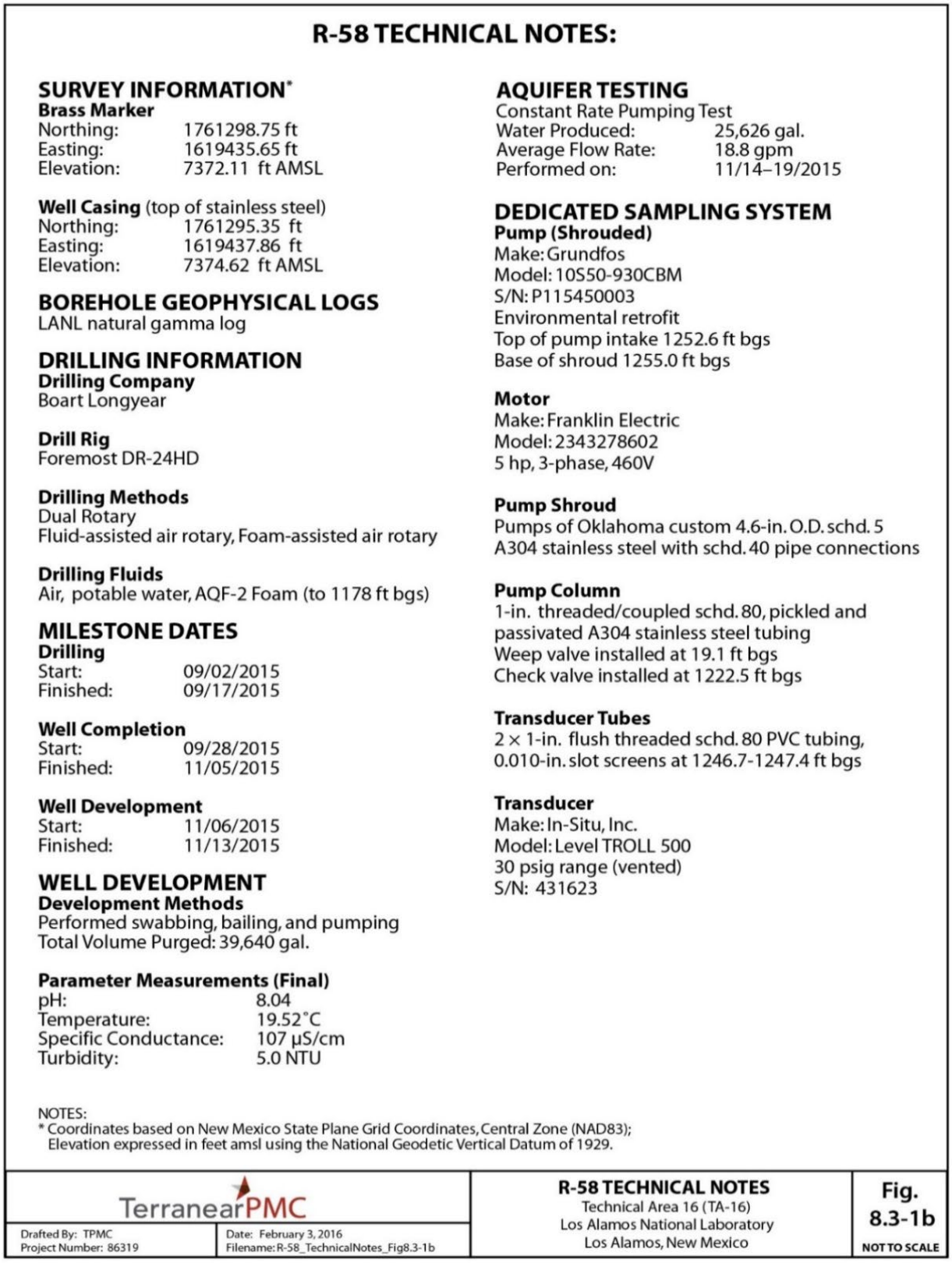


Figure 8 - R-58 As-built Diagram



R-58 TECHNICAL NOTES:

SURVEY INFORMATION*
Brass Marker
Northing: 1761298.75 ft
Easting: 1619435.65 ft
Elevation: 7372.11 ft AMSL

Well Casing (top of stainless steel)
Northing: 1761295.35 ft
Easting: 1619437.86 ft
Elevation: 7374.62 ft AMSL

BOREHOLE GEOPHYSICAL LOGS
LANL natural gamma log

DRILLING INFORMATION
Drilling Company
Boart Longyear

Drill Rig
Foremost DR-24HD

Drilling Methods
Dual Rotary
Fluid-assisted air rotary, Foam-assisted air rotary

Drilling Fluids
Air, potable water, AQF-2 Foam (to 1178 ft bgs)

MILESTONE DATES
Drilling
Start: 09/02/2015
Finished: 09/17/2015

Well Completion
Start: 09/28/2015
Finished: 11/05/2015

Well Development
Start: 11/06/2015
Finished: 11/13/2015

WELL DEVELOPMENT
Development Methods
Performed swabbing, bailing, and pumping
Total Volume Purged: 39,640 gal.

Parameter Measurements (Final)
pH: 8.04
Temperature: 19.52˚C
Specific Conductance: 107 µS/cm
Turbidity: 5.0 NTU

AQUIFER TESTING
Constant Rate Pumping Test
Water Produced: 25,626 gal.
Average Flow Rate: 18.8 gpm
Performed on: 11/14–19/2015

DEDICATED SAMPLING SYSTEM
Pump (Shrouded)
Make: Grundfos
Model: 10S50-930CBM
S/N: P115450003
Environmental retrofit
Top of pump intake 1252.6 ft bgs
Base of shroud 1255.0 ft bgs

Motor
Make: Franklin Electric
Model: 2343278602
5 hp, 3-phase, 460V

Pump Shroud
Pumps of Oklahoma custom 4.6-in. O.D. schd. 5 A304 stainless steel with schd. 40 pipe connections

Pump Column
1-in. threaded/coupled schd. 80, pickled and passivated A304 stainless steel tubing
Weep valve installed at 19.1 ft bgs
Check valve installed at 1222.5 ft bgs

Transducer Tubes
2 × 1-in. flush threaded schd. 80 PVC tubing, 0.010-in. slot screens at 1246.7-1247.4 ft bgs

Transducer
Make: In-Situ, Inc.
Model: Level TROLL 500
30 psig range (vented)
S/N: 431623

NOTES:
* 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
Drafted By: TPMC
Project Number: 86319
Date: February 3, 2016
Filename: R-58_TechnicalNotes_Fig8.3-1b

R-58 TECHNICAL NOTES
Technical Area 16 (TA-16)
Los Alamos National Laboratory
Los Alamos, New Mexico

Fig. 8.3-1b
NOT TO SCALE

Figure 9 - R-58 Technical Notes

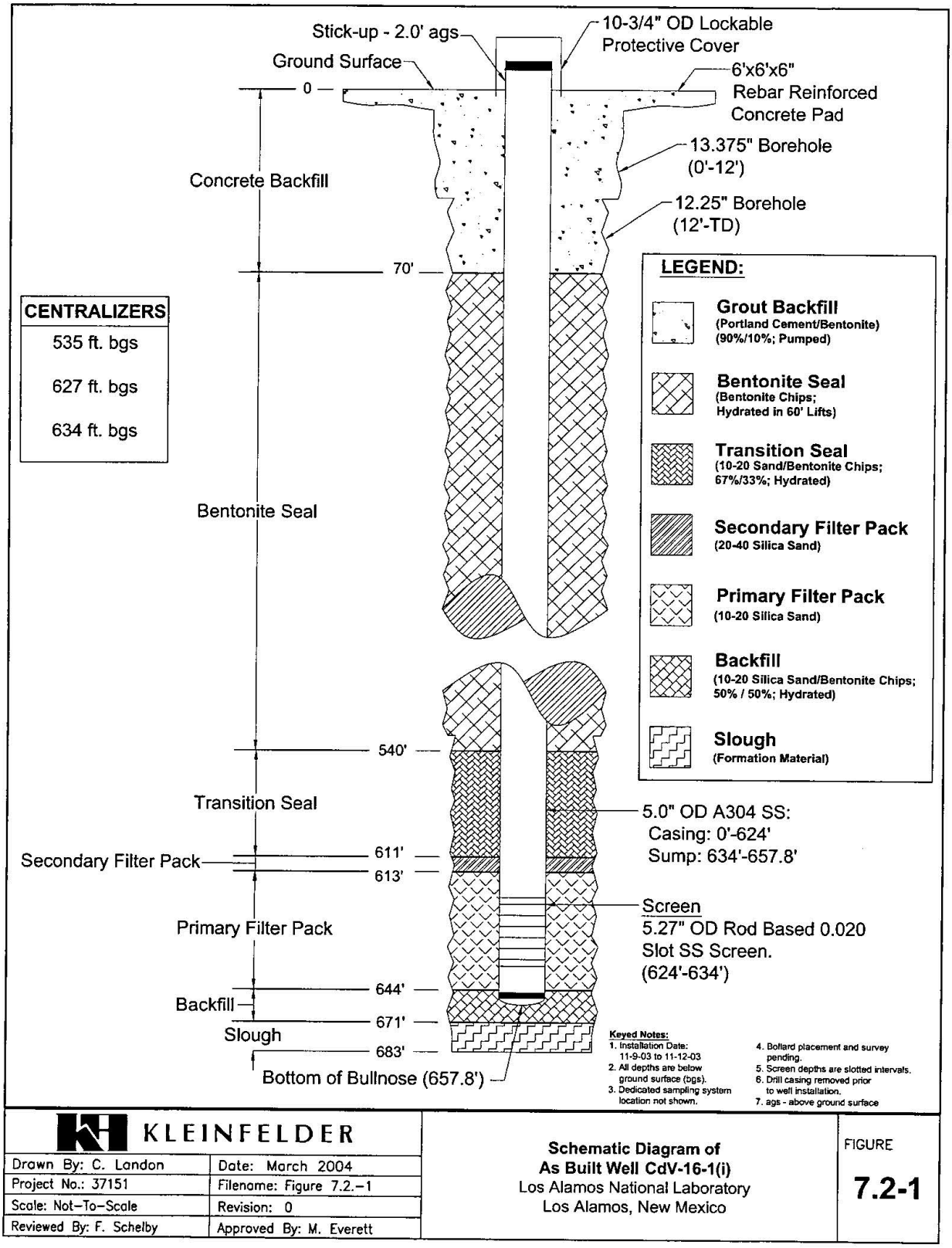


Figure 10 - CdV16-1(i) Schematic Diagram of As-Built Well

Appendix B

Borehole Video Logging
(on DVD included with this document)

N3B RECORDS	
Media Information Page	
This is a placeholder page for a record that cannot be uploaded or would lose meaning or content if uploaded. The record can be requested through regdocs@em-la.doe.gov	
Document Date: 5/9/2023	**EM ID number:** 702719-02
Document Title: Appendix B Well R-49 Maintenance Report	☒ **No restrictions** ☐ **UCNI** ☐ **Copyrighted**
Media type and quantity: 1 DVD	**Software and version required to read media:** Adobe Acrobat 9.0
Other document numbers or notes: Files are too numerous and large to upload.	