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Work Plan for the Technical Area 21 Monitoring Well Network Reconfiguration

Prepared by the Environmental Programs Directorate

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1.0 INTRODUCTION

This work plan has been developed in response to the New Mexico Environment Department's (NMED's) "Approval with Modifications, Technical Area 21 Monitoring Well Network Evaluation and Recommendations," dated December 2, 2010 (NMED 2010, 111462), requesting that Los Alamos National Laboratory (LANL or the Laboratory) generate a plan that describes enhancements that will be made to the Technical Area 21 (TA-21) vadose zone and groundwater monitoring network. An extension was requested by the Laboratory so that the findings from the TA-16 monitoring well network evaluation could be taken into account in the preparation of this work plan. In a letter dated January 24, 2011 (NMED 2011, 111676), NMED granted the extension request and set a revised due date of July 1, 2011. However, that due date also had to be extended, per the *force majeure* clause in the Compliance Order on Consent, because of the Las Conchas fire and the closing of the Laboratory from June 27 through July 5, 2011.

Based on preliminary findings from the TA-16 monitoring well network assessment, the Laboratory has determined that Westbay systems will no longer be used in the four TA-21 wells, and this work plan presents the field activities and testing that will be conducted during reconfiguration of the Westbay wells R-5, R-7, R-8, and R-9i, located near TA-21 (Figure 1.0-1).

2.0 TA-21 MONITORING WELL NETWORK

The four wells in the TA-21 monitoring network are currently configured as follows:

- R-5 currently has four intermediate zone/regional aquifer screens at the following depths:

Screened Zone	Depth
Upper intermediate zone (dry)	326.4–331.5 ft below ground surface (bgs)
Lower intermediate zone	372.8–388.8 ft bgs
Upper part of the regional aquifer	676.9–720.3 ft bgs
Deeper within the regional aquifer	858.7–863.7 ft bgs

- R-7 currently has three intermediate zone/regional aquifer screens at the following depths:

Screened Zone	Depth
Upper intermediate zone (dry)	363.2–379.2 ft bgs
Lower intermediate zone (water only in the sump)	730.4–746.4 ft bgs
Upper part of the regional aquifer	895.5–937.4 ft bgs

- R-8 currently has two regional aquifer screens at the following depths:

Screened Zone	Depth
Upper part of the regional aquifer	705.3–755.7 ft bgs
Deeper within the regional aquifer	821.3–828.0 ft bgs

- R-9i currently has two intermediate zone screens at the following depths:

Screened Zone	Depth
Upper intermediate zone	189.1–199.5 ft bgs
Lower intermediate zone	269.6–280.3 ft bgs

3.0 FIELD ACTIVITIES

This section describes the following activities that will be conducted at the four TA-21 monitoring wells:

- Westbay system removal
- video logging
- backfilling/abandonment
- swabbing and bailing
- purging and sampling
- prejetting step tests
- screen jetting
- postjetting step tests
- final sampling system design and installation

3.1 Removal of Westbay Sampling Systems, Video Logging, and Temporary Packer Installation

The Westbay systems will be removed in the following order: R-5, R-8, R-9i, and then R-7. The packers will be deflated and the casings will be removed. Following removal of the Westbay casing, a video log will be run in each well to document the condition of the well casing and screens and document whether water is flowing into each screen.

Temporary inflatable packers will be set to isolate the productive screens in the four wells. These temporary packers will be installed as soon as possible after removal of the Westbay systems to minimize cross-flow between screens.

3.2 Screen Abandonment

Table 3.2-1 summarizes the rationale for determining which screens will be retained, which screens will no longer be used, and which screens will be abandoned.

The lower portions of wells R-5 and R-9i will be backfilled with a combination of silica sand and cement in order to abandon the lower screened interval in each well (Figures 3.2-1 and 3.2-2). The backfill will be capped with a k-packer, isolating the backfill material from the functioning part of each well.

At R-7, a packer will be installed between the lower intermediate zone screen and the regional aquifer screen to isolate the intermediate zones from the regional aquifer (Figure 3.2-3). The upper intermediate screened interval at R-7 has never produced water, and the lower intermediate zone has had water only in the sump. A transducer will be placed above the packer to detect future groundwater flow that might occur. If water is detected, the source will be evaluated and appropriate measures will be taken at that time.

Similarly, at R-8, a packer will be installed between the two regional aquifer screens; the lower screen will continue to be monitored while the upper screen will no longer be used (Figure 3.2-4). Nearby well TW-3r (Figure 1.0-1) will be installed in 2012 to monitor the upper portion of the regional aquifer and will effectively replace the upper screen at R-8. A transducer will be placed above the packer in R-8 to detect future groundwater flow that might occur.

3.3 Swabbing/Bailing, Purging/Sampling

Swabbing/bailing and purging/sampling will be conducted beginning with well R-7, and then followed by R-5, R-8, and R-9i. The temporary packers will be removed from each well, and the retained screens will be swabbed and bailed to remove any formation fines present in the filter packs.

Next, a straddle packer and pump assembly capable of pumping 3−5 gallons per minute (gpm) will be installed. Pumping rates may need to be adjusted based upon the varying hydraulic yield of each screen. The packers will be set at a spacing which is greater than the length of each screen but which also minimizes the volume of water contained in the casing between packers.

In the case of R-5, swabbing/bailing and purging/sampling will begin with the lower screen in the regional aquifer. Some cross-flow will inherently occur between the retained intermediate zone screen and the regional aquifer during these activities, but it will minimized as much as possible. A cross-flow estimate will determine how much water will be purged from the regional aquifer before initiating sample collection in each screen.

During purging, field personnel will collect field parameters with a flow-through cell. At R-7, R-8, and R-9i, groundwater samples will be collected when key parameters are stable and after 3, 6, and 10 casing volumes have been removed. At R-5, samples will be collected after 3, 6, and 10 casing volumes, over and above the cross-flow volume, have been removed. Groundwater samples will be analyzed for the Earth and Environmental Sciences Group 14 (EES-14) indicator suite analytes consisting of metals and anions. Transducer data will be collected during pumping in each well to track drawdown.

3.4 Hydraulic Step Tests—Prejetting

Short-duration hydraulic step tests will be conducted at the retained screens in each well before jetting the screens. Packers will be used to isolate the target screens. The results of the step tests will be used to calculate the prejetting specific capacity of each screened interval.

3.5 Screen Jetting

At wells R-5, R-7, and R-8, a jetting tool will be used to redevelop the retained screens. This technique uses pressurized pulses of water across the screened interval and is often effective at increasing the specific capacity of screened zones. The high-pressure jetting tool will be attached to the end of the discharge pipe of a pump hoist rig and lowered into the well and rotated as the tool is raised and lowered across the screened interval. Pumping will be conducted simultaneously with jetting to remove any particles loosened by the jetting technique.

The retained intermediate zone screen at R-9i is set in fractured basalt. It will not be jetted because of concerns that the jetting might push the filter pack away from the well casing into basalt fractures. Redevelopment at this screen will consist of bailing/swabbing and purging/sampling as described above.

3.6 Hydraulic Step Tests—Postjetting

Postjetting hydraulic step tests will be conducted in the same manner as the prejetting step tests, with the exception of well R-9i, which will be tested only before jetting. The postjetting specific capacity data will be compared with the prejetting data to determine if specific capacity improved. Samples will be collected in the same manner as described in section 3.3. Pre– and postjetting analytical data will be compared to identify any improvements as a result of jetting. A report will be prepared to summarize the hydraulic testing data and the analytical results.

3.7 Deployment of Temporary Packer Strings

Following completion of the screen conversions and jetting, temporary packer strings will be deployed in each well until the final sampling systems have been designed and procured.

Each productive screened interval will be isolated. The packer strings will consist of a series of adequately pressurized inflatable packers that will ensure isolation of water-bearing zones.

3.8 Final Sampling System Installation

Final sampling systems will be installed in the TA-21 monitoring wells as follows:

- R-5: A two-pump Baski sampling system with dedicated transducers will be configured to sample the intermediate and upper regional aquifer screens.
- R-7: A single pump system will be installed to sample the regional aquifer screen.
- R-8: A single pump system will be installed to sample the retained regional aquifer screen.
- R-9i: A single pump system will be installed to sample the retained intermediate aquifer screen.

4.0 SCHEDULE

This work scope will be conducted following NMED approval of the work plan. The proposed start date is fiscal year 2012 with the selected sampling systems to be installed by October 11, 2012.

5.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

NMED (New Mexico Environment Department), December 2, 2010. "Approval with Modifications, Technical Area 21 Monitoring Well Network Evaluation and Recommendations," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2010, 111462)

NMED (New Mexico Environment Department), January 24, 2011. "Approval, Extension Request for the Submittal of Work Plans Implementing the Technical Area 21 Vadose Zone and Groundwater Monitoring Network Enhancements," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 111676)

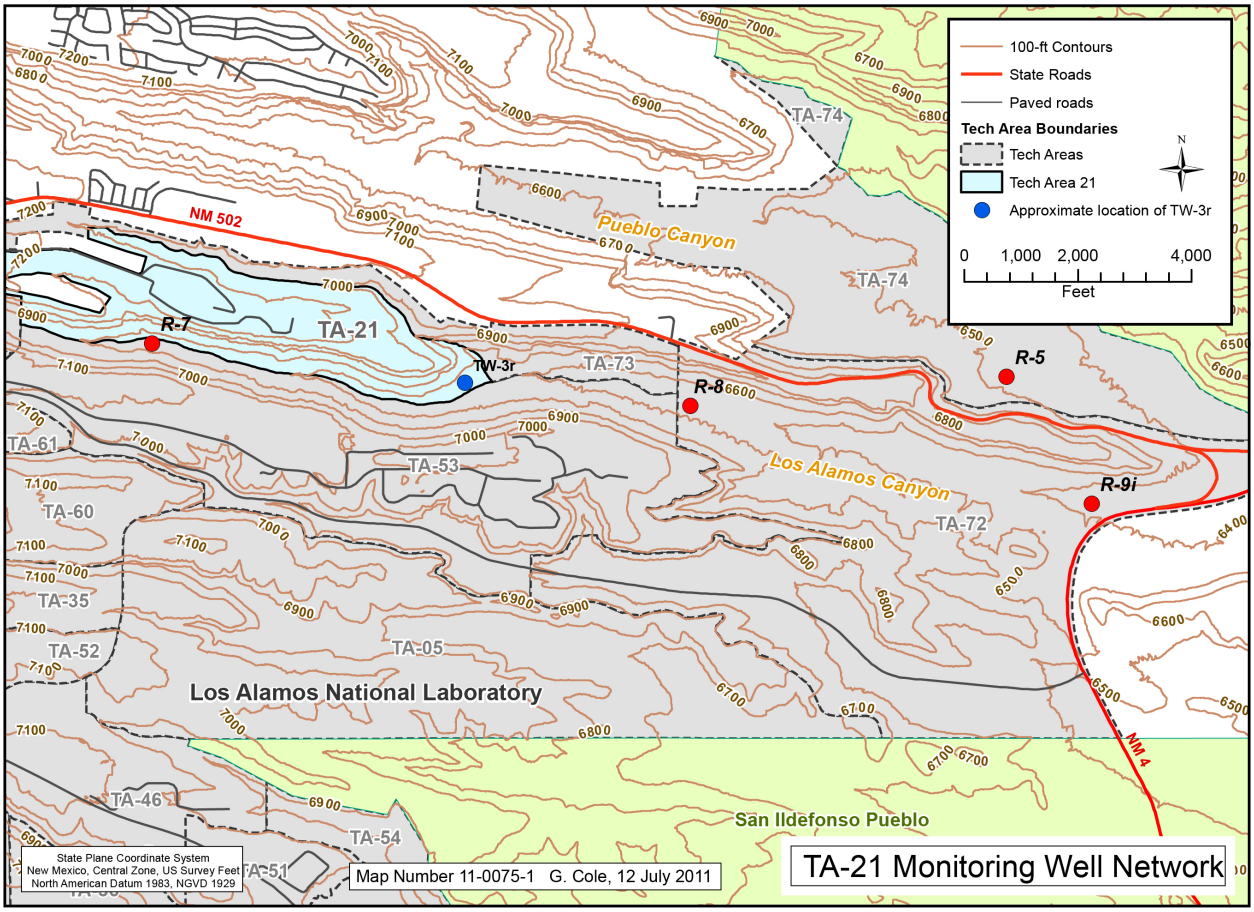

Figure 1.0-1 TA-21 monitoring well network

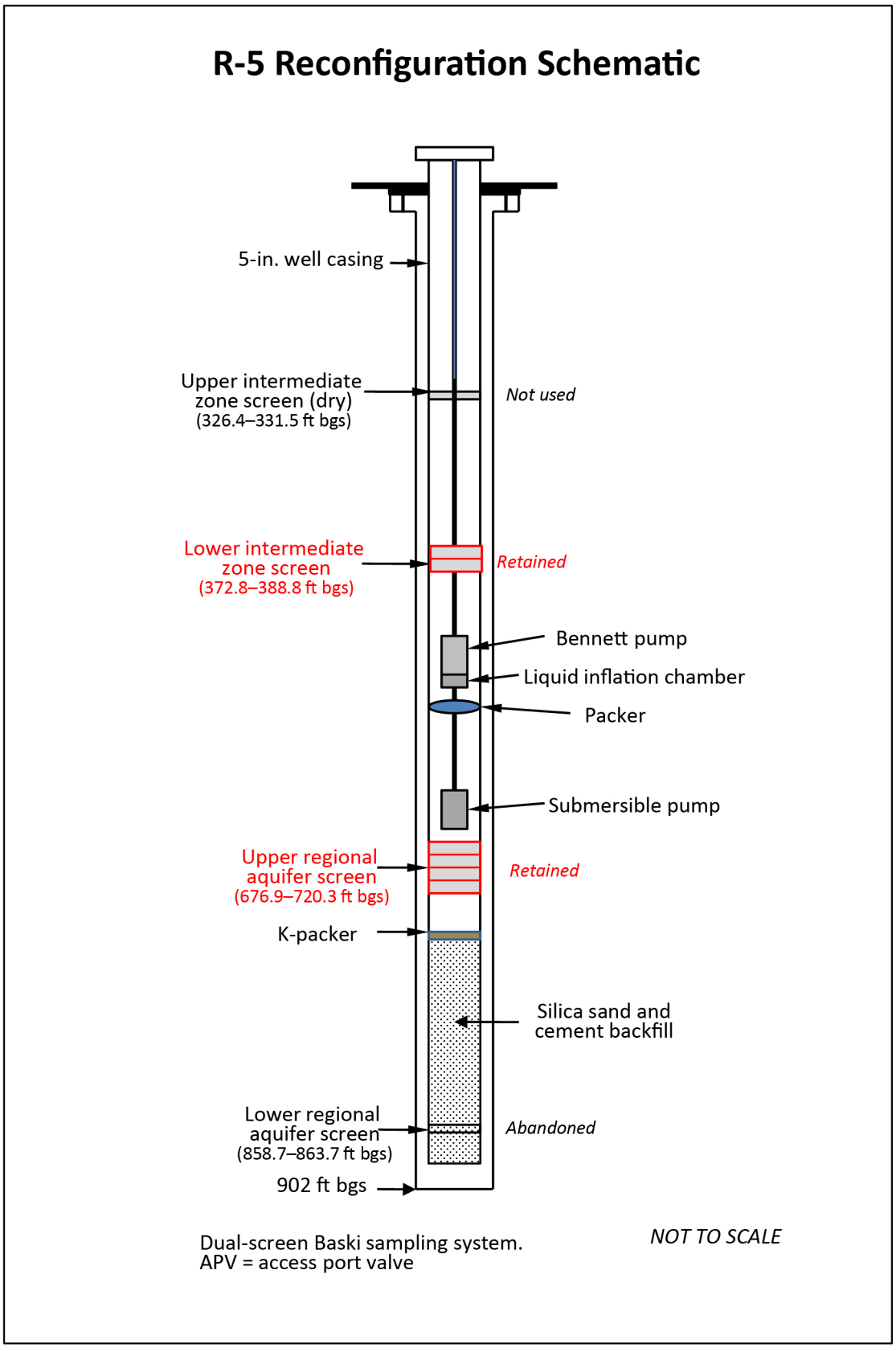

Figure 3.2-1 R-5 reconfiguration schematic

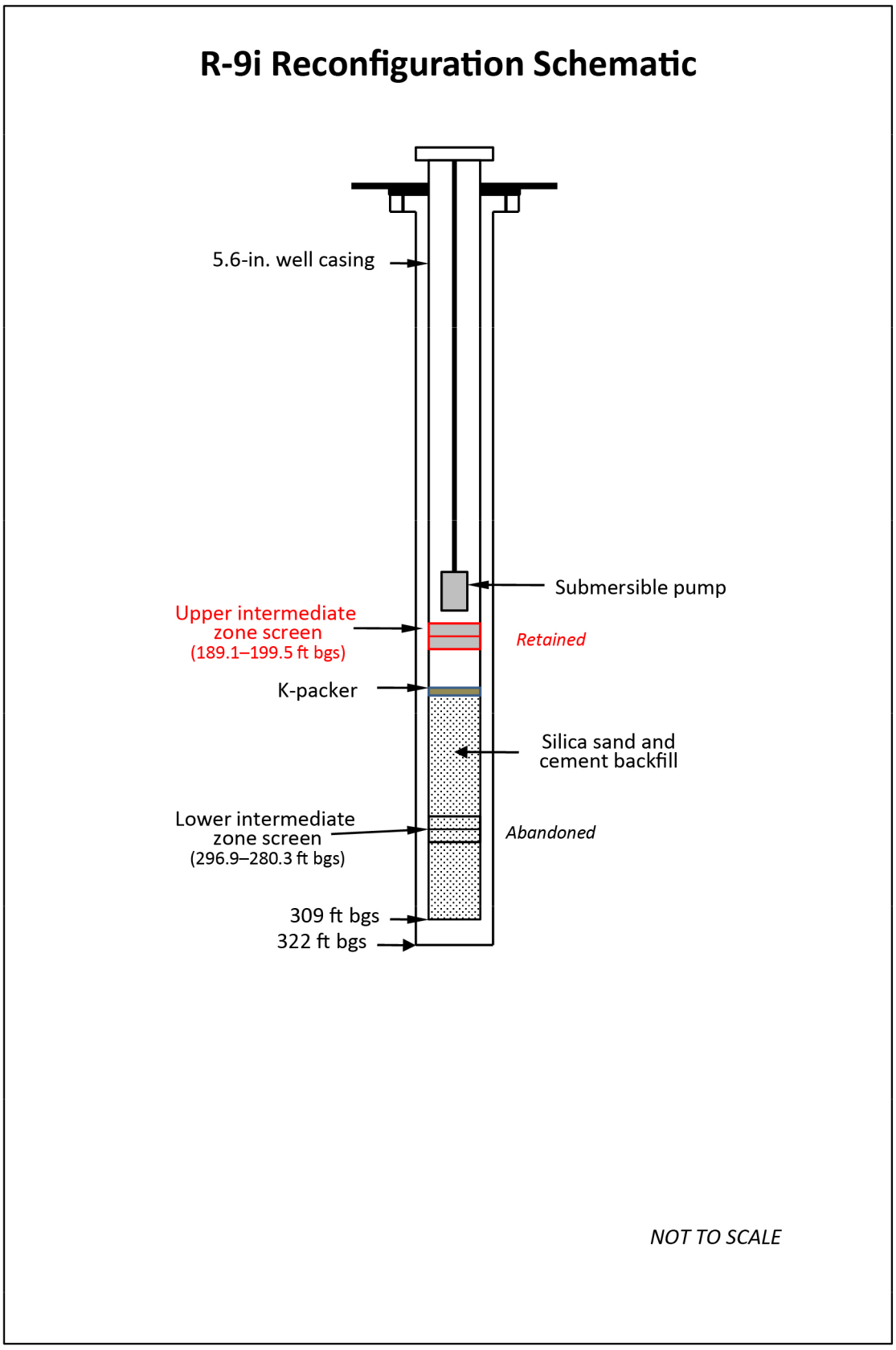

Figure 3.2-2 R-9i reconfiguration schematic

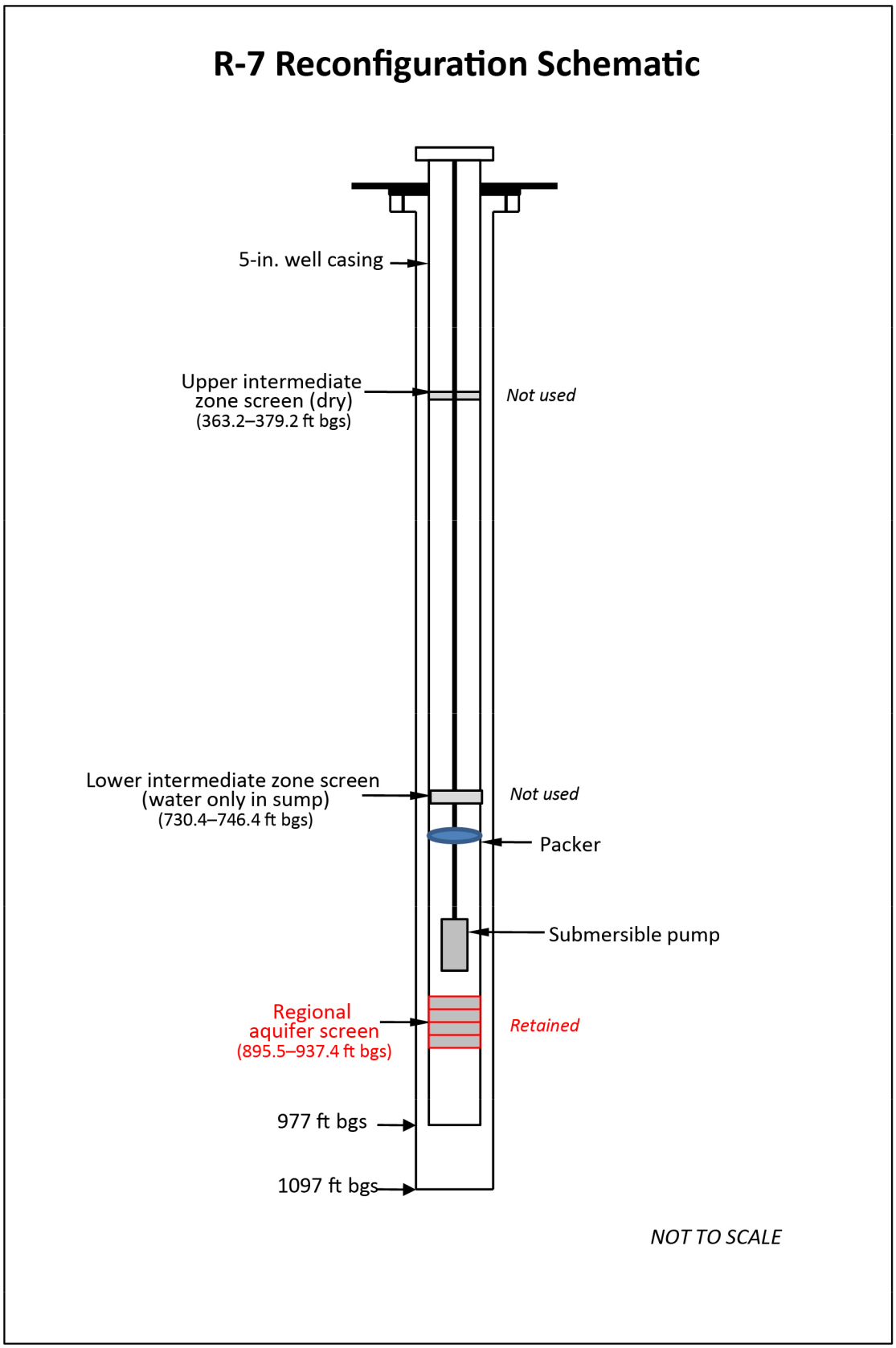

Figure 3.2-3 R-7 reconfiguration schematic

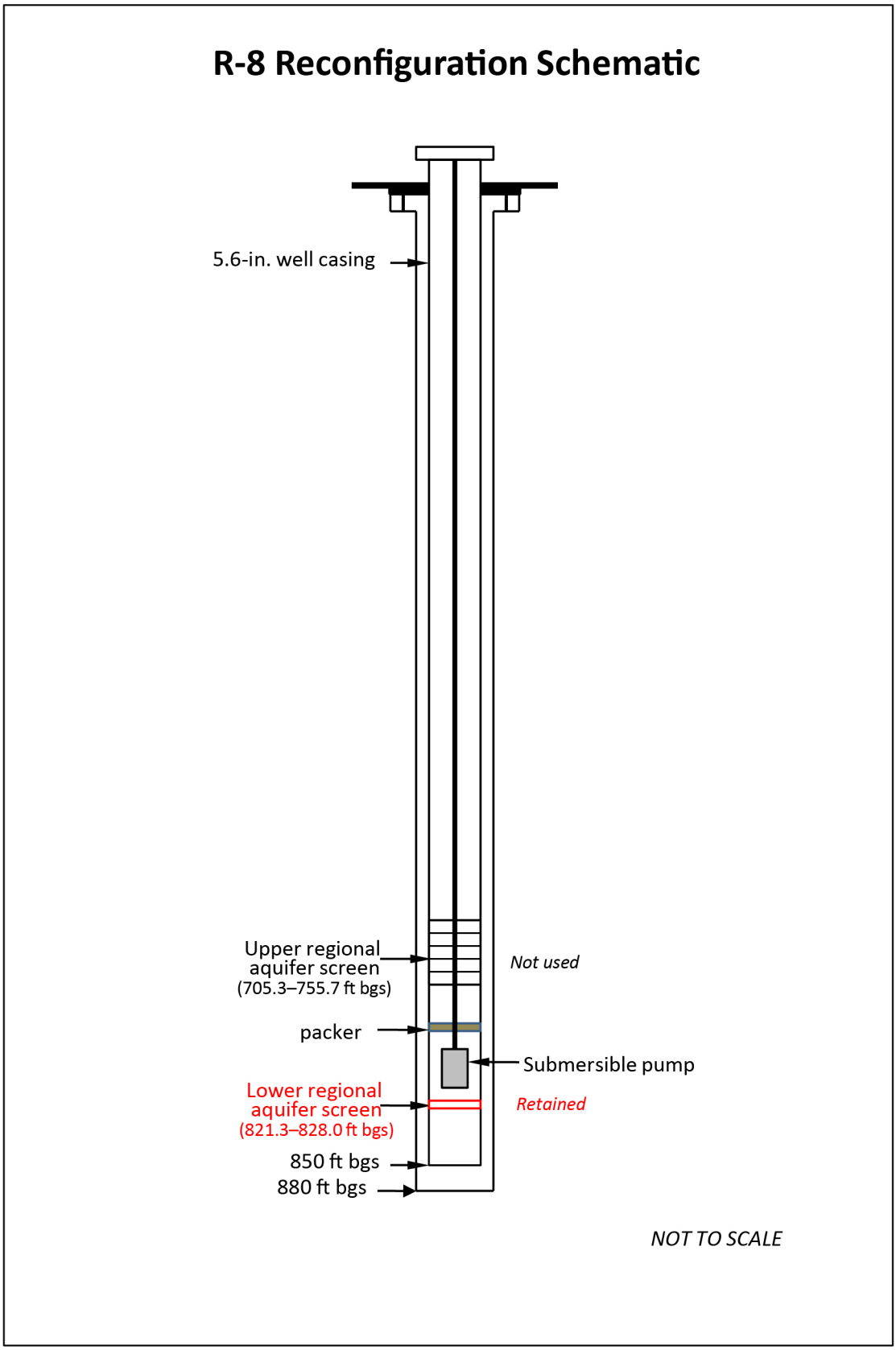

Figure 3.2-4 R-8 reconfiguration schematic

Table 3.2-1
TA-21 Monitoring Well Network Reconfiguration Rationale

Well	R-5	R-7	R-8	R-9i
Well Location	Southern end of lower Pueblo Canyon	Upper Los Alamos Canyon, one mile upstream of its confluence with DP Canyon	Middle Los Alamos Canyon	Los Alamos Canyon near eastern Laboratory boundary
Current screen numbers and monitored zones	Four screens: Upper intermediate zone (dry) Lower intermediate zone Upper regional aquifer Lower regional aquifer	Three screens: Upper intermediate zone (dry) Lower intermediate zone Upper regional aquifer	Two screens: Upper regional aquifer Lower regional aquifer	Two screens: Upper intermediate zone Lower intermediate zone
Screen(s) to be abandoned/no longer used	Upper intermediate zone (dry) Lower regional aquifer	Upper intermediate zone (dry) Lower intermediate zone	Upper regional aquifer	Lower intermediate zone
Screen(s) to be retained	Lower intermediate zone Upper regional aquifer	Upper regional aquifer	Lower regional aquifer	Upper intermediate zone
Justification for proposed well configuration	Retaining the lower intermediate zone screen will provide detection for first contaminants migrating in the subsurface. The upper regional aquifer screen is retained to monitor first arrival of potential contaminants reaching the regional aquifer.	The upper intermediate zone screen has been dry for the past 3 yr, and the lower intermediate zone screen has water only in the sump; therefore the regional aquifer screen will be the only screen retained.	The upper regional aquifer screen is in tight sediments and is unlikely to provide representative data from the top of the regional aquifer. Well TW-3r, which is planned for installation in 2012, will serve that purpose.	Injection tests of the completed well indicate that the upper screen has a relatively high hydraulic conductivity, whereas the lower screen has a very low hydraulic conductivity. Because Westbay is the only sampling system capable of monitoring this combination and configuration of hydraulic conductivities, the upper intermediate screen will be retained and the lower screen will be abandoned.

Table 3.2-1 (continued)

Well	R-5	R-7	R-8	R-9i
Well Location	Southern end of lower Pueblo Canyon	Upper Los Alamos Canyon, one mile upstream of its confluence with DP Canyon	Middle Los Alamos Canyon	Los Alamos Canyon near eastern Laboratory boundary
Method of screen abandonment	The lower part of the well will be filled with a combination of silica sand and cement. The backfill will be capped with a k-packer, isolating the abandonment material from the functioning portion of the well.	Not applicable; the upper unproductive screens will remain in place but be isolated from underlying regional aquifer with a packer.	Not applicable; the upper screen will no longer be used and it will be isolated from the lower screen with an inflatable packer.	The lower part of the well will be filled with a combination of silica sand and cement. The backfill will be capped with a k-packer, isolating the abandonment material from the functioning portion of the well.
Replacement sampling system	A two-pump Baski sampling system with dedicated transducers will be configured to sample the intermediate and uppermost regional aquifer screens.	A single pump system will be installed in the regional aquifer. An inflatable packer will be installed below the intermediate zones to isolate them from the regional aquifer. Transducers will be placed above and below the packer to monitor water levels.	A single pump system will be installed to sample the retained regional aquifer screen.	A single pump system will be installed to sample the retained intermediate zone screen.