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Las Conchas Wildfire Effects and Mitigation Actions in Affected Canyons

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1.0 INTRODUCTION

The Las Conchas wildfire started on June 26, 2011, in the Jemez Mountains, approximately 10 mi west of Los Alamos National Laboratory (LANL or the Laboratory). The fire spread quickly, driven by high winds, and forced the evacuation of the Los Alamos townsite and closure of the Laboratory on June 27, 2011. The fire burned to the west and south of the Laboratory but did not cross over NM 501 near the Laboratory's western boundary. A 1-acre spot fire in Technical Area 49 next to NM 4 was quickly extinguished. The evacuation order for Los Alamos was lifted on July 3, and the Laboratory reopened on July 7, 2011. The fire ultimately burned approximately 156,600 acres, making it the largest wildfire in New Mexico history and was not 100% contained until August 1, 2011. Figure 1.0-1 presents a map showing the extent of the Las Conchas fire.

The fire burned portions of three of the major watersheds that drain onto Laboratory property, including the Los Alamos Canyon, Pajarito Canyon, and Water Canyon/ Cañon de Valle watersheds. Burning in the upper portions of these watersheds greatly increased the risk of flash floods and flood damage in the downstream canyons. In response to this increased flood risk, the Laboratory implemented mitigation actions following the fire to lessen the potential for flood damage and to control the potential for mobilization of contamination. Although these efforts were effective in reducing the impacts of floods, several heavy rainfall events in August resulted in flooding significant enough to cause damage to Laboratory property.

This report identifies effects of the wildfire and subsequent flooding on Laboratory property during August 2011, describes completed mitigation actions, and identifies ongoing issues of concern.

2.0 FIRE AND FLOODING EFFECTS

2.1 Cañon de Valle Corrective Measures Implementation Activities

Corrective measures implementation (CMI) activities for surface-water and alluvial groundwater contamination associated with the Technical Area 16 (TA-16) 260 Outfall were in place in Cañon de Valle at locations downstream of burned areas. As described below, flooding associated with rainfall events in August 2011 has damaged some components of the CMI, including the permeable reactive barrier (PRB) and associated alluvial groundwater monitoring wells.

On August 3, 2011, a storm in the Cañon de Valle watershed produced a total precipitation of 1.73 in., with a 30-min maximum intensity of 1.37 in. This event produced moderate to severe flooding, erosion, and sediment transport in Cañon de Valle. On August 9, a site visit was conducted to evaluate the extent of flood damage to the PRB vessel and adjacent alluvial groundwater monitoring wells and equipment. The cover of the PRB was removed to inspect for infiltration by floodwater, sediment, and ash. Some infiltration of floodwater, sediment, and ash was observed in the first and second PRB vessel chambers where the vertical vapor sampling ports had broken off and been washed away during the flood event. The third and fourth vessel chambers were relatively unaffected.

Observed changes to the stream channel and damage to equipment following the August 3, 2011, flooding event included the following:

- A 4-ft-deep × 9-ft-wide × 20-ft-long headcut had formed in the Cañon de Valle channel just east (downgradient) of the PRB cutoff wall. This may have been initiated in part from disturbances associated with installation of the PRB.
- Channel cut and erosion exposed the piping that leads from the cutoff wall to the PRB.

- Two vapor-sampling ports were broken from the cover of the PRB.
- The pre-treatment vapor port to the PRB (location CDV-16-612215) was damaged by the floodwaters, lodging debris inside the intake piping.
- Two alluvial monitoring wells (CDV-16-611938 and CDV-16-611934) and their concrete footings were dislodged from the canyon floor.
- One piezometer location (CDV-16-611924) was damaged by floodwaters and debris.

On August 21, 2011, an even larger rain event occurred over the recent burn scar in the upper Cañon de Valle watershed. Runoff from the storm flooded NM 501 as well as the area upstream from the PRB with debris. The site was inspected on August 26, 2011. Additional changes to the channel and damage to equipment following the August 21, 2011, flooding event included the following:

- The flood incised through the PRB cutoff wall down to bedrock about 10 ft wide and about 5 ft deep.
- The cutoff wall was broken and splayed open downstream.
- Sediment was eroded from the channel bed and adjacent stream banks and sediment and rocks as large as 2 to 3 ft in diameter were deposited on top of the PRB vessel and throughout the canyon.
- All monitoring tubes and plumbing around the vessel were either transported downstream or buried.
- The tube connecting the cutoff wall to the vessel was ripped out of the vessel and the cutoff wall.
- Wells at locations CDV-16-611919, CDV-16-611934, CDV-16-611936, and CDV-16-611938 were washed away by flood waters, and the surface completion and well housing at location CDV-16-611931 was stripped away, leaving only PVC well casing.
- The piezometers at each of the cutoff wall's discharge points were broken off as well at locations CDV-16-611929 and CDV-16-611930.
- Debris from the PRB was found up to 1 mi downstream.

Photographs of the site after the August 21, 2011, event are presented in Appendix A.

2.2 Stream Gage Stations

Heavy rainfall events on August 21 and August 22, 2011, caused flooding that damaged or destroyed the following gage stations:

- E026 in Los Alamos Canyon below the ice rink
- E243 in Pajarito Canyon above Twomile Canyon
- E244 in Twomile Canyon above Pajarito Canyon
- E252 in Water Canyon at the west boundary of the Laboratory
- E252.5 in Water Canyon above S-Site Canyon
- E253 in Cañon de Valle at the west boundary of the Laboratory

- E256 in Cañon de Valle below Material Disposal Area P
- E262 in Cañon de Valle above Water Canyon
- E265 in Water Canyon below NM 4
- E350 in Frijoles Canyon near the Bandelier National Monument Visitor Center

Repairs at E026, completed on August 24, 2011, included removing log and flood debris from the channel, clearing sediment and debris from the stilling well, and redirecting the stream channel back to the gage. Repairs at E252 and E253, completed on September 12, included clearing debris from the stilling wells, redirecting the stream channel back to the gage, and replacing damaged sampling and data-logging equipment. At E265, an automated sampler, triggered by an actuator, was installed September 12.

Roads were damaged in Pajarito and Water Canyons, limiting access to make gage station repairs at E243, E244, E256, E262, and E252.5. At E252.5, the sampling and gaging equipment were dislodged and damaged but no stream controls were in place that could be damaged. At E256, the Parshall flume was washed from its location so is no longer functioning as a control, and gaging and sampling equipment were damaged. At this time, access to assess damage at E262 has not been possible. At E265, the Greenlee box was inundated with water and equipment inside was damaged; the stilling well is silted with debris. At E350, the stilling well, gaging, and sampling equipment were washed downstream but have been recovered.

Photographs of several damaged gage stations are presented in Appendix A.

2.3 Sediment Control Structures

Several sediment control structures were constructed in Los Alamos and Pueblo Canyons as part of the New Mexico Environment Department– (NMED-) approved interim measure work plan to mitigate contaminated sediment transport in Los Alamos and Pueblo Canyons (LANL 2008, 105716; NMED 2009, 104390). The grade-control structure in DP Canyon was damaged slightly by flooding from storms on August 21 and August 22, 2011, and was repaired on August 27.

3.0 COMPLETED MITIGATION ACTIONS

The following describes flood mitigation, fire mitigation, and restoration activities completed in the Los Alamos, Pajarito, and Water Canyon watersheds during and after the Las Conchas fire.

3.1 Flood Mitigation

3.1.1 Los Alamos Canyon Low-Head Weir

A low-head weir was installed in Los Alamos Canyon near the downstream boundary of the Laboratory after the Cerro Grande fire to collect sediments mobilized by floodwaters. In anticipation of increased sediment load following the Las Conchas fire, sediments were removed from the basins upstream of the weir to provide additional storage capacity. Approximately 1200 yd^3 of sediment was removed and staged in Los Alamos Canyon in a borrow pit well above the active stream channel and floodplain. The staging area was lined with plastic before the sediment was emplaced, and the sediment pile was sprayed with tackifier to prevent wind or water erosion. This activity was performed from July 8 to 11, 2011. In October 2011, once the monsoon season has ended, the Laboratory intends to land-apply and subsequently stabilize this removed sediment in the same manner and area as defined in the supplemental interim measure work plan to mitigate contaminated sediment transport in Los Alamos and Pueblo Canyons (LANL 2008, 105716) and approval (NMED 2009, 104390).

To prevent potential overtopping of the weir by floodwaters, more of the discharge standpipe at the base of the weir was exposed to increase the flow rate through the weir. This activity was performed in conjunction with the sediment-removal activities described above. At NMED's request, the standpipe was returned to its original configuration and wrapped with filter fabric on August 18, 2011. Photographs of the restored standpipe were provided to NMED on August 18, 2011, and are also included in Appendix A.

3.1.2 Wastes Stored in Los Alamos, Pajarito, and Water Canyons

At the time of the fire, various investigation-derived wastes were being stored in Los Alamos, Pajarito, and Water Canyons and Cañon de Valle. These wastes were generated from investigation and remediation activities that were being conducted in these canyons. To prevent possible damage to the waste containers caused by flooding or mobilization of wastes, the containers were removed from the canyons and transferred to a mesa-top storage area. Wastes removed from these canyons included more than 100 drums, 8 rolloff bins, and more than 13,000 gal. of purge and development water stored in 40 polyethylene tanks. This activity was performed from July 8 to 11, 2011.

3.1.3 Sediment Retention Basins in Los Alamos Canyon

Two sediment retention basins were constructed in Los Alamos Canyon as part of the interim measure for Solid Waste Management Unit (SWMU) 01-001(f). These basins were constructed to capture sediments contaminated with polychlorinated biphenyls (PCBs). Because the retention basins are located in the canyon bottom, the berms that form the basins could potentially be damaged by flooding. To prevent possible transport of PCB-contaminated sediments, the sediments that had accumulated in the basins were removed. Approximately 25 yd^3 of sediment was excavated from the basins, placed into rolloff bins, and removed from the site for off-site disposal. In addition to removing the sediments, the retention basins were protected to reduce the potential for damage from flooding. Concrete Jersey barriers were placed in the canyon floor in a configuration that should divert flood water around the basins. Photographs of the basins following sediment removal and armoring are included in Appendix A. Sediment removal and armoring was performed from July 8 to 11, 2011.

3.1.4 Groundwater Wells

Actions were taken to protect groundwater wells located in Los Alamos Canyon from flooding. A major concern was to prevent floodwater and debris from entering the wells in the event the wells were overtopped by flooding. Casings of alluvial groundwater-monitoring wells were sealed using expanding well plugs if the casing allowed their use. If expanding plugs could not be used, the casings were sealed using inflatable plugs. Some wells were equipped with Victaulic wellheads, which already have seals. For these wells, the seals were inspected and repaired, if necessary, to ensure they would seal. With several exceptions, if wells were equipped with transducers or pumps, these were removed before sealing. A total of 39 alluvial wells were sealed in this manner. Table 3.1-1 identifies the wells and the actions taken at each well. These activities were performed from July 15 to 21, 2011. Table 3.1-1 also identifies those wells scheduled for sampling in the 2011 Interim Facility-Wide Groundwater Monitoring Plan (IFGMP) (LANL 2011, 205231).

From July 8 to July 12, 2011, four intermediate and three regional groundwater-monitoring wells in Los Alamos Canyon and two alluvial wells in Pajarito and Twomile Canyons were also sealed in a similar manner. These wells are LAOI-3.2/3.2a, LAOI-7, PCAO-5, R-7, R-8, R-9, R-9I, and TMO-1. All these wells are scheduled for sampling in the 2011 IFGMP (LANL 2011, 205231).

Wells located in canyons are also subject to potential physical damage from water and debris during flooding. To provide protection from such damage, concrete Jersey barriers were placed upstream of

monitoring and water supply wells to divert floodwaters. Well armoring was performed from July 8 to 11, 2011.

Appendix A presents photographs of typical well seals and armoring.

3.2 Fire Mitigation

3.2.1 Los Alamos Canyon

Tree thinning was performed in Los Alamos Canyon to reduce the potential for fire spreading downcanyon toward the Los Alamos townsite. Thinning was performed in TA-43 from the Los Alamos County ice rink west to the Laboratory boundary during the week of June 27, 2011.

3.2.2 Pajarito Canyon

Potential fuels in Pajarito Canyon were removed from along each side of Pajarito Road in the vicinity of TA-54. Fuel reduction was accomplished by removing trees using a masticator and by mowing. Fuel reduction was performed to provide additional fire protection to TA-54. The masticated material was left on-site to provide soil stability and erosion control. Fuel reduction was performed during the week of June 27, 2011.

3.2.3 Western Laboratory Boundary

Back-burning was performed along the western boundary of the Laboratory to help prevent potential spreading of the Las Conchas fire eastward onto Laboratory property. Back-burning was performed along the western side of NM 501. Back-burning was performed on June 29, 2011.

Fuel reduction was performed near the western Laboratory boundary along the eastern side of NM 501. Fuel reduction was performed beneath power lines to protect the power lines. Fuel was removed using a masticator. The masticated material was left on-site to provide soil stability and erosion control. Fuel reduction was performed on June 29, 2011.

4.0 ISSUES OF CONCERN

4.1 Temporarily Plugged Monitoring Wells

As described in section 3.1.4, 41 alluvial monitoring wells, 4 intermediate monitoring wells, and 3 regional monitoring wells in the Los Alamos Canyon and Pajarito Canyon watersheds were plugged to prevent damage during flooding. Twenty-one of these wells are included as part of the General Surveillance and TA-21 monitoring groups in the 2011 IFGMP (LANL 2011, 205231). Because these well have been temporarily plugged, they were not included in sampling activities conducted since the fire. The wells are currently scheduled to be sampled in 2012. Monitoring data for these 21 wells will not be included in periodic monitoring reports for monitoring events that occur while the wells are plugged.

4.2 Cañon de Valle PRB

As described in section 2.1, the PRB in Cañon de Valle and several associated monitoring wells were damaged by flooding that occurred in August. Continued operation of the barrier and associated groundwater monitoring is not possible. As described in the 2010/2011 Monitoring Summary Report for the Technical Area 16 Permeable Reactive Barrier and Associated Corrective Measures Implementation Projects, which will be submitted to NMED on September 30, 2011, a flood recovery plan will be prepared

that will identify action to be taken in response to the damage that occurred to the PRB and associated wells.

4.3 Gage Stations

As described in section 2.2, 10 gage stations were damaged by flooding on August 21 and August 22, 2011. Stations E026, E252, and E253 have been repaired, but stream channels are continuing to shift, periodically isolating the gages from stormwater flow or burying sampling lines and stilling wells in sediment. These changing stream conditions are contributing to increased uncertainty in gage measurements and the decreased likelihood of sample collection. Sampling functionality has been reestablished at E265, but at this time rainfall and stream stage measurements are not functioning. Repairs at E243, E244, E252.5, E256, and E262, will be made following road repairs. No further stormwater sampling or stage measurements will be made at E243, E244, E252.5, E256, and E262 in 2011.

4.4 Canyons Investigations

Compliance Order on Consent investigations have been completed for the Los Alamos and Pueblo Canyons watershed (LANL 2004, 087390; LANL 2005, 091818) and the Pajarito Canyon watershed (LANL 2009, 106939), and the investigation report for the Water Canyon and Cañon de Valle watershed will be submitted to NMED by September 30, 2011. Flooding since the Las Conchas fire has resulted in partial erosion and redistribution of sediments in Los Alamos, Pajarito, and Water Canyons and Cañon de Valle. As a result, the current distribution of contaminants in sediments these canyons may be different from that reported in these investigation reports. Site visits, however, have found that sediment deposits with the highest measured concentrations of RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) and barium in Cañon de Valle are still in place. Transport of some contaminated sediments is not expected to result in deposits with higher concentrations because of the mixing of sediments from different sources and, therefore, the risk associated with sediment contamination would not have increased.

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.

LANL (Los Alamos National Laboratory), April 2004. "Los Alamos and Pueblo Canyons Investigation Report," Los Alamos National Laboratory document LA-UR-04-2714, Los Alamos, New Mexico. (LANL 2004, 087390)

LANL (Los Alamos National Laboratory), December 2005. "Los Alamos and Pueblo Canyons Supplemental Investigation Report," Los Alamos National Laboratory document LA-UR-05-9230, Los Alamos, New Mexico. (LANL 2005, 091818)

LANL (Los Alamos National Laboratory), October 2008. "Supplemental Interim Measures Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons," Los Alamos National Laboratory document LA-UR-08-6588, Los Alamos, New Mexico. (LANL 2008, 105716)

LANL (Los Alamos National Laboratory), August 2009. "Pajarito Canyon Investigation Report, Revision 1," Los Alamos National Laboratory document LA-UR-09-4670, Los Alamos, New Mexico. (LANL 2009, 106939)

LANL (Los Alamos National Laboratory), August 2011. "2011 Interim Facility-Wide Groundwater Monitoring Plan," Los Alamos National Laboratory document LA-UR-11-2183, Los Alamos, New Mexico. (LANL 2011, 205231)

NMED (New Mexico Environment Department), January 7, 2009. "Approval with Modifications for Sediment Removal at the Los Alamos Canyon Low Head Weir," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 104390)

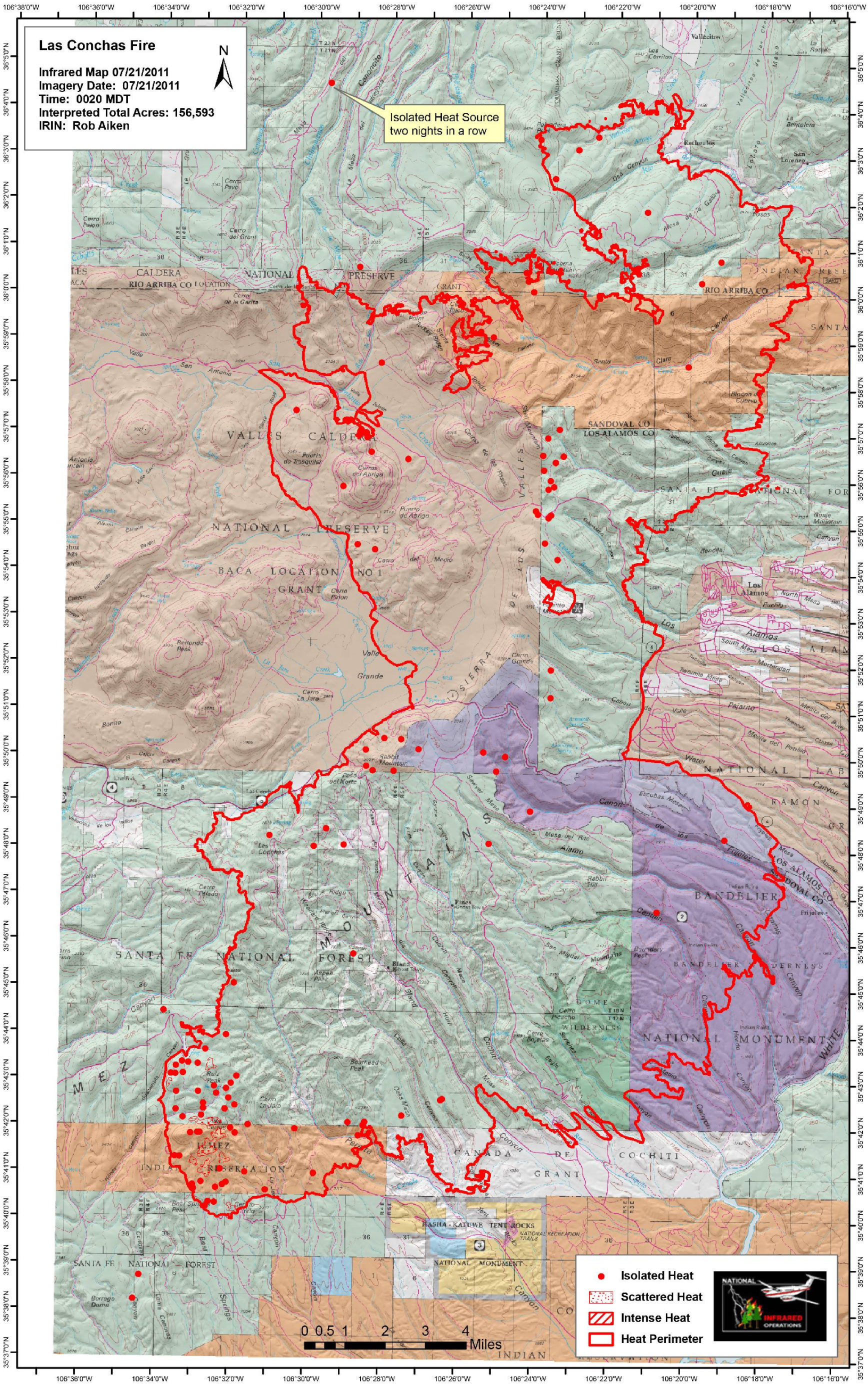

Figure 1.0-1 Extent of the June 2011 Las Conchas fire

Table 3.1-1
Status of Protective Measures for Alluvial Wells in Los Alamos Canyon

Well Name	Measures Taken to Fortify Inner Casing	Victaulic Wellhead?	Pump Installed?	Transducer Installed?	2011 IFGMP?
LAO R-1	Pulled pump assembly; 4-in. expansion plug installed	No	Yes	No	No
LAO R-2	2-in. expansion plugs installed.	No	No	No	No
LAO-0.3	Pulled pump assembly; 4-in. expansion plug installed	Yes	Yes	Yes	Yes
LAO-0.6	Victaulic gasket installed	Yes	Yes	Yes	Yes
LAO-0.7	Pulled pump assembly; 2-in. expansion plug installed	No	Yes	No	No
LAO-0.8	4-in. expansion plug installed	Yes	No	No	No
LAO-0.91	4-in. expansion plug installed	Yes	No	No	No
LAO-1	Pulled pump assembly; 4-in. inflatable plug installed	No	Yes	Yes	Yes
LAO-1.2	Fenco cap in place at initial inspection. No additional protection required	No	No	No	No
LAO-1.6g	Victaulic gasket installed; transducer remains in well	Yes	Yes	Yes	Yes
LAO-1.8	4-in. expansion plug in place at initial inspection	No	No	No	No
LAO-2	Pulled pump assembly; 4-in. inflatable plug installed	No	Yes	Yes	Yes
LAO-3	Pulled pump assembly; 4-in. inflatable plug installed	No	Yes	No	No
LAO-3A	Pulled pump assembly: 2-in. inflatable plug installed	No	Yes	Yes	Yes
LAO-4	Pulled pump assembly; 4-in. inflatable plug installed	No	Yes	No	No
LAO-4.5	Pulled pump assembly; 3-in. expansion plug installed	No	Yes	No	No
LAO-4.5a	2-in. inflatable plug installed	No	No	No	No
LAO-4.5b	2-in. inflatable plug installed	No	No	No	No
LAO-4.5c	Pulled pump assembly; 2-in. expansion plug Installed	No	Yes	Yes	Yes
LAO-5	4-in. inflatable plug installed	No	No	No	Yes
LAO-5.7	2-in. expansion plug installed	No	No	No	No
LAO-6	Pulled pump assembly; 4-in. expansion plug installed	No	Yes	No	No
LAO-6a	Pulled pump assembly; 2-in. expansion plug installed	No	Yes	Yes	Yes
LAO-B	Victaulic gasket in place	Yes	Yes	Yes	Yes

Table 3.1-1 (continued)

Well Name	Measures Taken to Fortify Inner Casing	Victaulic Wellhead?	Pump Installed?	Transducer Installed?	2011 IFGMP?
LAO-C	Pulled pump assembly; 4-in. inflatable plug installed	No	Yes	No	No
LAP 1.7	2-in. expansion plugs installed	No	No	No	No
LAP 3.5	2-in. expansion plugs installed	No	No	No	No
LAP-1	2-in. expansion plug installed	No	No	No	No
LAP-1.5	3 2-in. expansion plugs installed	No	No	No	No
LAO-1.2	3-in. black rubber cap with hose clamp in place at initial inspection. No additional protection required.	No	No	No	No
LAP-3	2-in. expansion plugs installed	No	No	No	No
LAP-4	2-in. inflatable plug installed	No	No	No	No
LAP-6b	4-in. expansion plug installed	No	No	No	No
LLAO-1B	Victaulic gasket installed; transducer remains in well	Yes	Yes	Yes	Yes
LLAO-2	Victaulic gasket installed	Yes	No	No	No
LLAO-3	Victaulic gasket installed	Yes	No	No	No
LLAO-4	Victaulic gasket installed	Yes	Yes	Yes	Yes
LLAO-5	4-in. expansion plug installed	No	No	No	No

Appendix A

Photographs of Mitigation Activities

Damage occurred at the Permeable Reactive Barrier (PRB) in Upper Water Canyon from storm events on August 3 and August 21

Storm event on August 21st produced significant runoff that damaged many gage stations within the Water Canyon watershed. Peak flows were estimated to be between 4950 cfs and 6190 cfs

To prevent potential overtopping of the LA weir by floodwaters, more of the discharge standpipe at the base of the weir was exposed to increase the flow rate through the weir. At the request of the NMED, the standpipe was returned to its original configuration on August 18, 2011

To prevent possible release of PCB-contaminated sediments, the sediments accumulated in the basins were removed (+/- 25 Cu/Yd).

The retention basins were armored to prevent possible damage from flooding. Concrete barriers were placed around the basins to provide armoring.

Concrete barriers were installed in Los Alamos Canyon to protect monitoring wells and sediment retention ponds.

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