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Status Report for the Solid Waste Management Units 03-010(a) and 03-001(e) Interim Measure Activities at Technical Area 03

Los Alamos
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1.0 INTRODUCTION

This status report presents the results to date of four interim-measure activities currently being conducted at Solid Waste Management Unit (SWMU) 03-010(a)—a former surface disposal site for a vacuum pump repair shop—and SWMU 03-001(e)—a former less-than-90-day storage area for vacuum-pump repair waste—at Los Alamos National Laboratory (LANL or the Laboratory) (Figure 1.0-1). These activities are being implemented by the Laboratory in response to the 2005 environmental investigations at SWMUs 03-010(a) and 03-001(e) during which a shallow groundwater body, located approximately 25 ft below ground surface (bgs) and immediately west of building 03-0030, was found to contain elevated levels of tritium and volatile organic compounds (VOCs) (Figure 1.0-2). The objective of the interim-measure activities is to obtain sufficient information to determine an effective control for the groundwater recharge system, thereby supporting a final remedy for the site. Successful implementation of these activities partially fulfills the requirements established in the New Mexico Environment Department (NMED) notice of disapproval (NOD) of the "Investigation Report for Solid Waste Management Units 03-010(a) and 03-001(e) at Technical Area 03" (DOE 2006, 092669; NMED 2006, 091513).

Data collected from wells drilled during the 2005 investigation at SWMUs 03-010(a) and 03-001(e) show that the groundwater body at building 03-0030 is relatively small and that the primary recharge source for the groundwater is in the immediate area of SWMU 03-001(e). Historical studies of the groundwater isotopic and geochemical signature indicated that the primary recharge source for the perched saturation was from an anthropogenic source such as the outflow from a cooling unit condensate line or lines at building 03-0030. However, the data were not conclusive, and additional data collection was proposed in the investigation report and the response to the third NOD (DOE 2006, 092669; DOE 2006, 095568) to better define the source of recharge as well as evaluate longer-term response actions of the building 03-0030 groundwater body. The four interim measure action items proposed were

- installation of pressure transducers in select monitoring wells to evaluate water-level changes over time,
- stable isotope characterization of the building 03-0030 condensate water to determine if it may be the primary source for groundwater recharge,
- a groundwater tracer study to help determine the existence of any additional recharge source(s), and
- quarterly monitoring of the 2005 investigation wells.

Only the data results and interpretation of the first three action items are presented in this status report; quarterly monitoring data for natural water systems throughout the Laboratory are collected and published separately by the Laboratory's Water Stewardship Program (LWSP) and can be found in the March 2007 Pajarito Canyon Watershed periodic monitoring report (LANL 2007, 095116).

2.0 SITE HISTORY

SWMUs 03-010(a) and 03-001(e) are located within the Laboratory's Technical Area (TA) 03 next to building 03-0030 (Figure 1.0-1). TA-03 is a highly developed portion of the Laboratory and contains the operational facilities of the Laboratory. SWMU 03-010(a) is located about 30 ft west of general warehouse building 03-0030, also called SM-30. SWMU 03-001(e) is immediately adjacent to the western edge of building 03-0030 (Figure 1.0-2). Both SWMUs are operationally inactive.

The following subsections provide a condensed review of SWMUs 03-010(a) and 03-001(e) historical operations and investigations and focus primarily on the groundwater issues that drive the interim measure activities. A comprehensive review of the site history of SWMUs 03-010(a) and 03-001(e) is presented in the 2006 investigation report (DOE 2006, 092669).

2.1 Operational History

SWMU 03-010(a) was a surface disposal site for vacuum-pump oil containing mercury and radionuclides, generated from a vacuum repair shop located in building 03-0030 (LANL 1995, 057590, p. 5-17-1). During the 1950s, it is estimated that more than 100 lb of mercury-contaminated vacuum-pump oil was discarded onto the canyon edge (LANL 1993, 020947, p. 6-12).

From 1957 to 1992, SWMU 03-001(e) was an active storage area for vacuum-pump repair waste. Before a 100- to 200-gal. holding tank was installed within a concrete containment berm, the waste oil was stored in drums on the ground, and periodically the drums overflowed (LANL 1995, 057590, p. 5-17-1).

2.2 Previous Investigations

In the early 1990s, past operations at building 03-0030 as well as the results of initial sampling and analysis efforts in the area were reviewed in preparation of the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan for Operable Unit (OU) 1114 (LANL 1993, 020947), a document that covered all of TA-03, TA-64, and the former TA-61. The document identified the SWMU 03-010(a) outfall as a potential contaminant source for surrounding soil and water.

RCRA characterization activities of the SWMU 03-010(a) outfall soils and surrounding surface waters began in 1993 with RFI Phase I investigation sampling, per the work plan for OU 1114 (LANL 1993, 020947). The results of the Phase I sampling showed elevated levels of radionuclides, mercury, lead, and total petroleum hydrocarbons (TPH) in the outfall soil and sediment (LANL 1995, 046195, pp. 28, 34–37, and 43).

A second round of RFI sampling began in 1994 per the Phase II sampling plan for SWMU 03-010(a) (LANL 1994, 042624). It was during this investigation that free water was encountered in two of the seven boreholes drilled: B-1 (borehole [BH] 03-2664) and B-4 (BH 03-2667) at approximately 23 ft bgs (Figure 1.0-2). The results of the Phase II sampling showed low concentrations of VOCs in all media sampled and analyzed: soil, soil vapor, surface water, seep, and groundwater.

In 1999, NMED requested additional investigations that would allow for a more refined analysis of the hydrogeologic conceptual model at SWMU 03-010(a) (NMED 1999, 064614). In response, between December 1999 and April 2000, the Laboratory collected additional groundwater, surface water, and sediment samples. The results of these sampling events showed contaminant concentrations at nearly the same or at lower levels than the results from previous sampling events for SWMU 03-010(a) (LANL 2000, 068736). Observation at monitoring well (MW) 1 (BH 03-2664) indicated that water levels varied slightly throughout the year. Observation of surface water activity in the immediate vicinity of SWMU 03-010(a) showed that water was present in the adjacent stream channels/arroyos only as a result of stormwater runoff from the parking lots and roof drains (LANL 2000, 068736). These observations indicated that groundwater and surface water were not connected; however, further information was required regarding the nature and extent of the shallow groundwater and potential contaminant sources (NMED 2001, 071422).

In August 2002, the Laboratory conducted a geophysical investigation to define the extent of the shallow groundwater around MW-1. The geophysical data indicated that the shallow saturated zone possibly extended beneath the foundation of building 03-0030 (LANL 2003, 081599).

The 2005 investigation of SWMUs 03-010(a) and 03-001(e) sought to establish the source of shallow groundwater, the nature and extent of remnant groundwater contamination, the lateral extent of shallow groundwater, the hydraulic gradient, and groundwater flow rates. The resulting investigation report (DOE 2006, 092669) advanced the following conclusions.

- The perched groundwater is of limited extent in the area surrounding SWMU 03-001(e) and mounds beneath B-10 (BH 03-24530) and B-13 (BH 03-24548).
- The perched groundwater is largely isolated and not directly connected to intermediate-depth groundwater zones or the regional aquifer.
- The perched groundwater contains multiple chemicals of potential concern (COPCs), including VOCs and tritium.
- Groundwater COPCs are distributed throughout and are present in concentrations exceeding applicable state and federal groundwater standards.
- The source of VOC contamination in the groundwater is probably historical activities conducted at SWMUs 03-010(a) and 03-001(e).
- The source of tritium contamination of the groundwater was not defined.
- The recharge source or sources of the groundwater was not positively identified.

Although historical information regarding the geometry of the groundwater, the COPC concentration trends, and the isotopic signature of the groundwater indicated that the groundwater may be derived from an evaporated source of water, the data were inconclusive. Several other features in the immediate vicinity of building 03-0030 were identified in the 2005 investigation report as possible primary or contributing sources and included one or more galvanized-steel roof drain culverts that run east to west beneath the building or infiltration of surface runoff from the arroyos to the north and west of building 03-0030.

2.3 Previous Remediation

In 1994, a voluntary corrective action (VCA) was conducted at SWMU 03-010(a) as a part of the RFI to remove soils containing mercury above 20 parts per million (ppm) and TPH above 100 ppm (LANL 1994, 042624, pp. 3–13). Approximately 120 yd^3 of soil containing mercury and radionuclides was removed. During the VCA soil removal, VOCs were detected in the soil (LANL 1994, 042624, pp. 1–13). Because VOCs had not been characterized, the VCA could not be considered as the final remedy, and further investigation of the site was required.

In 2006, MW-1 was pulled and the borehole abandoned. A compromised well-vault cover seal had allowed surface runoff to enter the well vault, resulting in accumulation and possible infiltration of surface runoff into the well casing. As a result, the well was no longer useful for groundwater monitoring and was a potential contaminant transport pathway to the shallow groundwater.

No other remediation activities have been performed to date, because the source of the groundwater needs to be determined to support a final remedy for the site.

3.0 CURRENT ACTIVITIES AT SWMU 03-010(a) AND 03-001(e)

Four additional site activities were recommended in the investigation report and NOD response (DOE 2006, 092669; DOE 2006, 095568). Two of these activities (water-level monitoring and quarterly groundwater sampling) are ongoing and currently conducted by LWSP. Water-level monitoring is discussed in section 3.1, and groundwater quarterly sampling is discussed in section 3.2. The third activity, the tracer study performed in October 2006, is discussed in section 3.3. The fourth activity, the sampling and analysis of condensate water discharge from an evaporative cooler located on the roof of building 03-0030, is discussed in section 3.4. In addition to these activities, the culvert draining the southern roof drains from building 03-0030 was video-logged to assist in interpreting the tracer study results. The findings from the video-logging are discussed in section 3.5.

3.1 Groundwater-Level Monitoring

Water-level measurements began March 9, 2006. Initial measurements were performed manually using an electric water-level indicator. Manual water-level measurements were taken throughout the month of March 2006 and again in June 2006. Beginning on June 27, 2006, water-level data were collected using pressure transducers.

3.1.1 Pressure Transducer Installation

Factory-new “Level Troll” data-logging pressure transducers were installed and set immediately off the bottom of wells B-9, B-10, and B-13. The placement of these transducers was based on previous observations of manual water-level measurements, which showed that water levels had dropped to below the screens in wells B-9 and B-10. Each Level Troll was equipped with a vented cable and a 15-pounds-per-square-inch-range transducer.

Water-level data were recorded by the data loggers once every minute. The data loggers were downloaded periodically by LWSP. Data that have been reviewed and determined usable are posted to the Water Quality and Hydrology (WQH) Database and are available at http://wqdbworld.lanl.gov/.

3.1.2 Water-Level Data Review

All water-level data collected manually as part of the SWMUs 03-010(a) and 03-001(e) characterization scope are presented in Table 3.1-1 and Figure 3.1-1. The transducer water-level data collection is ongoing as part of the LWSP implementation of the Pajarito Canyon groundwater monitoring effort. Figure 3.1-2 presents the average daily water levels for all three wells since June 2006, along with the daily precipitation data from the TA-06 weather station. The data are taken from the WQH database.

Manual groundwater-level measurements (Figure 3.1-1) show that wells B-9 and B-10 drain completely dry. These measurements were taken following prolonged periods of very low precipitation. The water columns measured in wells B-9 and B-10 on March 9, 2006, represent residual water remaining in the end caps of the wells. Measurements taken in the three wells in June 2006 confirm the above observations.

Transducer water-level data were collected from all three wells for a 1-yr period from June 2006 to June 2007 (Figure 3.1-2). Daily elevation changes in groundwater for wells B-13, B-10, and B-9 for June and July 2006 are shown in Figure 3.1-3. The highest water elevations occur in well B-10, with a slight downward gradient to B-13 and a steeper downward gradient to B-9. Water levels in B-10 and B-13 are similar in elevation and show a very similar response to precipitation events. However, water-level elevations in well B-9 are, on average, 5 ft lower than those in well B-10 and water-level responses are delayed by 1 to 2 days relative to those in B-10 and B-13. These data are interpreted to indicate that wells B-10 and B-13 share a similar hydraulic connection to the recharge source(s). Well B-9 is either not as well hydraulically connected to the recharge source(s) when compared to B-10 and B-13 or is potentially not connected at all. A conceptual model of recharge that is consistent with the data involves the direct infiltration recharge of B-10 and B-13 and subsequent groundwater flow to the northwest to recharge well B-9.

3.2 Summary of Quarterly Sampling Events

3.2.1 Sampling Activities

Quarterly groundwater sampling of wells B-9, B-10, and B-13 began on June 23, 2006, as part of the perched-groundwater investigation of SWMUs 03-010(a) and 03-001(e). Analytical samples for field parameters, metals, radionuclides, and VOCs were collected. Subsequent sampling was performed by LWSP in August 2006, December 2006, and March 2007 as part of the Pajarito Canyon periodic monitoring program, in accordance with the "Interim Facility-wide Groundwater Monitoring Plan" (LANL 2006, 094043).

3.2.2 Analytical Samples Collected

The dates of the completed quarterly sampling events and the analytical samples collected through the August 2006 sampling event have been previously reported in Appendix D of the periodic monitoring report for the Pajarito Watershed (LANL 2007, 095116). Wells B-10 and B-13 consistently produce sufficient water for sampling; well B-9 generally pumps or bails dry during sampling. Evaluation of the December 2006 and March 2007 samples will be presented in subsequent periodic monitoring reports.

3.2.3 Data Review and Summary

The analytical results presented in the periodic monitoring report for Pajarito Watershed identified lead in filtered water samples at concentrations as great as 20 µg/L (B-13) (LANL 2007, 095116). A maximum concentration of 94 µg/L of 1,1,1-trichloroethane in B-10 and 5.39 µg/L of 1,1,1-dichloroethene in B-13 were also identified, and both exceeded the New Mexico groundwater standards of 60 µg/L and 5 µg/L, respectively. Other organic analytes detected in wells B-10 and B-13 included diesel range organics, chlorinated solvents, dioxane, and chloroform at concentrations similar to those previously observed at SWMUs 03-010(a) and 03-001(e) (LANL 2007, 095116, p. 8-9). Radionuclide results evaluated in the periodic monitoring report for the Pajarito Watershed identified tritium, a historical site contaminant, at a concentration of 300 pCi/g in wells B-10 and B-13 (LANL 2007, 095116). Also detected in water samples from the site were strontium-90 in B-10 and B-13, cesium-137 in B-10, and plutonium-239 in B-13.

3.3 Tracer Test to Identify the Source of Groundwater Recharge

3.3.1 Test Goals and Approach

The goal of the tracer test performed at SWMUs 03-010(a) and 03-001(e) was to identify the source of groundwater recharge at the site. Historical observations of water levels and precipitation generally show a rapid change in water levels in wells B-9, B-10, and B-13 in response to precipitation events. As such, the test duration was limited to a 5-day sampling window. No attempt was made to describe longer-term migration or recharge mechanisms.

3.3.2 Potential Source Area Identification

The perched water body at the site is of limited extent (Figure 1.0-2) and only persistent in the area of well B-13. Over extended periods of low precipitation, wells B-10 and B-9 have been observed to drain completely (see Table 3.1-1). Recharge of the water body is tied to precipitation events, and the corresponding water-level rise in the wells is many times the amount of the precipitation event.

With the exception of the adjacent canyon and the drainage that parallels the north wall of building SM-30, the entire area near the wells is paved or covered by buildings. Because direct infiltration of rainwater on the ground surface is restricted locally by buildings and asphalt and the groundwater level increase is many times that of the associated precipitation events, nearby sources that collect rainwater were identified as potential recharge sources. The areas identified were

- the canyon adjacent to the west end of building 03-0030,
- the drainage that parallels the north wall of building 03-0030, and
- the two culverts connected to the roof drains of building 03-0030.

3.3.3 Tracer Selection and Application

Four tracer chemicals were selected by the Laboratory's Hydrology, Geology, and Geochemistry group (EES-6). Table 3.3-1 identifies each of the four potential recharge source areas and the unique tracers to be applied there. The mass of each tracer chemical and the dissolved tracer concentrations were calculated by EES-6 to ensure that a discharge permit would not be required. A notice of intent to discharge was submitted to NMED on July 12, 2006 (DOE 2006, 097193), and confirmation that no discharge permit was required was transmitted by NMED on August 28, 2006 (NMED 2006, 095635).

Tracers were applied at the site on September 21, 2006. New garden sprayers were used to distribute the 2,6-difluorobenzoate (2,6-DFBA) tracer evenly in the east-west drainage and the 2,5-difluorobenzoate (2,5-DFBA) tracer in the north-south drainage. These tracers were sprayed directly on the ground surface. The pentafluorobenzoate (PFBA) and potassium bromide tracers were then introduced to the roof drains serving the northern half and southern half, respectively, of the SM-30 roof. Equal volumes of potassium bromide tracer solution (~0.86 gal.) were poured directly into each roof drain on the southern half of the building roof. Similarly, equal volumes of PFBA tracer solution (~0.86 gal.) were poured directly into the roof drains serving the northern half of the building roof.

3.3.4 Tracer Sampling

Tracer sampling was planned to begin the first day following a rain event of less than 0.25 in. Precipitation on October 6, 2006, amounted to 0.19 in. at the site and did not trigger tracer sampling. The 0.47-in. precipitation event on October 8, 2006, triggered the start of tracer sampling on the morning of October 9, 2006.

Samples were collected from wells B-9, B-10, and B-13 beginning at 8:10 am on October 9, 2006. Each well was sampled every 50 min using a new dedicated bailer for each well. A total of 10 samples were collected each day for 5 consecutive days. Samples were transferred directly from the bailer to 40 mL amber septum vials. Tracer sample collection concluded on October 13, 2006, at 3:10 pm, when the 50th sample was collected from each well.

3.3.5 Results of Tracer Analyses

All samples were delivered under chain of custody to EES-6 for analysis on the morning of October 16, 2006. All sample analyses were performed by the Laboratory's EES-6 analytical laboratories. The results of the tracer sample analyses are presented in Figure 3.3-1. The figures present raw concentration data for each tracer chemical, which is adequate to confirm a link between the source areas and the perched groundwater.

3.3.6 Data Review

The data indicate that the first arrival of the tracers was not captured during the sampling, probably because of mobilization from the limited precipitation event on October 6, 2006. The sampling results showed the highest concentration of bromide (from the potassium bromide), PFBA, and 2,5-DFBA in the first, second, or third sample collected on the first day of sampling (October 9, 2006). Concentration curves for bromide, PFBA and 2,5-DFBA show very similar shapes with no apparent temporal shift. All three tracer chemicals have earliest maximum at the same time and decrease throughout the 5-day sampling event. The concentration trends are most comparable between wells B-13 and B-10 (Figure 3.3-1). The lack of a temporal shift in the concentration curves is unexpected, because each of the three tracers was applied in distinct source areas at different distances from the monitoring wells. PFBA and 2,5-DFBA had greater distances to travel than bromide and should have reached peak concentration later in the test than bromide. The implication is that all three tracers followed the same flow path to the monitoring wells.

Both bromide and PFBA are significantly elevated in wells B-13 and B-10 (Figure 3.3-1), indicating substantial input of these tracers into these wells. In well B-9, bromide is present at relatively constant values between approximately 2 to 3 ppm, despite the fact that PFBA concentrations are at or near detection limits. It is likely that these concentrations represent background bromide in this well. Although this concentration is relatively high for typical groundwater, it is possible given the fact that large amounts of road salt have been used in the area as deicers and that bromide from these salts likely entered the groundwater.

The detected concentrations of 2,6-DFBA are very low, with a maximum value of 0.15 ppm and most values under 0.10 ppm. Additionally, the data do not show a consistent temporal trend. The low concentrations and lack of a temporal trend are interpreted to indicate that these concentrations represent analytical detection limit for the groundwater matrix at the site. Alternatively, the low concentrations may be due to airborne deposition of a small amount of dust on the building 03-0030 roof before samples were collected.

Evaluation of PFBA and the Northern Culvert Source Term

Both bromide and PFBA are present in significant concentrations in wells B-13 and B-10, which was not expected given the application of each into different drain systems. To evaluate the possibility that PFBA reached the groundwater with the bromide, the engineering drawings for the building 03-0030 roof drains were reexamined. The review showed that two of the roof drains thought to be connected to the northern culvert are tied to the collector pipe that feeds to the southern culvert. This cross-connection resulted in approximately 9.1% of the PFBA tracer solution volume being directly introduced to the same piping system as the potassium bromide tracer solution (based on two of 22 drains). The inadvertent introduction of the tracer from the north roof drain system into the south roof drain system explains the occurrence of PFBA in wells B-13 and B-10 as well as the lack of any temporal shift in the PFBA concentration curve. No PFBA is thought to have reached the monitoring wells from the northern culvert during the week-long sampling event, because no secondary arrival of PFBA has been observed in the analytical data.

Evaluation of 2,5-DFBA and the North-South Drainage Source Term

2,5 DFBA was found in wells B-13 and B-10 at concentration between 0.5 and 0.9 ppm and shows the same general decrease in time as do bromide and PFBA. Evaluation of the occurrence of 2,5-DFBA discounts direct migration to the perched groundwater for the following reasons:

- No delay is observed in the maximum concentration of 2,5-DFBA as compared with bromide or PFBA.
- Since the 2,6-DBFA tracer flows from the east-west drainage to the north-south drainage, recharge from the north-south drainage should show both 2,5-DFBA and 2,6-DFBA. However, the concentrations of 2,6-DFBA appear to represent the detection limit for analysis of the site groundwater.
- The interpreted hydraulic gradient of the water body at SWMUs 03-010(a) and 03-001(e) indicates that flow is towards the north-south drainage (Figure 1.0-2). For the tracer to reach the monitoring wells from the north-south drainage, it would have to migrate upgradient.

These observations indicate that the 2,5-DFBA detected in wells B-13 and B-10 was introduced to the southern half of the building 03-0030 roof as a result of airborne dust deposition on the roof or some other means of cross-contamination.

3.3.7 Tracer Test Summary

Because no trend in the reported concentration of 2,6-DFBA was observed, there is no indication that migration of the tracer from either the east-west or north-south drainages occurred during the test. The existing hydraulic gradient at the site refutes migration of 2,5-DFBA to the site from the north-south drainage. Thus, the tracer study results indicate that the north-south and east-west drainages are not the sources of recharge to shallow groundwater at SWMUs 03-010(a) and 03-001(e).

Bromide and PFBA tracers reached wells B-13 and B-10 at the same time, and the tracer concentrations decreased similarly through time. This finding is inconsistent with migration to the wells from differing distances. The potassium bromide tracer was introduced only to the southern roof drain system of building 03-0030. The presence of the PBFA is explained by the unplanned introduction of the solution to two drains connected to the southern roof drain system, indicating the recharge to the shallow groundwater is through the southern roof drain system. This recharge pathway is also consistent with the interpreted hydraulic gradient at the site (Figure 1.0-2).

3.4 Condensate Line Sampling

In June 2006 and June 2007, samples of groundwater and condensate from the evaporative cooler line were collected for stable isotope analysis. Both samples were submitted for analysis of deuterium and oxygen-18; in addition, the sample collected in June 2007 was submitted for tritium analysis. The June 2007 sample data have not been received but will be included in a future status report.

The stable isotope ratios of oxygen and deuterium for precipitation, groundwater, and the condensate line are plotted in Figure 3.4-1. Precipitation samples from the Laboratory define a well-correlated array plotted as the local meteoric water line. Precipitation samples collected during June 2006 plot in a tight cluster along this line. The single groundwater sample collected in June 2006 also plots very near to the local meteoric water line, consistent with a precipitation source for this groundwater. In contrast, the condensate sample plots away from the June 2007 precipitation and the groundwater data. The condensate sample also plots above the local meteoric line. These data indicate that the perched groundwater was not derived from the condensate line.

3.5 Video-Logging Results

In April 2007, the Laboratory inspected and video-logged the southern culvert because the tracer study indicated that it may be the source of recharge to the shallow groundwater at SWMUs 03-010(a) and 03-001(e). The entire length of the culvert and the collector pipe entombed within the building's concrete foundation were logged.

Review of the video log identified a gash in the corrugated metal culvert, 2 ft west (outside) of the building foundation. The video log further showed that the collector pipe for the southern roof drain system is intact.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Quarterly monitoring confirms the groundwater conditions previously discussed in the investigation report for SWMUS 03-010(a) and 03-001(e). Based on the information presented in the most recent periodic monitoring report for Pajarito Watershed (LANL 2007, 095116), no additional wells are needed, and quarterly sampling should continue as required in the "Interim Facility Site-wide Groundwater Monitoring Plan" (LANL 2006, 094043).

The results of the tracer study point to the building roof as a source of recharge to the perched groundwater body at SWMUs 03-010(a) and 03-001(e). The stable isotope data from the groundwater and condensate samples indicate a precipitation source for the perched groundwater. In addition, the results of the video-logging of the culvert leading from the roof drains on the southern half of the building show a significant break near the building foundation. This break may be the pathway that allows precipitation from the roof drains to recharge the perched groundwater. Repair of the culvert is recommended and is currently being planned by the Laboratory for fiscal year 2007.

Recommendations for future groundwater monitoring at the site depend on the results of the culvert repair. Because the three monitoring wells at the site are located within or near a roadway, they are subject to damage by snowplows. Well B-10 was damaged and repaired; well B-9 was damaged sometime between January and March 2007 and has not yet been repaired. Damage to well B-9 is limited to the surface completion and does not appear to have affected the integrity of the well. However, it is recommended that well B-9, which is often dry, be used for water-level measurements only until the culvert leading from the building 03-0030 storm drains is repaired. If perched groundwater is not eliminated as a result of the culvert repair, well B-9 will be repaired for continued future sampling. Wells B-10 and B-13 will continue to be sampled on a quarterly basis.

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 number. This information is also included in text citations. ER ID numbers 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; the U.S. Department of Energy–Los Alamos Site Office; the U.S. Environmental Protection Agency, Region 6; 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.

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LANL (Los Alamos National Laboratory), July 2006. “Interim Facility-Wide Groundwater Monitoring Plan, Revision 1.1,” Los Alamos National Laboratory document LA-UR-06-4975, Los Alamos, New Mexico. (LANL 2006, 094043)

LANL (Los Alamos National Laboratory), March 2007. “Periodic Monitoring Report for Pajarito Watershed Sampled August 15–31, 2006,” Los Alamos National Laboratory document LA-UR-07-1425, Los Alamos, New Mexico. (LANL 2007, 095116)

NMED (New Mexico Environment Department), December 1, 1999. “Response to 'Response to the Notice of Deficiency for the RFI Report for SWMU 3-010(a)',” New Mexico Environment Department letter to J.C. Browne (LANL Director) and T. Taylor (DOE-LAAO) from J.E. Kieling (NMED), Santa Fe, New Mexico. (NMED 1999, 064614)

NMED (New Mexico Environment Department), October 22, 2001. “Request for Supplemental Information, RFI Report Addendum for Solid Waste Management Unit 3-010(a),” New Mexico Environment Department letter to T. Taylor (DOE-LAAO) and J. Browne (LANL Director) from J. Young (NMED), Santa Fe, New Mexico. (NMED 2001, 071422)

NMED (New Mexico Environment Department), February 20, 2006. “Notice of Disapproval, Investigation Report for Solid Waste Management Units 03-0101(a) and 03-001(e) at Technical Area 3,” 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 2006, 091513)

NMED (New Mexico Environment Department), August 28, 2006. “Response to the Notice of Intent to Discharge for Los Alamos National Laboratory,” New Mexico Environment Department letter to D. Gregory (DOE LASO) from W.C. Olson (NMED), Santa Fe, New Mexico. (NMED 2006, 095635)

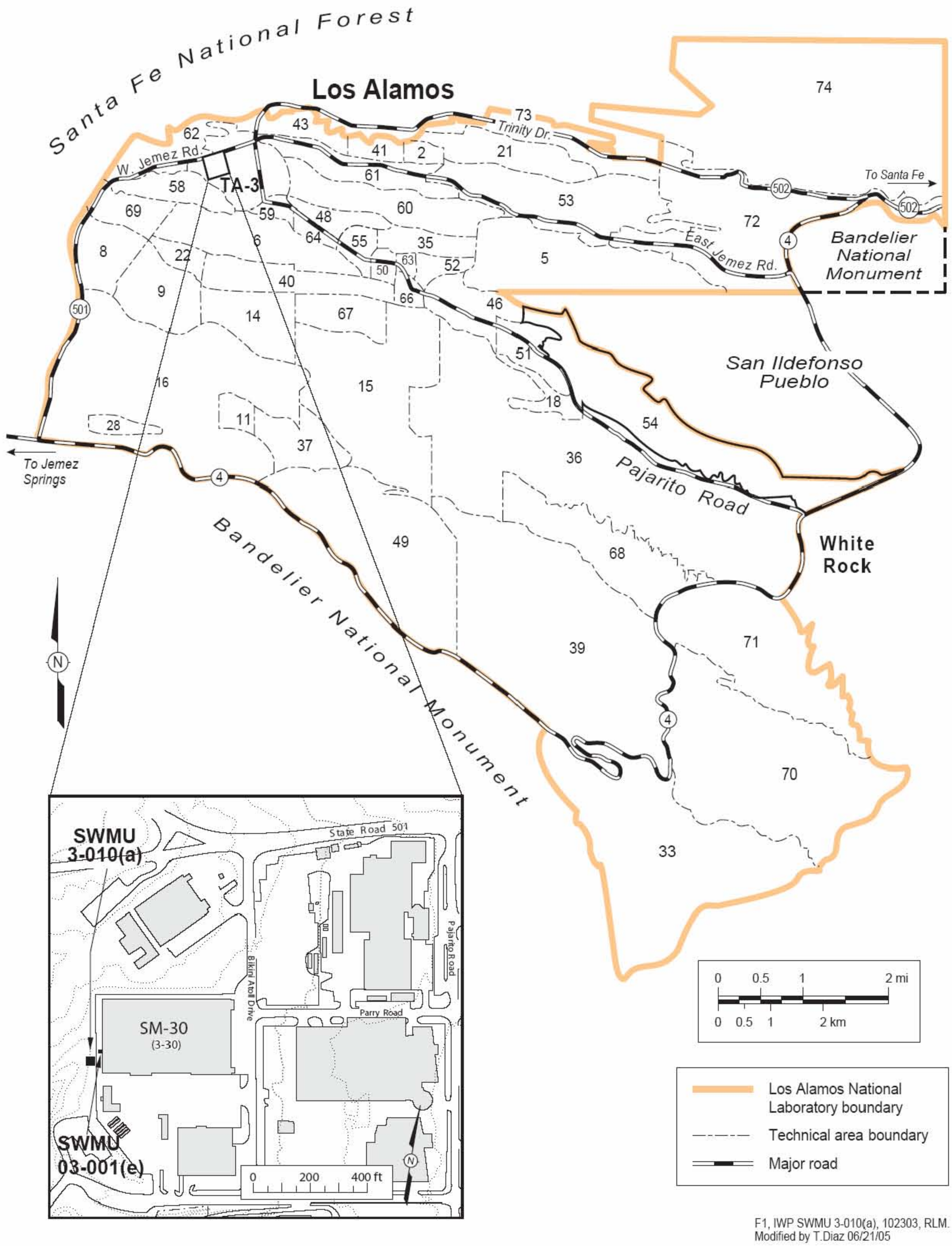


Figure 1.0-1 Location of TA-03 and SWMUs 03-010(a) and 03-001(e) with respect to laboratory TAs and surrounding land holdings

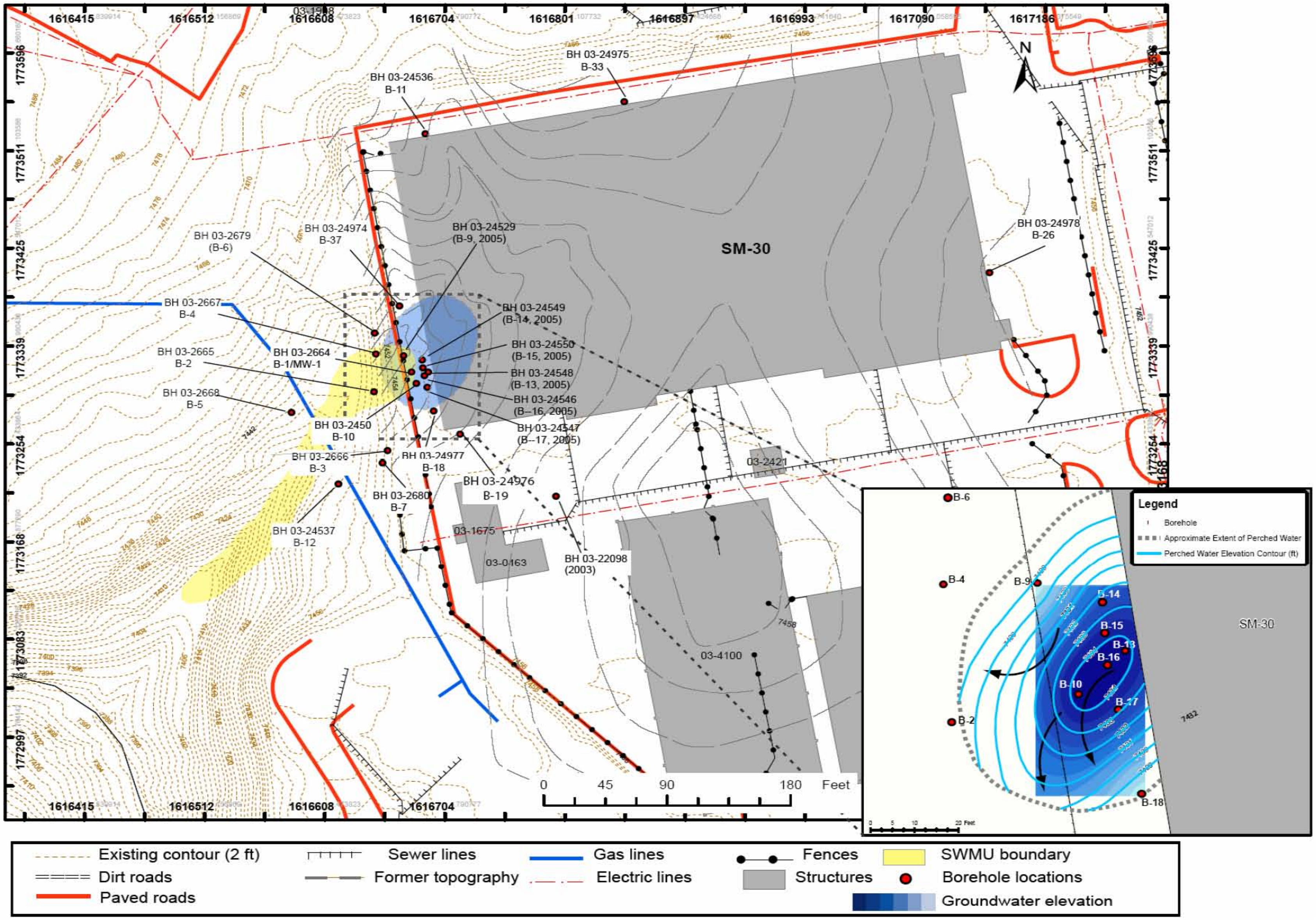
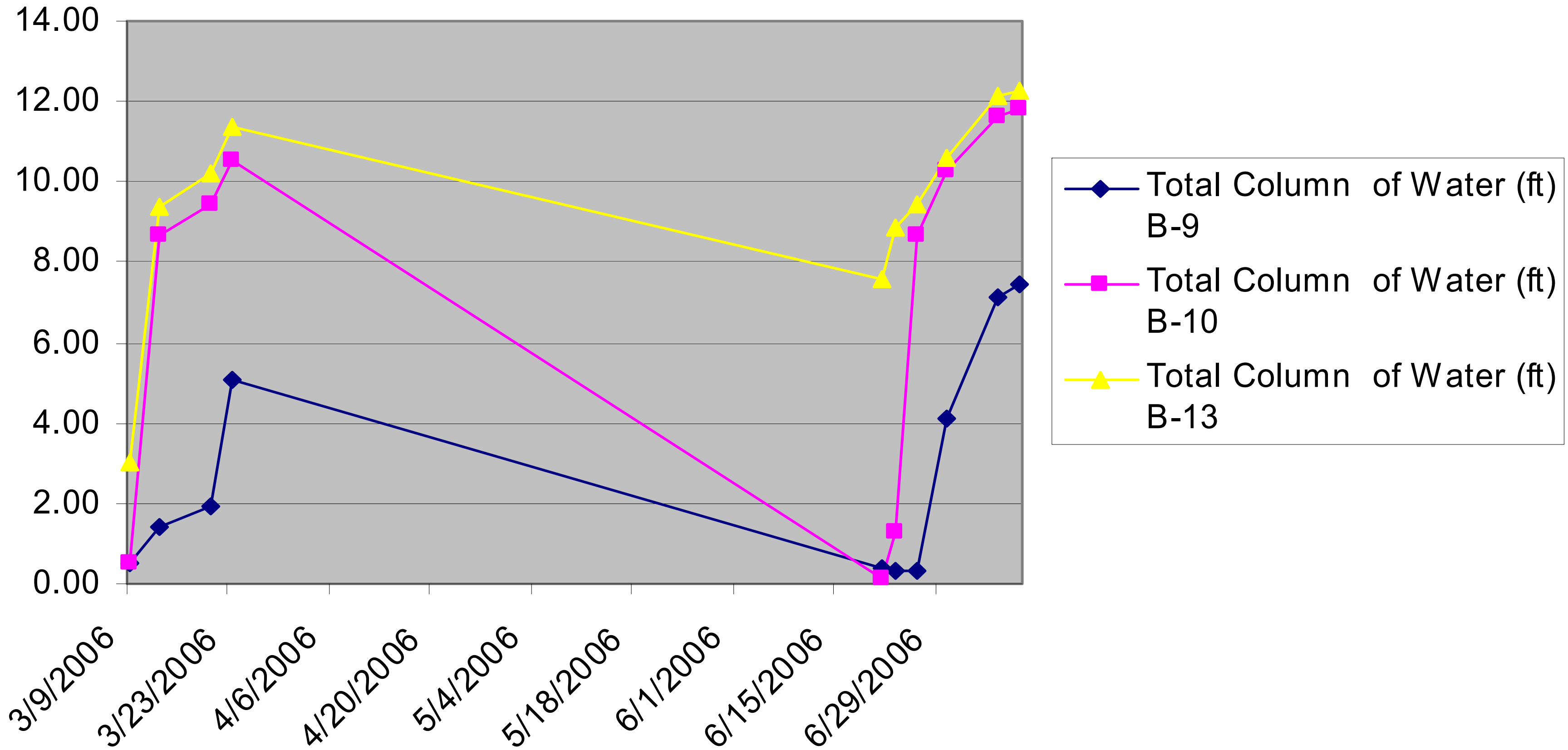


Figure 1.0-2 Historical borehole and well locations and interpreted groundwater conditions at SWMUs 03-010(a) and 03-001(e)



Note: The March 9th and June 21st measurements represent standing water below the bottom of the screens in wells B-9 and B-10.

Figure 3.1-1 Height of water columns in wells B-9, B-10, and B-13 at SWMUs 03-010(a) and 03-001(e) as determined by manual measurements

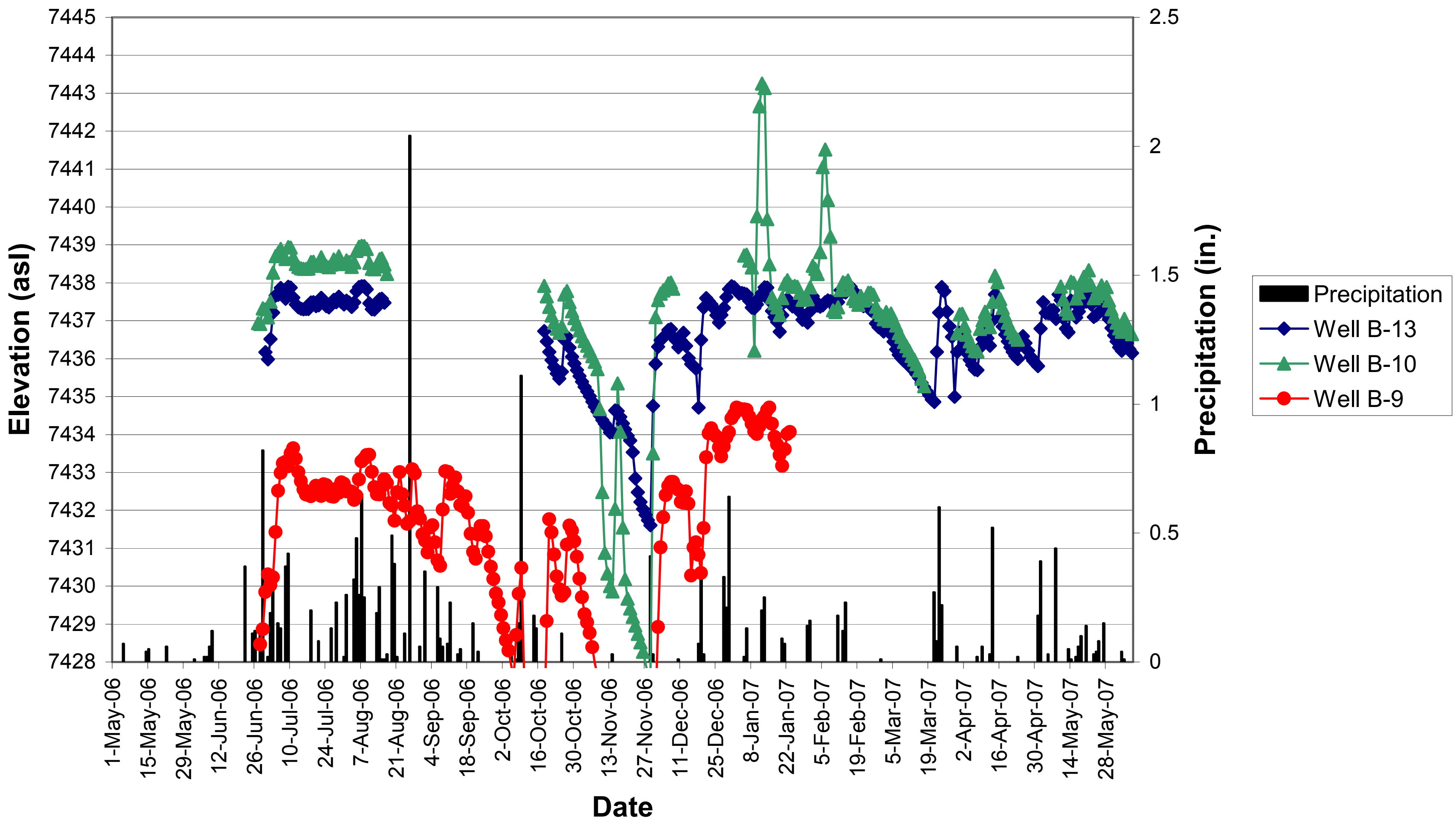


Figure 3.1-2 Elevation of water levels in wells B-13, B-10, and B-9 obtained using pressure transducers

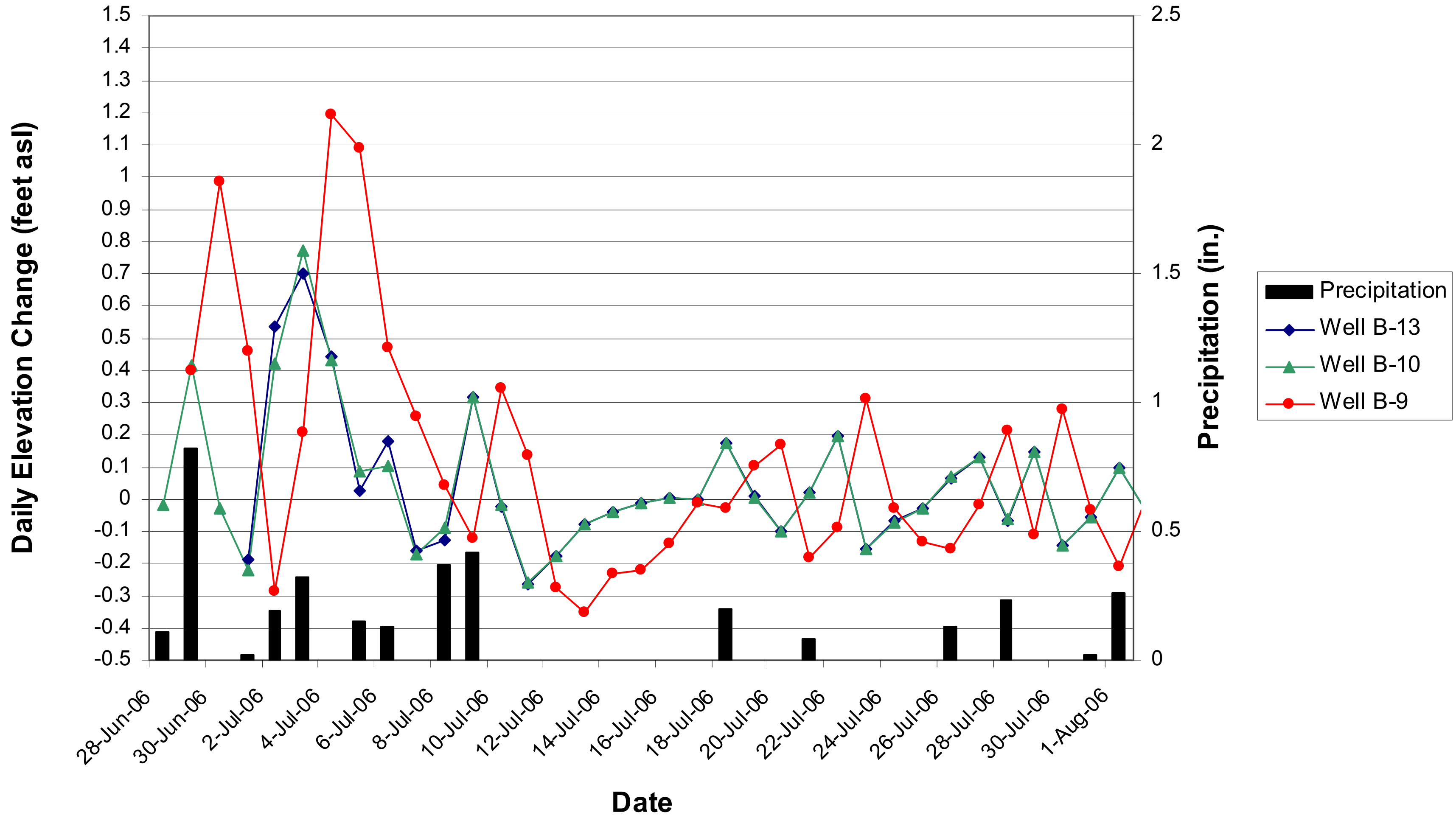


Figure 3.1-3 Plot of daily elevation change in groundwater for wells B-13, B-10, and B-9 for June and July 2006

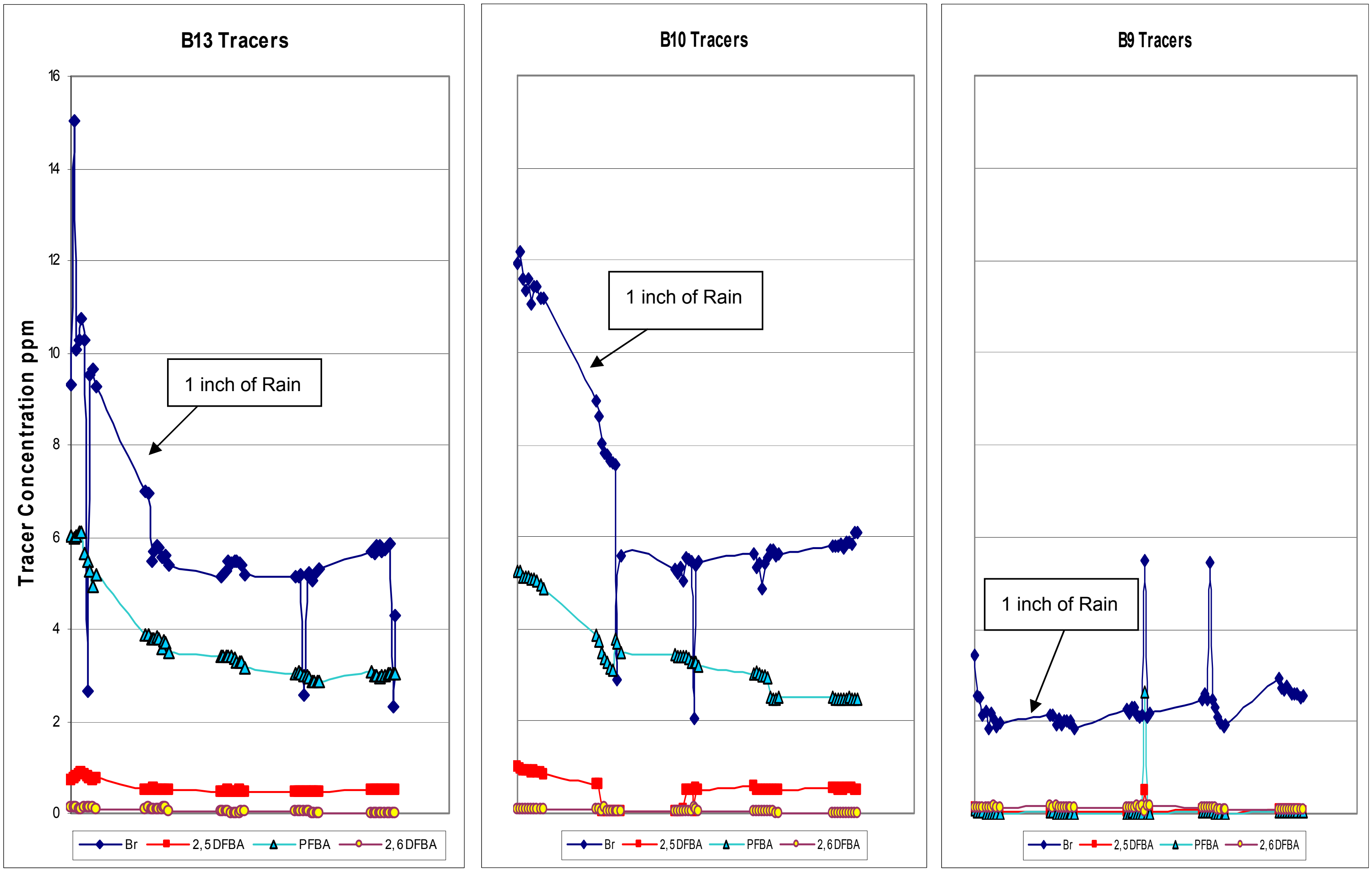
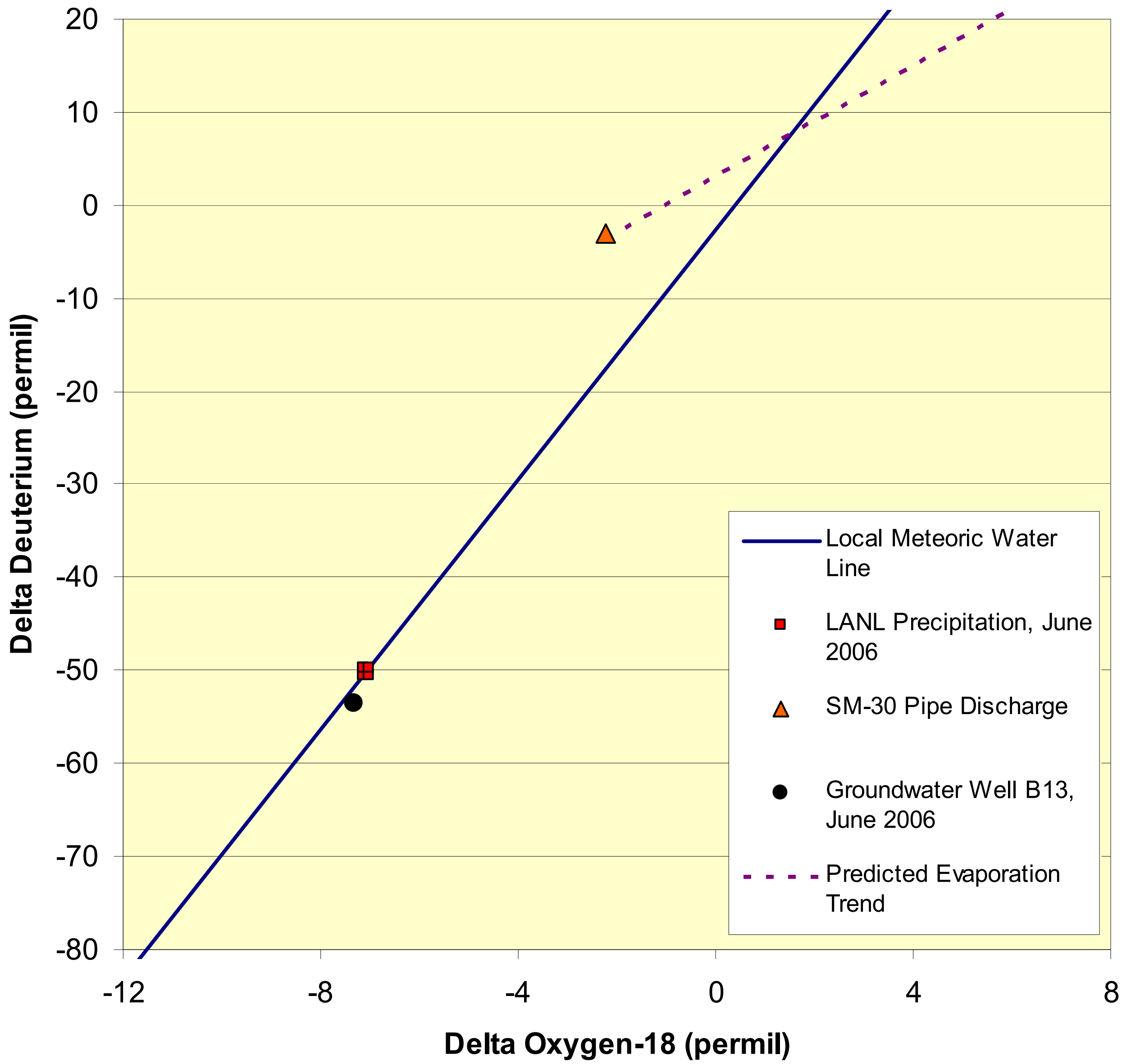


Figure 3.3-1 Tracer concentrations in wells B-13, B-10, and B-9 plotted versus time over the 5-day sampling period



Note: Local meteoric water line is from LANL, EES-6 unpublished data.

Figure 3.4-1 Plot of delta deuterium versus delta oxygen-18 for samples collected at SM-30

Table 3.1-1
Manual Water-Level Measurements at SWMUs 03-010(a) and 03-001(e)

Well Id	Date	Depth to Water (ft bgs)	Total Well Depth (ft)	Total Length of Water Column (ft)	Comments
03-24529 (B-9)	3/9/2006	31.30	31.80	0.50	
03-24530 (B-10)		30.60	31.10	0.50	
03-24548 (B-13)		29.00	32.00	3.00	
03-24529 (B-9)	3/13/2006	30.40	31.80	1.40	0.29 in. of precipitation from 3/10/06 to 3/12/06
03-24530 (B-10)		22.45	31.10	8.65	
03-24548 (B-13)		22.60	32.00	9.40	
03-24529 (B-9)	3/20/2006	29.85	31.80	1.95	
03-24530 (B-10)		21.68	31.10	9.42	
03-24548 (B-13)		21.82	32.00	10.18	
03-24529 (B-9)	3/23/2006	26.70	31.80	5.10	The two culverts from roof drains off SM-30 were flowing at a rate of approximately 5 gal. per minute into the drainage of Two Mile Canyon. The cooling system was not operating so no condensate water was present.
03-24530 (B-10)		20.55	31.10	10.55	
03-24548 (B-13)		20.65	32.00	11.35	
03-24529 (B-9)	6/21/2006	31.40	31.80	0.40	The cooling system was not operating so no condensate water was present.
03-24530 (B-10)		30.95	31.10	0.15	
03-24548 (B-13)		24.45	32.00	7.55	
03-24529 (B-9)	6/23/2006	31.48	31.80	0.32	On 6/22/06, a rain event took place at 1336 and lasted for approximately 1 hr producing 0.75 in. Roof drains and drainage were flowing
03-24530 (B-10)		29.81	31.10	1.29	
03-24548 (B-13)		23.13	32.00	8.87	
03-24529 (B-9)	6/26/2006	31.46	31.80	0.34	0.175 in. of precipitation from the night of 6/24/06 to the morning of 6/26/06
03-24530 (B-10)		22.41	31.10	8.69	
03-24548 (B-13)		22.59	32.00	9.41	
03-24529 (B-9)	6/30/2006	27.7	31.80	4.1	0.35 in. of precipitation from 6/26/06 to 6/30/06
03-24530 (B-10)		20.85	31.10	10.25	
03-24548 (B-13)		21.41	32.00	10.59	
03-24529 (B-9)	7/7/2006	24.65	31.80	7.15	1.25 in. of precipitation from 6/30/06 to 7/07/06
03-24530 (B-10)		19.48	31.10	11.62	
03-24548 (B-13)		19.84	32.00	12.16	
03-24529 (B-9)	7/10/2006	24.32	31.80	7.48	0.5 in. of precipitation from 7/07/06 to 7/10/06
03-24530 (B-10)		19.3	31.10	11.8	
03-24548 (B-13)		19.75	32.00	12.25	

Table 3.3-1
Type and Quantity of Tracers Deployed

Location	Tracer Name	Quantity of Tracer (kg)	Quantity of Water (gal.)	Application Method	Application Rate
Roof North*	Pentafluorobenzoate (PFBA)	0.75	12.6	Direct pour into roof drains	~0.86 gal. per roof drain
Roof South	Potassium bromide	0.75	12.6	Direct pour into roof drains	~0.86 gal. per roof drain
East-West Drainage*	2,6-difluorobenzoate (2,6-DFBA)	0.75	12.6	Pressure sprayer	Spray at 11.0 mL/ft^2
North-South Drainage*	2,5-difluorobenzoate (2,5-DFBA)	0.75	12.6	Pressure sprayer	Spray at 5.0 mL/ft^2

*Note sodium hydroxide tablets were added to the water to sustain the pH ≥7, which increased the tracer solubility.