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Date: November 15, 2008
Refer To: EP2008-0550

James P. Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Submittal of the Supplemental Investigation Work Plan for Consolidated Units 16-007(a)-99 and 16-008(a)-99 at Technical Area 16

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the Supplemental Investigation Work Plan for Consolidated Units 16-007(a)-99 and 16-008(a)-99 at Technical Area 16. This document was requested in the New Mexico Environment Department's "Notice of Approval with Direction Investigation Report for Consolidated Units 16-007(a)-99 and 16-008(a)-99 at Technical Area 16, Revision 1" letter dated February 11, 2008. In an email dated July 21, 2008, Ms Neelam Dhawan of your staff approved a streamlined format for this work plan. The majority of the background information relevant to these consolidated units is presented in the original work plan (LA-UR-05-1694/ER2005-0126) and in the investigation report (LA-UR-08-0256/EP2008-0018).

If you have any questions, please contact John McCann at (505) 665-1091 (jmccann@lanl.gov) or Woody Woodworth at (505) 665-5820 (lwoodworth@doeal.gov).

Sincerely,

Michael J. Graham, Associate Director
Environmental Programs
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Sincerely,

David R. Gregory, Project Director
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30250

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Enclosures: Two hard copies with electronic files: Supplemental Investigation Work Plan for Consolidated Units 16-007(a)-99 and 16-008(a)-99 at Technical Area 16 (LA-UR-08-6892)

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LA-UR-08-6892
November 2008
EP2008-0550

Supplemental Investigation Work Plan for Consolidated Units 16-007(a)-99 and 16-008(a)-99 at Technical Area 16

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Prepared by the Environmental Programs Directorate

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LA-UR-08-6892
EP2008-0550

Supplemental Investigation Work Plan for Consolidated Units 16-007(a)-99 and 16-008(a)-99 at Technical Area 16

November 2008

Responsible project leader:

Printed Name	Signature	Title	Organization	Date
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David R. Gregory	for	Project Director	DOE-LASO	

EXECUTIVE SUMMARY

This investigation work plan presents proposed supplemental investigation and remediation activities at Consolidated Units 16-007(a)-99 (the 30s Line) and 16-008(a)-99 (the 90s Line) at Technical Area 16 (TA-16) at Los Alamos National Laboratory (the Laboratory). The 30s and 90s Lines include structures within the post–World War II era S-Site complex historically used to process high explosives (HE).

The objectives of the investigation and remediation activities proposed in this work plan are to define the vertical extent of several contaminants and to remove HE contamination identified by previous investigations at Consolidated Unit 16-007(a)-99 and hexavalent chromium contamination identified by previous investigations at Consolidated Unit 16-008(a)-99.

Consolidated Unit 16-007(a)-99 has been thoroughly investigated and characterized. Elevated HE concentrations were detected at 7.5- to 8.0 ft in borehole location 16-23739. Although the vertical extent of this contamination is defined and poses no potential unacceptable risk to human or ecological receptors, the area of contamination will be removed as a best management practice (BMP) and confirmation sampling will be conducted at this location.

Consolidated Unit 16-008(a)-99 has been thoroughly investigated. Elevated hexavalent chromium concentrations were detected at 3.5- to 4.0 ft in location 16-02384. The nature and extent of hexavalent chromium are defined, but this location poses a potential unacceptable risk to a construction worker. To reduce the potential risk to construction workers, remediation and confirmation sampling will be conducted at this location.

Specific activities to be performed include the following:

- Perform site surveys
- Excavate and remove areas of HE contamination at Consolidated Unit 16-007(a)-99 and hexavalent chromium contamination at Consolidated Unit 16-008(a)-99.
- Collect samples to confirm cleanup and to characterize the lateral and vertical extent of any residual contamination at both sites.
- Advance a single 300-ft depth borehole next to location 16-26669 to determine the vertical extent of copper, RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), trinitrobenzene[1,3,5-], and acetone in soil and tuff.
- Develop and sample the monitoring well at borehole location 16-26644 on a quarterly basis for 1 yr and install a pressure transducer to monitor water-level fluctuations on a continuous basis following well development. Evaluate the results from the four sampling events in the context of the goals of the intermediate and deep groundwater corrective measures evaluation for Consolidated Unit 16-021(c)-99.
- Provide a strategy for collecting sediment samples within the 90s Line Pond and upstream of the BMPs installed in June 2008 in the tributary drainages to the pond to minimize transport of contaminated sediment into the pond. Collect samples at periodic intervals (every 5 yr) to evaluate whether contaminant concentrations in sediment in the pond are increasing. The first sediment samples will be collected in June 2013; data will be reported within 30 days of receipt of validated sample results.

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Appendix

Appendix A Management Plan for Investigation-Derived Waste

Acronyms and Abbreviations

AGI	American Geological Institute
AK	acceptable knowledge
AOC	area of concern
ASTM	American Society for Testing and Materials
bgs	below ground surface
BMP	best management practice
BV	background value
CME	corrective measures evaluation
COC	chain of custody
COPC	chemical of potential concern
D&D	decontamination and decommissioning
DOE	Department of Energy (U.S.)
DOT	Department of Transportation (U.S.)
dpm	disintegrations per minute
DRO	diesel range organics
EP	Environmental Programs Directorate
EPA	Environmental Protection Agency (U.S.)
EQL	estimated quantitation limit
GC/MS	gas chromatography/mass spectrometry
HSA	hollow-stem auger
HE	high explosives
HMX	cyclotetramethylene-tetranitramine
HPLC/MS/MS	high-performance liquid chromatography/tandem mass spectrometry
IDW	investigation-derived waste
LANL	Los Alamos National Laboratory
MCL	maximum contaminant level
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NOI	notice of intent
NTU	nephelometric turbidity unit
PAH	polycyclic aromatic hydrocarbon
PID	photoionization detector
PPE	personal protective equipment

QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RFI	RCRA facility investigation
RPF	Records Processing Facility
SAA	satellite accumulation area
SMO	Sample Management Office
SOP	standard operating procedure
SSL	soil screening level
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TA	technical area
TAL	target analyte list
TCLP	toxicity characteristic leaching process
TNB	trinitrobenzene[1,3,5-]
TPH	total petroleum hydrocarbon
TSDF	treatment, storage, and disposal facility
VCA	voluntary corrective action
VOC	volatile organic compound
WAC	waste acceptance criteria
WCSF	waste characterization strategy form
wt%	weight percent
XRF	x-ray fluorescence

1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE) and managed by Los Alamos National Security, LLC. The Laboratory is located in north-central New Mexico, approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers 40 mi^2 of the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 to 7800 ft above sea level.

The Laboratory's Environmental Programs (EP) Directorate (the Directorate), formerly the Environmental Restoration Project, is participating in a national effort by DOE to clean up sites and facilities previously involved in weapons research and development. The goal of the Directorate is to ensure that past operations do not threaten human health and safety or the environmental in and around Los Alamos County, New Mexico. To achieve this goal, the Directorate is currently investigating sites potentially contaminated by past Laboratory operations. The sites under investigation are designated as solid waste management units (SWMUs), areas of concern (AOCs), or consolidated units.

This work plan addresses supplemental investigation and remediation activities to be implemented at the high explosives (HE) ponds areas, which include Consolidated Units 16-007(a)-99 (the 30s Line) and 16-008(a)-99 (the 90s Line) at Technical Area 16 (TA-16) (S-Site). The consolidated units consist of former HE-processing buildings, former materials storage buildings, sumps, drainlines, settling ponds, and outfall systems (drainages) associated with the 30s and 90s Lines. The settling ponds were used to store wastewater generated in the nearby buildings during HE-processing operations. The wastewater in the settling ponds was known to contain hazardous, and possibly radioactive, components and is, therefore, undergoing the Resource Conservation and Recovery Act (RCRA) corrective action process.

Corrective actions at the Laboratory are subject to the March 1, 2005, Compliance Order on Consent (the Consent Order). Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to the New Mexico Environment Department (NMED) in accordance with DOE policy.

1.1 General Site Information

TA-16 is located in the southwest corner of the Laboratory and is surrounded by a security fence (Figure 1.1-1). TA-16 covers approximately 2410 acres (3.8 mi^2) and is on a portion of land acquired in 1943 by the U.S. Department of the Army for the Manhattan Project. TA-16 is bordered by Bandelier National Monument along NM 4 to the south and by the Santa Fe National Forest along NM 501 to the west. To the north and east it is bordered by TA-08, TA-09, TA-11, TA-14, TA-15, TA-37, and TA-49 (Figure 1.1-2). Water Canyon, a 200-ft-deep ravine with steep walls, separates NM 4 from active sites at TA-16 and Cañon de Valle forms the northern boundary of TA-16.

The 30s Line [Consolidated Unit 16-007(a)-99] and 90s Line [Consolidated Unit 16-008(a)-99] facilities are located near the western end of TA-16 (Figures 1.1-2 and 1.1-3) and were used for HE-processing operations, including electroplating and machining. Discharge from the 30s Line and 90s Line facilities was contained in settling ponds (referred to as the 30s Line Ponds and 90s Line Pond, respectively) (Figure 1.1-3). The associated ponds were unlined and received wastes contaminated with HE, barium, and possibly uranium and organic compounds. The 30s Line and 90s Line facilities have been removed; only the 90s Line Pond remains but is inactive. Buildings associated with the 30s Line and 90s Line underwent decontamination and decommissioning (D&D) in 1960 and 1996, respectively.

1.2 Investigation Objectives

The objectives of this work plan for Consolidated Units 16-007(a)-99 and 16-008(a)-99 are as follows:

- Remove HE contamination at Consolidated Unit 16-007(a)-99
- Remove hexavalent chromium contamination at Consolidated Unit 16-008(a)-99
- Advance a single 300-ft deep borehole next to borehole location 16-26669 to determine the vertical extent of several contaminants
- Develop and sample the monitoring well at borehole location 16-26644 on a quarterly basis for 1 yr. Install a pressure transducer to monitor water-level fluctuations on a continuous basis following well development.
- Provide a strategy for collecting sediment samples within the 90s Line Pond and upstream of the best management practices (BMPs) installed in June 2008 in the tributary drainages to the pond to minimize transport of contaminated sediment into the pond. Collect samples at periodic intervals (every 5 yr) to evaluate whether contaminant concentrations in sediment in the pond are increasing. The first sediment samples will be collected in June 2013; the data will be reported within 30 d of receipt of validated sample results.

These investigation objectives satisfy the requirements for additional investigation and remediation contained in the February 11, 2008, NMED letter approving with direction the revised investigation report for Consolidated Units 16-007(a)-99 and 16-008(a)-99 (NMED 2008, 100477).

2.0 BACKGROUND

This section provides background information related to the supplemental investigation of Consolidated Units 16-007(a)-99 and 16-008(a)-99. Much of the background information was previously provided in the investigation work plan for Consolidated Units 16-007(a)-99 and 16-008(a)-99 (LANL 2005, 089331). The original investigation work plan was submitted to NMED in March 2005 and approved by NMED in August 2005 (NMED 2005, 091672). General background information previously presented in the 2005 approved investigation work plan, including operational history, land use, relationship to other SWMUs and AOCs, contaminant transport, potential receptors, waste inventory, and historical releases, is not included in detail in this work plan. Rather, this section focuses on previous investigations at these sites and the results of those investigations. This information is presented as background for understanding the objectives and scope of the proposed remediation and investigation activities.

2.1 Previous Investigations

Investigation and voluntary corrective action (VCA) activities have previously been conducted at these sites. These activities include those conducted prior to and as part of the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) process and under the Consent Order. The pre-2006 RFI sampling locations are shown in Figure 2.1-1. Data and a figure showing the nature and distributions of contaminants are provided in the previous investigation report (LANL 2008, 102052.18).

2.1.1 1986 and 1989 Pre-RFI

Soil, sediment, and surface water samples were collected and analyzed from the 30s Line and 90s Line in 1986 and 1989 (LANL 2005, 089331, Appendix B, p. B-6). Soil samples from the 30s Line were found to contain metals, volatile organic compounds (VOCs), and radionuclides. No HE was detected; however,

the data were noted to be of poor quality (LANL 2005, 089331, pp. 10–11). Soil samples collected from the 90s Line were found to contain metals, VOCs, and HE. A sample collected on the shore of the 90s Line Pond was found to have a maximum of 0.02 weight percent (wt%) total HE. All other soil samples contained total HE below 0.02 wt% or HE was not detected (Baytos 1986, 005834). Three water samples collected from the 90s Line Pond contained metals and VOCs (LANL 2005, 089331, Appendix B). These early investigations were conducted before the RFI process was established, the data were not processed through the Laboratory's Sample Management Office (SMO), and samples were not analyzed by off-site analytical laboratories. Therefore, the quality of the data is uncertain.

2.1.2 1996 VCA

In 1996, a VCA was conducted at Consolidated Unit 16-008(a)-99 (the 90s Line) to remove contamination (LANL 1997, 087847). The 1996 VCA was conducted in coordination with D&D activities at the 90s Line facilities (LANL 1997, 087847). Aboveground and belowground structures and several hundred cubic yards of soil and sediment were removed. Following the removal, samples collected beneath the excavated areas and former sumps, drainlines, outfalls, drainages, and drum storage area were field screened, and a subset was sent for off-site laboratory analysis. Based on the analytical results, further material was excavated both vertically and laterally until the concentrations were below one-half the industrial preliminary remediation goals, based on field-screening analyses (LANL 1997, 087847, p. 4-8). Confirmation samples were collected at locations where the final excavation and cleanup occurred from depths of 2 to 3 ft beneath the excavated soil and sediment. The results of the confirmation sampling and analyses indicated metals above background values (BVs), low-level detected concentrations of organic chemicals (HE, VOCs, and semivolatile organic compounds [SVOCs]), and no detected radionuclides. The results of the sampling and analyses are presented in section B-3.0 of Appendix B of the investigation work plan for Consolidated Units 16-007(a)-99 and 16-008(a)-99 (LANL 2005, 089331, Appendix B). These results indicated further work was required to define the nature and extent of contamination at the 90s Line.

2.1.3 2004 RFI

In 2004, an RFI was initiated at Consolidated Unit 16-007(a)-99 (the 30s Line) to characterize the nature and extent of contamination in the subsurface soil, sediment, and bedrock within the boundaries of the 30s Line and 90s Line areas and to determine if additional investigation or corrective actions were warranted (LANL 2005, 089331, Appendix B). RFI field work was conducted at the 30s Line in 2004, based on the U.S. Environmental Protection Agency– (EPA-) approved RFI work plan (LANL 1993, 020948, pp. 5-222-5-225). The investigation indicated that inorganic and organic chemical contamination was present in both soil and tuff. Inorganic chemicals above BVs were pervasive in the areas investigated. Barium was detected frequently, with a maximum detected concentration of 2270 mg/kg occurring at a depth of 7 to 8 ft in the northernmost pond (location 16-23740). Low-level concentrations of organic chemicals, including HE, VOCs, polycyclic aromatic hydrocarbons (PAHs), and other SVOCs, were detected at all the areas investigated. Most of the detected VOC and SVOC concentrations, however, were slightly more than the laboratory estimated quantitation limit (EQL). HE was also detected frequently: the highest concentrations of RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) above 1000 mg/kg were noted in the northernmost pond (location 16-23739). The results of the sampling and analyses are detailed in the approved 30s Line and 90s Line investigation work plan (LANL 2005, 089331, Appendix B). The investigation concluded that the scope of the RFI sampling did not define the nature and extent of contamination at the 30s Line Ponds, and further investigation was required.

2.1.4 2006–2007 Investigation

Section VI.D.2 of the Consent Order required the Laboratory to submit an investigation work plan for the continued investigation of SWMU 16-008(a). Because the background, operational history, geographic setting, and investigation approach of Consolidated Units 16-007(a)-99 and 16-008(a)-99 were similar, the Laboratory submitted a comprehensive work plan addressing the 30s Line and 90s Line Ponds and adjacent areas of former processing facilities rather than a plan only addressing SWMU 16-008(a) (LANL 2005, 089331). The approved investigation work plan was implemented during 2006–2007. The scope of the investigation included collecting surface and subsurface soil and tuff samples and collecting a surface water sample from the 90s Line Pond (Figure 2.1-2). A total of 90 boreholes were installed for collecting subsurface samples. Eighty-four of the boreholes were shallow (i.e., total depth generally in the range of 10–50 ft), and six of the boreholes were of intermediate depth (generally 150 ft total depth). Twelve of shallow boreholes were installed at Consolidated Unit 16-007(a)-99, 72 shallow boreholes were installed at Consolidated Unit 16-008(a)-99, and 3 intermediate depth boreholes were installed at each consolidated unit. One of the intermediate boreholes installed at Consolidated Unit 16-008(a)-99 encountered perched water. The water was sampled, and the borehole was completed as a monitoring well. The remaining boreholes were abandoned by plugging.

A total of 61 soil and tuff samples were collected at Consolidated Unit 16-007(a)-99, and 200 soil and tuff samples were collected at Consolidated Unit 16-008(a)-99. All samples were analyzed for target analyte list (TAL) metals, anions, explosive compounds, perchlorate, SVOCs, VOCs, and general wet chemistry parameters. In addition, selected samples from Consolidated Unit 16-008(a)-99 were analyzed for hexavalent chromium and total petroleum hydrocarbons–diesel range organics (TPH–DRO). A filtered and an unfiltered groundwater sample were collected from an intermediate-depth borehole at Consolidated Unit 16-008(a)-99 where water had been encountered. The unfiltered sample was analyzed for anions, explosive compounds, metals, perchlorate, SVOCs, VOCs, and wet chemistry. The filtered sample was analyzed for metals and wet chemistry. One unfiltered sample of surface water from the 90s Line Pond at Consolidated Unit 16-008(a)-99 was collected and analyzed for metals, anions, explosive compounds, perchlorate, SVOCs, VOCs, and general wet chemistry.

With several exceptions, the results of the 2006–2007 investigation indicated the nature and extent of contamination at Consolidated Units 16-007(a)-99 and 16-008(a)-99 had been defined and the sites did not pose a potential unacceptable risk under current and reasonably foreseeable future land use. The investigation report made several recommendations for additional investigation or remediation (LANL 2008, 102052.18, p. 41). The results of the 2006–2007 investigation associated with these recommendations are described below.

2.2 Results of 2006–2007 Investigation

The results of the 2006–2007 investigation, augmented by decision-level data from previous investigations, were used to determine the nature and extent of contaminant releases and to assess potential human-health and ecological risk. The NMED-approved investigation report (LANL 2008, 102052.18; NMED 2008, 100477) concluded that nature and extent had been determined for Consolidated Units 16-007(a)-99 and 16-008(a)-99, except for

- the vertical extent of copper; RDX; trinitrobenzene[1,3,5-] (TNB); and acetone near borehole location 16-26669 and
- the lateral extent of copper, nickel, silver, and PAHs in a tributary to Cañon de Valle.

The NMED-approved investigation report (LANL 2008, 102052.18; NMED 2008, 100477) concluded that no unacceptable risk for current land use exists, except for a potential risk to construction workers from hexavalent chromium at one location. An area of RDX contamination at concentrations much higher than other locations was identified and recommended for removal. Finally, the report concluded that groundwater conditions where the one monitoring well had been installed were not fully characterized.

2.2.1 Vertical Extent of Contamination

The vertical extent of copper is not defined, as indicated by its concentrations above the range of background concentrations in samples from the total depth of four of the six deep (i.e., 150 ft) boreholes. Copper was detected above the range of background concentrations for upper tuff units (6.2 mg/kg) in the deepest sample collected in one of the three deep boreholes at Consolidated Unit 16-007(a)-99 and all three deep boreholes at Consolidated Unit 16-008(a)-99. These results were as follows: 9.34 mg/kg in borehole location 16-26731 in Consolidated Unit 16-007(a)-99; 6.68 mg/kg in borehole location 16-600938; 23.6 mg/kg in borehole location 16-26643; and 7.37 mg/kg in borehole location 16-26644 in Consolidated Unit 16-008(a)-99. In addition, the results in borehole location 16-26643 indicate increasing concentrations in the bottom three samples (5.41 mg/kg at 136.0–137.5 ft, 13.4 mg/kg at 137.5–139.0 ft, and 23.6 mg/kg at 149.0–150.5 ft).

Both RDX and TNB are historical process-related chemicals and are present at concentrations slightly above the EQLs in samples collected from the total depth in a subset of the deep boreholes. RDX was detected in only one sample collected in borehole location 16-26731, but it was detected in all samples from the other two deep boreholes at Consolidated Unit 16-007(a)-99 (locations 16-26732 and 16-26733). In borehole location 16-26732, RDX was detected in concentrations ranging from 4.34–0.61 mg/kg, with concentrations decreasing with depth. In borehole location 16-26733, RDX was detected at concentrations ranging from 0.465–0.178 mg/kg, and its concentrations also decreased with depth. At Consolidated Unit 16-008(a)-99, RDX was detected in two of the three deep boreholes. In borehole location 16-26643, RDX was detected in all but the shallowest sample at concentrations ranging from 0.112–0.652 mg/kg. There were no clear trends in concentrations with depth. RDX was not detected in borehole location 16-026644, and it was detected in two samples from borehole location 16-600938 (0.62 mg/kg at 40.5–42.0 ft and 0.114 mg/kg at 70.5–71.5 ft).

TNB was detected in two of the three deep boreholes at Consolidated Unit 16-007(a)-99, was not detected in borehole location 16-26731, and was detected in only one sample from borehole location 16-26733 (0.435 mg/kg at 77.5–80.0 ft). TNB was detected in all but the deepest sample from borehole location 16-26732. Concentrations of TNB ranged from 1.69–0.303 mg/kg and decreased with depth. At Consolidated Unit 16-008(a)-99, TNB was detected in six of nine samples collected in borehole location 16-26643 at concentrations ranging from 0.103–1.77 mg/kg. The concentrations generally decreased with depth with the highest concentration at 53.0–55.0 ft and no detection in the deepest sample. TNB was detected only in the deepest sample from borehole location 16-26644 (0.221 mg/kg), and it was detected in six of seven samples collected in borehole location 16-600938 at concentrations ranging from 0.103 mg/kg to 1.4 mg/kg. Concentrations of TNB generally decreased with depth with the highest concentration at 40.5–42.0 ft and no detection in the deepest sample.

Acetone was detected in all three deep boreholes at Consolidated Unit 16-007(a)-99 but was not detected below 82.0 ft at any of these locations. At Consolidated Unit 16-008(a)-99, acetone was detected in four of nine samples from borehole location 16-26643 at concentrations ranging from 0.00323 mg/kg to 0.0869 mg/kg. The deepest concentration was 0.0869 mg/kg at 119.5–120.5 ft. Acetone was detected in all four samples collected in borehole location 16-26644, at concentrations ranging from 0.00866 mg/kg to 0.0464 mg/kg, with no clear trend in concentration with depth. Acetone was detected in the shallowest

(0.00735 mg/kg at 3.5–5.0 ft) and deepest (0.0149 mg/kg at 148.0–150.5 ft) samples collected from borehole location 16-600938.

Based on the above data, the NMED-approved investigation report recommended installing one 300-ft borehole near the southwestern boundary of the 90s Line Pond next to shallow borehole location 16-26669 to bound the vertical extent of copper, RDX, TNB, and acetone (LANL 2008, 102052.18, p. 41). This recommendation was approved by NMED (2008, 100477).

2.2.2 Lateral Extent of Contamination

Soil samples were collected along the 90s Line drainage to Cañon de Valle in 2006–2007. The sample collected from the most distal sampling location (location 16-26737) contained 44.5 mg/kg copper (soil BV is 14.7 mg/kg), 104 mg/kg nickel (soil BV is 15.4 mg/kg), and 65.1 mg/kg silver (soil BV is 1.0 mg/kg). The detection of concentrations substantially elevated above BVs indicates lateral extent has not been defined. This sample also had detected concentrations of six PAHs: anthracene (estimated concentration of 0.0117 mg/kg); benzo(b)fluoranthene (estimated concentration of 0.124 mg/kg); chrysene (0.0838 mg/kg); fluoranthene (0.123 mg/kg); phenanthrene (0.0809 mg/kg); and pyrene (0.178 mg/kg).

Although lateral extent was not defined by the samples collected during the 2006–2007 90s Line investigation, further lateral migration of these chemicals of potential concern (COPCs) is being addressed as part of the near-surface RFI/corrective measures evaluation (CME) for Consolidated Unit 16-021(c)-99 (260 Outfall). These COPCs were evaluated as part of the 260 Outfall Phase III RFI (LANL 2003, 077965). In addition, the canyons investigation of lower Cañon de Valle and Water Canyon will further evaluate the distribution of these COPCs. None of these COPCs contributed to a potential risk that requires cleanup in Cañon de Valle, nor did any of these COPCs exceed water-quality standards in the surface water or alluvial groundwater in Cañon de Valle (LANL 2003, 085531). All are also part of the monitoring program for the corrective measures implementation in the canyon associated with the 260 Outfall (LANL 2007, 096003).

Because migration of contaminants from the 90s Line drainage to Cañon de Valle is being addressed by other investigations, the investigation report recommended no additional sampling to define lateral extent in the 90s Line drainage as part of the investigation for Consolidated Unit 16-008(a)-99 (LANL 2008, 102052.18, p. 41). This recommendation was approved by NMED (2008, 100477), and no further lateral-bounding sampling is proposed in this supplemental investigation work plan.

2.2.3 Area of Hexavalent Chromium Contamination

An area of elevated hexavalent chromium contamination at the location of former structure 16-93 was identified during the 1996 VCA. A soil sample collected from 3.5–4.0 ft at sample location 16-02384 contained 67.7 mg/kg hexavalent chromium and 226 mg/kg total chromium. No other samples from the 1996 VCA were analyzed for hexavalent chromium. This sample was analyzed for hexavalent chromium based on elevated field-screening results. All other samples from the 1996 VCA were analyzed for total chromium, and only one sample contained a total chromium concentration above the range of background concentrations. The sample from location 16-02386 collected from 1.5–2.0 ft contained 52.9 mg/kg total chromium, which exceeds the maximum soil background concentration of 36.5 mg/kg. This location is approximately 160 ft north (downstream) of sampling location 16-02384. The VCA sampling locations nearest location 16-02384 are location 16-02394, which is approximately 20 ft to the west; location 16-02575, which is approximately 35 ft to the northwest; and location 16-02255, which is approximately 40 ft north (downstream). None of the four samples from these three locations had total

chromium above BV. Thus, the results of the 1996 VCA indicated the extent of chromium contamination was localized at location 16-02384.

Sixteen tuff samples collected from eight locations during the 2006–2007 investigation were analyzed for hexavalent chromium. These sampling locations were in the drainage from former structure 16-93, downstream from location 16-02384, and in the drainage from former structure 16-92. Hexavalent chromium was detected in only two of these samples. The sample from 4.8–7.0 ft at location 16-26686 had an estimated hexavalent chromium concentration of 0.0617 mg/kg. Hexavalent chromium was not detected in the other sample collected at this location from 9.0–11.2 ft. The sample from 8.0–9.4 ft at location 16-26687 had a hexavalent chromium concentration of 0.114 mg/kg. Hexavalent chromium was not detected in the other sample collected at this location from 4.2–6.2 ft. Both of these sampling locations are in the drainage from former structure 16-93. Hexavalent chromium was not detected in other samples collected farther downstream from these sampling locations. These results are consistent with the results of the 1996 VCA and indicate hexavalent chromium contamination is localized at location 16-02384.

Additional samples were collected near location 16-02384 during the 2006–2007 investigation. A borehole was advanced at location 16-26697, which is next to location 16-02384, and samples were collected from 9.3–11.0, 16.0–18.0, and 40.0–41.5 ft. Chromium was not detected above BV in any of these samples, thereby defining the vertical extent of contamination. A borehole was also advanced at location 16-26717, which is approximately 30 ft west of location 16-02384, and samples were collected from 0–1.0, 11.0–12.5, and 17.0–19.0 ft. Chromium was not detected above BV in any of these samples.

Based on the results of the 1996 VCA and 2006–2007 investigation, elevated hexavalent chromium concentrations are limited to the vicinity of location 16-02384. The hexavalent chromium at this location caused the total excess cancer risk at the 90s Line to slightly exceed the NMED target cancer risk level of 1×10^{-5} for the construction worker scenario. Therefore, the Laboratory recommended removing contamination in this area to reduce the potential risk to construction workers, followed by confirmation sampling (LANL 2008, 102052.18, p. 41). This recommendation was approved by NMED (2008, 100477), and the proposed excavation and sampling activities are described in this supplemental work plan.

2.2.4 Area of High Explosives Contamination

The results of the 2004 RFI identified an area of HE contamination within the former 30s Line Ponds. The explosive compound detected at the highest concentration was RDX. The discussion of results focuses on RDX because the spatial distribution of concentrations for other explosive compounds was similar to that of RDX. The sample collected from 7.5–8.0 ft at borehole location 16-23739, near the northeast corner of SWMU 16-007(a), contained 1040 mg/kg RDX. RDX was not detected in the sample collected from 3.0–4.0 ft at this same location. RDX was also not detected in samples collected at the two locations nearest to borehole location 16-23739: borehole location 16-23737 (approximately 75 ft to the northwest), and borehole location 16-23738 (approximately 75 ft to the west). Three samples were collected at borehole location 16-23737 from 3.0–3.5 ft, 7.0–8.0 ft, and 8.0–9.0 ft. One sample was collected at borehole location 16-23738 from 7.5–8.5 ft. These results indicated that elevated concentrations of explosive compounds were limited in extent.

Additional sampling was performed near borehole location 16-23739 during the 2006–2007 investigation to define the extent of the area of HE contamination. A borehole was advanced at location 16-26719, approximately 20 ft to the northwest, and samples were collected from 0–1.0, 13.0–15.0, 21.0–23.0, 26.0–28.0, and 60.7–61.5 ft. RDX was detected in all but the shallowest sample, with a maximum concentration of 11 mg/kg at 21.0–23.0 ft. Another borehole was advanced at location 16-26720,

approximately 20 ft to the east, and samples were collected from 0–1.0, 6.0–7.0, and 16.0–18.0 ft. RDX was not detected in the shallowest sample but was detected at 1.27 mg/kg and 1.52 mg/kg in the other two samples. A third borehole was advanced at location 16-26721, approximately 30 ft to the west, and samples were collected from 0–1.0, 8.0–10.0, 16.0–18.0, and 51.0–53.0 ft. RDX was detected in all but the shallowest sample, with a maximum concentration of 9.7 mg/kg at 8.0–10.0 ft. A 150-ft borehole was also advanced at location 16-26731, approximately 35 ft to the east, and samples were collected from 9.1–11.0, 33.0–35.0, 35.3–37.3, 68.9–71.0, 80.0–82.0, 120.0–122.0, and 147.2–149.2 ft. The only detection of RDX was in the sample from 68.9–71.0 ft, which had an estimated concentration of 0.11 mg/kg.

Based on the results of the 2004 RFI and 2006–2007 investigation, the elevated concentrations of RDX and other explosive compounds appear to be limited to the immediate vicinity of borehole location 16-23739. The concentrations of explosive compounds at this location did not result in a potential unacceptable risk under the construction worker scenario. The Laboratory recommended removing this area of contamination, followed by conducting confirmation sampling (LANL 2008, 102052.18, p. 41). This recommendation was approved by NMED (2008, 100477), and proposed excavation and sampling activities are described in this supplemental work plan.

2.2.5 Groundwater Sampling

Saturated conditions were encountered in one of the six intermediate depth boreholes installed during the 2006–2007 investigation. During drilling at borehole location 16-26644, south of the 90s Line Pond, a saturated interval was identified from 140–145 ft below ground surface (bgs). This zone was a densely welded tuff with clay-filled fractures. The target depth of this borehole was 150 ft bgs. After the drill string was pulled from the bottom of the hole, standing water level was measured at 138 ft bgs. A bailer attached to a wire line was used to collect water samples from the borehole. A total of 10 L of water was collected, and filtered and unfiltered samples were submitted for off-site laboratory analyses. The water was extremely turbid, probably from the clay-filled fractures.

The following inorganic chemicals were detected in one or both of the samples (one filtered and one unfiltered) collected from borehole location 16-26644 at concentrations exceeding one or more of the groundwater standards/screening levels identified in the investigation report (LANL 2008, 102052.18, p. 38).

- Aluminum, iron, and manganese exceeded the EPA secondary maximum contaminant level (MCL) in the filtered sample and all three groundwater standards/screening levels (New Mexico Water Quality Control Commission [NMWQCC] groundwater standards, EPA secondary MCLs, and EPA Region 6 tap water screening levels) in the unfiltered sample.
- Arsenic and lead exceeded all three groundwater standards/screening levels in the unfiltered sample.
- Barium, chromium, and uranium exceeded the EPA MCLs and the NMWQCC groundwater standards in the unfiltered sample.
- Beryllium and cadmium exceeded the EPA MCLs in the unfiltered sample.
- Cobalt and nickel exceeded the NMWQCC groundwater standards in the unfiltered sample.
- Vanadium exceeded the EPA Region 6 tap water screening level in the unfiltered sample.

The following organic chemicals were detected in the unfiltered sample collected from borehole location 16-26644 at concentrations exceeding one or more groundwater standards/screening levels identified in the investigation report (LANL 2008, 102052.18, p. 38):

- RDX exceeded the EPA Region 6 tap water screening level.
- Tetrachloroethene and trichloroethene exceeded the EPA Region 6 tap water screening levels.

A single completion monitoring well was installed in this borehole after the design was approved by NMED (Young 2007, 098733). The well casing is 2-in.-diameter polyvinyl chloride pipe with a 15-ft screened interval from 132–147 ft bgs. The investigation report recommended developing the monitoring well at this location and sampling it on a quarterly basis for 1 yr (LANL 2008, 102052.18, p. 41). The investigation report also recommended installing a pressure transducer to monitor water-level fluctuations on a continuous basis. These recommendations were approved by NMED (2008, 100477). The results of the groundwater monitoring will be evaluated as part of the intermediate and deep groundwater CME for the 260 Outfall. Groundwater monitoring results will be reported in the periodic groundwater monitoring reports for the Water Canyon watershed.

3.0 SCOPE OF ACTIVITIES

In the February 11, 2008, notice of approval with direction for the Consolidated Units 16-007(a)-99 and 16-008(a)-99 investigation report (NMED 2008, 100477), NMED requested that the Laboratory submit a work plan for the additional investigation and remediation activities proposed in section 8.0 of the investigation report (LANL 2008, 102052.18). This section identifies the specific activities to be performed during the supplemental investigation and remediation of the TA-16 ponds area.

Specific supplemental contaminant removal and investigation activities to be conducted at Consolidated Units 16-007(a)-99 and 16-008(a)-99 include

- removing soil and tuff with elevated concentrations of explosive compounds detected from 7.5–8.0 ft at borehole location 16-23739 associated with Consolidated Unit 16-007(a)-99;
- removing soil and tuff with elevated hexavalent chromium concentrations detected from 3.5–4.0 ft at borehole location 16-02384 associated with Consolidated Unit 16-008(a)-99;
- defining potential waste types and volumes to be removed;
- installing a single 300-ft deep borehole next to borehole location 16-26669 to determine the vertical extent of copper, RDX, TNB, and acetone in soil and tuff; and
- developing and sampling the monitoring well at borehole location 16-26644 on a quarterly basis for 1 yr and installing a pressure transducer to monitor water-level fluctuations on a continuous basis following well development.

Section 8.0 of the investigation report also recommended installing BMPs consisting of check dams in the tributary drainages to the 90s Line Pond to minimize transport of contaminated sediment to the 90s Line Pond (LANL 2008, 102052.18, p. 41). NMED's approval with direction required that the Laboratory install these BMPs and submit proof of their installation by June 30, 2008. The BMPs were installed, and the Laboratory submitted the required proof to NMED (LANL 2008, 102904). These BMPs were subsequently approved by NMED (2008, 102291).

The following site activities are anticipated:

- Mobilization and site preparation
- Presampling geodetic and utilities surveys
- BMP installation
- Excavation
- Confirmatory sampling
- Subsurface and/or groundwater sampling
- Site restoration and demobilization
- Postsampling geodetic surveys
- Investigation-derived waste (IDW) management

Health and safety activities will be governed by a Laboratory-approved site-specific health and safety plan and integrated work documents. The Laboratory does not anticipate that associated health and safety concerns will prohibit the implementation of this work plan.

3.1 Removal of Area of Contamination and Confirmatory Sampling

Section 8.0 of the investigation report recommended the excavation and removal of residual HE contamination identified by previous investigations at Consolidated Unit 16-007(a)-99 and residual hexavalent chromium contamination identified by previous investigations at Consolidated Unit 16-008(a)-99 followed by confirmation sampling (LANL 2008, 102052.18, p. 41).

3.1.1 Consolidated Unit 16-007(a)-99

Consolidated Unit 16-007(a)-99 has been thoroughly investigated and characterized. At borehole location 16-23739, the tuff sample collected from 7.5–8.0 ft contained elevated HE, including HMX (cyclotetramethylenetetranitramine) at a concentration of 84.4 mg/kg; RDX at a concentration of 1040 mg/kg; and 2,4,6-trinitrotoluene at a concentration of 359 mg/kg. HE was either not detected or was detected at low concentrations that decreased with depth in samples collected from proximate borehole locations 16-23737, 16-23738,16-23740, 16-26719, 16-26720, 16-26721, and 16-26731 (LANL 2008, 102052.18). Therefore, the extent of HE contamination is defined. Although the extent of this contamination is defined and the area poses no potential unacceptable risk to human or ecological receptors for current and expected future land use, the area of contamination will be removed as a BMP and confirmation sampling will be conducted at this location. The size of the area to be excavated at borehole location 16-23739 is approximately 20 ft × 20 ft × 8 ft deep (Figure 3.1-1). Soil and tuff from this location will be removed, characterized, and disposed of at an appropriate waste facility. The target cleanup levels are industrial soil screening levels (SSLs). Field screening to be used to guide removal of contaminated media will include HE (by spot test) and D TECH analyses. Residential SSLs will be used as conservative field-screening levels to ensure cleanup levels are met. Excavation will continue until screening results show screening levels have been reached. Eight confirmation samples will be collected from four locations within the excavated area (three new confirmatory sample locations and location 16-23739) to document current conditions (Figure 3.1-1). Samples will be collected from two depth intervals (0–1 ft and 3–4 ft below the bottom of the excavation) and submitted to an off-site contract laboratory for analysis of explosive compounds. Table 3.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

3.1.2 Consolidated Unit 16-008(a)-99

Consolidated Unit 16-008(a)-99 has been thoroughly investigated and characterized. At borehole location 16-02384, the sample collected from 3.5–4.0 ft had an elevated hexavalent chromium concentration of 67.7 mg/kg, which poses a potential unacceptable risk to the construction worker. To reduce the risk to construction workers, remediation and confirmation sampling will be conducted at this location. Chromium was not detected above BV in samples collected from proximate borehole locations 16-02255, 16-02572, 16-02394, 16-02575, 16-26697, and 16-26717. Therefore, the extent of hexavalent chromium is defined. The size of the area to be excavated at borehole location 16-02384 is approximately 10 ft × 10 ft × 6 ft deep (Figure 3.1-2). Soil and tuff from this location will be removed, characterized, and disposed of at an appropriate waste facility. The cleanup goal will be the construction worker SSL of 26.1 mg/kg for hexavalent chromium. Field screening of confirmation samples will not be conducted because the x-ray fluorescence (XRF) detection limit for chromium is too high. Six confirmation samples will be collected from three locations (two new confirmatory sample locations and location 16-02384) within the excavated area (Figure 3.1-2). Samples will be collected from two depth intervals (0–1 ft and 3–4 ft below the bottom of the excavation) and submitted to an off-site contract laboratory for analysis of hexavalent chromium. Table 3.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

3.2 Installation of 300-ft Borehole at Consolidated Unit 16-008(a)-99

Section 8.0 of the investigation report recommended advancing a single deep borehole to a depth of 300 ft bgs adjacent to borehole location 16-26669 to determine the vertical extent of copper, RDX, TNB, and acetone in soil and tuff (Figure 2.1-2) (LANL 2008, 102052.18, p. 41). This location is at the confluence of a prominent drainage and the 90s Line Pond and central to the three previously drilled 150-ft boreholes (locations 16-600938, 16-26643, and 16-26644). NMED subsequently approved the recommendation in the February 11, 2008, notice of approval with direction of the Consolidated Units 16-007(a)-99 and 16-008(a)-99 investigation report (NMED 2008, 100477). If perched water is encountered, drilling will be stopped and a groundwater sample will be collected. After groundwater samples are collected, any remaining water will be purged from the borehole and it will be allowed to equilibrate overnight. If water is present after equilibrating overnight, the Laboratory will contact NMED to determine whether to construct a monitoring well. If so directed by NMED, this borehole will be completed as a monitoring well and subsequently developed and sampled.

Subsurface Tuff Sampling

A new borehole will be drilled to a total depth of 300 ft bgs adjacent to borehole location 16-26669 and is expected to penetrate into Unit 3 of the Bandelier Tuff. This new borehole will be sampled every 50 ft as the borehole is advanced for explosive compounds, TAL metals, and VOCs. The borehole will be logged using a neutron probe, and intervals exhibiting elevated pore-water contents or visible fractures will also be selected for screening and laboratory analysis. Table 3.0-1 lists all proposed samples and analytical suites.

3.3 Development and Sampling of Monitoring Well at Consolidated Unit 16-008(a)-99

Section 8.0 of the investigation report recommended developing a monitoring well at borehole location 16-26644 and sampling on a quarterly basis for 1 yr to provide additional information on groundwater characteristics and potential contaminant migration (Figure 2.1-2) (LANL 2008, 102052.18, p. 41). In addition, the report recommended installing a pressure transducer in the well to monitor water-level fluctuations on a continuous basis following well development.

3.3.1 Well Development

The monitoring well will be developed in accordance with EP-ERSS-SOP-5033, “Well Development,” and will take into consideration site-specific hydrogeologic conditions.

All well drilling and installation procedures create a skin, or filter cake, on the borehole wall. During well development, the fine particulate matter is removed from the well or saturated formation near the screen. A secondary function of development is to settle the annular fill to a stable position. The following factors influence the success of well development: (1) the drilling method used in the well construction, (2) the design and completion of the well, and (3) the type of geologic material surrounding the screen. Because of the small size of weathering products from the volcanic tuff in some of the perched aquifers in the region, it is virtually impossible to eliminate turbidity while the well is being developed. Various techniques may be effective in developing wells, depending on the hydrogeologic conditions encountered in the aquifer, the drilling method used, and the well design. Well development activities will be described in the supplemental investigation report for Consolidated Units 16-007(a)-99 and 16-008(a)-99.

3.3.2 Groundwater Monitoring

A pressure transducer and data logger will be installed in the monitoring well to monitor water-level fluctuations on a continuous basis following well development. Transducer measurements will be obtained at specific time intervals, usually 60-min and are, therefore, sometimes referred to as continuous measurements (relative to the periodic manual measurements).

The monitoring well will be sampled quarterly for 1 yr in conjunction with the monitoring performed in the Water Canyon watershed under the Interim Facility-Wide Groundwater Monitoring Plan (LANL 2008, 101897). Groundwater samples will be analyzed for the same constituents specified for other new wells in the Water Canyon watershed. This includes quarterly monitoring for TAL metals, VOCs, explosive compounds (including RDX-degradation products), general inorganic chemicals, and perchlorate and annual monitoring for SVOCs, radionuclides, low-level tritium, and stable isotopes. Results from the sampling will be evaluated in the context of the goals of the intermediate and deep groundwater CME for Consolidated Unit 16-021(c)-99 (260 Outfall) and will be reported in the Water Canyon watershed periodic groundwater monitoring reports.

3.4 Sediment Sampling above BMPs in Tributary Drainages to and within the 90s Line Pond at Consolidated Unit 16-008(a)-99

Section 8.0 of the investigation report recommended installing BMPs (check dams) in the tributary drainages to the 90s Line Pond to minimize transport of contaminated sediment from the former building footprint areas into the pond (Figure 3.4-1). BMPs were installed in the two major drainages to the 90s Line Pond in June 2008 (LANL 2008, 102904). The BMPs consisted of juniper bales designed to minimize sediment transport from the drainages to the pond. These BMPs will be maintained and inspected on an annual basis; proof of maintenance will be submitted annually to NMED by November 30, 2008 (NMED 2008, 102291).

Sediment Sampling

Sediment samples will be collected from three locations within the pond boundary and two locations upstream of the BMPs at periodic intervals (every 5 yr) to evaluate whether contaminant concentrations in sediment in the pond are increasing (Figure 3.4-1). The sediment samples will be collected from 0–1 ft and analyzed for explosive compounds, TAL metals, VOCs, and SVOCs (Table 3.0-1). The first sediment

samples will be collected in June 2013, 5 yr after the BMPs were installed. Data will be reported within 30 d of receipt of validated sample results.

3.5 Investigation-Derived Waste

The IDW generated as a result of field investigation and remediation activities may include, but is not limited to, contaminated soil and tuff; drill cuttings; potentially contaminated groundwater; potentially contaminated personal protective equipment (PPE); sampling and remediation supplies; fluids from the decontamination of sampling and remediation equipment; returned samples; and all other waste potentially coming in contact with contaminants. Any IDW generated during the supplemental investigation and remediation of Consolidated Units 16-007(a)-99 and 16-008(a)-99 will be managed to protect human health and the environment, comply with applicable federal, state, and Laboratory requirements, and adhere to Laboratory waste-minimization goals. The management of IDW is described in Appendix A of this work plan.

3.6 Geodetic Surveys

A postinvestigation geodetic survey will be conducted at all sampling locations to confirm the exact locations of samples collected and to ensure any deviations from the proposed sampling design are documented.

3.7 Site Restoration

Site restoration will include backfilling of all sampling and excavation locations to the surrounding grade of the ground surface. Revegetation will be required upon completion of investigation and remediation activities; a native seed mix will be hand-dispersed over areas of significant disturbance. In addition, BMPs for controlling stormwater run-on and runoff will be installed, inspected, and maintained, as needed.

All sampling and decontamination equipment, materials, and IDW will be removed from the site (Appendix A). A final site inspection will be conducted to ensure site restoration, decontamination, and demobilization activities have been completed. All site preparation, site field work (excavation, sampling, etc.), and site restoration activities will be documented in field logbooks.

4.0 INVESTIGATION METHODS

The following sections describe the primary field methods to be used in implementing this work plan. A list of applicable standard operating procedures (SOPs) for field activities is provided in Table 4.0-1. A summary of the investigation methods associated with these procedures is presented in Table 4.0-2.

4.1 Collection of Confirmation and Sediment Samples

Postexcavation confirmation samples will be collected using either a spade or scoop in accordance with SOP-06.09, “Spade and Scoop Method for Collection of Soil Sample,” or a hand auger according to SOP-06.10, “Hand Auger and Thin-Wall Tube Sampler.” Samples will be collected at each location from 0–1 ft bgs and 3–4 ft bgs in the bottom of each excavation. The second depth interval may be adjusted based on field conditions observed at the time of sampling. The reasons for any adjustments to the depth of the second sample depth will be documented on the sample collection log. Field quality assurance

(QA)/quality control (QC) samples (e.g., field duplicates) will be collected at a minimum frequency of 10% of total samples collected (EP-ERSS-SOP-5059, “Field Quality Control Samples”).

The sediment samples to be collected within the 90s Line Pond and at locations upstream of the BMPs beginning in June 2013 will be collected from 0–1 ft bgs. The sediment samples will be collected in accordance with EP-ERSS-SOP-5027, “Geomorphic Characterization,” and SOP-06.09 “Spade and Scoop Method for Collection of Soil Samples.”

4.1.1 Field Analytical Methods

Each sample will be qualitatively screened for health and safety purposes and to select sample locations for fixed-laboratory analysis. These qualitative field-screening methods include (1) screening for gross radionuclides (beta-gamma) using a sodium iodide detector; (2) HE spot testing; and (3) immunoassay testing for RDX. Field-screening results will be recorded in the field boring logs and field notebooks in accordance with SOP-5181, “Notebook Documentation for Waste and Environmental Services Technical Field Activities.”

Radiological screening will target gross alpha-, beta-, and gamma-emitting radionuclides. Field screening will be conducted within 1 in. of sample material by the radiation control technician from surface, shallow subsurface and subsurface material in core or in the sample-mixing bowl before material is placed in sample jars. All radiological screening will be conducted using an Eberline E-600 radiation meter with an SHP-380AB alpha/beta scintillation detector, or equivalent. This equipment consists of a dual phosphor plate covered by two mylar windows housed in a light-excluding metal body. The phosphor plate is a plastic scintillator for the detection of beta emissions and is thinly coated with zinc sulfide for detecting alpha emissions.

The operational range varies from trace emissions to 1-mm disintegrations per minute (dpm). Should field screening indicate a result greater than 2 times the instrument background level for the site, a total uranium sample will be collected for laboratory analysis. Instrument background levels will be collected twice daily, at a minimum, once in the morning and once in the afternoon. If more than one site is screened in a day, background levels will be calculated before work begins at each new site. Background will be measured from 10 locations surrounding the site and away from known or suspected areas of radiological contamination. An average will then be calculated to determine the instrument background level for the site. Radiological field screening will be conducted in accordance with SOP-10.14. All instrument background checks, background ranges, and calibration procedures will be documented daily in the field logbook in accordance with the current version of SOP-12.01.

D TECH immunoassay test kits from Strategic Diagnostics, Inc., will be used to field screen soil and tuff samples for RDX. This semiquantitative field-screening method will be used to guide excavation and sampling investigation activities. The field analytical method for RDX is EPA SW-846 (Update III) Method 4051 and the D TECH detection limit for RDX in soil is 1.0 mg/kg.

4.1.2 Fixed-Laboratory Analytical Methods

Fixed-laboratory analytical samples will be submitted as outlined in section 3.0 and summarized in Table 3.0-1. Sample collection and analysis will be coordinated with SMO. The SMO will ship samples to an analytical laboratory that is qualified and on the EP-approved list of suppliers. Table 4.1-1 lists the analytical suites and methods to be used for soil, sediment, tuff, and groundwater samples.

The QA/QC procedures for sampling will include collecting field duplicates (at a rate of 1 in 10 samples or 1 per day, whichever is more frequent) to evaluate the reproducibility of the sampling techniques, rinsate

blanks to evaluate decontamination procedures (if decontaminated equipment is being reused for sampling), and trip blanks (for VOCs) to evaluate possible laboratory cross-contamination (EP-ERSS-SOP-5059, “Field Quality Control Samples”). The blank samples will be collected at a frequency consistent with the SOP.

Waste samples will be analyzed for metals using the toxicity characteristic leaching procedure (TCLP) rather than the method for total metals analysis.

4.2 Drilling Methods

4.2.1 Drilling Protocol

The new borehole adjacent to borehole location 16-26669 will be drilled with the hollow-stem auger (HSA) method to refusal. The air-rotary method will then be used to advance the borehole to a total depth of 300 ft. Casing will be advanced as the drill bit advances and will prevent sloughing of any material from soft, unconsolidated intervals into the borehole during and after drilling is completed.

The hollow-stem continuous flight auger consists of a hollow steel shaft with a continuous spiral steel flight welded to the exterior site of the stem. The stem is connected to an auger bit and transports cuttings to the surface when rotated. The hollow stem of the auger allows drill rods, split-spoon core barrels, Shelby tubes, and other samplers to be inserted through the center of the auger so samples may be retrieved during the drilling operations. The hollow stem also temporarily cases the borehole so the well screen and casing (riser) may be inserted down through the center of the augers once the desired depth is reached, minimizing the risk of possible collapse of the borehole. A bottom plug or pilot bit can be fastened onto the bottom of the augers to keep out most of the soil and/or water that have a tendency to clog the bottom of the augers during drilling. Drilling without a center plug is acceptable provided the soil plug, formed in the bottom of the auger, is removed before sampling or installing well casings. The soil plug can be removed by washing out the plug using a side discharge rotary bit, or by drilling out the plug with a solid-stem auger bit sized to fit inside the HSA. In situations where heaving sands are a problem, potable water may be poured into the augers to equalize the pressure so that the inflow of formation materials and water is held to a minimum when the bottom plug is removed. The HSA method is best suited for drilling shallow overburden wells.

The air-rotary method consists of a drill pipe or drill stem coupled to a drill bit that rotates and cuts through soil and rock. The cuttings produced from the rotation of the drilling bit are transported to the surface by compressed air, which is forced down the borehole through the drill pipe and returns to the surface through the annular space (between the drill pipe and the borehole wall). The circulation of the compressed air not only removes the cuttings from the borehole but also helps to cool the drill bit. Air-rotary drilling is best suited for hard-rock formations. In soft, unconsolidated formations, the casing is driven to keep the formation from caving. The air compressor will have an in-line filter system to filter the air coming from the compressor. The filter system will be inspected regularly to ensure the system is functioning properly. In addition, a cyclone velocity dissipator or similar air containment/dust-suppression system will be used to funnel the cuttings to one location instead of allowing the cuttings to discharge uncontrolled from the borehole. Air rotary that uses the dual-tube (reverse-circulation) drilling system is acceptable because the cuttings are contained within the drill stem and are discharged through a cyclone velocity dissipator to the ground surface.

4.2.2 Neutron Logging of the Borehole

The proposed 300-ft borehole will be moisture-logged using a neutron probe, after drilling to total depth is completed. Logging will be conducted at 1-ft intervals to total depth in accordance with EP-ERSS-SOP-5040, “Subsurface Moisture Measuring Using a Neutron Probe.”

4.2.3 Collection of Subsurface Tuff Samples

Subsurface tuff samples will be collected from the core barrel sampler and put into sealed sleeves or core-protect bags to preserve core moisture by using the methods described in SOP-6.26, “Core Barrel Sampling for Subsurface Earth Materials.” Tuff samples will be collected from intervals where contamination is suspected because of elevated field-screening results and/or visual inspection that identify fractures or staining; otherwise, samples will be collected at the 50-ft default interval.

Field documentation of samples collected from fractures (if fractures are encountered) will include a detailed physical description of the fracture-fill material and rock matrix sampled following EP-ERSS-SOP-12.01, “Field Logging, Handling, and Documentation of Borehole Materials,” and in general accordance with American Society for Testing and Materials (ASTM) or American Geological Institute (AGI) methods. The relative volumes of fracture-fill and rock-matrix material included in the sample will be estimated from field measurements. An additional sample will be collected from the rock matrix next to the fracture sample material for comparison. The fracture and matrix samples will be assigned unique identifiers. Characteristics of fractures and surrounding matrix material will be recorded in the field in the borehole logs.

Tuff samples from the 300-ft borehole will be analyzed by the methods specified in Table 4.1-1. The QA/QC samples will include field duplicate samples for evaluating the reproducibility of the sampling technique, rinsate blanks for evaluating decontamination procedures, and trip blanks (for VOCs) for evaluating contamination during transport or at the analytical laboratories. Collection of these samples will follow the procedures and the frequency described in EP-ERSS-SOP-5059, “Field Quality Control Samples.”

Subsurface tuff samples will be collected using 4-in.-outside-diameter stainless-steel split-spoon core barrels or nonstainless barrels with Lexan liners. Material will be collected from the split-spoon core barrel into sealed containers to preserve core moisture following SOP-06.26, “Core-Barrel Sampling for Subsurface Earth Materials.” A minimum of one tuff sample for every 50 ft of boring will be submitted for analyses to an off-site contract laboratory.

4.2.4 Collection of Perched Water Samples

Water samples will be collected from the borehole if groundwater is encountered during drilling. The procedures for sampling water during drilling differ from those used for sampling water from a completed well, which are described in section 5.3.

If saturation is encountered as a borehole advances, drilling will stop and the water level will be measured to determine if sufficient water volume is available for sample collection and field measurement of water quality parameters. Water-quality parameters will include measurements for pH, specific conductivity, and temperature. If groundwater samples are collected, analyses will include VOCs, SVOCs, metals, explosive compounds, anions, perchlorate, alkalinity, uranium, cyanide, and total dissolved solids (Table 3.0-1). Unfiltered samples will be submitted for all analytes and an additional filtered sample will be collected for metals. The total volume required for each analysis is usually 0.5–1 L. If a sufficient volume of groundwater cannot be collected for analysis, the borehole will continue to be advanced to the planned

total depth or until saturation is encountered again, in which case the water-collection process will be repeated. Insufficient water sample volumes from discrete depths will not be commingled to obtain the required volume for analysis.

If a sufficient volume of groundwater is collected, the sample will be submitted for analysis on an expedited turnaround time. An expedited sample turnaround will typically provide analytical results within 48 h. After the sample is collected, the borehole will be advanced to the base of saturation or the perching horizon. The objective is to identify, but not to penetrate, the perching horizon and thereby determine the thickness of the zone of saturation and the characteristics of the perching horizon. Borehole drilling will be halted at the base of saturation or the perching horizon, and the Laboratory will contact NMED to determine whether a monitoring well will be constructed. If a well is to be constructed, a well design will be developed and submitted to NMED for approval. Following approval of the design, a monitoring well will be installed.

4.3 Borehole Abandonment

If groundwater is not encountered in the 300-ft borehole or groundwater is encountered but a well is not constructed, the borehole will be abandoned in accordance with EP-ERSS-SOP-5034, “Monitoring Well and Borehole Abandonment,” by filling the borehole with a bentonite/concrete mixture. A tremie pipe will be used to fill the borehole upward from the bottom of the borehole to the surface. All information regarding borehole abandonment will be provided in the supplemental investigation report.

4.4 Equipment Decontamination

Following drilling and sampling activities, all equipment used in drilling and sampling activities will be decontaminated. Residual material adhering to equipment will be removed using dry decontamination methods such as the use of wire brushes and scrapers (EP-ERSS-SOP-5061, “Field Decontamination of Equipment”). If equipment cannot be decontaminated using dry decontamination methods, wet decontamination methods will be used. If wet decontamination is required, the equipment will be pressure-washed on a temporary decontamination pad covered with a high-density polyethylene liner. Cleaning solutions and wash water will be collected and contained for proper disposal. Decontamination solutions will be sampled and analyzed to determine the final disposition of the wastewater and the effectiveness of the decontamination procedures.

5.0 GROUNDWATER MONITORING

5.1 Well Development

The monitoring well will be developed in accordance with EP-ERSS-SOP-5033, “Well Development.” The objective of development is to remove fine particulate matter from the well and from the saturated formation near the well screen. Development also serves to settle the annular fill material around the screen to a stable position. The specific development procedures to be used will depend on the amount of water that the well can yield. Initially, a bailer will be used to remove highly turbid water from the well and sediment from the well sump. Surging with a surge block may be used in conjunction with bailing to remove fine sediment from the zone outside the well screen. If the well yield is sufficient, a submersible pump will be used following bailing and surging for further development.

Field water-quality parameters (pH, specific conductance, and temperature) and turbidity will be measured periodically during development. Development will continue until at least five casing volumes of water have been removed, water quality parameters are stable, and turbidity has been reduced to

5 nephelometric turbidity units (NTU) or less. If these conditions cannot be met, the Laboratory will notify NMED.

All water removed from the well during development will be containerized on site. Development water will be sampled and analyzed to determine the appropriate means of disposal in accordance with the approved notice of intent (NOI) decision tree process discussed in Appendix A.

5.2 Transducer Installation

Following completion of well development, a pressure transducer will be installed in accordance with ENV-DO-201, “Pressure Transducer Installation, Removal, and Maintenance.” Before the transducer is installed, the groundwater level will be measured in accordance with ENV-DO-202, “Manual Groundwater Level Measurements,” and the groundwater elevation will be calculated based on the surveyed elevation of the well head. The transducer will then be prepared and checked according to the manufacturer’s instructions and lowered into the well. The transducer cable will be fixed and secured at the top of the well casing. The transducer will be installed at an appropriate depth to monitor the full range of expected water level fluctuations. This depth will be determined after well development based on the measured height of the water column in the well. The data logging software will then be initialized according to the manufacturer’s instructions. After verifying the function of the transducer and data logger, the data logger will be programmed to take water-level measurements on an hourly basis.

5.3 Groundwater Sampling

Groundwater samples from the monitoring well will be collected using a dedicated submersible pump. The specific type of pump will be determined following well development based on consideration of factors such as the well yield, well drawdown characteristics, required lift, and purge volume. Groundwater sampling will be conducted in accordance with RRES-WQH-SOP-049, “Groundwater Sampling Using Submersible Pumps.” Before sampling is conducted, the well will be purged using the purging procedure described in the SOP. Field parameters (i.e., temperature, conductivity, pH, dissolved oxygen, and turbidity) will be measured at the start of purging and several times during purging. The samples will be collected when either three casing volumes have been removed or field parameters have been stabilized. Field parameters are considered stable when the pH varies by less than 0.2 units or when the variation in the other parameters over a series of four readings is within 10%. If the field parameters do not stabilize, a sample will be collected and the field parameters will be recorded. Field parameters will be measured for each sample using the procedures described in ENV-DO-203, “Field Analytical Measurements of Groundwater.”

Groundwater samples requiring filtration or chemical preservation will be filtered and preserved in accordance with ENV-WQH-SOP-066, “Filtering and Chemical Preservation of Water Samples.” Groundwater samples for laboratory analyses will be placed in appropriate secondary containers and transported to the SMO for shipment to off-site analytical laboratories. The procedures for sample packaging and delivery are contained in EP-ERSS-SOP-5057, “Handling, Packaging, and Transporting Field Samples.”

Table 5.3-1 lists the analytical suites and methods to be used for all groundwater samples. These methods and analytical suites are similar to those specified in the 2008 Interim Facility-Wide Groundwater Monitoring Plan (LANL 2008, 101897) for groundwater samples collected in the Water Canyon watershed.

All purge water will be containerized on site and sampled and analyzed to determine the appropriate means of disposal.

6.0 SCHEDULE

Removing areas of contamination and collecting confirmation samples, as proposed herein for Consolidated Units 16-007(a)-99 and 16-008(a)-99 are expected to take a total of 30 d. Drilling activities and sampling of the 300-ft borehole are scheduled to take 10 d. Development of and installation of the pressure transducer in the monitoring well will be completed within 3 d. The well will then be developed and sampled on a quarterly basis for 1 yr. The sampling schedule will be the same as for other wells in the Water Canyon watershed that are sampled quarterly under the 2008 Interim Facility-Wide Groundwater Monitoring Plan (LANL 2008, 101897). Sampling data will be reported in the periodic groundwater monitoring reports for the Water Canyon watershed. Data from the sediment samples to be collected every 5 yr starting in June 2013 within the pond boundary and upstream of the BMPs will be reported within 30 d of receipt of validated sampling results. The supplemental investigation report is scheduled to take 3 mo to complete after all validated analytical data are received.

7.0 REFERENCES AND MAP DATA SOURCES

7.1 References

The following list includes all documents cited in this plan. 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 DOE–Los Alamos Site Office; the EPA, 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.

Baytos, J.F., October 8, 1986. "Analysis of Soil for Residual Explosives from Core Samples Taken at Pond at TA-16-92," Los Alamos Scientific Laboratory memorandum to J.L. Parkinson (WX-3) from J.F. Baytos (M-1), Los Alamos, New Mexico. (Baytos 1986, 005834)

LANL (Los Alamos National Laboratory), July 1993. "RFI Work Plan for Operable Unit 1082," Los Alamos National Laboratory document LA-UR-93-1196, Los Alamos, New Mexico. (LANL 1993, 020948)

LANL (Los Alamos National Laboratory), February 5, 1997. "Voluntary Corrective Action Completion Report for Potential Release Sites at TA-16, 90s-Line," Los Alamos National Laboratory document LA-UR-96-3285, Los Alamos, New Mexico. (LANL 1997, 087847)

LANL (Los Alamos National Laboratory), September 2003. "Phase III RFI Report for Solid Waste Management Unit 16-021(c)-99," Los Alamos National Laboratory document LA-UR-03-5248, Los Alamos, New Mexico. (LANL 2003, 077965)

LANL (Los Alamos National Laboratory), November 2003. "Corrective Measures Study Report for Solid Waste Management Unit 16-021(c)-99," Los Alamos National Laboratory document LA-UR-03-7627, Los Alamos, New Mexico. (LANL 2003, 085531)

LANL (Los Alamos National Laboratory), March 2005. "Investigation Work Plan for Consolidated Solid Waste Management Units 16-007(a)-99 (30s Line) and 16-008(a)-99 (90s Line) at Technical Area 16," Los Alamos National Laboratory document LA-UR-05-1694, Los Alamos, New Mexico. (LANL 2005, 089331)

LANL (Los Alamos National Laboratory), May 2007. "Corrective Measures Implementation Plan for Consolidated Unit 16-021(c)-99," Los Alamos National Laboratory document LA-UR-07-2019, Los Alamos, New Mexico. (LANL 2007, 096003)

LANL (Los Alamos National Laboratory), January 2008. "Investigation Report for Consolidated Units 16-007(a)-99 and 16-008(a)-99 at Technical Area 16, Revision 1," Los Alamos National Laboratory document LA-UR-08-0256, Los Alamos, New Mexico. (LANL 2008, 102052.18)

LANL (Los Alamos National Laboratory), May 2008. "2008 Interim Facility-Wide Groundwater Monitoring Plan," Los Alamos National Laboratory document LA-UR-08-3273, Los Alamos, New Mexico. (LANL 2008, 101897)

LANL (Los Alamos National Laboratory), June 30, 2008. "Proof of Installation of Erosion Controls in Drainages to the 90s Line Pond," Los Alamos National Laboratory letter (EP2008-0303) to J.P. Bearzi (NMED-HWB) from S. Stiger (LANL) and D. Gregory (DOE-LASO), Los Alamos, New Mexico. (LANL 2008, 102904)

NMED (New Mexico Environment Department), August 19, 2005. "Approval of the Investigation Work Plan for Consolidated Solid Waste Management Units 16-007(a)-99 (30s Line) and 16-008(a)-99 (90s Line) at Technical Area 16," New Mexico Environment Department letter to D. Gregory (DOE LASO) and R.W. Kuckuck (LANL Director) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2005, 091672)

NMED (New Mexico Environment Department), February 11, 2008. "Notice of Approval with Direction, Investigation Report for Consolidated Units 16-007(a)-99 and 16-008(a)-99 at Technical Area 16, Revision 1," 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 2008, 100477)

NMED (New Mexico Environment Department), July 7, 2008. "Approval of Erosion Controls Installed in Drainages to the 90s Line Pond, Consolidated Unit 16-008(a)-99," 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 2008, 102291)

Young, J., August 9, 2007. RE: Status of water in borehole. E-mail message to D. Hickmott (LANL) and N. Dhawan (NMED) from J. Young (NMED), Santa Fe, New Mexico. (Young 2007, 098733)

7.2 Map Data Sources

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

Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.

Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.

Potential Release Sites; Los Alamos National Laboratory, Environment and Remediation Support Services Division, GIS/Geotechnical Services Group, EP2007-0682; 1:2,500 Scale Data; 29 October 2007.

Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Division; 19 September 2007.

Primary Electric Grid; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.

Primary Gas Distribution Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.

Sewer Line System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.

Water Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.

Point Feature Locations of the Environmental Restoration Project Database; Los Alamos National Laboratory, Environment and Remediation Support Services Division, EP2007-0683; 29 October 2007

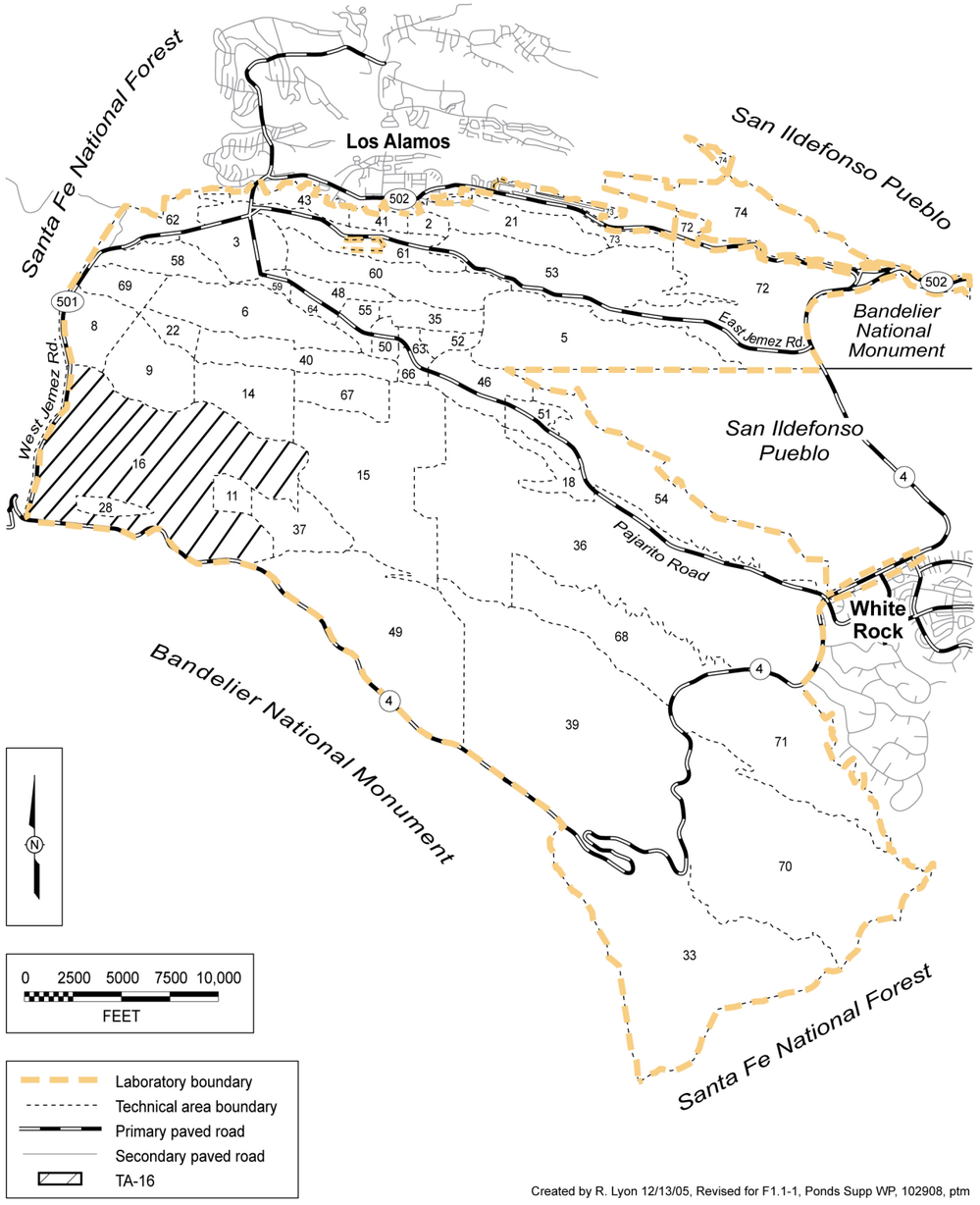

Figure 1.1-1 Location of TA-16 with respect to Laboratory TAs and surrounding land holdings

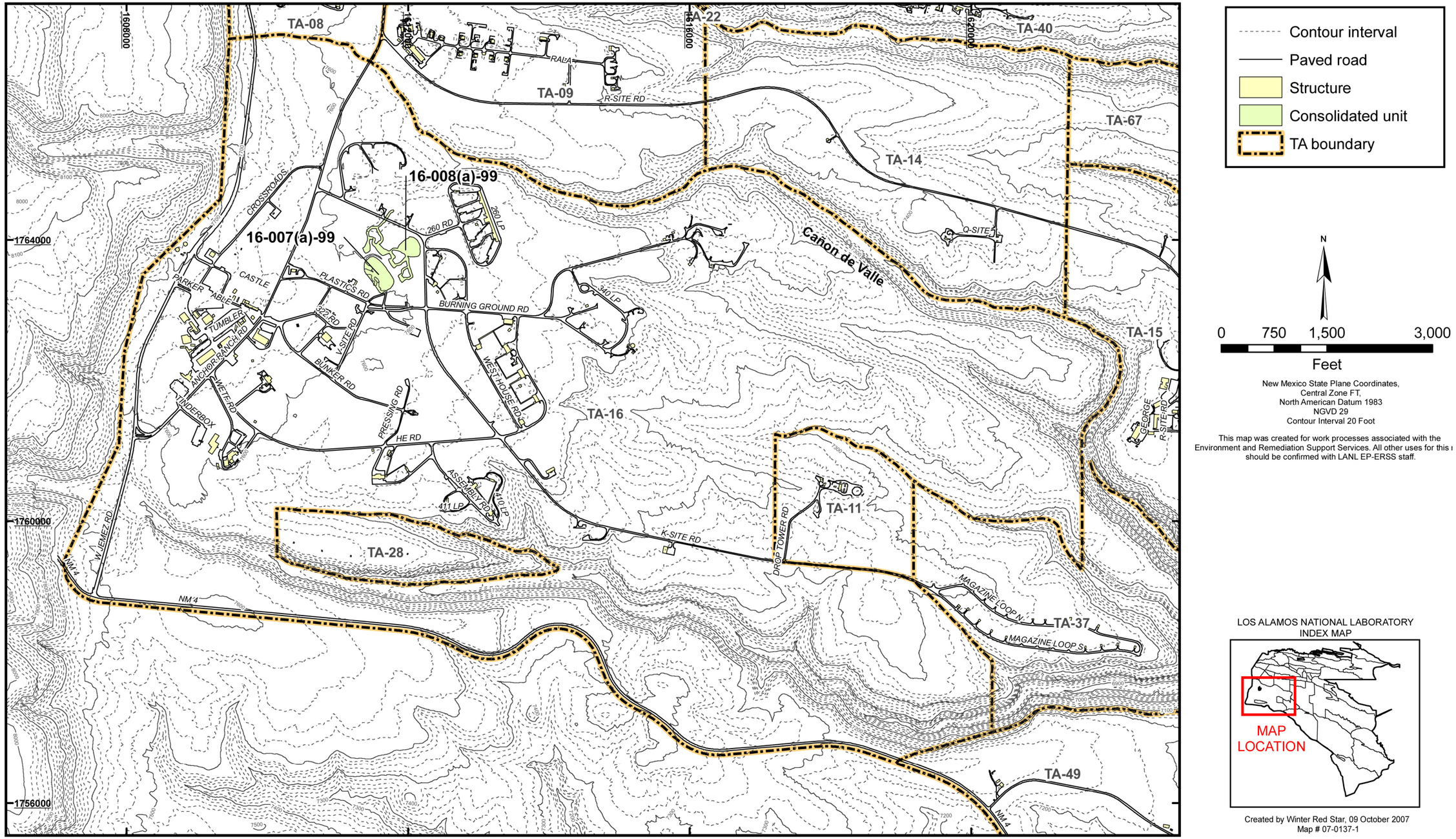

Figure 1.1-2 Locations of Consolidated Units 16-007(a)-99 and 16-008(a)-99 with respect to Laboratory TAs

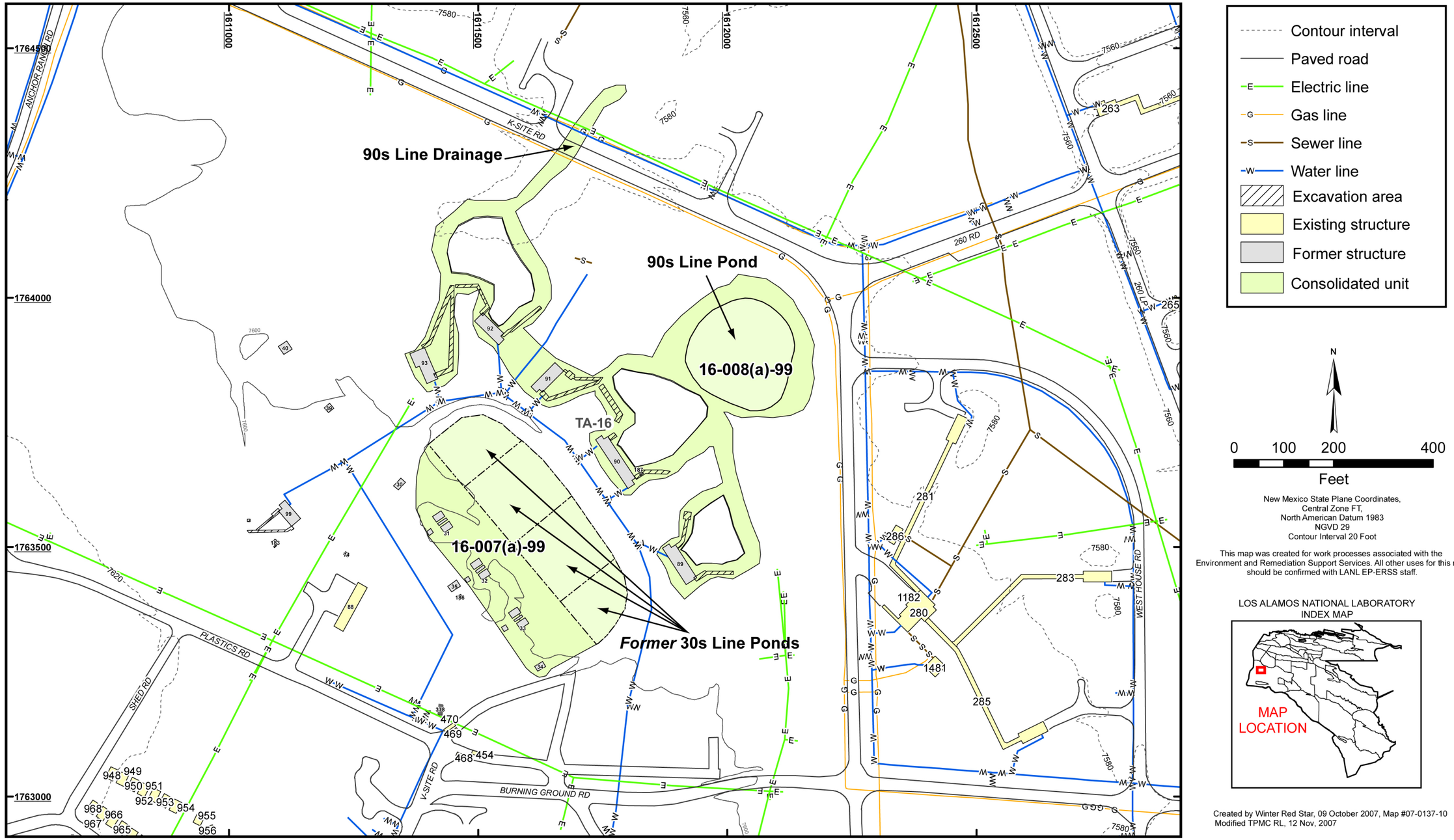

Figure 1.1-3 Locations of Consolidated Units 16-007(a)-99 and 16-008(a)-99 and associated features

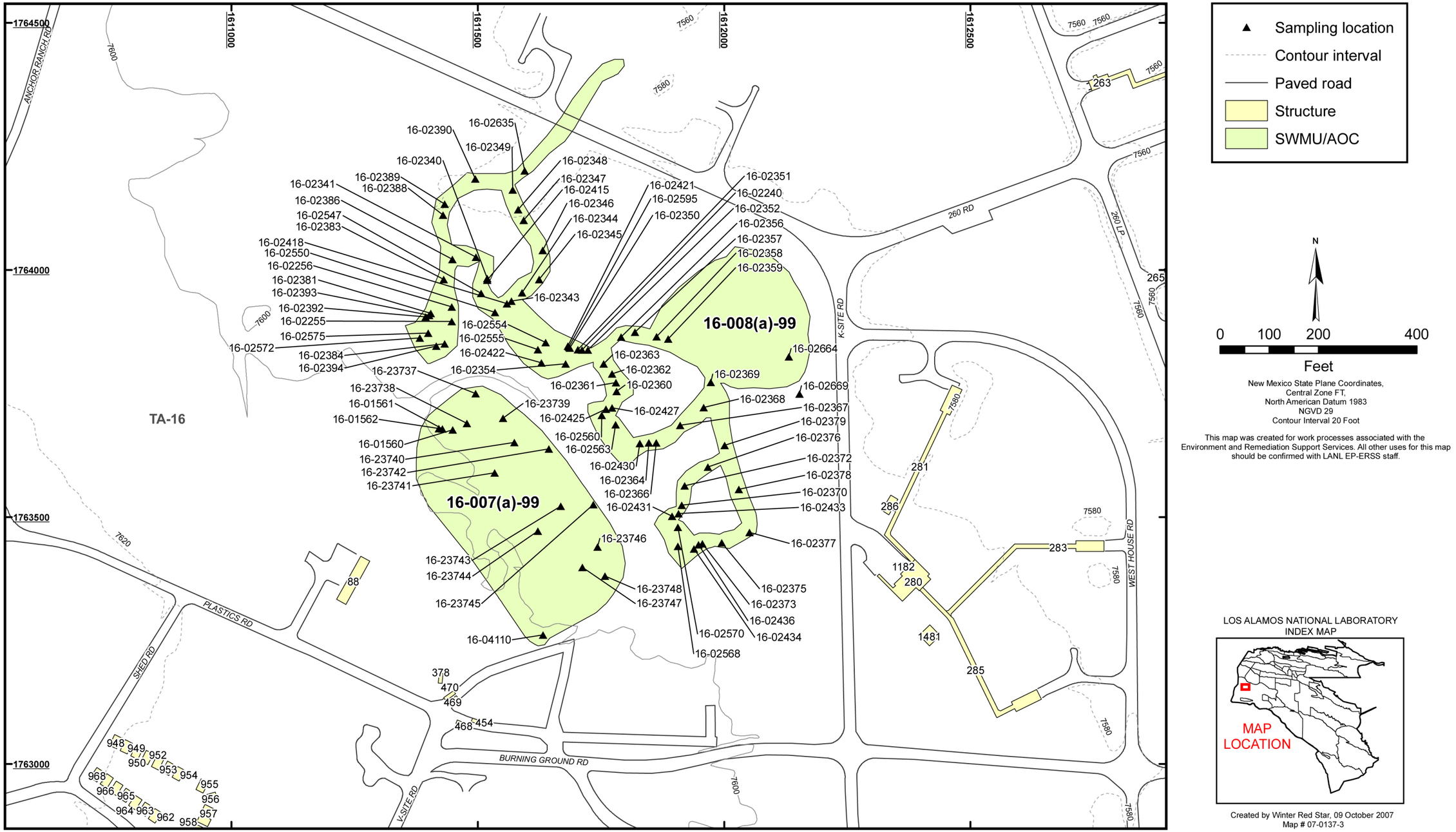

Figure 2.1-1 Pre-2006 RFI sampling locations at Consolidated Units 16-007(a)-99 and 16-008(a)-99

Figure 2.1-2 2006–2007 investigation sampling locations at Consolidated Units 16-007(a)-99 and 16-008(a)-99. Also shown are locations of new 300-ft borehole and well to be developed.

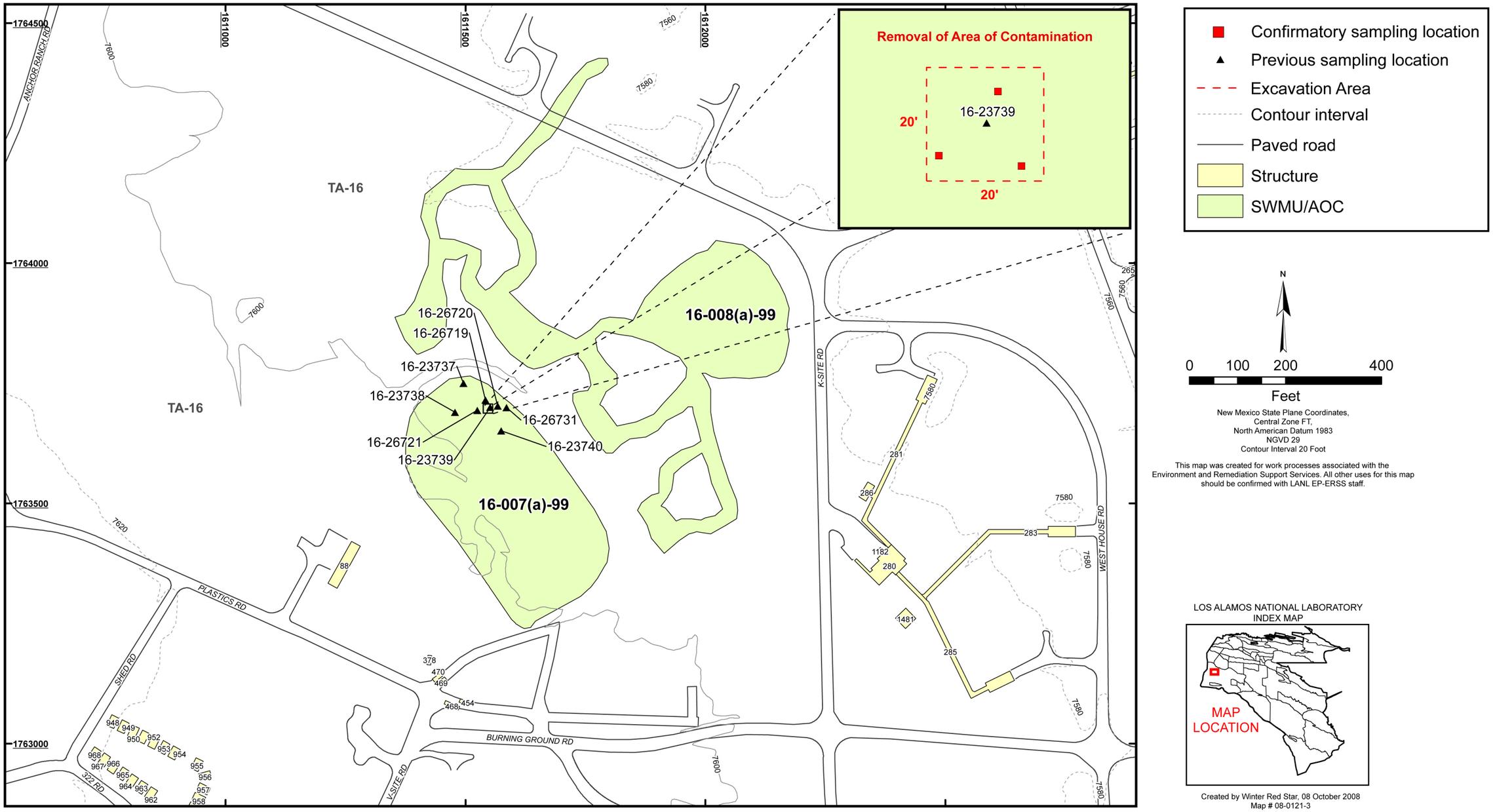

Figure 3.1-1 Proposed removal of area of contamination and confirmation sampling locations at Consolidated Unit 16-007(a)-99

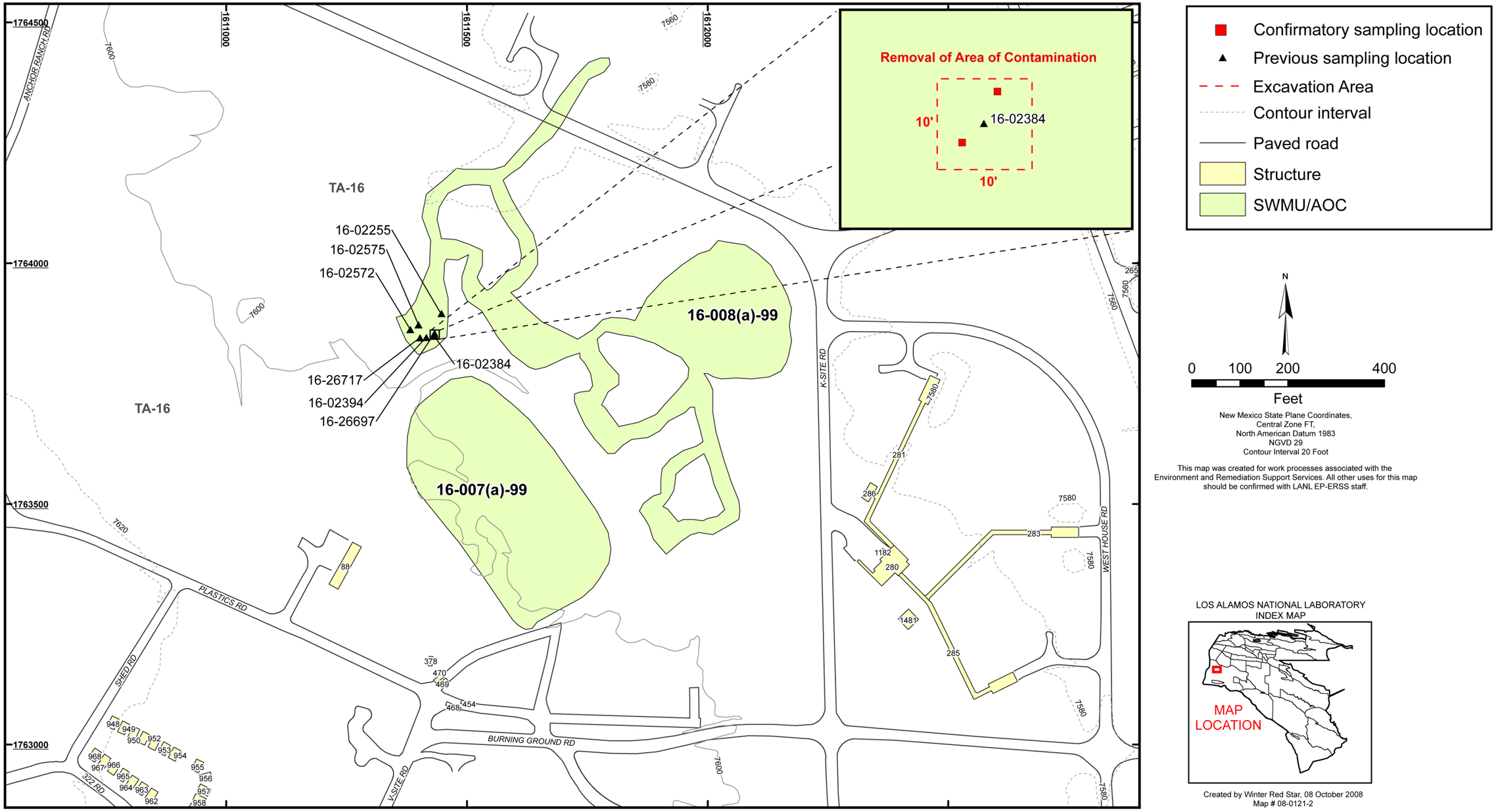

Figure 3.1-2 Proposed removal of area of contamination and confirmation sampling locations at Consolidated Unit 16-008(a)-99

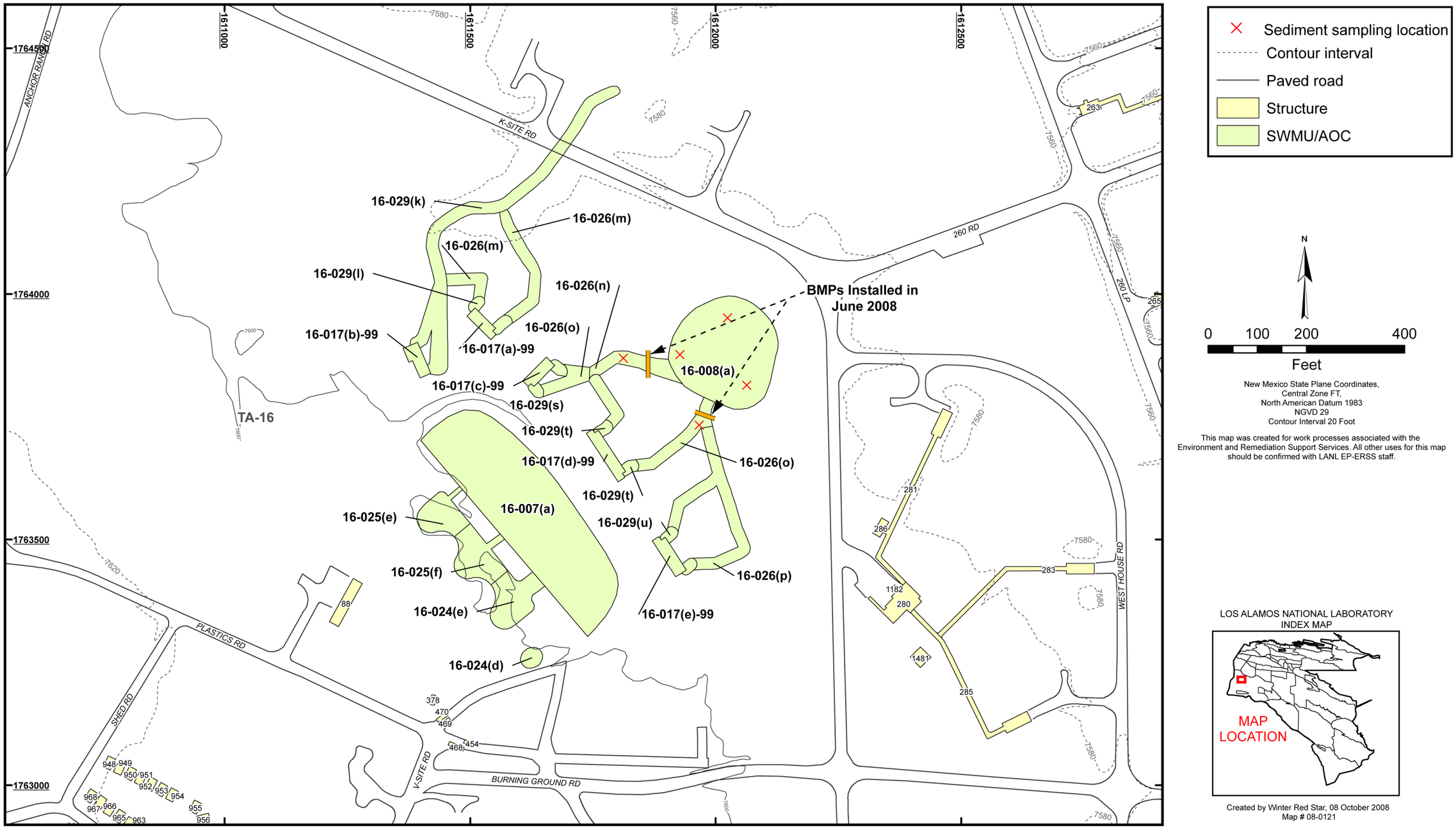

Figure 3.4-1 Locations of BMPs installed in 90s Pond tributary drainages and proposed sediment sampling locations to be sampled in June 2013

Table 3.0-1
Proposed Sampling and Analyses for Consolidated Units 16-007(a)-99 and 16-008(a)-99

Location Description	Sampling Strategy	Section/ Figure	Sampling Depth (ft)	Media	TAL Metals	VOCs	SVOCs	Explosive Compounds	Chromium VI	Perchlorate	General Inorganics	Radionuclides	Low-Level Tritium	Stable Isotopes
Consolidated Unit 16-007(a)-99														
Location 16-23739	Eight confirmation samples collected from 4 locations in excavation (three new confirmatory sampling locations and sampling location 16-23739) following removal of area of contamination	Section 3.1.1 Figure 3.1-1	0–1 3–4 below bottom of excavation	Soil, tuff	—[a]	—	—	X[b]	—	—	—	—	—	—
Consolidated Unit 16-008(a)-99														
Location 16-02384	Six confirmation samples collected from 3 locations in excavation (two new confirmatory sampling locations and sample location 16-02384) following removal of area of contamination.	Section 3.1.2 Figure 3.1-2	0–1 3–4 below bottom of excavation	Soil, tuff		—	—	—	X	—	—	—	—	—
New 300-ft borehole next to location 16-26669 If water is encountered, the borehole will be completed as a monitoring well, developed, and sampled.	Six tuff samples collected every 50 ft.	Section 3.2.1 Figure 2.1-2	50–55 100–105 150–155 200–205 250–255 300–305	Tuff	X	X		X	—		—	—	—	—
Develop and sample monitoring well at location 16-26644.	Groundwater samples collected quarterly for 1 yr	Section 3.3.2 Figure 2.1-2	To be determined	Water[c]	Q[d]	Q	A[e]	Q[f]	Q	Q	Q	A	A	A

Table 3.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Sampling Depth (ft)	Media	TAL Metals	VOCs	SVOCs	Explosive Compounds	Chromium VI	Perchlorate	General Inorganics	Radionuclides	Low-Level Tritium	Stable Isotopes
Tributary drainages to and 90s Line Pond	Sediment samples collected every 5 yr beginning in June 2013 from two locations above BMPs in tributary drainages and three locations within 90s Line Pond	Section 3.4.1 Figure 3.4-1	0–1	Sediment	X	X	X	X	—	—	—	—	—	—

[a] — = Analysis is not proposed and will not be performed.

[b] X = Analysis will be performed.

[c] Nonfiltered and filtered samples will be collected for general inorganic chemicals (excluding anions) and metals. Anions and perchlorate samples will be filtered. Samples collected for radionuclide analysis will be filtered and nonfiltered, excluding tritium, which is nonfiltered. Samples for organic constituents are nonfiltered. Stable isotope samples for nitrogen isotopes are filtered; stable isotope samples for deuterium and oxygen isotopes are not filtered.

[d] Q = Sampling and analysis will be performed quarterly.

[e] A = Sampling and analysis will be performed annually.

[f] Analysis will also include RDX-degradation products.

Table 4.0-1
Procedures for Supplemental Investigation Activities
at Consolidated Units 16-007(a)-99 and 16-008(a)-99

ENV-DO-201, Pressure Transducer Installation, Removal, and Maintenance
ENV-DO-202, Manual Groundwater Level Measurements
EP-ERSS-SOP-5056, Sample Containers and Preservation
EP-ERSS-SOP-5057, Handling, Packaging, and Transporting Field Samples
ENV-WQH-QP-062, Groundwater Level Data Processing, Review, and Validation
EP-ERSS-SOP-5055, General Instructions for Field Investigations
EP-ERSS-SOP-5058, Sample Control and Field Documentation
EP-ERSS-SOP-5059, Field Quality Control Samples
EP-ERSS-SOP-5022, Characterization and Management of Environmental Restoration Project Waste
EP-ERSS-SOP-5061, Field Decontamination of Equipment
EP-ERSS-SOP-5058, Coordinating and Evaluating Geodetic Surveys
EP-ERSS-SOP-5034, Monitoring Well and Borehole Abandonment
EP-ERSS-SOP-5040, Subsurface Moisture Measuring Using a Neutron Probe
SOP-06.09, Spade and Scoop Method for the Collection of Soil Samples
SOP-06.10, Hand Auger and Thin-Wall Tube Sampler
SOP-06.24, Sample Collection from Split-Spoon Samplers and Shelby-Tube Samplers
SOP-06.26, Core-Barrel Sampling for Subsurface Earth Materials
SOP-12.01, Field Logging, Handling, and Documentation of Borehole Materials
SOP-5181, Notebook Documentation of Waste and Environmental Services Technical Field Activities
EP-ERSS-WSP-1003, Quality Assurance Project Plan for the Groundwater Level Monitoring Project
EP-ERSS-SOP-5027, Geomorphic Characterization
EP-ERSS-SOP-5033, Well Development
ENV-WQH-SOP-066, Filtering and Chemical Preservation of Water Samples
ENV-DO-203, Field Water Quality Analyses
RRES-WQH-SOP-049, Groundwater Sampling Using Submersible Pumps

Note: These procedures are available at http://www.lanl.gov/environment/all/qa/adep.shtml.

Table 4.0-2
Summary of Methods for the Supplemental Investigation at Consolidated Units 16-007(a)-99 and 16-008(a)-99

Method	Summary
Sample Containers and Preservation	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on EPA guidance for environmental sampling, preservation, and quality assurance. Specific requirements for each sample are printed on the sample collection logs provided by the SMO (size and type of container, i.e., glass, amber glass, polyethylene, preservative). All samples are preserved by placing in insulated containers with ice to maintain a temperature of 4°C. Other requirements, such as use of nitric acid or other preservatives, may apply to different media or analytical requests.
Handling, Packaging, and Shipping of Samples	Field team members seal and label samples before packing and ensure that the sampling and transport containers are free of external contamination. Field team members package all samples to minimize the possibility of breakage during transportation. After all environmental samples are collected, packaged, and preserved, a field team member transports them to the SMO. A split of each sample is sent to an SMO-approved radiation screening laboratory under chain of custody (COC). Once the radiation screening results are received, the SMO arranges for the corresponding analytical samples to be shipped to fixed laboratories for full analyses.
Sample Control and Field Documentation	The collection, screening, and transport of samples are documented on standard forms generated by the SMO. These forms include sample collection logs, COC forms, and sample container labels. The collection logs are completed at the time the samples are collected and are signed by the sampler and a reviewer who verifies the logs for completeness and accuracy. Corresponding labels are initialed and applied to each sample container, and custody seals are placed around container lids or openings. COC forms are completed and assigned to verify that the samples are not left unattended.
Field Quality Control Samples	Field quality control samples are collected as directed in the Consent Order as follows: *Field Duplicate*: At a frequency 10%; collected at the same time as a regular sample and submitted for the same analyses. *Equipment Rinsate Blank*: At a frequency of 10%; collected by rinsing sampling equipment with deionized water, which is collected in a sample container and submitted for laboratory analysis. *Trip Blanks*: Required for all field events that include collecting samples for VOC analysis. Trip blanks containers of certified clean sand that are opened and kept with the other sample containers during the sampling process.
Management, Characterization, and Storage of IDW	IDW will be managed, characterized, and stored in accordance with an approved waste characterization strategy form that documents site history, field activities, and the characterization approach for each waste stream managed. Waste characterization will comply with on-site or off-site waste acceptance criteria, as appropriate. All stored IDW will be marked with appropriate signage and labels. Drums containing IDW will be stored on pallets to prevent deterioration of containers. The means to store, control, and transport each potential waste type and classification will be determined before field operations begin. A waste storage area will be established before waste is generated. Each container of waste generated will be individually labeled with waste classification, item identification number, and radioactivity (if applicable), immediately following containerization. All waste will be segregated by classification and compatibility to prevent cross-contamination.

Table 4.0-2 (continued)

Method	Summary
Field Decontamination of Drilling and Sampling Equipment	Dry decontamination is the preferred method to minimize the generation of liquid waste. Dry decontamination may include the use of a wire brush or other tool to remove soil or other material adhering to the sampling equipment, followed by use of a commercial cleaning agent (nonacid, waxless cleaners) and paper wipes. Dry decontamination may be followed by wet decontamination if necessary. Wet decontamination may include washing with a nonphosphate detergent and water, followed by a water rinse and a second rinse with deionized water. Alternatively, steam cleaning may be used.
Coordinating and Evaluating Geodetic Surveys	Geodetic surveys are focused on obtaining survey data of acceptable quality for use during project investigations. Geodetic surveys will be conducted with a Trimble 5700 differential global positioning system. The survey data will conform to Laboratory Information Architecture project standards IA-CB02, "GIS Horizontal Spatial Reference System," and IA-D802, "Geospatial Positioning Accuracy Standard for A/E/C/ and Facility Management." All coordinates will be expressed as SPCS 83, NM Central, U.S. ft coordinates. All elevation data will be reported relative to the National Geodetic Vertical Datum of 1983.
Monitoring Well and Borehole Abandonment	Borehole abandonment will be performed on specific boreholes to ensure the plugging and complete sealing of a borehole with materials of low hydraulic conductivity in such a manner as to preclude migration of surface runoff or groundwater along the length of the well. The conditions and construction details of the borehole will be evaluated before it is plugged and abandoned. The borehole will be sounded (its depth measured with a weighted line or other appropriate method) immediately before it is plugged and abandoned to ensure that it contains no obstructions that could interfere with filling and sealing. In accordance with the Consent Order, sealing material will be pumped under pressure from the bottom of the hole (via the tremie pipe method) to ensure that the borehole is properly filled and sealed. The borehole will be filled to the surface with cement grout or within 2 ft of the surface with bentonite grout. After the placement of the bentonite (if used), the remaining portion of the well will be sealed with cement.
Spade and Scoop Collection of Soil Samples	This method is used for collecting shallow (i.e., 0–6 in.) soil or fill samples. The spade-and-scoop method involves digging a hole to the desired depth, as prescribed in the work plan, and collecting a discrete grab sample. The sample is typically homogenized and placed in a decontaminated stainless-steel bowl for transfer into appropriate sample containers.
Hand-Auger Sampling	This method is typically used for sampling soil or sediment at depths of less than 10–15 ft but may in some cases be used to collect samples of weathered or nonwelded tuff. The method involves hand-turning a stainless-steel bucket auger (typically 3–4 in. inner diameter), creating a vertical hole that can be advanced to the desired sampling depth. When the desired depth is reached, the auger is decontaminated before the hole is advanced through the sampling depth. The sample material is transferred from the auger bucket to a stainless-steel sampling bowl before the required sample containers are filled.
Split-Spoon Core-Barrel Sampling	In this method, a stainless-steel core barrel (typically 4 in. inner diameter, 2.5 ft long) is advanced using a powered drilling rig. The core barrel extracts a continuous length of soil and/or rock that can be examined as a unit. The split-spoon core barrel is a cylindrical barrel split lengthwise so that the two halves can be separated to expose the core sample. Once extracted, the section of core is typically screened for radioactivity and organic vapors, photographed, and described in a geologic log. A portion of the core may then be collected as a discrete sample from the desired depth and submitted for fixed laboratory analysis.

Table 4.0-2 (continued)

Method	Summary
Field Logging, Handling, and Documentation of Borehole Materials	After they reach the surface, the core barrels are immediately opened for field screening, logging, and sampling. Logging of borehole materials includes noting the run number, core recovery in feet, depth interval (in 5-ft increments), field-screening results, and lithological and structural description and taking photographs. Once the core material is logged, selected samples are taken from discrete intervals of the core. All borehole material not sampled is then disposed of as waste. No material from the boreholes will be archived.
Subsurface Moisture Measurement Using a Neutron Probe	This method is used to determine the in situ moisture content of subsurface materials. The neutron probe contains a source of fast neutrons and determines the moisture content by measuring the attenuation of fast neutrons by water in the subsurface materials. The probe is lowered into the borehole and readings are obtained at specified depths. The instrument readings are then correlated to moisture content using calibration data.
Well Development	This method is used to develop monitoring wells to remove fine particulate matter from the well and from the saturated formation near the well screen. Development is also used to settle the annular fill material around the screen to a stable position. The specific development procedures used at a well will depend somewhat on the amount of water that the well can yield. Generally, a bailer will be used first to remove highly turbid water from the well and sediment from the well sump. A surge block may be used in conjunction with bailing to remove fine sediment from the zone outside the well screen. If the well yield is sufficient, a submersible pump will be used following bailing and surging for further development. Field water-quality parameters (pH, specific conductance, and temperature and turbidity) are measured periodically during development. Development is generally continued until at least 5 casing-volumes of water has been removed, the water-quality parameters are stable, and turbidity has been reduced to 5 NTU or less.
Groundwater Sampling Using a Submersible Pump	This method is used to collect groundwater samples from monitoring wells using dedicated submersible pumps. Pumps are set at a sufficient depth below the water table so drawdown during pumping does not allow air to enter the pump and the pumping rate is set to avoid excessive drawdown. The wells are purged before sampling to ensure a representative groundwater sample is collected. Field parameters (pH, temperature, specific conductance, turbidity) and water level are monitored during purging to determine when stable conditions have been achieved. Samples are collected directly into sample containers. During sample collection, the pumping rate is adjusted to produce a smooth, constant flow rate and so that turbulent flow is not allowed during filling of sample bottles.
Pressure Transducer Installation, Removal, and Maintenance	This method is used to collect water-level measurements in wells using pressure transducers. Water-level data are collected periodically at specified intervals and are stored electronically for later retrieval. The transducer is installed at a fixed location in the well and measures the hydrostatic pressure of the water column above transducer. This pressure is used to calculate the water level. Compensated pressure transducers are used to compensate for the effects of atmospheric pressure on measurements. Manual water-level measurements are used to confirm transducer readings.
Manual Groundwater Level Measurements	This method is used to measure the depth to the groundwater level in a monitoring well. The depth to water is measured using an electric water-level meter, which consists of a flat graduated measurement tape attached to a weighted stainless-steel probe containing an electrode that emits an audible and visible signal when contact is made with water. The probe is lowered into the well until there is a signal that water has been contacted. The depth to water from a reference point, usually the top of the well casing, is then read from the measurement tape.

Table 4.1-1
Analytical Methods for Soil, Sediment, and Tuff Samples

Analytical Method	Analytical Description	Analytical Suite
Inorganic Chemical Methods		
EPA SW-846: 6010B/6020	Inductively coupled plasma emission spectrometry—atomic emission spectroscopy	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, silver, thallium, vanadium, and zinc (TAL metals)
EPA SW-846: Method 7196A	Hexavalent chromium by colorimetric techniques	Hexavalent chromium
Organic Chemical Methods		
EPA SW-846:8260B	Gas chromatograph/mass spectrometry	VOCs
EPA SW-846: Method 8321A	Solvent extractable nonvolatile compounds by high performance liquid chromatography/ thermospray/mass spectrometry	Explosive compounds

Table 5.3-1
Analytical Methods for Groundwater Samples

Analytical Method	Analytical Description	Analytical Suite
Inorganic Chemical Methods		
EPA SW-846 Method 6010B, EPA SW-846 Method 6020	Inductively coupled plasma-atomic emission spectrometry, inductively coupled plasma-mass spectrometry	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, silver, thallium, vanadium, and zinc (TAL metals)
EPA SW-846 Method 6850	Perchlorate by high-performance liquid chromatography/tandem mass spectrometry (HPLC/MS/MS)	Perchlorate
EPA 300, EPA 310.1 EPA 335.3, EPA 350.1, EPA 351.2, EPA 353.1. EPA 365.4	Inorganic anions by ion chromatography; alkalinity by titration; total cyanide by semiautomated colorimetry; ammonia nitrogen by semiautomated colorimetry;total Kjeldahl nitrogen by semiautomated colorimetry; nitrate-nitrite by automated colorimetry; total phosphorus by block digestion and automated colorimetry	Bromide, chloride, fluoride, orthophosphate, sulfate, alkalinity, cyanide, ammonia nitrogen, total Kjeldahl nitrogen, nitrate-nitrite nitrogen, total phosphate (general inorganics)
USGS	Isotope ratio mass spectroscopy	Carbon-12/carbon-13 ratio, deuterium ratio, nitrogen-15/nitrogen-14 ratio, oxygen-18/oxygen-16 ratio (stable isotopes) (annual)
Organic Chemical Methods		
EPA SW-846 Method 8270C	SVOCs by gas chromatography/mass spectrometry (GC/MS)	SVOCs
EPA SW-846 (Update III) Method 8260B	VOCs by GC/MS	VOCs
EPA SW-846 Method 8321A (Modified) standard suite, including PETN	Solvent extractable nonvolatile compounds by HPLC/TS/MS or ultraviolet detection	Explosive Compounds
EPA SW-846 Method 8330A	Nitroaromatics and nitramines by HPLC	RDX-degradation products
Radiochemical Methods		
EPA 900, EPA 901.1, EPA 905.0, HASL-300	Gross alpha and gross beta by proportional counting; gamma spectroscopy, strontium-90 by beta proportional counting, alpha spectroscopy	Gross alpha, gross beta, gamma-emitting radionuclides, strontium-90, americium-241, isotopic plutonium, isotopic uranium (radionuclides)
EPA 903.1	Radium-226 by radon emanation	Radium-226
EPA 904.0	Radium-228 in drinking water	Radium-228
LLEE	Low-level tritium by electrolyitic enrichment	Low-level tritium

Appendix A

Management Plan for Investigation-Derived Waste

A-1.0 INTRODUCTION

This appendix describes how investigation-derived waste (IDW) generated during the supplemental investigation of the Technical Area 16 (TA-16) ponds [Consolidated Units 16-007(a)-99 (the 30s Line) and 16-008(a)-99 (the 90s Line)] at Los Alamos National Laboratory (LANL or the Laboratory) will be managed. IDW is waste generated by field-investigation activities and may include, but is not limited to, drill cuttings, purge water, contact waste, decontamination fluids, and all other waste that has potentially come into contact with contaminants.

A-2.0 INVESTIGATION-DERIVED WASTE

All IDW generated during the TA-16 ponds supplemental site investigation and remediation activities will be managed in accordance with applicable standard operating procedures (SOPs). These SOPs incorporate the requirements of all applicable U.S. Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) regulations, U.S. Department of Energy (DOE) orders, and Laboratory requirements. The SOPs applicable to the characterization and management of IDW are

- EP-ERSS-SOP-5022, "Characterization and Management of Environmental Restoration (ER) Project Waste" (http://www.lanl.gov/environment/all/qa/adep.shtml).
- EP-ERSS-SOP-5061, "Field Decontamination of Equipment"
- SOP-01.12, "Field Site Closeout Checklist"

The most recent version of the Laboratory's Hazardous Waste Minimization Report will be implemented during the investigation to minimize waste generation. The Hazardous Waste Minimization Report is updated annually as a requirement of Module VIII of the Laboratory's Hazardous Waste Facility Permit.

The IDW waste streams associated with groundwater monitoring and supplemental site investigation activities are identified in Table A-2.0-1 and are briefly described below. Table A-2.0-1 also summarizes the waste types, estimated volumes, and methods of on-site management.

A waste characterization strategy form (WCSF) will be prepared and approved per requirements of EP-ERSS-SOP-5022, "Characterization and Management of Environmental Restoration (ER) Project Waste." The WCSF will provide detailed information on IDW characterization methods, management, containerization, and potential volumes. IDW characterization is completed through review of sampling data and/or documentation or by direct sampling of the IDW or the media being investigated (e.g., groundwater, surface soil, subsurface soil). Waste characterization may include a review of historical information and process knowledge to identify whether listed hazardous waste may be present (i.e., due diligence reviews). If low levels of listed hazardous waste are identified, a "contained in" determination may be submitted for approval to NMED.

Wastes will be containerized and placed in clearly marked and appropriately constructed waste accumulation areas. Waste accumulation area postings, regulated storage duration, and inspection requirements will be based on the type of IDW and its classification. Container and storage requirements will be detailed in the WCSF and approved before the waste is generated. Transportation and disposal requirements will also be detailed in the WCSF and approved before waste is generated.

The waste streams that are anticipated to be generated during work plan implementation are described below.

A-2.1 Purge Water

This waste stream consists of water purged from wells before and during sampling. Purge water will be initially placed in containers at a hazardous waste accumulation area until they are characterized. If the water is nonhazardous, it will be stored as nonhazardous waste. Purge water will be land applied if it meets the criteria in the NMED-approved Notice of Intent (NOI) Decision Tree for Land Application of Groundwater. Purge water will be characterized based on the results of the analysis of water samples from the associated well(s) or by direct sampling and analysis of the purge water. The Laboratory expects the purge water to be land applied. If the purge water is classified as hazardous waste, it will be managed in accordance with hazardous waste management requirements.

A-2.2 Drill Cuttings/Core

This waste stream consists of soil, sediment, and tuff generated by the drilling of boreholes for the intent of sampling. Drill cuttings include excess core samples not submitted for analysis and any returned samples sent for analysis. Drill cuttings will be initially placed in containers at a hazardous waste accumulation area until the cuttings are characterized. If the drill cuttings are found to be nonhazardous, they will be stored as nonhazardous waste. Cuttings will be land applied if they meet the criteria in the NMED-approved NOI Decision Tree for Land Application of Investigation Derived Waste Solids from Construction of Wells and Boreholes. This waste stream will be characterized based either on direct sampling of the waste or on the results from core samples. If directly sampled, the following analyses will be performed: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), explosive compounds, total metals, and, if needed, toxicity characteristic leaching procedure (TCLP) metals. If process knowledge, odors, or staining indicate the cuttings may be contaminated with petroleum products, the materials will also be analyzed for total petroleum hydrocarbons (TPH) and polychlorinated biphenyls (PCBs). Other constituents may be analyzed as necessary to meet the waste acceptance criteria (WAC) for a receiving facility. The Laboratory expects most cuttings will be land applied.

A-2.3 Contact Waste

The contact waste stream consists of potentially contaminated wastes that “contacted” purge water or environmental media during sampling. This waste stream consists primarily of, but is not limited to, plastic sheeting (e.g., tarps and contamination control covers); personal protective equipment (PPE) such as disposable gloves and coveralls; dry decontamination wastes such as paper towels; and disposable sampling supplies such as plastic scoops, plastic bags, jars, containers and materials from used test kits. Characterization of this waste stream will use acceptable knowledge (AK) of the waste materials, the methods of generation, and analysis of the material contacted (e.g. drill cuttings, soil, water, etc.). Contact waste will be initially placed in containers at a hazardous waste accumulation area until it is characterized. If the waste is found to be nonhazardous, it will be stored as nonhazardous waste. The Laboratory expects most of these contact wastes will be nonhazardous waste that will be disposed of at an authorized facility.

A-2.4 Decontamination Fluids

The decontamination fluids waste stream will consist of liquid wastes from decontamination activities (i.e., decontamination solutions and rinse waters). Consistent with waste minimization practices, the Laboratory employs dry decontamination methods to the extent possible. If dry decontamination cannot be performed, liquid decontamination wastes will be collected in containers at the point of generation. The decontamination fluids will be characterized through AK of the waste materials, the levels of contamination observed in the environmental media (e.g., the results of the associated water samples)

and, if necessary, direct sampling of the containerized waste. If directly sampled, the following analyses will be performed: VOCs, SVOCs, explosive compounds, total metals, and if needed, TCLP metals. The Laboratory expects most of these wastes to be nonhazardous liquid waste that will be sent to a Laboratory wastewater treatment facility where the WAC allows the waste to be received.

A-2.5 Spent Acetone

Soil screening for explosives will include an extraction step using acetone as a solvent. Acetone, as a spent solvent, is a listed hazardous waste (EPA Hazardous Waste Number F003) based on ignitability. This waste stream will be stored in sealed secondary containers at a registered on-site satellite accumulation area (SAA) until a waste profile form and a consolidated remote waste storage site disposal request are approved. This waste will be sent to an appropriate permitted treatment, storage, and disposal facility (TSDF) for disposal.

A-2.6 Empty Sodium Azide Containers

The D TECH test kits include buffer solution bottles containing sodium azide; however, these components are typically used up completely during the screening process and will likely only exist as residual material inside the bottles. The empty containers from the transfer of the sodium azide buffer solution are considered to be nonhazardous solid waste because they contained a product used for its intended purpose per the field analytical method. The waste will be disposed of at an authorized facility.

A-2.7 Residual Sodium Azide Buffer Solution

Approximately 1 mL of residual sodium azide buffer solution is left over per sample analysis and will be transferred into a 1-L polyethylene bottle. The Laboratory expects most of these wastes to be nonhazardous liquid waste because sodium azide is not being used as the sole active ingredient in the buffer solution. This waste will be sent to a Laboratory wastewater treatment facility where the WAC allows the waste to be received.

A-2.8 Excavated Environmental Media

Excavated material from Consolidated Units 16-007(a)-99 and 16-008(a)-99 will be placed in rolloff containers. Representative samples will be collected as the media are excavated, composited for each 50 yd^3 composited material, and submitted for laboratory analyses of target analyte list metals, nitrate, cyanide, perchlorate, VOCs, SVOCs, and explosive compounds. The Laboratory expects most of the potentially contaminated media to be designated as hazardous waste and will be disposed of at a Laboratory-authorized, permitted treatment, storage and disposal facility.

Table A-2.0-1
Summary of Anticipated Waste Generation and Management for the TA-16 Ponds Supplemental Investigation

Waste Stream	Expected Waste Type	Estimated Volume	Characterization Method	On-Site Management and Final Disposition
Purge water	Liquid, nonhazardous, nonradioactive	5 to 100 gal. per well per sampling event	Analytical results from purge water and water samples	Accumulation in lined drums or tanks Land application for water meeting the criteria of the NOI decision tree, otherwise disposal at an off-site facility for which waste meets WAC
Decontamination fluids	Liquid, nonhazardous, nonradioactive	<300 gal. (<6 gal. per day)	AK	Treatment at an on-site wastewater treatment facility for which waste meets WAC
Spent acetone	Liquid hazardous F003, D001	<4 L	AK	Containment in polyethylene bottles stored in a sealed secondary container at a registered on-site SAA Disposal off-site at an appropriate permitted TSDF
Contact waste (e.g., plastics, PPE, and sample equipment waste)	Solid nonhazardous, nonradioactive	<110 gal.	AK	Accumulation in 55-gal. drums with drum liners Disposal off-site at an industrial waste landfill
Drill cuttings/core	Solid nonhazardous, nonradioactive	<20 yd^3	Analytical results from waste and core samples	Accumulation in 55-gal. steel drums, covered rolloff containers, or cubic yard soft-sided, strong, tight containers with liners Land application for cuttings meeting the criteria of the NOI decision tree, otherwise disposal at an off-site facility for which waste meets WAC
Excavated environmental media	Solid hazardous, nonradioactive	<200 yd^3	Analytical results from waste samples	Accumulation in covered rolloff containers. Disposal off-site at an appropriate permitted TSDF
Empty sodium azide containers	Solid nonhazardous, nonradioactive	<5 gal.	AK	Accumulation in drums with drum liners Disposal off-site at an industrial waste landfill
Residual sodium azide buffer solution	Liquid nonhazardous, nonradioactive	<1 L	AK	Containment in polyethylene bottles stored in a sealed secondary container Treatment at an on-site wastewater treatment facility for which waste meets WAC