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Pueblo Canyon Aggregate Area Phase II Investigation Work Plan

Los Alamos
NATIONAL LABORATORY
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Prepared by the Environmental Programs Directorate

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Phase II Investigation Work Plan

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EXECUTIVE SUMMARY

This work plan presents the proposed investigation activities required to finalize characterization of solid waste management units (SWMUs) and areas of concern (AOCs) located within the Pueblo Canyon Aggregate Area for which additional requirements have been identified. The Pueblo Canyon Aggregate Area is located in the Los Alamos townsite and within the Pueblo Canyon watershed. A total of 45 SWMUs and AOCs (also called "sites") are located within the Pueblo Canyon watershed and are collectively referred to as the Pueblo Canyon Aggregate Area. This Phase II work plan outlines additional work to be conducted at five of these sites, including

- SWMU 00-018(a), the Pueblo Canyon Wastewater Treatment Plant;
- AOC 00-030(eS), a former septic tank;
- AOC 00-030(h), a former septic tank;
- SWMU 31-001, a former septic system; and
- Consolidated Unit 45-001-00, a wastewater treatment plant.

These sites are located on former Los Alamos National Laboratory property that is now part of the Los Alamos townsite. Property transfer of these sites occurred historically either to Los Alamos County or to private landholders.

The objectives of the Phase II work proposed in this plan are to satisfy any remaining requirements at these five sites. The specific objectives for the sites are to

- finalize determination of the vertical extent of inorganic chemicals of potential concern at three sites [AOC 00-030(eS), SWMU 31-001, and Consolidated Unit 45-001-01],
- remediate contamination to meet residential risk levels so land use is unrestricted at one site [AOC 00-030(h)], and
- satisfy additional New Mexico Environment Department requirements at one site [SWMU 00-018(a)].

The primary activities associated with these investigations are (1) surface and subsurface soil and tuff sampling and (2) excavation of soil associated with a former septic tank and confirmation sampling of material remaining on site following excavation. All activities are contingent upon the approval of respective property owners and the conditions-of-access agreement between the U.S. Department of Energy, Los Alamos National Security, LLC, and the property owners.

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Acronyms and Abbreviations

AK	acceptable knowledge
AOC	area of concern
asl	above mean sea level
bgs	below ground surface
COC	chain of custody
D&D	decontamination and decommissioning
DDT	dichlorodiphenyltrichloroethane
DOE	Department of Energy (U.S.)

DOT	Department of Transportation (U.S.)
ENV	Environmental Stewardship
EP-CAP	Environmental Programs Directorate–Corrective Action Projects
EPA	Environmental Protection Agency (U.S.)
GPS	global-positioning system
IDW	investigation-derived waste
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
msl	mean sea level
NMED	New Mexico Environment Department
NOD	notice of disapproval
NOI	notice of intent
PCB	polychlorinated biphenyl
PID	photoionization detector
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RLW	radioactive liquid waste
RPF	Records Processing Facility
SSL	soil screening level
SMO	Sample Management Office
SOP	standard operating procedure
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TA	technical area
TAL	target analyte list
TPH	total petroleum hydrocarbons
VCA	voluntary corrective action
VOC	volatile organic compound
WAC	waste acceptance criteria
WCSF	waste characterization strategy form
WWTP	wastewater treatment plant

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 (LANS). The Laboratory is located in north-central New Mexico, approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory covers 40 mi^2 of the Pajarito Plateau, which consists of a series of fingerlike mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation between 6200 and 7800 ft above mean sea level (msl).

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

The two SWMUs, two AOCs, and one consolidated unit addressed in this Phase II investigation work plan are potentially contaminated with both hazardous and radioactive components. The New Mexico Environment Department (NMED), pursuant to the New Mexico Hazardous Waste Act, regulates cleanup of hazardous wastes and hazardous constituents. DOE regulates cleanup of radioactive contamination, pursuant to DOE Order 5400.5, "Radiation Protection of the Public and the Environment," and DOE Order 435.1, "Radioactive Waste Management." Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with DOE policy.

Corrective actions at the Laboratory are subject to the March 1, 2005, Compliance Order on Consent (the Consent Order). This work plan describes activities that will be executed and completed in accordance with the Consent Order.

1.1 General Site Information

The Pueblo Canyon Aggregate Area consists of 45 SWMUs and AOCs (also referred to as "sites") that are located within the Pueblo Canyon watershed or that discharged directly to the Pueblo Canyon watershed from the mesa top (Figures 1.1-1 and 1.1-2). These sites are located on former Laboratory property that is now part of the Los Alamos townsite or in Pueblo Canyon. Property transfer of these sites occurred historically either to Los Alamos County or to private landholders.

The Pueblo Canyon Aggregate Area investigation work plan was submitted to NMED in May 2005 (LANL 2005, 090579, p. 28) and was approved by NMED in September, 2005 (NMED 2005, 091388). Field work was conducted in accordance with the approved work plan, and the investigation report for the Pueblo Canyon Aggregate Area (LANL 2008, 102408) was submitted to NMED in March 2008. As a result of recommendations in the investigation report as well as additional work identified in the subsequent notice of disapproval (NOD) (NMED 2008, 102049) and approval with modifications (NMED 2008, 103002), this Phase II work plan details additional work at five sites, including

- SWMU 00-018(a), the Pueblo Canyon Wastewater Treatment Plant (WWTP);
- AOC 00-030(eS), a former septic tank;

- AOC 00-030(h), a former septic tank;
- SWMU 31-001, a former septic system; and
- Consolidated Unit 45-001-00, a WWTP.

1.2 Investigation Objectives

The objectives of the Phase II work proposed in this plan are to satisfy any remaining requirements at these five sites. The specific objectives for the sites are to

- finalize determination of the vertical extent of inorganic chemicals of potential concern (COPCs) at three sites [AOC 00-030(eS), SWMU 31-001, and Consolidated Unit 45-001-01];
- remediate contamination to meet residential risk levels so land use is unrestricted at one site [AOC 00-030(h)]; and
- satisfy requirements of the NOD (NMED 2008, 102049) and approval with modifications at one site (NMED 2008, 103002) [SWMU 00-018(a)].

To help achieve these objectives, this investigation work plan presents

- a summary of site background and current site conditions,
- the scope proposed for final characterization/remediation based on the results presented in the investigation report for the Pueblo Canyon Aggregate Area (LANL 2008, 102408) and direction given in the NOD (NMED 2008, 102049) and approval with modifications (NMED 2008, 103002),
- the methods for achieving final site characterization/remediation, and
- the proposed schedule for conducting and reporting the site activities outlined in this work plan.

2.0 BACKGROUND

This section presents a brief site description and operational history for each site within the Pueblo Canyon Aggregate Area requiring additional investigation. More complete descriptions are presented in the original investigation work plan for Pueblo Canyon Aggregate Area (LANL 2005, 090579).

2.1 SWMU 00-018(a), Pueblo Canyon WWTP

2.1.1 Site Description and Operational History

SWMU 00-018(a) is the decommissioned Pueblo Canyon WWTP located at the end of Olive Street in Pueblo Canyon (Figure 1.1-2) on Los Alamos County property (LANL 1997, 056614, p. 28). The plant was built between 1946 and 1948 and began operating in 1951, primarily receiving waste from residential and business properties, including the Los Alamos Medical Center (LANL 1997, 056614, p. 28). Originally, the Zia Company operated the plant for the Atomic Energy Commission (LANL 1997, 056614, p. 28). In the early 1960s, Los Alamos County assumed control of the plant (LANL 1997, 056614, p. 28). From 1953 to 1983, this WWTP also received laboratory-scale (e.g., less than 10 L/mo, or 2.6 gal./mo) waste from the Health Research Laboratory at Technical Area 43 (TA-43), which is the only known Laboratory contribution to the waste stream at the plant (LANL 1997, 056614, p. 29). This waste stream, which consisted of salt buffers, cell culture media, and various alcohols, totaled less than 1000 gal. of Laboratory waste over the life of the WWTP. From 1983 to 1991, the plant received only sanitary waste from Los Alamos businesses and residences (LANL 1992, 007667, p. 5-61; LANL 1997, 056614, p. 29).

Based on the monthly operating reports from Los Alamos County from 1989, the volume of waste processed at the Pueblo WWTP averaged approximately 9.5 million gal./mo. Los Alamos County decommissioned the Pueblo Canyon WWTP during 1991 and 1992 (LANL 1997, 056614, p. 29). After initial decommissioning of the WWTP, sludge was transferred from the sludge digestion tank to the sludge beds that were sampled during the 1996 Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) (LANL 1997, 056614, p. 29). However, many of the WWTP structures were left standing following this effort.

Final decontamination and decommissioning (D&D) of the WWTP occurred during the summer of 2008. In August and September 2008, the remaining WWTP structures were demolished to 3 ft below ground surface (bgs) by Los Alamos County. Portions of structures deeper than 3 ft bgs were left in place. As part of the County's site restoration and grading plan, soil and concrete and asphalt pieces were imported as fill for areas of the site where existing material was not sufficient. Figure 2.1-1 is a photograph showing current site conditions. "As-built" drawings for the D&D of the Pueblo Canyon WWTP will be provided by Los Alamos County as soon as they are finalized.

2.1.2 Conceptual Site Model

Contamination at SWMU 00-018(a) resulting from historical Laboratory operations would have originated from the oldest sludge drying beds at the site as water-soluble components infiltrated the underlying filter media or when dried sludge was used as fill material at the site. Therefore, the 1996 RFI focused on the oldest sludge beds and the sludge-fill area to the east-southeast of the sludge beds because these areas would have had the greatest potential for being impacted by Laboratory wastes. The typical depth of the fill was 6 to 12 in., although in some places it was observed to be as deep as 2 ft (LANL 1997, 056614, p. 31). No accidental spills or releases have been documented for SWMU 00-018(a) (LANL 1992, 007667, p. 5-54). In 2008, rainwater and sludge found in the sludge digestion tank were drained to the site by Los Alamos County during the final D&D of the WWTP.

The following transport mechanisms may lead to the exposure of human and/or ecological receptors:

- Dissolution and/or particulate transport of surface contaminants during rainfall and snowmelt runoff events
- Airborne transport of contaminated surface soil
- Continued dissolution and advective/dispersive transport of chemicals in surface/subsurface soil
- Biotic perturbation and translocation of contaminants in subsurface soil

Based on current site conditions, the following human receptors could reasonably be expected to be present (current and potential future exposure scenarios) at SWMU 00-018(a):

- Recreational users

Terrestrial ecological receptors are also expected to be present at AOC 00-018(a).

2.1.3 Nature and Extent of Contamination

Based on the data presented in the Pueblo Canyon Aggregate Area investigation report (LANL 2008, 102408, p. B-36), the lateral and vertical extent of inorganic, radionuclide, and organic COPCs are defined for SWMU 00-018(a).

2.2 AOC 00-030(eS), Septic Tank

2.2.1 Site Description and Operational History

AOC 00-030(eS), a septic tank (structure 4A) located on private property south of Canyon Road (Figure 1.1-2) at the Chapel Apartments, was installed sometime between 1943 and 1947 (LANL 1996, 056432, pp. 4-5). Structure 4A served residences and may have been connected to TA-01 (LANL 1992, 007667, p. 5-94; LANL 1996, 056432, p. 1). The mean elevation of the former TA-01 area is 7263 ft above sea level (asl). The ground surface at AOC 00-030(eS) is approximately 7279 ft asl. With the septic tank inlet buried approximately 5 ft bgs (elevation of 7274 ft asl), it is not likely the septic tank received waste from a gravity-feed system originating in TA-01 downgradient of AOC 00-030(eS). The tank ceased to operate when the central WWTP became operational in 1947 (LANL 1996, 056432, p. 1). The tank was likely to have been removed when the Chapel Apartments were built in 1949 (LANL 1996, 056432, pp. 28, 32). The site is currently a paved parking lot. The outlet pipe runs across Canyon Road to Pueblo Canyon and is still in place.

2.2.2 Conceptual Site Model

Contamination at AOC 00-030(eS) could have originated from effluent intentionally discharged at the outfall or from leaks from the tank and lines. Therefore, samples were collected from the former septic tank, line, and outfall locations. Contamination at the site may also originate from the parking lot and Canyon Road.

The following transport mechanisms may lead to the exposure of human and/or ecological receptors:

- Dissolution and/or particulate transport of surface contaminants during rainfall and snowmelt runoff events before the placement of clean fill
- Airborne transport of contaminated surface soil before the placement of clean fill
- Continued dissolution and advective/dispersive transport of chemical and radiological contaminants contained in surface/subsurface soil
- Biotic perturbation and translocation of contaminants in subsurface soil

The following human receptors could be reasonably expected to be present (current and potential future) at AOC 00-030(eS):

- Residents
- Recreational users

Terrestrial ecological receptors are also expected to be present at AOC 00-030(eS).

2.2.3 Nature and Extent of Contamination

Based on the data presented in the Pueblo Canyon Aggregate Area investigation report (LANL 2008, 102408, p. B-43), the lateral and vertical extent of most COPCs are defined for AOC 00-030(eS). However, the vertical extent of lead and zinc is not defined at one pipeline location.

2.3 AOC 00-030(h), Septic Tank

2.3.1 Site Description and Operational History

AOC 00-030(h) is a septic tank (structure 7) located on private property north of Canyon Road (Figure 1.1-2) beneath the asphalt-paved west parking lot of the new Catholic church at 3600 Canyon Road (LANL 1992, 007667, p. 5-96; LANL 1996, 053799, p. 1). Constructed of reinforced concrete, structure 7 was 30 ft long × 20 ft wide × 12 ft deep (LANL 1996, 053799, p. 7). It consisted of two chambers, a concrete baffle between the chambers, and a 6-ft × 2-ft splash box at the inlet line (LANL 1996, 053799, p. 7). Structure 7, which was bounded on the west by the Los Alamos High School athletic fields and parking lot access road, probably served the areas between Canyon Road and Trinity Drive (LANL 1996, 053799, p. 1; LANL 1996, 062416, p. 1). Buildings in this area were associated with the special engineering detachment, which included the Fort Leonard Wood housing units, dormitories, military barracks, west mess hall, supply room, gymnasium, post office, and recreational buildings (LANL 1996, 053799, p. 1).

The tank was used from 1945 to 1947, when the central WWTP became operational (LANL 1996, 053799, p. 1). During the voluntary corrective action (VCA) conducted in 1996, the tank was found to have had its top removed and had been backfilled (LANL 1996, 062416, p. 6–7). Investigation of the west chamber revealed the presence of two distinct soil horizons: the upper 0 to 11 ft consisted of moist backfill material (silty/sandy/clayish soil and tuff boulders), and the bottom 11 to 12 ft was a saturated, black sludge. The east chamber consisted of backfill material (silty/sandy/clayish soil and tuff boulders) from 0 to 12 ft (LANL 1996, 062416, p. 7). The remainder of the tank and the backfill material were removed during the VCA (LANL 1996, 062416, p. 13–14). Although activities at the buildings that the septic system was thought to have served would not have produced radioactive wastes, plutonium-239 was detected in samples collected from the west chamber.

The outlet pipe and outfall for the tank were not located during the RFI (LANL 1996, 062416, p. 14), but the trench indicating the former location of the outlet line was located during 2006 sampling activities. The outlet line itself appears to have been removed, most likely during the original abandonment of the tank.

2.3.2 Conceptual Site Model

Contamination at AOC 00-030(h) could have originated from effluent intentionally discharged at the outfall or from leaks from the tank and lines. Therefore, samples were collected from the former septic tank, line, and outfall locations. Contamination at the site could also originate from runoff from the church parking lot and access road (asphalt and fuel components) and the athletic fields (pesticides) located next to the site.

The following transport mechanisms may lead to the exposure of human and/or ecological receptors:

- Dissolution and/or particulate transport of surface contaminants during rainfall and snowmelt runoff events before the placement of clean fill
- Airborne transport of contaminated surface soil before the placement of clean fill
- Continued dissolution and advective/dispersive transport of chemical and radiological contaminants contained in surface/subsurface soil
- Biotic perturbation and translocation of contaminants in subsurface soil

The following human receptors could reasonably be expected to be present (current and potential future) at AOC 00-030(h):

- Residents
- Recreational users

Terrestrial ecological receptors are also expected to be present at AOC 00-030(h).

2.3.3 Nature and Extent of Contamination

Based on the data presented in the Pueblo Canyon Aggregate Area investigation report (LANL 2008, 102408, p. B-47), the lateral and vertical extent of all inorganic, radionuclide, and organic COPCs are defined for AOC 00-030(h).

2.4 SWMU 31-001, Septic System

2.4.1 Site Description and Operational History

SWMU 31-001 is a former septic system located at former TA-31. This system consisted of a septic tank (structure 00-7), two sanitary sewer manholes (structures 00-41 and 00-42), associated waste lines, and an outfall (LANL 1992, 007668, p. 3-46). From 1945 to 1954, former TA-31 served as the receiving area for all truck shipments to the Laboratory (LANL 1995, 058085, p. 1; LANL 1996, 054320, p. 32), and SWMU 31-001 served former building 31-7. The septic tank (structure 00-7), constructed of reinforced concrete, measured 4 ft × 3 ft in area and was several feet high (LANL 1992, 007668, p. 3-48). This septic tank was located aboveground on a small bench above the rim of Pueblo Canyon, north of building 31-7 (LANL 1992, 007668, p. 3-48). TA-31 was located in what is now the eastern residential area of Los Alamos, immediately west of the Los Alamos County Airport (LANL 1995, 058085, p. 1; LANL 1996, 054320, p. 32) (Figure 1.1-2). The septic tank was constructed in 1949, operated until 1954, and was removed in 1988 (LANL 1992, 007668, p. 3-47). The waste line was not encountered when the septic tank was removed in 1988 (LANL 1995, 058085, p. 4). The outfall discharged to Pueblo Canyon, approximately one-half mile upgradient of Pueblo Canyon reach P-2W and 1 mi below Pueblo Canyon reach P-1E, as described in the Los Alamos and Pueblo Canyons investigation report (LANL 2004, 087390). The contents of the septic tank were sampled when the tank was removed; no hazardous materials were found (LANL 1995, 058085, p. 4).

2.4.2 Conceptual Site Model

Contamination at SWMU 31-001 could have originated from effluent intentionally discharged at the outfall, or from leaks from the tank and lines. Therefore, samples were collected from the former septic tank, line, and outfall locations.

The following transport mechanisms may lead to the exposure of human and/or ecological receptors:

- Dissolution and/or particulate transport of surface contaminants during rainfall and snowmelt runoff events
- Airborne transport of contaminated surface soil
- Continued dissolution and advective/dispersive transport of chemicals in surface/subsurface soil
- Biotic perturbation and translocation of contaminants in subsurface soil

The following human receptors could reasonably be expected to be present (current and potential future) at SWMU 31-001:

- Residents
- Recreational users

Terrestrial ecological receptors are also expected to be present at SWMU 31-001.

2.4.3 Nature and Extent of Contamination

Based on the data presented in the Pueblo Canyon Aggregate Area investigation report (LANL 2008, 102408, p. B-57), the lateral and vertical extent of all inorganic, radionuclide, and organic COPCs are defined for SWMU 31-001, with the exception of the vertical extent of lead at one location.

2.5 Consolidated Unit 45-001-00, TA-45 WWTP

2.5.1 Site Description and Operational History

Consolidated Unit 45-001-00, which consists of Consolidated Unit 01-002(b)-00, SWMUs 45-001, 45-002, 45-003, and 45-004, and AOC C-45-001, is located next to Acid Canyon (Figure 1.1-2) These SWMUs, AOC, and consolidated unit were associated with past wastewater treatment and disposal activities at TA-45, which was used as an industrial waste discharge area and later served as the Laboratory's first radioactive liquid waste (RLW) treatment facility (LANL 1992, 007668, p. 3-69; LANL 1995, 048856, p. 1). In October 1966, D&D of TA-45 began and included the excavation and removal of industrial waste and contaminated soil and tuff and the removal of all buildings and structures in the area, with the exception of the sewage lift station. The site was released without restriction to Los Alamos County on July 1, 1967 (LANL 1992, 007668, p. 3-71; LANL 1995, 048856, p. 1).

The Sanitary Sewer Emergency Bypass (SWMU 45-004), which is the only site within Consolidated Unit 45-001-01 included in this Phase II work plan, consists of a sanitary sewer outfall associated with the sanitary sewer system constructed in 1947 to serve the Los Alamos townsite (LANL 1995, 048856, p. 68). This sewer system included a sanitary sewer lift station (structure 45-3) and sanitary sewer manholes (structures 45-5 and 45-6).

2.5.2 Conceptual Site Model

Radioactive liquid waste was treated at the TA-45 site. No known wastes remain after the 1966 D&D activities. Potential residual contamination from intentional discharges or leaks may include metals, radionuclides, and organic chemicals in surface or subsurface soil or tuff.

The following transport mechanisms may lead to the exposure of human and/or ecological receptors:

- Dissolution and/or particulate transport of surface contaminants during rainfall and snowmelt runoff events
- Airborne transport of contaminated surface soil
- Continued dissolution and advective/dispersive transport of chemicals in surface/subsurface soil or tuff
- Biotic perturbation and translocation of contaminants in subsurface soil

The following human receptors could reasonably be expected to be present at Consolidated Unit 45-001-00:

- Residents (potential future exposure scenario)
- Recreational users (current and potential future exposure scenario)

Terrestrial ecological receptors are also expected to be present at Consolidated Unit 45-001-00.

2.5.3 Nature and Extent of Contamination

Based on the data presented in the Pueblo Canyon Aggregate Area investigation report (LANL 2008, 102408, p. B-59), the lateral and vertical extent of contamination are defined for all inorganic, radionuclide, and organic COPCs at Consolidated Unit 45-001-00 with the exception of silver and mercury within the footprint of SWMU 45-004.

3.0 SITE CONDITIONS

Surface features and subsurface geologic characteristics of the Pueblo Canyon Aggregate Area are described in detail in the original investigation work plan (LANL 2005, 090579). In general, conditions at the five sites included in this Phase II work plan are influenced by

- a semiarid climate with low precipitation and a high evapotranspiration rate that limits the extent of subsurface moisture percolation and, therefore, limits the amount of moisture available to leach radionuclides or hazardous waste constituents; and
- a thick, relatively dry, unsaturated (vadose) zone that greatly restricts or prevents downward migration of contaminants in the liquid phase through the vadose zone to the regional aquifer.

These and other elements of the environmental setting in the Pueblo Canyon Aggregate Area are considered when evaluating investigation data with respect to the fate and transport of contamination from historical site activities.

4.0 SCOPE OF ACTIVITIES

This section describes the specific activities to be performed during the Phase II investigation of two SWMUs, two AOCs, and one consolidated unit in the Pueblo Canyon Aggregate Area. The objective of the Phase II work proposed in this plan is to satisfy any remaining requirements at these five sites. The primary activities associated with achieving this objective are (1) surface and subsurface soil and tuff sampling and (2) excavation of soil and/or tuff associated with a former septic tank and confirmation sampling of material remaining on site following excavation [(AOC 00-030(h)]. All activities are contingent upon the approval of respective property owners and the conditions-of-access agreement among DOE, LANS, which manages the Laboratory, and the property owners.

4.1 Sampling and Analysis for SWMU 00-018(a), Pueblo Canyon WWTP

Additional sampling is proposed for SWMU 00-018(a) to comply with the requirements outlined in the NOD to the Pueblo Canyon Aggregate Area investigation report (NMED 2008, 102049) and the approval with modifications letter (NMED 2008, 103002).

The following sampling requirements are identified in the NOD.

- Two locations will be sampled at two depths each (one from the soil/tuff interface and one from the underlying tuff) from (two locations each) in the former westernmost sludge bed.
- Two locations will be sampled at two depths each (one from the soil/tuff interface and one within the underlying tuff) from (two locations each) in the former central sludge bed.
- Four locations will be sampled at two to three depths each (one from undisturbed soil, if present, one from the soil/tuff interface, and one from underlying tuff) beneath the former trickling filter tank.
- One location will be sampled at two depths at the former sludge digestion tank.
- One location will be sampled at two depths at the former primary settling tank.
- One location will be sampled at two depths at the former final settling tank.

The additional sampling locations required by the NOD (NMED 2008, 102049) for SWMU 00-018(a) are shown in Figure 4.1-1. The locations of four of the samples associated with former tanks (i.e., trickling filter tank, sludge digestion tank, and primary and final settling tanks) have been positioned to capture any potential leakage from valves and/or lines associated with the tanks. Additional modifications may be made, if necessary and with concurrence from NMED, based on the final as-built drawings to be provided by Los Alamos County. The purpose of each of the proposed samples, the approximate sampling depths, and the proposed laboratory analyses are summarized in Table 4.1-1.

The NOD also specified collecting a liquid sample from the sludge digestion tank. The liquid in the tank included residual sludge from Los Alamos County operations and rainwater accumulated since the decommissioning of the tank in the early 1990s. In 2008, the facility owner, Los Alamos County, sampled the sludge and rainwater before the facility was demolished and drained the tank via a trench leading to the western sludge bed. Data from the sludge sample Los Alamos County collected will be presented in the Phase II investigation report for Pueblo Canyon Aggregate Area. However, it is not expected that the analytical results from the sludge/rainwater sample would be representative of any Laboratory activities that may have impacted the WWTP over 25 yr ago. These results will be representative of the last wastes Los Alamos County processed at the WWTP.

4.2 Sampling and Analysis for AOC 00-030(eS), Septic System

Additional sampling is proposed for AOC 00-030(eS) to finalize the determination of the vertical extent of inorganic chemicals, specifically lead and zinc, at one location along the outlet pipe.

The following samples will be collected:

- Samples will be collected from two depths (approximately 6 to 7 and 9 to 10 ft bgs) at location 00-25486 and analyzed for target analyte list (TAL) metals.

The additional samples proposed at AOC 00-030(eS) are shown in Figure 4.2-1. The purpose of the proposed samples, the approximate sampling depths, and the proposed laboratory analyses are summarized in Table 4.2-1.

4.3 Soil Removal and Confirmation Sampling at AOC 00-030(h), Septic System

Based on the existing analytical data from AOC 00-030(h) and the risk screening results presented in the investigation report for the Pueblo Canyon Aggregate Area (LANL 2008, 103243), a soil removal action is

proposed for this site. Excess potential risk, above the 1×10^{-5} limit set by NMED, is driven primarily by arsenic, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, 4,4'-DDT (dichlorodiphenyltrichloroethane), and dibenz(a,h)anthracene in soil and tuff at AOC 00-030(h).

Most of the analytical results for these chemicals that approach or exceed the residential soil screening levels (SSLs) are from samples collected in the vicinity of the outlet line, outfall, and side canyon that receive drainage from the Catholic church parking lot where AOC 00-030(h) is located. The maximum detected concentrations of arsenic and 4,4'-DDT occur at the outfall; the maximum detected concentration of bis(2-ethylhexyl)phthalate occurs in the head of the canyon; the maximum detected concentrations of benzo(a)pyrene and benzo(b)fluoranthene occur in the canyon bottom, approximately 100 ft from the head of the canyon. Dibenz(a,h)anthracene was detected at concentrations below the estimated quantitation limit in six 1996 samples from the tank and outfall areas; it was not detected in any 2006 samples. The maximum detected concentration was used as the exposure point concentration because most of the dibenz(a,h)anthracene results were not detected.

In a very limited area at the northern end of the former tank location from approximately 7 to 10 ft bgs, benzo(a)pyrene was detected above the residential SSL in two 1996 samples. No other samples from within the former tank footprint have COPCs that exceeded residential SSLs, including samples collected from a borehole drilled in 2006 to a depth of 18.5 ft bgs near the northern end of the former tank location. Samples collected from 9 to 9.5 ft in this borehole (location 00-04816) had detected concentrations of benzo(a)pyrene at more than an order of magnitude below the SSL. The two deeper samples from this location (13 to 13.5 and 18 to 18.5 bgs) had no detectable benzo(a)pyrene, effectively bounding the vertical extent.

Before the removal action is conducted, two additional sampling locations are proposed along the outlet line between the tank and the two trench locations sampled in 2006. Although the nature and extent of contamination have been defined for this site, based on decreasing trends of COPCs with depth and the distance downgradient of the site, these additional locations are proposed to determine if benzo(a)pyrene concentrations remain above the SSL between the tank and the trench locations. The excavation area and volume may be adjusted based on the results of samples collected from these locations, as described in Table 4.3-1.

Pending property-owner approval, a removal action will be conducted to reduce the potential risk at AOC 00-030(h). This removal action, which may be phased, will focus on the outlet line, outfall, and canyon area as the locations where concentrations of COPCs substantially exceed SSLs. The volume of materials to be removed from this area is anticipated to be less than 400 yd^3. Figure 4.3-1 shows the approximate area where soil removal is proposed.

Pending property-owner approval, additional removal action may be conducted if necessary in the area near the north end of the former tank footprint to reduce the potential risk to below 1×10^{-5}. If soil is removed, the volume is anticipated to be less than 100 yd^3. Figure 4.3-1 shows the approximate area where soil removal is proposed.

Confirmation samples will be collected as needed at the base of the excavation (Table 4.3-1). If adequate existing data are available to characterize an area following excavation (e.g., where deeper samples remain following excavation), confirmation sampling may not be necessary.

4.4 Sampling and Analysis for SWMU 31-001, Septic System

Additional sampling is proposed for SWMU 31-001 to finalize the determination of the vertical extent of inorganic chemicals, specifically lead, at one location.

The following samples will be collected:

- Samples will be collected from two depths (approximately 16–17 and 19–20 ft bgs) at location 31-01008 and analyzed for TAL metals.

The additional samples proposed at SWMU 31-001 are shown in Figure 4.4-1. The purpose of the proposed samples, the approximate sampling depths, and the proposed laboratory analyses are summarized in Table 4.4-1.

4.5 Sampling and Analysis for Consolidated Unit 45-001-00, TA-45 WWTP

Additional sampling is proposed for SWMU 45-004, the Sanitary Sewer Emergency Bypass, which is part of Consolidated Unit 45-001-00. This sampling is proposed to finalize the determination of the vertical extent of inorganic chemicals, specifically of mercury and silver.

The following samples will be collected:

- Samples will be collected from two depths (approximately 4–5 and 7–8 ft bgs) at location 45-01068 and analyzed for TAL metals.
- Samples will be collected from two depths (approximately 4–5 and 7–8 ft bgs) at a location upgradient of location 45-01068 and analyzed for TAL metals.

The additional samples proposed at SWMU 45-004 are shown in Figure 4.5-1. The purpose of the proposed samples, the approximate sampling depths, and the proposed laboratory analyses are summarized in Table 4.5-1.

5.0 INVESTIGATION METHODS

The standard operating procedures (SOPs) applicable to the scope included in this work plan is provided in Table 5.0-1. Current versions of the EP procedures are available at http://www.lanl.gov/environment/all/qa/adep.shtml. These SOPs, or equivalent subcontractor procedures, will be used to conduct the work described in this plan. Additional procedures may be added as necessary to describe and document quality-affecting activities.

5.1 Site Surveys

Reconnaissance will be performed at each site and will consist of evaluations of available engineering drawings and site maps, as well as a preliminary site walkover. During the site walkover, the surface conditions and access restrictions will be evaluated, including restrictions specified in the access agreements.

The exact sampling locations will be determined using global-positioning system (GPS) field surveys of the original sampling locations, utility locations identified as part of the excavation permitting process, and other access-restrictive surface conditions following the current version of EP-ERSS-SOP-5028, “Coordinating and Evaluating Geodetic Surveys.” A line location survey will also be conducted to further define potentially dangerous utility lines in the work area. Each location will be thoroughly examined to identify potential hazards for subsurface drilling.

5.2 Subsurface Sampling

Subsurface sampling will be conducted using either a hand auger or hollow-stem auger drill rig. A hollow-stem auger consists of a hollow steel shaft with a continuous spiraled steel flight welded onto the exterior site of the stem. The stem is connected to an auger bit, and it transports cuttings to the surface when it is 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 to allow the samples to be retrieved during drilling. The hollow stem also acts to encase the borehole temporarily so the casing (riser) may be inserted through the center of the augers once the desired depth is reached, thus minimizing the risk of possible borehole collapse.

Immediately after sampling, all boreholes will be abandoned using bentonite chips or a bentonite/concrete mixture. All borehole cuttings will be managed as investigation-derived waste (IDW), as described in Appendix A of this work plan. All borehole abandonment information will be provided in the Pueblo Canyon Aggregate Area Phase II investigation report.

Because the SWMUs, AOCs, and consolidated unit included in this work plan are located on private property or on Los Alamos County property, the property owners must agree upon all sampling locations, as described in the access agreements.

5.3 Field Screening

Because sampling is being conducted to finalize nature and extent based on recent analytical laboratory data, field screening will be conducted primarily for health and safety purposes. The Laboratory's proposed field-screening approach will be to (1) visually examine all samples for evidence of contamination, (2) screen for organic vapors, and (3) screen for radioactivity. The field-screening methods and their limitations are discussed below.

Volatile Organic Compounds

Per the Pueblo Canyon Aggregate Area investigation report, the nature and extent of all volatile organic COPCs has been determined for the sites included in this Phase II work plan. Therefore, volatile organic compound (VOC) screening will be conducted for health and safety purposes. Screening will be conducted using a photoionization detector (PID) capable of measuring quantities as low as 1 part per million. Based on the available characterization data, it is not anticipated that VOC screening information will result in advancing boreholes to depths greater than those proposed in this Phase II work plan.

Vapor screening of subsurface core for VOCs will be conducted using a PID equipped with an 11.7 electron volt lamp. For each sample, the maximum value and the ambient-air temperature will be recorded on the field borehole or test-pit log. The PID will be calibrated daily to the manufacturer's standard for instrument operation, and the daily calibration results will be documented in the field logbooks. All instrument background checks, background ranges, and calibration procedures will be documented daily in the field logbooks in accordance with EP-ERSS-SOP-5181, "Notebook Documentation for Waste and Environmental Services Technical Field Activities."

Radioactivity

Per the Pueblo Canyon Aggregate Area investigation report, the nature and extent of radiological COPCs have been determined for all of the sites included in this Phase II work plan. Therefore, field screening for radioactivity will be conducted for health and safety purposes. Radiological screening will target gross

alpha, beta, and gamma radiation. Field screening for alpha, beta, and gamma radiation will be conducted within 6 in. from the core material. Based on the available characterization data, it is not anticipated that radioactivity screening information will result in advancing boreholes to depths greater than those proposed in this Phase II work plan.

5.4 Collection of Soil and Tuff Samples

Samples will be collected at the target depths specified in Tables 4.1-1 through 4.5-1. Sampling depths may be adjusted based on field observations or conditions. All subsurface sampling activities will be performed in accordance with appropriate procedures to ensure health and safety requirements are reviewed and addressed during field operations.

Tables 4.1-1 through 4.5-1 provide the target depths for each sampling location. Based on historical RFI data, most sites have low (or no) detectable concentrations of VOCs. However, if VOC screening is positive, the boreholes will be advanced a minimum of 5 ft beyond the last positive detection. If a positive field-screening result is detected within 5 ft of the target depth, the borehole will be advanced in 5-ft intervals until no positive field-screening result is detected over a 5-ft interval. All samples submitted to the laboratory will be analyzed as specified in Tables 4.1-1 through 4.5-1.

Quality assurance (QA)/quality control (QC) samples will include (1) field duplicate samples to evaluate the reproducibility of the sampling technique and (2) rinsate blanks to evaluate decontamination procedures. These samples will be collected in accordance with the current version of EP-ERSS-SOP-5059, "Field Quality Control Samples," and will comply with a field-duplicate collection frequency of 10% of the total samples collected.

Field documentation will also include detailed borehole logs for each location sampled with a hollow-stem auger. The borehole logs will document the matrix material in detail and will include the results of all field screening. Field documentation will be completed in accordance with the current version of EP-ERSS-SOP-5059, "Sample Control and Field Documentation," and EP-ERSS-SOP-5181, "Notebook Documentation for Waste and Environmental Services Technical Field Activities."

5.5 Soil Excavation and Removal

Excavation at AOC 00-030(h) is expected to be accomplished using a combination of heavy equipment and hand tools. A backhoe may be used to remove soil from the outlet line and tank area, as needed. Shovels and buckets may be used to remove sediment accumulation in the drainage area. During removal of soils and debris at AOC 00-030(h), the excavated material will be field screened for radiological and VOC contamination for health and safety purposes. Neither radiological nor VOC contamination is driving the removal action at AOC 00-030(h) and, therefore, the field-screening results are not expected to be useful in directing removal actions or assisting in waste segregation. Existing analytical data will be used to direct removal and to make an initial waste determination.

Excavated soils will be placed in 20-yd^3 rolloff bins or other appropriate containers. These containers may be staged on-site or moved for storage elsewhere. Transportation of these wastes will be based on the initial waste determination and will be done in accordance with all applicable requirements. A final waste determination will be made based on data from direct sampling of the excavated materials. The plan for managing the IDW is described in Appendix A of this work plan.

5.6 Equipment Decontamination

Following sampling and remediation activities, project personnel will decontaminate all equipment that came into contact with potentially contaminated environmental media in accordance with EP-ERSS-SOP-5061, "Field Decontamination of Equipment." Residual material adhering to equipment will be removed using dry decontamination methods such as using wire brushes and scrapers. If equipment cannot be decontaminated using dry decontamination methods, wet decontamination methods will be used. Pressure-washing of equipment will be performed on a temporary decontamination pad with a high-density polyethylene liner. Cleaning solutions and wash water will be collected and contained for proper disposal, as described in Appendix A. Decontamination solutions will be sampled and analyzed to determine the final disposition of the wastewater and the effectiveness of the decontamination procedures.

6.0 ONGOING MONITORING AND SAMPLING PROGRAM

Currently, no ongoing groundwater monitoring is taking place at any of the SWMUs and AOCs in the Pueblo Canyon Aggregate Area. Existing wells in Pueblo Canyon are sampled as part of the interim facility-wide groundwater monitoring program (LANL 2007, 096665).

7.0 SCHEDULE

The date for submitting the Pueblo Canyon Aggregate Area Phase II investigation work plan to NMED is October 24, 2008. Administrative activities, including contract award and private property access agreements, will begin after the Phase II work plan has been approved. These activities are anticipated to take approximately 120 d. Field-activity preparation and implementation will begin once a contract is in place and access agreements have been signed. Field preparation is anticipated to require approximately 90 d. Implementation of this work plan, including the phased removal action at SWMU 00-030(h), is anticipated to require 180 d, including confirmation sampling and waste management. Investigation results from analytical laboratories are expected to be received 60 d after final site demobilization, at which time report preparation will begin. Based on this schedule, the Pueblo Canyon Aggregate Area Phase II investigation report will be submitted 24 mo after NMED approves this work plan.

8.0 REFERENCES AND MAP DATA SOURCES

8.1 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 U.S. Department of Energy–Los Alamos Site Office; the U.S. Environmental Protection Agency, Region 6; and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

LANL (Los Alamos National Laboratory), May 1992. "RFI Work Plan for Operable Unit 1071," Los Alamos National Laboratory document LA-UR-92-810, Los Alamos, New Mexico. (LANL 1992, 007667)

LANL (Los Alamos National Laboratory), May 1992. "RFI Work Plan for Operable Unit 1079," Los Alamos National Laboratory document LA-UR-92-850, Los Alamos, New Mexico. (LANL 1992, 007668)

LANL (Los Alamos National Laboratory), May 5, 1995. "RFI Report for PRS 31-001," Los Alamos National Laboratory document LA-UR-95-1542, Los Alamos, New Mexico. (LANL 1995, 058085)

LANL (Los Alamos National Laboratory), June 12, 1995. "RFI Report for PRSs 1-002, 45-001, 45-002, 45-003, 45-004, C-45-001," Los Alamos National Laboratory document LA-UR-95-1542, Los Alamos, New Mexico. (LANL 1995, 048856)

LANL (Los Alamos National Laboratory), February 26, 1996. "Voluntary Corrective Action Completion Report for Potential Release Sites 21-013(c), 21-013(d), 21-013(e), 31-001," Rev. 1, Los Alamos National Laboratory document LA-UR-96-259, Los Alamos, New Mexico. (LANL 1996, 054320)

LANL (Los Alamos National Laboratory), March 1996. "Voluntary Corrective Action Completion Plan for Potential Release Sites 0-030(d,h,i,j,k,n,o,p), Town Site Septic Tank Systems," Los Alamos National Laboratory document LA-UR-96-936, Los Alamos, New Mexico. (LANL 1996, 053799)

LANL (Los Alamos National Laboratory), June 1996. "RFI Report for Potential Release Sites, 0-030(eN,eS,f)," Los Alamos National Laboratory document LA-UR-96-2135, Los Alamos, New Mexico. (LANL 1996, 056432)

LANL (Los Alamos National Laboratory), September 1996. "Voluntary Corrective Action Completion Report for Potential Release Sites 0-030(h,i,n,o,p), Group 0-3 Septic Tanks," Los Alamos National Laboratory document LA-UR-96-3351, Los Alamos, New Mexico. (LANL 1996, 062416)

LANL (Los Alamos National Laboratory), September 1997. "RFI Report for PRSs 0-018(a,b), Wastewater Treatment Plants," Los Alamos National Laboratory document LA-UR-97-3319, Los Alamos, New Mexico. (LANL 1997, 056614)

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

LANL (Los Alamos National Laboratory), May 2005. "Pueblo Canyon Aggregate Area Investigation Work Plan," Los Alamos National Laboratory document LA-UR-05-2366, Los Alamos, New Mexico. (LANL 2005, 090579)

LANL (Los Alamos National Laboratory), May 2007. "2007 Interim Facility-Wide Groundwater Monitoring Plan," Los Alamos National Laboratory document LA-UR-07-3271, Los Alamos, New Mexico. (LANL 2007, 096665)

LANL (Los Alamos National Laboratory), March 2008. "Investigation Report for Pueblo Canyon Aggregate Area," Los Alamos National Laboratory document LA-UR-08-1853, Los Alamos, New Mexico. (LANL 2008, 102408)

NMED (New Mexico Environment Department), September 23, 2005. "Approval with Modifications, Pueblo Canyon Aggregate Area Investigation Work Plan," 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 2005, 091388)

NMED (New Mexico Environment Department), June 27, 2008. "Notice of Disapproval, Investigation Report for Pueblo Canyon Aggregate Area," 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, 102049)

NMED (New Mexico Environment Department), August 22, 2008. "Approval with Modifications, Investigation Report for Pueblo Canyon Aggregate Area, 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, 103002)

8.2 Map Data Sources

Data sources for all figures are provided below, unless otherwise indicated on the figures themselves.

Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Potential Release Sites (SWMU/AOC); Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2005-0748; 1:2500 Scale Data; 22 November 2005.

Material Disposal Areas; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2004-0221; 1:2500 Scale Data; 23 April 2004.

Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 05 January 2005.

Hypsography, 10, 20, and 100 Foot Contour Interval; Los Alamos National Laboratory, RRES Remediation Services Project; 1991.

Water Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 05 January 2005.

Steam Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 05 January 2005.

Sewer Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 05 January 2005.

Industrial Waste Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Electric Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Communication Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 08 August 2002; Development Edition of 05 January 2005.

ER Location IDs point (borehole and sample locations); Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1:2500 Scale Data; 10 November 2005.

Former Drainline; Los Alamos National Laboratory, ENV Environmental Remediation and Stewardship Program; 1:2500 Scale Data, 02 October 2006.

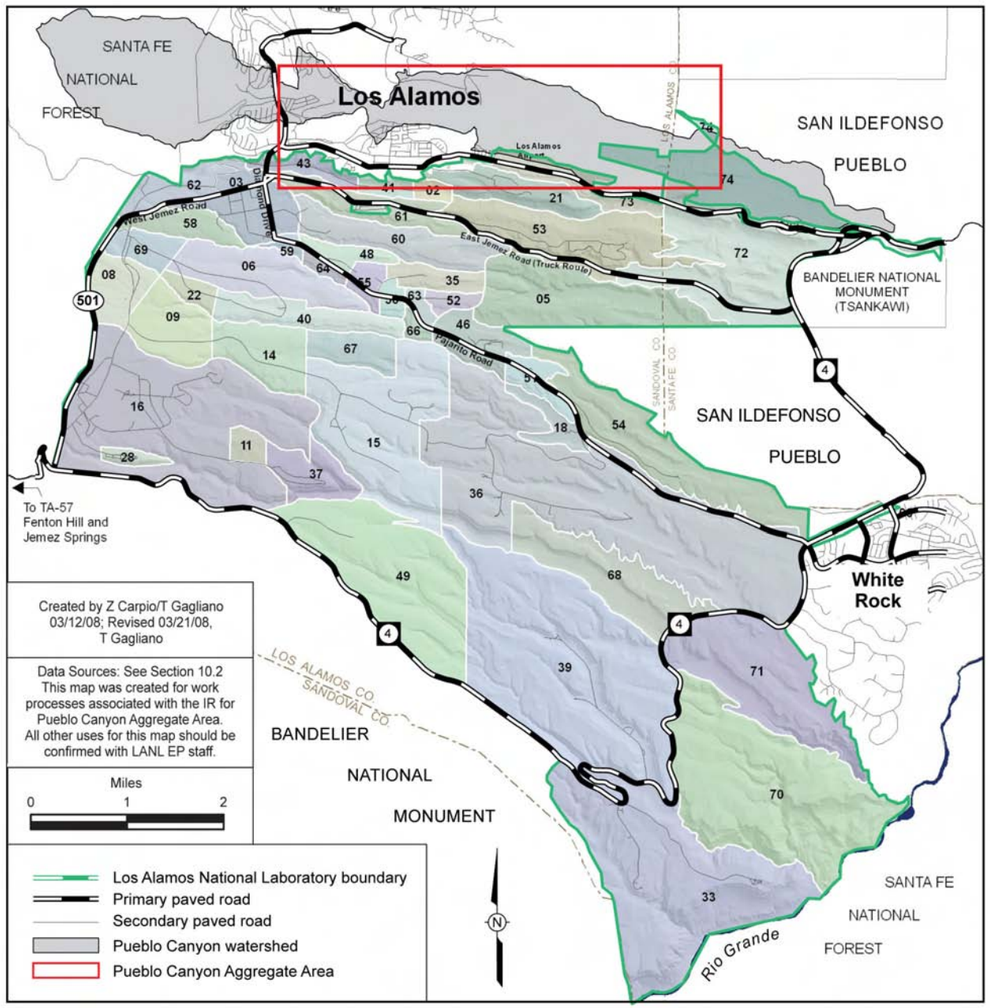

Figure 1.1-1 Location of Pueblo Canyon Aggregate Area with respect to Laboratory technical areas and surrounding land holdings

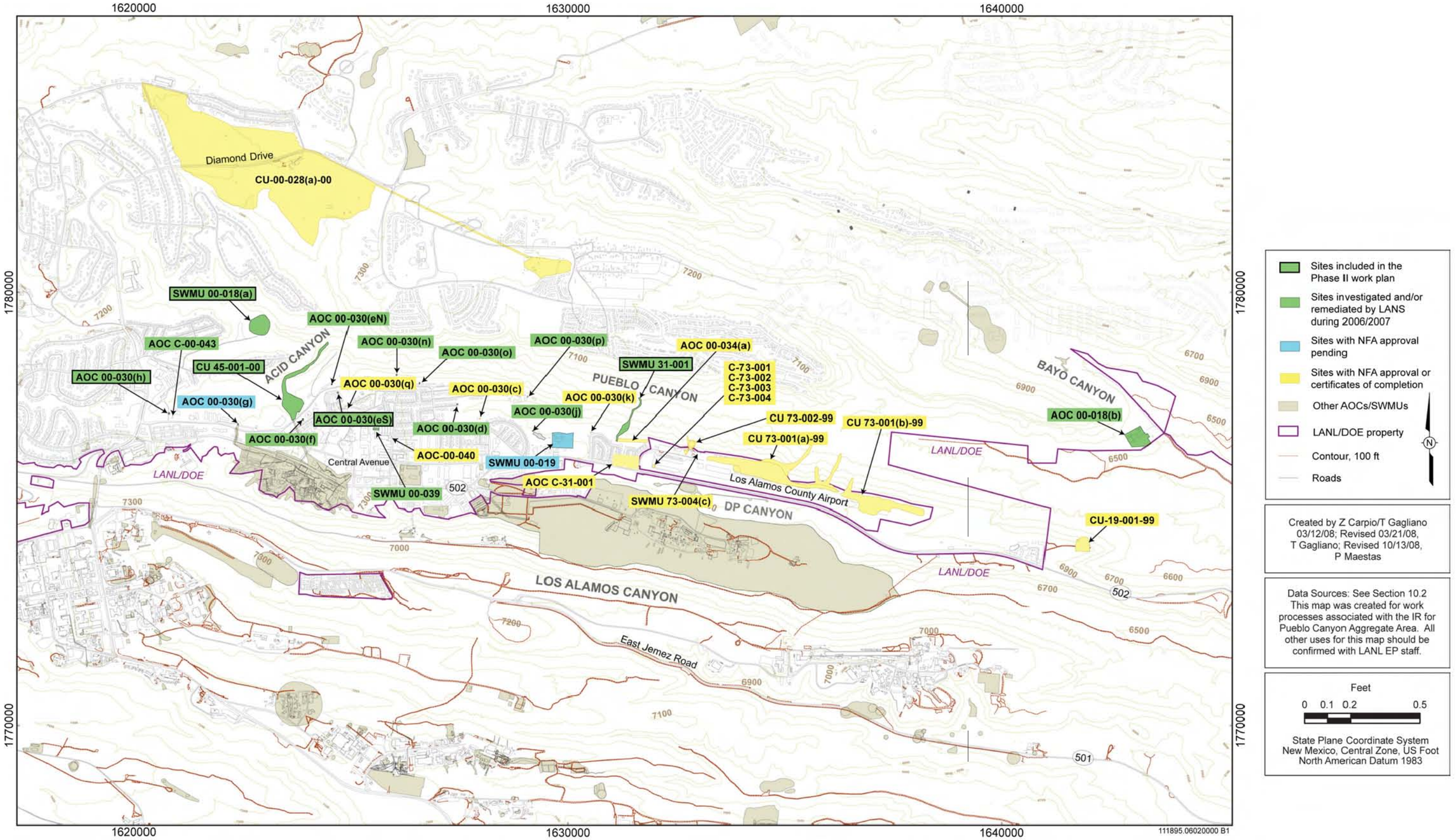

Figure 1.1-2 Locations of Pueblo Canyon Aggregate Area SWMUs, AOCs, and consolidated units

Figure 2.1-1 Current site conditions at SWMU 00-018(a). Photograph taken from the access road looking north toward the former location of the trickling filter tank.

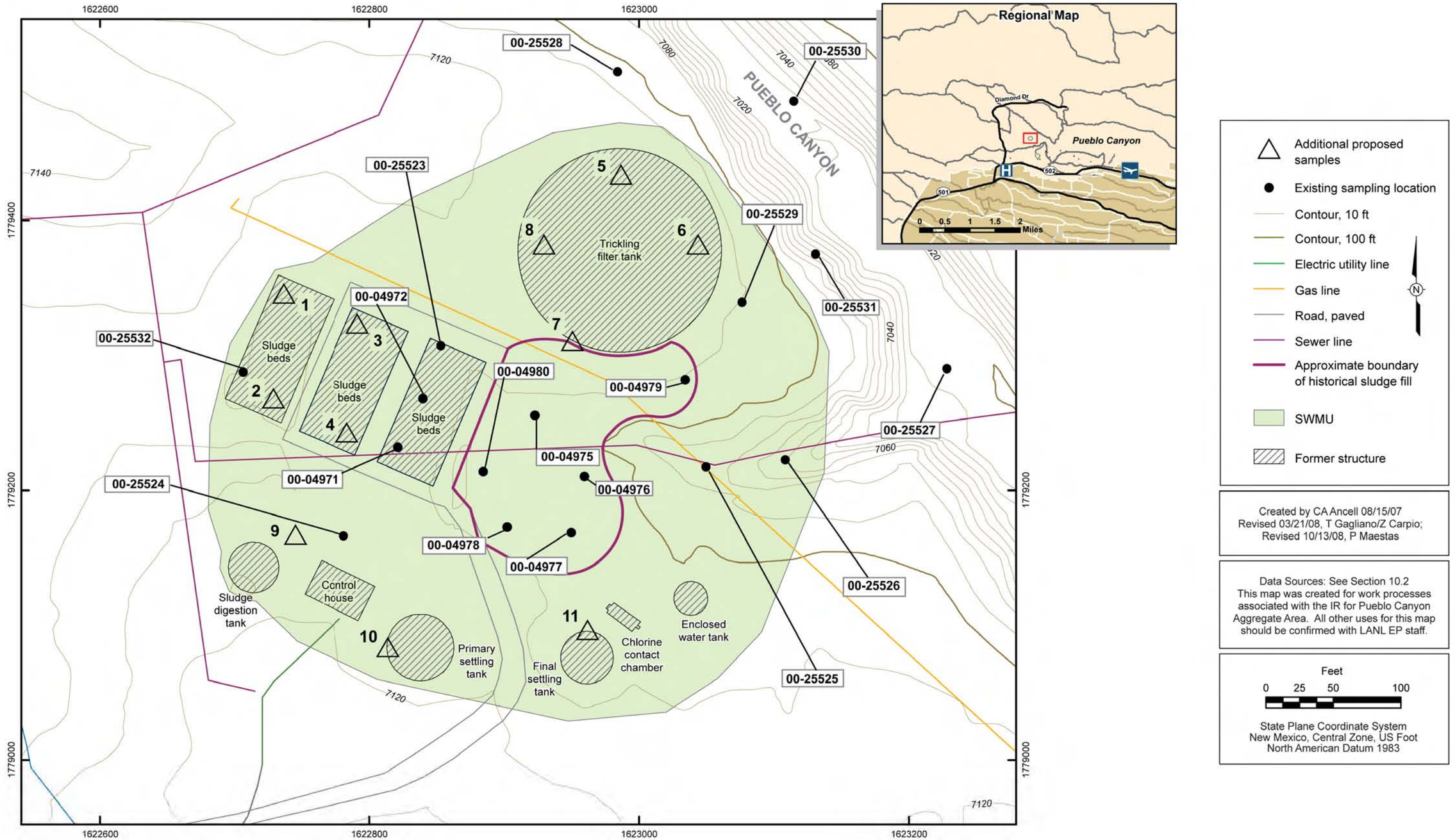

Figure 4.1-1 Existing and proposed locations of surface and subsurface samples collected at SWMU 00-018(a)

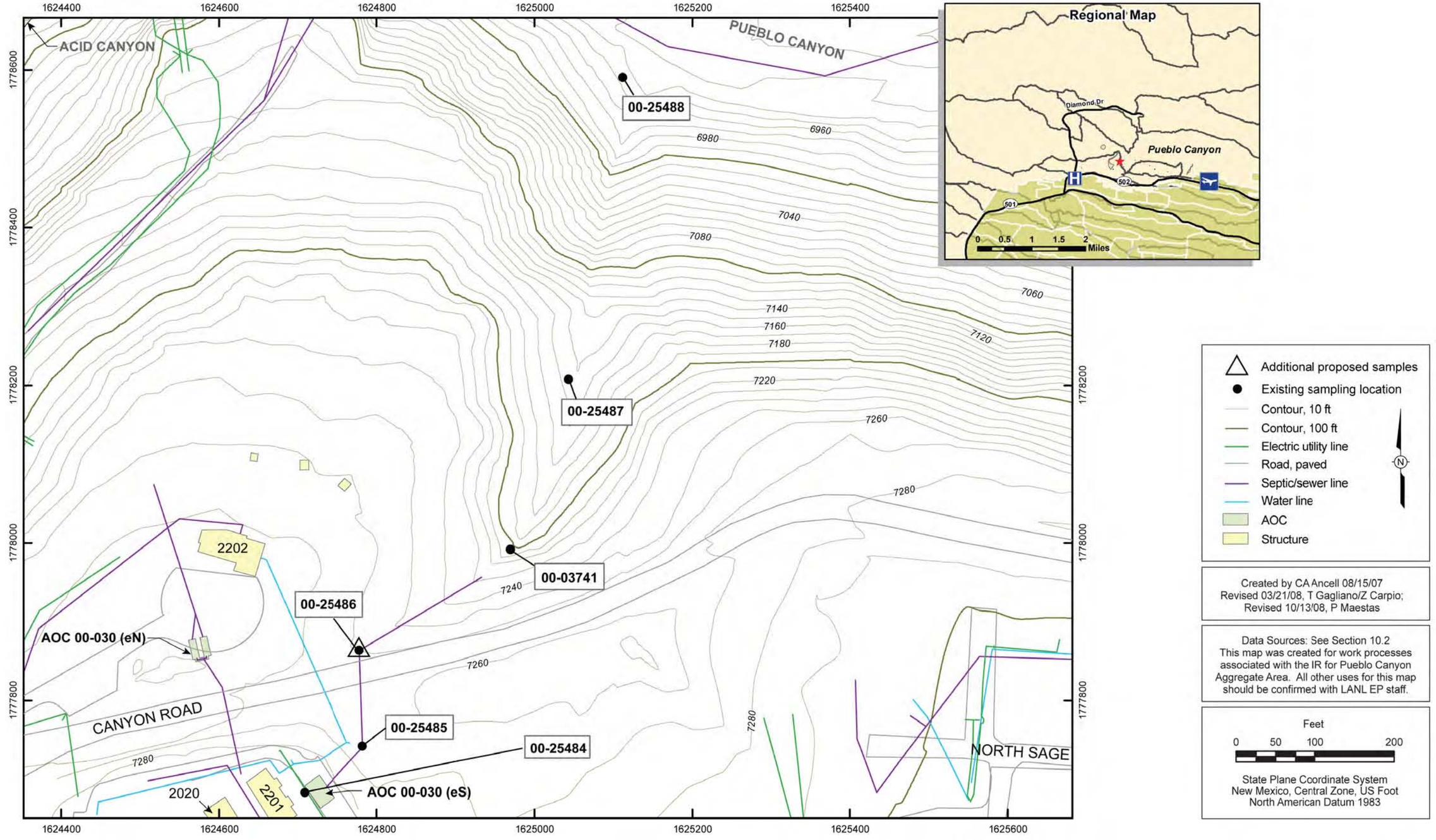

Figure 4.2-1 Existing and proposed locations of surface and subsurface samples collected at AOC 00-030(eS)

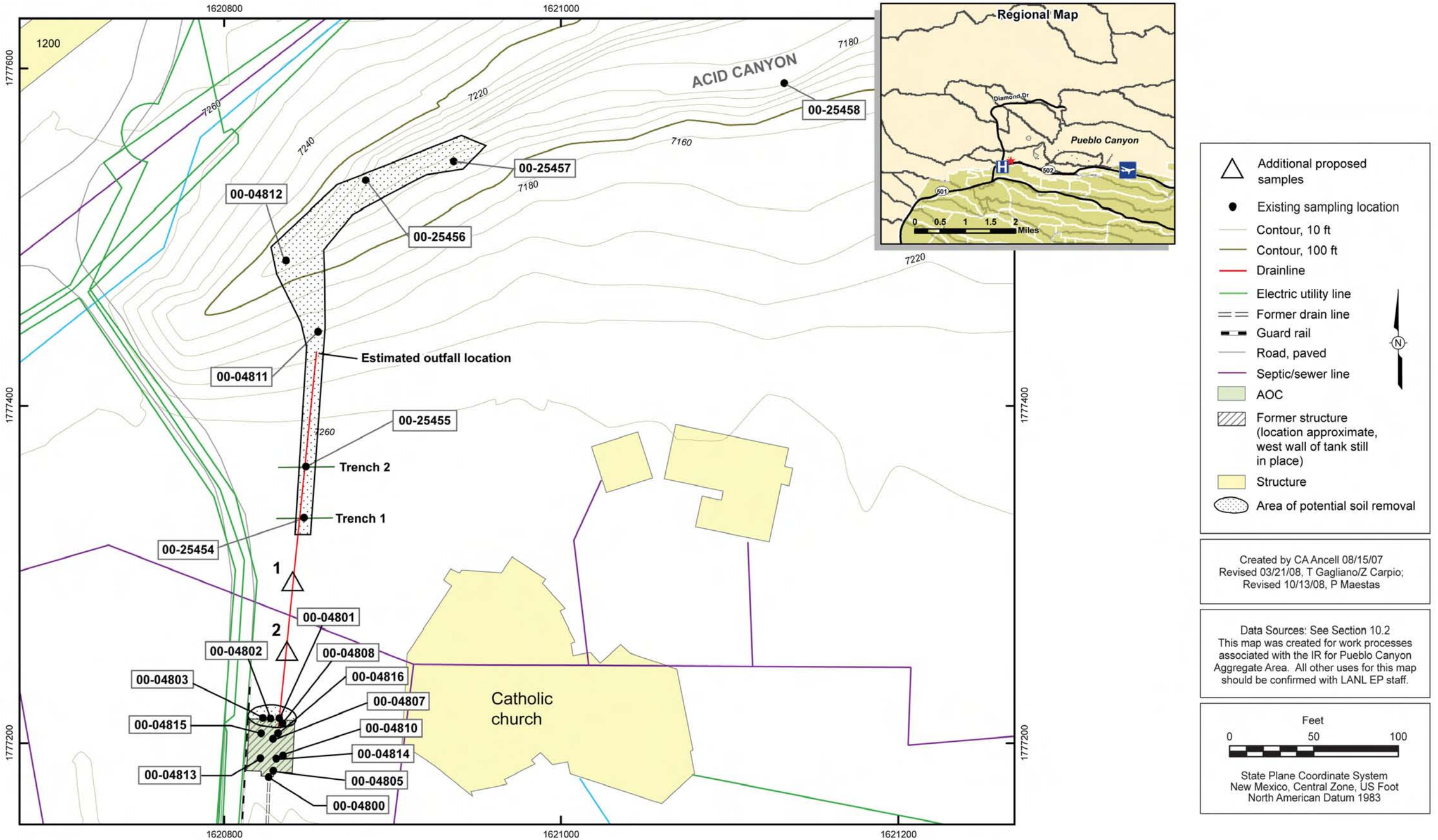

Figure 4.3-1 Locations of surface and subsurface samples collected at AOC 00-030(h) and area of potential soil removal

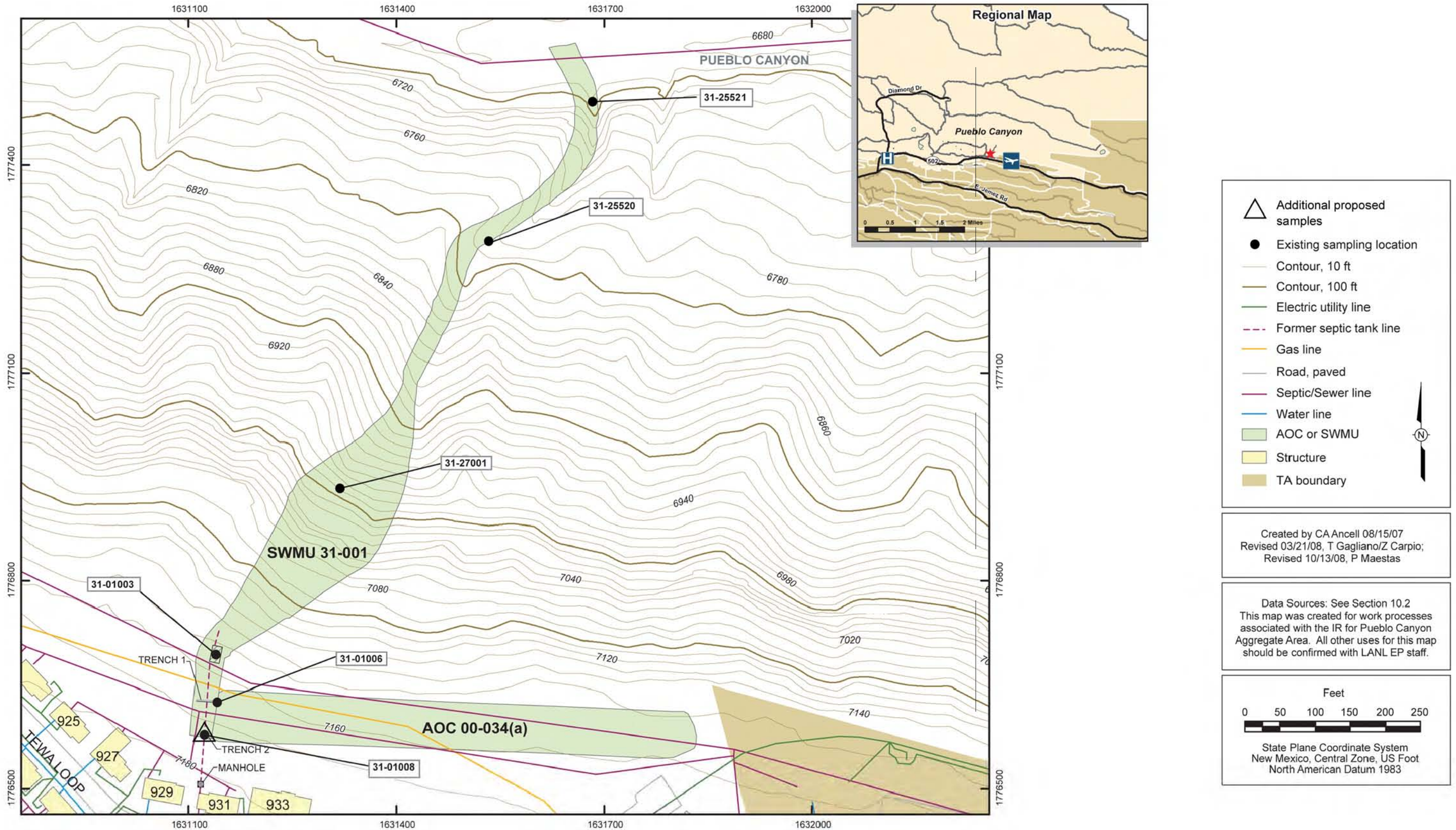

Figure 4.4-1 Existing and proposed locations of surface and subsurface samples collected at SWMU 31-001

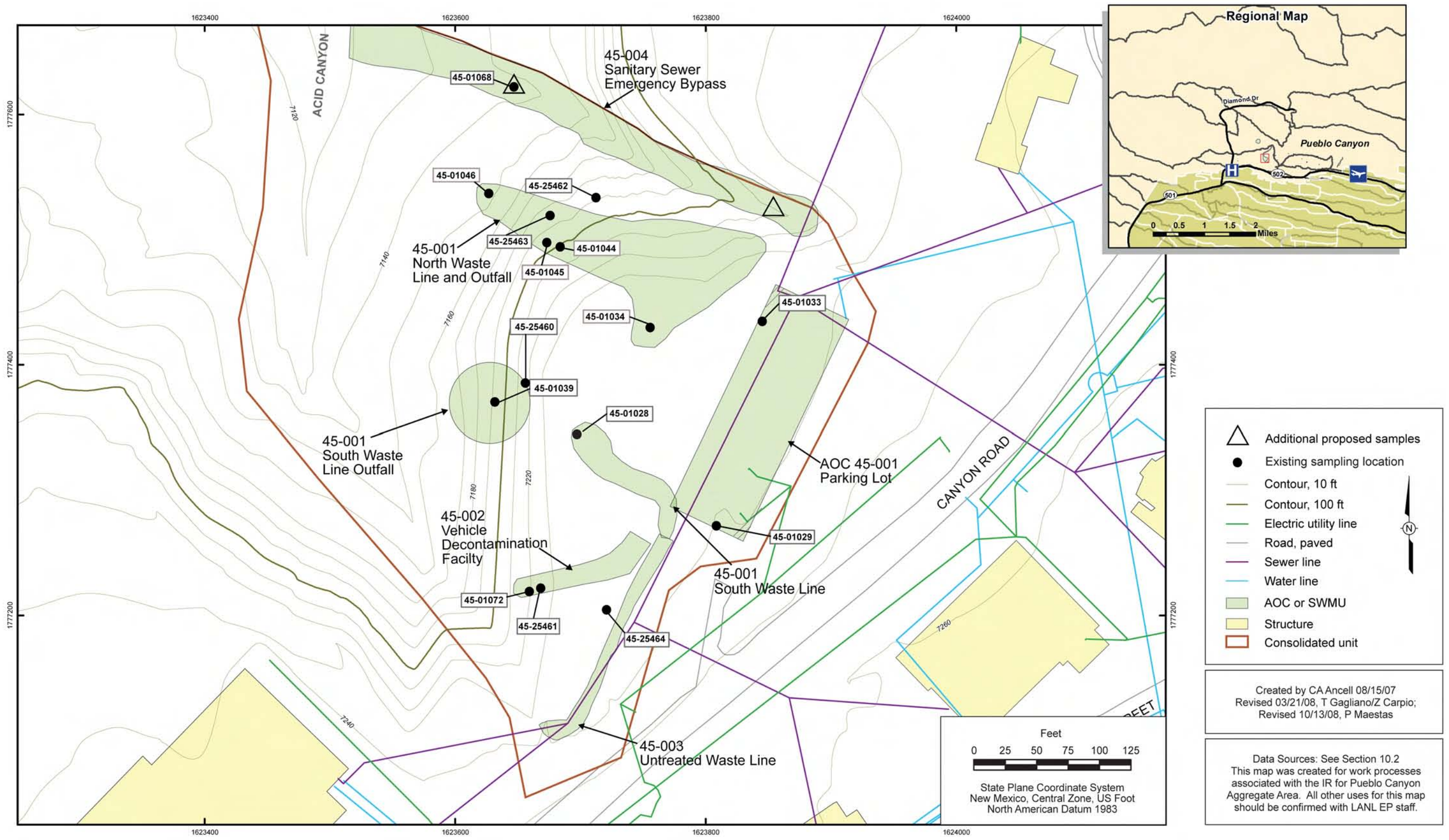

Figure 4.5-1 Existing and proposed locations of surface and subsurface samples collected at Consolidated Unit 45-001-00

Table 4.1-1
SWMU 00-018(a) Proposed Soil and Tuff Samples

Location	Location Description	Sampling Justification	Depth	Media Type	pH (SW-846 9045C)	Nitrates (EPA Method 300.0)	Cyanide (SW-846 9012A)	Perchlorate (EPA Method 314.0 and SW 846 8321A)	TAL Metals (SW-846 6010B)	VOCs (SW-846 8260B)	SVOCs (SW-846 8270C)	Pesticides (SW-846 8081A)	PCBs (SW-846 8082)	Gamma Spectroscopy (EPA Method 901.1)
1	West sludge bed	Satisfy NMED requirements	Soil-tuff interface (TBD) Underlying tuff (TBD)	Tuff Tuff	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X
2	West sludge bed	Satisfy NMED requirements	Soil-tuff interface (TBD) Underlying tuff (TBD)	Tuff Tuff	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X
3	Central sludge bed	Satisfy NMED requirements	Soil-tuff interface (TBD) Underlying tuff (TBD)	Tuff Tuff	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X
4	Central sludge bed	Satisfy NMED requirements	Soil-tuff interface (TBD) Underlying tuff (TBD)	Tuff Tuff	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X
5	Trickling filter tank	Satisfy NMED requirements	Undisturbed soil (if present) Soil-tuff interface (TBD) Underlying tuff (TBD)	Soil Tuff Tuff	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X
6	Trickling filter tank	Satisfy NMED requirements	Undisturbed soil (if present) Soil-tuff interface (TBD) Underlying tuff (TBD)	Soil Tuff Tuff	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X
7	Trickling filter tank	Satisfy NMED requirements	Undisturbed soil (if present) Soil-tuff interface (TBD) Underlying tuff (TBD)	Soil Tuff Tuff	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X
8	Trickling filter tank	Satisfy NMED requirements	Undisturbed soil (if present) Soil-tuff interface (TBD) Underlying tuff (TBD)	Soil Tuff Tuff	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X
9	Sludge digestion tank—former valve location	Satisfy NMED requirements	Undisturbed soil (if present) Soil-tuff interface (TBD) Underlying tuff (TBD)	Soil Tuff Tuff	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X

Table 4.1-1 (continued)

Location	Location Description	Sampling Justification	Depth	Media Type	pH (SW-846 9045C)	Nitrates (EPA Method 300.0)	Cyanide (SW-846 9012A)	Perchlorate (EPA Method 314.0 and SW 846 8321A)	TAL Metals (SW-846 6010B)	VOCs (SW-846 8260B)	SVOCs (SW-846 8270C)	Pesticides (SW-846 8081A)	PCBs (SW-846 8082)	Gamma Spectroscopy (EPA Method 901.1)
10	Primary settling tank—former valve location	Satisfy NMED requirements	Undisturbed soil (if present) Soil-tuff interface (TBD) Underlying tuff (TBD)	Soil Tuff Tuff	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X
11	Final settling tank—former valve location	Satisfy NMED requirements	Undisturbed soil (if present) Soil-tuff interface (TBD) Underlying tuff (TBD)	Soil Tuff Tuff	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X

Notes: TBD = To be determined. SVOC = Semivolatile organic compound. PCB = Polychlorinated biphenyl.

Table 4.2-1
AOC 00-030(eS) Proposed Tuff Samples

Location	Location Description	Sampling Justification	Approximate Depth (ft bgs)	Media Type	TAL Metals (SW-846 6010B)
00-25486	Drainline location, north side of Canyon Road	Conduct sampling to define vertical extent of lead and zinc	6–7 9–10	TBD* TBD	X X

*TBD = To be determined.

Table 4.3-1
AOC 00-030(h) Proposed Soil and Tuff Samples

Location	Location Description	Sampling Justification	Approximate Depth (ft bgs)	Media Type	Pesticides (SW-846 8081A)	TAL Metals (SW-846 6010B)	SVOCs (SW-846 8270C)
1	Outlet line	Refine lateral extent of COPCs above SSLs	6–7 8–9	TBD* TBD	—	—	X X
2	Outlet line	Refine lateral extent of COPCs above SSLs	4–5 6–7	TBD TBD	—	—	X X
00-25454	Outlet line	Conduct confirmation sampling at base of excavation to verify efficacy of removal action and recalculate risk	4–5	TBD	X	X	X
00-25455	Outlet line	Conduct confirmation sampling at base of excavation to verify efficacy of removal action and recalculate risk	4–5	TBD	X	X	X
00-04811	Outfall	Conduct confirmation sampling at base of excavation to verify efficacy of removal action and recalculate risk	2–3	TBD	X	X	X
00-04812	Head of drainage	Conduct confirmation sampling at base of excavation to verify efficacy of removal action and recalculate risk	2–3	TBD	X	X	X
00-25456	Bottom of drainage	Conduct confirmation sampling at base of excavation to verify efficacy of removal action and recalculate risk	2–3	TBD	X	X	X
00-25457	Bottom of drainage	Conduct confirmation sampling at base of excavation to verify efficacy of removal action and recalculate risk	2–3	TBD	X	X	X
00-00-4803	North end of tank	If excavation is needed, conduct confirmation sampling at base of excavation to verify efficacy of removal action and recalculate risk	8–9	TBD	X	X	X

*TBD = To be determined.

Table 4.4-1
SWMU 31-001 Proposed Soil and Tuff Samples

Location	Location Description	Sampling Justification	Depth (ft bgs)	Media Type	TAL Metals (SW-846 6010B)
31-01008	Former drainline location	Collect samples at historical location to define vertical extent of lead detected above background in tuff	16–17 19–20	Tuff Tuff	X X

Table 4.5-1
Consolidated Unit 45-001-00 Proposed Soil and Tuff Samples

Location	Location Description	Sampling Justification	Depth (ft bgs)	Media Type	TAL Metals (SW-846 6010B)
45-01068	Sanitary Sewer Emergency Bypass, SWMU 45-004	Sample to define vertical extent of lateral and vertical contamination of silver and mercury within SWMU 45-004	4–5 7–8	TBD* TBD	X X
New location	Sanitary Sewer Emergency Bypass, SWMU 45-004	Sample upgradient of location 45-01068 to define lateral and vertical extent of metals	4–5 7–8	TBD TBD	X X

*TBD = To be determined.

Table 5.0-1
Summary of Applicable Procedures

Procedure	Title	Summary
EP-ERSS-SOP-5055	General Instructions for Field Investigations	This SOP provides an overview of instructions regarding activities to be performed before, during, and after field investigations. It is assumed that field investigations involve standard sampling equipment, personal protective equipment, waste-management, and site-control equipment/materials. The procedure covers premobilization activities, mobilization to the site, documentation and sample collection activities, sample media evaluation, surveying, and completing lessons learned.
EP-ERSS-SOP-5056	Sample Containers and Preservation	This SOP describes the specific requirements/process for sample containers, preservation techniques, and holding times as specified by field regulations and guidance documents. The use of specific types of sample containers and preservation techniques is mandatory for hazardous-site investigations because the integrity of any sample is diminished over time. Physical factors (light, pressure, temperature, etc.), chemical factors (changes in pH, volatilization, etc.), and biological factors may alter the original quality of the sample. Because the various target parameters are uniquely altered at varying rates, distinct sample containers, preservation techniques, and holding times have been established to maintain sample integrity for a reasonable and acceptable period of time. The procedure covers documenting SOP deviations, using proper sample containers and preservatives, performing data entry, implementing containment procedures, preserving samples, implementing holding times, completing documentation, implementing postoperation activities, and conducting lessons learned.
EP-ERSS-SOP-5057	Handling, Packaging and Transporting Field Samples	This SOP directs field team members in the preparation of environmental and waste characterization samples for transportation to the Laboratory's Sample Management Office (SMO) or an approved radiation-screening laboratory. In general, samples taken are expected to have a low concentration of potential contaminants, although higher concentrations will be present in some cases. These low-concentration samples that do not satisfy the U.S. Department of Transportation (DOT) hazard-class definitions are classified as environmental samples and are not subject to DOT regulations. Historical data, knowledge of processes, and field screening results will assist the team members in making decisions as to whether a sample can be designated as "environmental" or needs to be treated as a DOT-regulated material. The procedure covers transportation of environmental and DOT-regulated samples.
EP-ERSS-SOP-5058	Sample Control and Field Documentation	This SOP describes the process for documenting samples collected using sample control and field documentation, specifically, container labels, sample collection logs, chain of custody (COC)/request for analysis forms, and daily activity log forms or field notebooks. The procedure covers performing request notification, generating sample control and field documentation, completing sample collection logs, using field COC forms, delivering samples to the Laboratory's SMO, delivering samples to another analytical laboratory, using custody seals, collecting the samples, completing sample control and field documentation, completing field investigation summaries, and performing field closeouts.
EP-ERSS-SOP-5059	Field Quality Control Samples	This SOP describes the requirements for the collection of field quality control (QC) samples to ensure the reliability and validity of field and laboratory data. Field QC samples shall be collected as described in this procedure and taken to the Laboratory's SMO with the regular field samples for subsequent chemical and physical testing. The procedure covers pre-operation activities, collecting and preparing each type of QC sample including equipment rinsate blank, field duplicate, and trip blank.

Table 5.0-1 (continued)

Procedure	Title	Summary
EP-ERSS-SOP-5022	Characterization and Management of Environmental Restoration Project Waste	This SOP describes the process for characterizing and managing waste generated during corrective action activities. This procedure outlines the preparation, approval, and retention of all required documents associated with waste generation and characterization. The procedure covers waste identification and characterization, waste minimization/recycling, waste generation/storage, segregation, waste treatment, authorized release limits, packaging/transportation, disposal options, and specific policies, including area of contamination policy, environmental media, and contained in policy.
EP-ERSS-SOP-5061	Field Decontamination of Equipment	This SOP describes the process for the general field decontamination of drilling and sampling equipment. It is intended to help ensure the integrity of soil, sediment, rock, water, and other samples collected from potentially contaminated sites and to minimize the potential for cross contamination between sampling locations. Implementation of this procedure will help protect site and community personnel, requiring that equipment not be removed from a controlled area without proper decontamination. The procedure covers set up of dry and wet decontamination areas, drilling/excavation equipment decontamination, and sampling equipment decontamination.
EP-ERSS-SOP-5028	Coordinating and Evaluating Geodetic Surveys	This SOP describes the methodology for coordinating and evaluating geodetic surveys and establishing quality assurance (QA) and control for geodetic survey data. The procedure covers evaluating geodetic survey requirements, preparing to perform a geodetic survey, performing geodetic survey field activities, preparing geodetic survey data for QA review, performing QA review of geodetic survey data, and submitting geodetic survey data.
SOP-06.09	Spade and Scoop Method for the Collection of Soil Samples	This SOP describes the process for spade-and-scoop collection of shallow (i.e., typically 0 to 12 in.) soil samples. The spade-and-scoop method involves digging a hole to the desired depth, as prescribed in the sampling and analysis plan, and collecting a discrete grab or portion of a composite sample. The procedure covers pre-sampling activities, sampling activities, and post sampling activities.
SOP-06.10	Hand Auger and Thin-Wall Tube Sampler	This SOP states the responsibilities and describes the process for collecting surface and subsurface soil samples with a hand auger and thin-wall tube sampler. This procedure describes selecting and using sampling methods and equipment at sites that may include contamination with hazardous or radioactive materials. The procedure covers presampling activities, sampling activities, collecting field duplicates, and postsampling activities.
EP-ERSS-SOP-5018	Integrated Fieldwork Planning and Authorization	This SOP describes the responsibilities and defines the process for conducting readiness planning and reviews. The procedure is used as a planning tool for preparing field work, as a method to ensure compliance with all identified requirements and gain consensus on key preparations before field activities can proceed. The SOP defines the personnel responsible for the various readiness planning and review activities. A readiness-review checklist is required to ensure all requirements are met and to assign responsible personnel for meeting the requirements.

Table 5.0-1 (continued)

Procedure	Title	Summary
EP-ERSS-SOP-5181	Notebook Documentation for Waste & Environmental Services Technical Field Activities	This SOP describes the responsibilities and process for properly documenting environmental restoration technical activities and defines the requirements for documenting field activities including those for notebooks, notebook entries, notebook attachments, notebook data evaluation, technical review of notebooks, Quality Integration and Improvement review of notebooks, and notebook submission as a record.
EP-DIR-QAP-0001	Quality Assurance Plan for the Environmental Programs	The quality assurance plan establishes implementing requirements, assigns responsibilities, and describes the management systems established to assure the quality of EP Directorate activities and products. The document is based on the requirements of NQA-1-2000, Quality Assurance Requirements for Nuclear Facility Applications.

Note: Equivalent subcontractor procedures may be used.

Appendix A

Management Plan for Investigation-Derived Waste

A-1.0 INTRODUCTION

This appendix describes how investigation-derived waste (IDW) generated during the investigation or soil removal at five sites within the Pueblo Canyon Aggregate Area at Los Alamos National Laboratory (the Laboratory) will be managed. IDW may include, but is not limited to, drill cuttings, excavated environmental media and debris, contact waste, decontamination fluids, and all other waste that has potentially come into contact with contaminants.

A-2.0 IDW

All IDW generated during implementation of the Pueblo Canyon Aggregate Area Phase II investigation work plan will be managed in accordance with applicable standard operating procedure EP-ERSS-SOP-5022, "Characterization and Management of Environmental Restoration Project Waste," available at http://www.lanl.gov/environment/all/qa/adep.shtml. This procedure incorporates the requirements of applicable U.S. Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) regulations, U.S. Department of Energy (DOE) orders, and Los Alamos National Laboratory (the Laboratory) requirements for waste.

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

A waste characterization strategy form (WCSF) will be prepared and approved per the requirements of EP-ERSS-SOP-5022, "Characterization and Management of Environmental Restoration Project Waste." The WCSF will provide information on IDW characterization methods, management, containerization, and potential volumes.

Characterization of IDW is completed through review of sampling data and/or documentation or by direct sampling of the IDW or the media being investigated (e.g., surface soil, subsurface soil, etc.). Waste characterization may also 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. Table A-1.0-1 summarizes how waste will be managed.

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

A-2.1 Drill Cuttings

This waste stream consists of soil and rock chips generated by the drilling of boreholes. Drill cuttings may include excess core sample not submitted for analysis and any returned samples sent for analysis. Drill cuttings will be collected and placed in containers at the point of generation (i.e., at the drill rig). Because additional data collected during this investigation are not expected to change the regulatory status of cuttings, initial waste management (in hazardous or nonhazardous accumulation areas) will be based the existing data. The drill cuttings waste stream will be characterized using analytical results from core

samples, augmented by direct sampling of the containerized cuttings, if needed. If directly sampled, the following analyses will be performed, as needed: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), radionuclides, total metals, and toxicity characteristic metals. Other constituents may be analyzed as necessary to meet the waste acceptance criteria (WAC) for a receiving facility. If process knowledge, odors, or staining indicate that the cuttings may be contaminated with petroleum products, the materials will also be analyzed for total petroleum hydrocarbons (TPH) and polychlorinated biphenyls (PCBs).

In undeveloped areas, cuttings will be land applied if they meet the criteria in the NMED-approved Notice of Intent (NOI) Decision Tree for Land Application of Investigation Derived Waste Solids from Construction of Wells and Boreholes. If they cannot be land-applied in the undeveloped areas or are generated from developed areas, they will be disposed. Based on existing data, the Laboratory expects these drill cuttings to be designated as nonhazardous waste that will either be used as cover soil or disposed of at Technical Area 54 (TA-54), or disposed of at an authorized off-site facility.

A-2.2 Excavated Environmental Media and Debris

Overburden soil and rock will be excavated at Area of Concern (AOC) 00-030(h) to reduce the risk from SVOCs, pesticides, and arsenic. Although the tank and pipes at AOC 00-030(h) are believed to have been removed completely during past field activities, any piping and debris encountered during soil removal may also be excavated and removed. Clean fill will be used to fill the excavation. The excavated overburden and debris will be placed in containers (e.g., rolloff bins) and representative samples will be collected and composited as it is excavated. The nature and extent of contamination at this site have been determined so the excavated overburden will be initially managed as nonhazardous, based on the existing data, until the media are characterized and a waste determination finalized. The overburden will be directly sampled, as needed, for VOCs, SVOCs, radionuclides, total metals, and toxicity characteristic metals. Other constituents may be analyzed as necessary to meet the WAC for a receiving facility. If process knowledge, odors, or staining indicate that soils may be contaminated with petroleum products, the materials will also be analyzed for TPH and PCBs.

Based on existing data, the Laboratory expects these drill cuttings to be designated as nonhazardous waste that will either be used as cover soil or disposed of at TA-54, or disposed of at an authorized off-site facility.

A-2.3 Contact Waste

The contact waste stream consists of potentially contaminated materials that “contacted” waste during sampling and excavation. This waste stream consists primarily of, but is not limited, to personal protective equipment (PPE) such as gloves, decontamination wastes such as paper wipes, and disposable sampling supplies. Characterization of this waste stream will use acceptable knowledge (AK) of the waste materials, the extent of contamination on the contact waste, the methods of generation, and analytical data for the media contacted (e.g., drill cuttings, soil, debris, etc.). Contact waste will be initially placed in containers (e.g., 5-gal. poly buckets) and managed at a hazardous waste or nonhazardous waste accumulation area, as appropriate.

Because additional data collected during this investigation are not expected to change the regulatory status of the environmental media, initial waste management (in hazardous or nonhazardous accumulation areas) will be based the existing environmental media data. The Laboratory expects most of the contact waste to be designated as nonhazardous, nonradioactive waste that will be disposed of at an authorized waste landfill.

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 measured in the environmental media (e.g., the results of the associated drill cuttings) and, if necessary, direct sampling of the containerized waste. If directly sampled, the following analyses will be performed, as needed: VOCs, SVOCs, radionuclides, total metals, and toxicity characteristic metals. Other constituents may be analyzed as necessary to meet the WAC for a receiving facility.

Because additional data collected during this investigation are not expected to change the regulatory status of the environmental media, initial waste management (in hazardous or nonhazardous accumulation areas) will be based the existing data for the environmental media. The Laboratory expects most of these wastes to be nonhazardous liquid waste that will treated at one of the Laboratory's wastewater treatment facilities.

Table A-1.0-1
Summary of Estimated IDW Generation and Management

Waste Stream	Expected Waste Type	Estimated Volume	Characterization Method	On-Site Management	Expected Disposition
Drill cuttings	Solid waste, nonhazardous, potentially low-level radioactive waste	<10 yd^3	AK or direct sampling, if needed	Accumulation in 55-gal. drums, yd^3 soft-sided containers, or other appropriate containers	Land application, TA-54, Area G (as waste or cover soil, as appropriate, or authorized off-site facility
Excavated environmental media and debris	Solid waste, nonhazardous, potentially low-level radioactive waste	500 yd^3	Analytical results from waste samples	Accumulation in covered rolloff bins or other appropriate containers	TA-54, Area G (as waste or cover soil, as appropriate, or authorized off-site facility
Contact waste	Solid waste, nonhazardous, nonradioactive	<1 yd^3	AK	Accumulation in 5-gal. poly bucket or other appropriate container	TA-54, Area G or authorized off-site facility
Decontamination fluids	Liquid waste, nonhazardous	To be determined	Direct sampling	Accumulation in 55-gal. drums or other appropriate container	TA-50 Radioactive Liquid Waste Treatment Facility or TA-46 Sanitary Wastewater Systems Plant