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Date: July 20, 2009
Refer To: EP2009-0317

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

Subject: Submittal of the Response to the Notice of Disapproval for the Investigation Work Plan for Potrillo and Fence Canyons Aggregate Area and Revision 1

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the response to the notice of disapproval for the Investigation Work Plan for Potrillo and Fence Canyons Aggregate Area and Revision 1 of the work plan. Also enclosed is an electronic copy of a redline/strikeout version of the work plan that includes all changes made in response to the New Mexico Environment Department's (NMED's) notice of disapproval. A table detailing where revisions have been made to the work plan with cross-references to NMED's numbered comments is also included.

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,

B. G. Schappell for MJG
Michael J. Graham, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

Edwin P. Worth for
David R. Gregory, Project Director
Environmental Operations
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31843

MG/DG/DM/JM:sm

Enclosures: Two hard copies with electronic files:

1) Response to the Notice of Disapproval for the Investigation Work Plan for Potrillo and Fence Canyons Aggregate Area (LA-UR-09-4328)
2) Investigation Work Plan for Potrillo and Fence Canyons Aggregate Area, Revision 1 (LA-UR-09-4327)
3) An electronic copy of the redline-strikeout version of the plan that includes all changes and edits to the document
4) Cross-reference table of NMED NOD comments and revisions to Potrillo and Fence Canyons investigation work plan

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Response to the "Notice of Disapproval for the Investigation Work Plan for Potrillo and Fence Canyons Aggregate Area, Los Alamos National Laboratory EPA ID No: NM0890010515, HWB-LANL-09-015," Dated June 23, 2009

INTRODUCTION

To facilitate review of this response, the New Mexico Environment Department's (NMED's) comments are included verbatim. The comments are divided into general and specific categories, as presented in the notice of disapproval. Los Alamos National Laboratory's (LANL's or the Laboratory's) responses follow each NMED comment. This response contains data on radioactive materials, including source, special nuclear, and byproduct material. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with U.S. Department of Energy policy.

GENERAL COMMENTS

NMED Comment

1. *The Permittees must submit the most contaminated sample collected at each site proposed for investigation and/or remediation for analysis of polychlorinated byphenols (PCBs) and dioxins/furans, unless PCB and dioxin/furan sampling is already proposed. The sample selection must be based on field screening and location relative to potential contaminant sources. The Permittees must revise Table 4.0-1 to reflect this change.*

LANL Response

1. The most contaminated sample collected at each site proposed for investigation and/or remediation will be submitted for analysis of polychlorinated biphenyls (PCBs) and dioxins/furans, where PCB and/or dioxin/furan sampling was not already proposed based on operational history of the site. The sample selection will be based on field screening as described in section 5.2 of the work plan and on the location relative to potential contaminant sources. Sections 4.0 and 5.3 have been revised to describe the criteria for collecting these samples, and Table 4.0-1 has been revised to include the additional analyses.

NMED Comment

2. *In Section 5.3.4 and Appendix B of the Plan, the Permittees propose that drill cuttings and any soil removed from excavations will be returned to the borehole or excavation, provided sampling shows that industrial soil screening levels (SSLs) are not exceeded. The Permittees shall not return contaminated media to boreholes or excavations. Therefore, similar to the practices at Technical Area (TA) 21, the Permittees may return only media that does not exceed residential SSLs.*

LANL Response

2. Section 5.3.4 and Appendix B of the work plan have been revised to indicate any soil removed from excavations will be returned to the excavation area if sampling data show it is not hazardous waste

and residential soil screening levels (SSLs) are not exceeded. This approach is consistent with that used at Technical Area 21, which requires that the media not be hazardous waste (i.e., listed) and meet residential SSLs. Appendix B, section B-2.1, states that drilling cuttings may be land-applied if they meet the criteria in the NMED-approved Notice of Intent Decision Tree for Land Application of Investigation Derived Waste Solids from Construction of Wells and Boreholes.

NMED Comment

3. *Throughout the Plan, the Permittees explain that sediment sampling conducted under the approved South Canyons Investigation Work Plan (supplemented where necessary by sampling under this Plan) will be used to determine whether or not contaminants are migrating off-site from solid waste management units (SWMUs) and areas of concern (AOCs) within the Potrillo/Fence aggregate area and which are deferred from investigation per Table IV-2 of the March 1, 2005 Order on Consent (Consent Order).*

   NMED requires that all applicable sediment and stormwater sampling data collected during implementation of the South Canyons Work Plan, be included in the Potrillo and Fence Canyons Aggregate Area Investigation Report (if available).

LANL Response

3. Where applicable and available, data from sediment sampling conducted under the approved South Canyons investigation work plan (LANL 2006, 093713) will be provided and used to determine whether or not contaminants are migrating off-site from the solid waste management units (SWMUs) and areas of concern (AOCs) within the Potrillo and Fence Canyons Aggregate Area that are deferred from investigation per Table IV-2 of the Consent Order. The investigation report for the Potrillo and Fence Canyons portion of the South Canyons investigation is currently due to NMED by August 31, 2011. Section 4.0 of the investigation work plan has been revised to indicate that available sediment data from downstream reaches will be provided and used to evaluate contaminant migration from deferred SWMUs and AOCs. In addition, section 4.0 of the investigation work plan has been revised to indicate that stormwater data collected in Potrillo and Fence Canyons under the Laboratory's National Pollution Discharge Elimination System Individual Permit will be included in the investigation report. Section 6.2 of the investigation work plan also states that available data from site monitoring areas, which monitor stormwater runoff from individual SWMUs and AOCs or groups of SWMUs and AOCs in Potrillo and Fence Canyons will be provided.

SPECIFIC COMMENTS

NMED Comment

1. ***Section 2.3.4, Cleanup Standards, page 3:***

   Permittees' Statement: *"As specified in Section VII.B.1 of the Consent Order, screening levels will be used as soil cleanup levels unless they are determined impracticable or unless values do not exist for the current and reasonably foreseeable future land use."*

   The Permittees must revise the text to cite the proper Consent Order reference: Section VIII.B.1 (Soil Cleanup Levels), rather than Section VII.B.1 (Interim Measures).

LANL Response

1. Section 2.3.4 has been revised to cite Section VIII.B.1 (Soil Cleanup Levels), rather than Section VII.B.1 (Interim Measures) of the Compliance Order on Consent (the Consent Order) for screening levels to be used as soil cleanup levels.

NMED Comment

***2. Section 4.1.13, AOC C-15-004, Former Transformer Station, Proposed Activities, page 29**:*

Permittees' Statement: *"Four samples will be collected from two depths (0-1 ft and 2 to 3 ft bgs) at two locations beneath the former location of the transformer platform to confirm that there is no residual PCB contamination at this site (Figure 4.1-27). All four samples will be analyzed for PCBs only."*

Due to the proximity of the transformer station to the E-F Firing Site, the Permittees must analyze the proposed samples, referenced above, for TAL metals in addition to PCBs. The Permittees must revise Table 4.0-1 to reflect this change.

LANL Response

2. Section 4.1.13 and Table 4.0-1 have been revised to indicate that four samples to be collected at AOC C-15-004 will be analyzed for target analyte list metals and isotopic uranium, in addition to PCBs, to determine if the area was impacted by E-F Firing Site.

NMED Comment

3. Section 5.3.2.3, Hollow-Stem Auger, Borehole Abandonment, page 47:

Permittees' Statement: *"All hollow-stem auger boreholes will be properly abandoned according to the most recent version of SOP-5.03, Monitoring Well and RFI Borehole Abandonment, by one of the following methods."*

The Permittees must abandon all boreholes in accordance with Section X.D of the Consent Order. The Permittees must revise the text to reflect this change. Additionally, the Permittees must revise Table 5.0-1, Summary of Investigation Methods*, to provide a brief description of the proposed borehole abandonment methods (SOP-5.03), in accordance with Section IX.A of the Consent Order.*

LANL Response

3. Section 5.3.2.3 has been revised to indicate the borehole abandonment procedure in SOP-5034 (which has superseded SOP-5.03) meets the requirements of Section X.D of the Consent Order. Additionally, Table 5.0-1 has been revised to include a brief description of the borehole abandonment method contained in SOP-5034, as required by Section IX.A of the Consent Order.

NMED Comment

4. ***Section 5.8.1, Removal of Surficial and Buried Waste, Inactive Units, Contaminated Soil and Sediment; Site Preparation, page 49:***

   The Permittees have included "abandoning monitoring wells" in the general sequence of waste-removal activities in the Portillo and Fence Canyon aggregate. There are no monitoring wells within the immediate vicinity of any sites proposed for remediation. Furthermore, the Permittees are prohibited from abandoning any wells or boreholes without the written approval of NMED. The Permittees must therefore remove this bullet item from the list of Site Preparation activities.

LANL Response

4. The item "abandoning monitoring wells" has been removed from the list of site-preparation activities provided in section 5.8.1 of the work plan.

NMED Comment

5. ***Table 4.0-1, Summary of Proposed Samples and Analyses, pages 127-130:***

   See general comment #1 and specific comment #2.

LANL Response

5. Table 4.0-1 has been revised to address NMED's General Comment 1 and Specific Comment 2. See responses to General Comment 1 and Specific Comment 2.

NMED Comment

6. ***Appendix B, Section B-2.1, Drill Cuttings, page B-2:***

   Permittees' Statement: *"Cuttings may or may not contain residues of drilling additives (e.g., foam) used to promote borehole integrity."*

   Because the deepest borehole proposed by the Permittees is approximately 16 feet below ground surface (bgs), the use of drilling additives will not be necessary. The Permittees must remove this statement from the text.

LANL Response

6. The statement "Cuttings may or may not contain residues of drilling additives (e.g., foam) used to promote borehole integrity…" has been removed from section B-2.1 of Appendix B.

REFERENCES

LANL (Los Alamos National Laboratory), September 2006. "South Canyons Investigation Work Plan," Los Alamos National Laboratory document LA-UR-06-5979, Los Alamos, New Mexico. (LANL 2006, 093713)

LA-UR-09-4327
July 2009
EP2009-0318

Investigation Work Plan for Potrillo and Fence Canyons Aggregate Area, Revision 1

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

LA-UR-09-4327
EP2009-0318

Investigation Work Plan for Potrillo and Fence Canyons Aggregate Area, Revision 1

July 2009

Responsible project leader:

John McCann	[signature]	Project Leader	Environmental Programs	7-14-09
Printed Name	Signature	Title	Organization	Date

Responsible LANS representative:

Michael J. Graham	[signature]	Associate Director	Environmental Programs	7/20/09
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Responsible DOE representative:

David R. Gregory	[signature]	Project Director	DOE-LASO	7/23/09
Printed Name	Signature	Title	Organization	Date

EXECUTIVE SUMMARY

The Potrillo and Fence Canyons Aggregate Area includes a total of 42 solid waste management units (SWMUs) and areas of concern (AOCs) located in Technical Area 15 (TA-15) and TA-36 at Los Alamos National Laboratory. Of these 42 sites, 15 have been previously investigated and/or remediated and have been approved for no further action. For the remaining 27 sites under investigation, 16 are located in TA-15, and 11 are located in TA-36. This investigation work plan identifies and describes the activities needed to complete the investigation of the remaining 27 SWMUs and AOCs. Details of previous investigations and analytical results for the 27 sites included in this work plan are provided in the historical investigation report for the Potrillo and Fence Canyons Aggregate Area.

The sampling strategy proposed in this work plan will be integrated with the data results of the South Canyons investigation to assess potential contaminant migration from sites within the Potrillo and Fence Canyons Aggregate Area. Additional data collected in Potrillo and Fence Canyons under the Laboratory’s National Pollution Discharge Elimination System Individual Permit relevant to Potrillo and Fence Canyons Aggregate Area sites will be included in the report to be submitted following execution of this work plan.

The objective of this work plan is to evaluate the historical data and, based on that evaluation, to propose additional sampling as necessary to define the nature and extent of contamination associated with the SWMUs and AOCs within the Potrillo and Fence Canyons Aggregate Area.

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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 fingerlike mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 and 7800 ft above mean sea level. The location of the Potrillo and Fence Canyons Aggregate Area with respect to the Laboratory technical areas (TAs) is shown in Figure 1.0-1.

The Laboratory's Environmental Programs (EP) Directorate, which includes the former Environmental Restoration (ER) Project, is participating in a national effort by DOE to clean up sites and facilities. The goal of EP is to ensure that past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve this goal, EP 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).

The SWMUs and AOCs addressed in this 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 work activities that will be executed and completed in accordance with the Consent Order.

1.1 Work Plan Overview

The Potrillo and Fence Canyons Aggregate Area includes a total of 42 SWMUs and AOCs located in TA-15 and TA-36 at the Laboratory (Plate 1). Historical details of previous investigations and data for these sites are provided in the historical investigation report (HIR) for the Potrillo and Fence Canyons Aggregate Area (LANL 2009, 105251). Of these 42 sites, 15 have been previously investigated and/or remediated and have been approved for no further action (NFA) status (NFA-approval documents are referenced in Table 1.1-1). Of the remaining 27 sites under investigation, 16 are located in TA-15, and 11 are located in TA-36. This work plan addresses the remaining 27 sites using the information from previous field investigations or removal actions to evaluate current conditions at each site.

Section 2 of the work plan presents the general site information, operational history, and the preliminary conceptual site model of the Potrillo and Fence Canyons Aggregate Area sites. General site conditions are discussed in section 3. Section 4 provides summaries of previous investigations and data collected and presents the scope of proposed activities for each site. The sites within the Potrillo and Fence Canyons Aggregate Area are widespread; therefore, they are organized by TA. Each TA subsection includes background information on operational history; summary of releases; current site use; and status of the sites in the TAs. Section 5 provides investigation methods for proposed field activities. Ongoing monitoring and sampling programs in the Potrillo and Fence Canyons Aggregate Area are presented in section 6. Section 7 is an overview of the anticipated schedule of the investigation and reporting activities.

The references cited in this work plan and the map data sources are provided in section 8. Appendix A of this work plan includes a list of acronyms and abbreviations, a glossary, metric conversion table, and a data qualifier definitions table. Appendix B describes the management of investigation-derived waste (IDW).

1.2 Work Plan Objectives

The objective of this work plan is to determine the nature and extent of releases from the 27 sites.

To accomplish this objective, this work plan

- presents historical and background information on the sites;
- describes the rationale for proposed data collection activities;
- identifies and proposes appropriate methods and protocols for collecting, analyzing, and evaluating data to characterize these sites; and
- identifies and proposes appropriate methods and protocols for remediating select sites.

2.0 BACKGROUND

2.1 General Site Information

TA-15, also known as R-Site, occupies portions of Threemile Mesa on the Pajarito Plateau near the southwestern boundary of the Laboratory (Plate 1). TA-15 occupies approximately 1200 acres and is used for high explosives (HE) research, development, and testing, primarily through hydrodynamic testing and dynamic experimentation. TA-15 contains the Pulsed High-Energy Radiographic Machine Emitting X-rays (PHERMEX) facility, the Dual Axis Radiographic Hydrodynamic Test (DARHT) facility, and building 15-0206, all of which are or were formerly used for testing weapons under development. Other activities at TA-15 include the investigation of weapons functioning and systems behavior in nonnuclear testing.

TA-36, also known as Kappa Site, is located in the Potrillo and Fence Canyons in a remote area near the eastern boundary of the Laboratory (Plate 1). TA-36 has been used from the 1950s to the present. TA-36 consists of a series of firing sites that support explosives experiments. The firing sites and facilities at TA-36 accommodate shipping, receiving, transporting, and testing HE. A total of over 30,000 test shots have been fired at Kappa Site, using an estimated 2200 to 4400 lb of depleted uranium (DU). Initially, the Kappa Site consisted of group offices; four firing sites named Eenie, Meenie, Minie, and Lower Slobbovia; and a storage magazine at Moe. In 1983, the boundary of TA-36 was expanded to incorporate the I-J Firing Site, formerly located in TA-15 (LANL 1993, 015313, p. 2-2).

2.2 Operational History

TA-15 has been used from the mid-1940s to the present for explosives experiments. In that capacity, test explosions ranging from a few kilograms of HE to as much as 650 kg were conducted. These experiments used natural uranium metal, DU metal, lesser quantities of beryllium, and other metals. In most cases, the tests were carried out aboveground, which resulted in the test materials being scattered over areas. Based on Laboratory records, it is estimated that some 75 metric tons of natural uranium and DU have been expended at the TA-15 firing sites since the mid-1940s (LANL 1993, 020946, pp. E2, E9).

2.3 Conceptual Site Model

The sampling proposed in this work plan uses a conceptual site model to predict areas of potential contamination and allow for adequate characterization of these areas. A conceptual site model describes potential contaminant sources, transport mechanisms, and receptors.

2.3.1 Potential Contaminant Sources

Releases at sites within Potrillo and Fence Canyons Aggregate Area may have occurred as a result of air emissions or effluent discharges. Previous sampling results indicate contamination from inorganic chemicals, organic chemicals, and radionuclides (LANL 2009, 105251). Additional sampling is needed to determine the nature and extent of contamination.

2.3.2 Potential Contaminant Transport Mechanisms

Current potential transport mechanisms that may lead to exposure include

- dissolution and/or particulate transport of surface contaminants during precipitation and runoff events,
- airborne transport of contaminated surface soil,
- continued dissolution and advective/dispersive transport of chemical contaminants contained in subsurface soil and tuff as a result of past operations,
- disturbance of contaminants in shallow soil and subsurface tuff by Laboratory operations, and
- disturbance and uptake of contaminants in shallow soil by plants and animals.

2.3.3 Potential Receptors and Pathways

Potential receptors and pathways may include

- Laboratory workers and
- plants and animals both on-site and in areas immediately surrounding the sites.

2.3.4 Cleanup Standards

As specified in Section VIII.B.1 of the Consent Order, screening levels will be used as soil cleanup levels unless they are determined to be impracticable or unless values do not exist for the current and reasonably foreseeable future land use. Soil screening levels (SSLs) for an industrial scenario are presented in Table 2.3-1 for previously detected inorganic and organic chemicals. The screening action levels (SALs) for the industrial scenario are also provided in Table 2.3-1 for previously detected radionuclides.

2.4 Data Overview

Data evaluated in this work plan include historical data collected from 1995 through 2006, as part of Resource Conservation and Recovery Act (RCRA) facility investigations (RFIs) and other corrective actions. In the Sample Management Database, all data records include a vintage code field denoting how and where samples were submitted for analyses.

Samples described in this work plan have undergone analyses at both on-site and off-site laboratories. Because analytical practices and documentation of analyses vary in quality and completeness, analytical data presented are of either screening-level or decision-level data. Screening-level data are appropriate for applications that only require determination of gross contamination areas and/or for general site characterization. Screening-level data are also often used to specify areas where additional data should be collected. Decision-level data are used to quantify the nature and extent of releases and to perform risk assessments. The decision-level data provide supporting information for the investigation activities proposed in the work plan.

Inorganic chemical and radionuclide data from previous investigations were compared with background values (BVs) and fallout values (FVs) (LANL 1998, 059730, p. 6-2). Fallout radionuclides in soil greater than a depth of 6 in. or in rock and organic chemicals are evaluated based on detection status.

This work plan summarizes the available decision-level data (and where appropriate, screening-level data) to determine whether the nature and extent of contamination are defined for each site. In addition, this work plan proposes sampling activities and analytical suites for those sites at which the nature and extent of contamination have not been defined.

3.0 SITE CONDITIONS

3.1 Surface Conditions

3.1.1 Soil

Soil on the Pajarito Plateau was initially mapped and described by Nyhan et al. (1978, 005702). The soil on the slopes between the mesa tops and canyon floors was mapped as mostly steep rock outcrops consisting of approximately 90% bedrock outcrop and patches of shallow, weakly developed colluvial soil. South-facing canyon walls generally are steep and usually have shallow soil in limited, isolated patches between rock outcrops. In contrast, the north-facing canyon walls generally have more extensive areas of shallow, dark-colored soil under thicker forest vegetation. The canyon floors generally contain poorly developed, deep, well-drained soil on floodplain terraces or small alluvial fans (Nyhan et al. 1978, 005702).

The soil in the bottom of Potrillo and Fence Canyons consists of well-drained soil of the Totavi series. The Totavi series consists of deep, well-drained soil that formed in alluvium in canyon bottoms. The surface soil is a brown gravelly loamy sand, or sandy loam, with 15 to 20% gravel. The permeability of this soil is high, runoff is very slow, and erosion hazard rating is low (Nyhan et al. 1978, 005702, p. 31).

The eastern half of the top of Mesita del Potrillo is classified as rock outcrop, mesic land type, which is found on moderately sloping to steep mesa tops and edges and consists of about 65% tuff rock outcrop with small areas of very shallow undeveloped soil. The western half of the top of Mesita del Potrillo consists of very shallow to shallow, well-drained soil of the Hackroy series; a Hackroy rock outcrop complex; moderately deep, well-drained soil of the Nyjack series; and deep well-drained soil of the fine-loamy Typic Eutroboralfs (LANL 1994, 034756, p. 3-23). The surface layer of the Hackroy soils is a brown sandy loam or loam that has medium runoff and moderate erosion hazard. The Hackroy rock outcrop complex has moderate to severe erosion hazard and medium to high runoff (Nyhan et al. 1978, 005702, p. 25). The surface layer of the Nyjack soil is a brown loam, very fine sandy loam, or sandy loam. This soil has moderate permeability, slow runoff, and slight erosion hazard (Nyhan et al. 1978, 005702, p. 25). The surface layer of the fine-loamy Typic Eutroboralfs soils is a very dark grayish brown loam, sandy loam, or very fine sandy loam. This soil exhibits slow runoff and moderate erosion hazard (Nyhan et al. 1978, 005702, p. 32).

3.1.2 Surface Water

Most surface water in the Los Alamos area occurs as ephemeral, intermittent, or interrupted streams in canyons cut into the Pajarito Plateau. Springs on the flanks of the Jemez Mountains, west of the Laboratory's western boundary, supply flow to the upper reaches of Cañon de Valle and to Guaje, Los Alamos, Pajarito, and Water Canyons (Purtymun 1975, 011787; Stoker 1993, 056021). These springs discharge water perched in the Bandelier Tuff and Tschicoma Formation at rates from 2 to 135 gal./min (Abeele et al. 1981, 006273). The volume of flow from the springs maintains natural perennial reaches of varying lengths in each of the canyons.

Mesas of the Pajarito Plateau are generally dry, both on the surface and within the bedrock forming the mesas. The surface water and alluvial groundwater hydrology of the south canyons watersheds is related to several primary factors, including the location and discharge volume of natural and anthropogenic water sources, seasonal events (e.g., snowmelt runoff and stormwater runoff), and general regional climatic conditions. Surface water flow in the south canyons system is generally ephemeral and occurs primarily as short-duration stormwater runoff. Locally persistent surface water has been observed in bedrock pools or where alluvial groundwater discharges from springs or seeps. Intermittent flow also occurs during snowmelt runoff or is associated with the discharge of alluvial groundwater from stream beds. Surface water supports small wetlands in three locations in the south canyons watersheds: in Fishladder Canyon, in S-Site Canyon, and in an additional mesa-top location in TA-16 (USACE 2005, 092220).

Most stream channels that drain the south canyons watersheds are dry for most of the year and are characterized by ephemeral or intermittent flow with only localized areas of perennial flow. In the south canyons watersheds, only Cañon de Valle and Water Canyon support perennial flow. Perennial flow is derived from springs in the eastern Jemez Mountains or the western Pajarito Plateau, but the volume is insufficient to maintain surface flows across the Laboratory before the water is depleted by evaporation, transpiration, and infiltration (LANL 2005, 091523, p. 24). In Water Canyon, snowmelt runoff can extend from the Jemez Mountains to the Rio Grande following heavy winter snowfalls. Stormwater runoff also occasionally extends across the Laboratory to the Rio Grande in the south canyons but is transient and associated with heavy rainfall events.

The mesa-top portion of the Potrillo and Fence Canyons Aggregate Area is currently an industrially developed area. No natural surface water is present in this area. During summer thunderstorms and spring snowmelt, runoff flows from the mesa top down the hillsides and into the ephemeral streams in Potrillo and Fence Canyons. Surface runoff from the mesa top enters both canyons by way of several drainages (LANL 1992, 007672).

Potrillo Canyon has a relatively small drainage area (3.4 mi^2) that originates at TA-15 at an elevation of approximately 7280 ft. The canyon extends southeast from TA-15 to the Rio Grande for a distance of approximately 6.5 mi. Stream flow in Potrillo Canyon is ephemeral and results primarily from natural runoff. The Potrillo Canyon watershed has no perennial springs or tributaries on Laboratory property (LANL 1997, 055622, p. 3-27). Fence Canyon also has a small drainage (1.1 mi^2) that originates near the boundary between TA-36 and TA-68 at an elevation of approximately 7094 ft. The canyon extends southeast before joining Potrillo Canyon in TA-71. Stream flow in Fence Canyon is ephemeral and results primarily from natural runoff. The Fence Canyon watershed has no perennial springs or tributaries on Laboratory property (LANL 1997, 055622, p. 3-27).

3.1.3 Land Use

Currently, land use of the Potrillo and Fence Canyons Aggregate Area is industrial. TA-15 has been used since the 1940s and TA-36 has been used from the 1950s to the present time for explosive experiments. The TAs are remote with small office and Laboratory buildings, utilities, paved and unpaved roads, and firing site structures scattered throughout the area. Most of the sites in this aggregate area are located on the mesa top of Mesita del Potrillo on the northern and southern edges of Potrillo Canyon. The Lower Slobbovia Firing Site, also known as the Skunk Works Firing Site, and three burn pits in central TA-36 are located in Potrillo Canyon. Fence Canyon borders the southern half of TA-36 (Plate 1).

3.2 Subsurface Conditions

3.2.1 Anticipated Stratigraphic Units

The generalized stratigraphy underlying the south canyons watersheds is shown in Figure 3.2-1. The headwaters of Cañon de Valle and Water Canyon occur within dacitic lavas of the Tschicoma Formation (Tt) in the eastern Jemez Mountains (Griggs and Hem 1964, 092516; Smith et al. 1970, 009752), and this unit also occurs at depths beneath the western part of the Laboratory. The mesa-top settings generally consist of Bandelier Tuff (Qbt) overlain by a relatively thin layer of soil. The Bandelier Tuff unit is subdivided into two members: the Otowi and the Tshirege (in ascending order). The Tshirege Member underlies the mesas of the Pajarito Plateau and is a compound cooling unit divided into four distinct cooling units: Qbt 4, 3, 2, and 1v/1g (Broxton et al. 1995, 050121; Broxton and Reneau 1995, 049726; Gardner et al. 2001, 070106). Cooling unit 4 (Qbt 4) is generally the uppermost unit in the western part of the Laboratory. Cooling unit 3 (Qbt 3) is generally the uppermost unit in the central part of the Laboratory, and cooling unit 2 (Qbt 2) is generally the uppermost unit in the eastern part of the Laboratory. Under the mesa tops and locally exposed along canyon walls, the Otowi and Tshirege Members are typically separated by the Cerro Toledo interval (Qct), a sequence of volcaniclastic sediments and primary fallout deposits. The basal Guaje Pumice Bed of the Otowi Member typically separates the Bandelier Tuff from the underlying clastic fanglomerate sediments of the Puye Formation (Tp) or basalts of the Cerros del Rio volcanic field (Tb), which are exposed in canyons in the eastern part of the Laboratory (Griggs and Hem 1964, 092516; Smith et al. 1970, 009752; Dethier 1997, 049843) and have been penetrated in drill holes beneath the Laboratory. Sedimentary rocks of the Santa Fe Group (Tsf) occur beneath the Puye Formation and the Cerros del Rio basalts and are also locally exposed in the easternmost part of the Laboratory near the Rio Grande.

The stratigraphic units underlying the Potrillo and Fence Canyons Aggregate Area from the surface to the regional aquifer are described briefly in the following sections. The descriptions begin with the oldest (deepest) and proceed to the youngest (topmost).

3.2.1.1 Santa Fe Group

The Santa Fe Group is penetrated by water supply wells PM-2 and PM-4, both of which are located north of TAs-15 and -36 in Pajarito Canyon. Based on borehole lithological and geophysical logs, Purtymun (1995, 045344, p. 4) informally divided the Santa Fe Group into three formations, which include (in ascending order) the Tesuque Formation, the Chamita Formation, and a coarse-grained upper facies.

The Tesuque and Chamita Formations are terrestrial sedimentary deposits that filled the Española Basin of the Rio Grande during subsidence in late Tertiary time. The coarse-grained upper facies of the Santa Fe Group was deposited in a late Miocene trough 3 to 4 mi (4.8 to 6.4 km) wide and 7 to 8 mi (11 to 13 km) long that extended northeastward beneath the Pajarito Plateau (see Figure 2-4 in the hydrogeologic workplan [LANL 1998, 059599]). This trough is filled with up to 1500 ft (approximately 450 m) of gravel, cobble, and boulders derived from the Jemez volcanic field and with volcanic, metamorphic, and sedimentary rocks derived from highlands to the north and east. The trough is partly coincident with low gravity anomalies that Ferguson et al. (1995, 056018) interpreted as a sediment-filled graben on the western side of the Española Basin of the Rio Grande rift. The eastern side of this trough crosses Cañada del Buey near state road NM 4. The western margin of the trough is not well constrained but may be located in the western portion of the Laboratory.

3.2.1.1.1 Tesuque Formation

In PM-3, located in Sandia Canyon, the Tesuque Formation primarily consists of poorly consolidated, light pinkish brown, silty sandstone, siltstone, and claystone (Cooper et al. 1965, 008582, p. 52). The sandstones are predominately fine-to-medium-grained, and the sand grains are subrounded to well-rounded.

3.2.1.1.2 Chamita Formation

The Chamita Formation is similar in appearance to the Tesuque Formation but reportedly contains a larger proportion of volcanic and granitic clasts in its gravel layers (Galusha and Blick 1971, 021526, p. 71) and Paleozoic limestone cobbles in its conglomerate layers (Dethier and Manley 1985, 021506). The Chamita Formation contains lithologically distinct quartzitic gravels (Galusha and Blick 1971, 021526, p. 71). Upper layers of the Chamita Formation may contain cobbles of Jemez volcanic rocks, primarily andesites and dacites. However, because of similarities of appearance, obvious time overlaps, and interfingering relations, differentiation of the Chamita Formation from the coarse-grained upper facies of the Santa Fe Group is often difficult, particularly in boreholes. The Chamita Formation was reported to be absent in PM-3 (Purtymun 1995, 045344, pp. 275-277). The coarse-grained upper facies of the Santa Fe Group may be a facies variation of the Chamita Formation.

3.2.1.1.3 Coarse-Grained Upper Facies of the Santa Fe Group

The coarse-grained upper facies of the Santa Fe Group is composed of a mixture of volcanic debris from the Sierra de los Valles and arkosic and granitic debris from the highlands to the north and east of the Pajarito Plateau. Purtymun (1995, 045344, p. 6) called this distinctive group of coarse-grained sediment at the top of the Santa Fe Group the “Chaquehui Formation.” The name “Chaquehui Formation” as related to Santa Fe Group sediment is a potentially confusing designation because the type section of the “Chaquehui Formation” in Chaquehui Canyon is much younger than the coarse-grained upper facies of the Santa Fe Group identified in boreholes on the Pajarito Plateau. The Chaquehui Formation constitutes quartzite clast-bearing maar deposits of the Cerros del Rio volcanic field. In PM-3, the upper coarse-grained facies consists of medium- to coarse-grained sandstone, conglomerate, and siltstone (Purtymun 1967, 011829, p. 9). Because of the high permeability characteristics of this facies, it is an important aquifer for the development of high-yield, low-drawdown municipal and industrial water supply wells on the Pajarito Plateau.

3.2.1.2 Puye Formation, Tschicoma Formation, and Cerros del Rio Basalts

The Puye Formation is mostly a fanglomerate deposit generally consisting of poorly sorted boulders, cobbles, and coarse sands. At PM-3, the clasts are composed of dacite, rhyolite, and fragments of basalt and pumice (Purtymun 1967, 011829, p. 8). At TW-8 (located in Mortandad Canyon), the fanglomerate consists predominately of fine- to coarse-grained sands and interbedded clay, silt, and gravel (Baltz et al.

1963, 008402, Figure 4). The lower fanglomerate includes more than 95 ft (29 m) of light tan to light gray tuff and tuffaceous sand.

The lower Puye Formation includes coarse sand and boulder deposits interpreted to represent an axial facies deposit of the ancestral Rio Grande as described by Manley (1976, 057673) and Dethier (1997, 049843). The axial facies deposit was previously (informally) called the “Totavi Lentil” (Griggs and Hem 1964, 092516). At PM-3, this deposit is composed of gravel and boulders of dacite, rhyolite, and quartzite (Purtymun 1967, 011829, p. 9). The thickness of the axial facies deposit varies from 40 ft (12 m) at PM-4 (located in Cañada del Buey) to 70 ft (21 m) at PM-2 (located in Pajarito Canyon) and PM-5 (located on Mesita del Buey) (Purtymun 1995, 045344, pp. 275–277). The axial facies deposit interfingers with the fanglomerates of the Puye Formation and basaltic rocks of the Cerros del Rio volcanic field in White Rock Canyon.

At PM-2, PM-3, PM-4, and PM-5, a sequence of brown and gray basaltic lava flows split the Puye Formation into the main lower part and a thin upper part (Purtymun 1995, 045344, pp. 275–277). Similar basalts were penetrated in the Puye Formation by other deep boreholes in the area. These basalts are present beneath the Guaje Pumice Bed at PM-2 and PM-4, although variable thickness of fanglomerate facies may be present above the basalts. The basalts are stratigraphically equivalent to the basaltic rocks of the Cerros del Rio volcanic field and probably represent an extension of that volcanic field beneath the Pajarito Plateau.

Dacitic volcanic rocks, presumably representing the distal edge of a Tschicoma Formation lava flow, were encountered beneath the Bandelier Tuff in borehole SHB-1 (located west of TA-55). The dacite flow appears to occupy a similar stratigraphic position within the Puye Formation, as do the basalts. Similar dacite flows may underlie the upper and middle sections of Potrillo and Fence Canyons. However, several deep boreholes drilled to 750 ft (225 m) at TA-46 did not encounter either the dacite or the basalt flows in the upper Puye Formation (Purtymun 1995, 045344, p. 209). This may indicate that the volcanic flows in the Puye Formation do not extend laterally beneath the entire Pajarito Plateau.

The top of the regional zone of saturation beneath the Pajarito Plateau is usually encountered within the fanglomerate facies of the Puye Formation and the associated interbedded basalts. The regional zone of saturation initially was encountered beneath Sandia Canyon at a depth of 722 ft (220 m) in PM-1, 740 ft (225 m) in PM-3, and recently at a depth of 805 ft (245 m) in regional well R-12 (located in lower Sandia Canyon). A possible intermediate perched zone was encountered at a depth of 450 ft (140 m) in basalts within the Puye Formation during the drilling of PM-1. A perched intermediate zone of saturation was encountered from a depth of 443 ft to 519 ft in the lower part of the basaltic rocks of the Cerros del Rio volcanic field and in the underlying old alluvium in well R-12 (Purtymun 1995, 045344; Broxton et al. 1998, 059665).

3.2.1.3 Otowi Member of the Bandelier Tuff

The Otowi Member is a nonwelded, poorly consolidated ignimbrite sheet composed of stacked ash-flow units. These units are composed of pumice lapilli supported by a matrix of ash and crystal fragments. The Otowi Member varies in reported thickness from 184 ft (56 m) in borehole SHB-1 to 465 ft (142 m) in EGH-LA-1 (located in Mortandad Canyon). The deposits of the Otowi Member beneath upper Sandia and middle Mortandad Canyon (near TW-8 and EGH-LA-1) are among the thickest on the Pajarito Plateau from deposition in a pre-Bandelier Tuff paleovalley (see Figure 5 in Broxton and Reneau 1996, 055429, p. 330). The paleovalley containing the thick Otowi Member sediments continues southward across middle Cañada del Buey and Pajarito Canyon.

The Otowi Member outcrops in lower-offsite Sandia Canyon east of state road NM4 and is known to exist in the subsurface beneath the canyons from drill-hole data. The Otowi Member is 320 ft (98 m) thick at PM-4, 140 ft (43 m) thick at PM-3, and 120 ft (37 m) thick at PM-1. The Otowi Member thins eastward against a north-trending basaltic highland that crosses Sandia Canyon and Cañada del Buey near NM 4. The Otowi Member is absent in the lower off-site Sandia Canyon and Cañada del Buey where it either was not deposited or was removed by erosion before the Tshirege Member was deposited.

The basal part of the Otowi Member includes the Guaje Pumice Bed, which is a sequence of well stratified pumice-fall and ash-fall deposits. The Guaje Pumice Bed typically is 30 ft to 35 ft (9.1 m to 10.7 m) thick beneath the Pajarito Plateau (27 ft [8 m] at PM-2). Beneath lower Sandia Canyon, the Guaje Pumice Bed thickens from west to east and is 20 ft (6 m) thick in PM-3 and 45 ft (13.7 m) thick in PM-1 (Purtymun 1995, 045344, pp. 275–276).

3.2.1.4 Tephra and Volcaniclastic Sediment of the Cerro Toledo Interval

Tephra and volcaniclastic sediment of the Cerro Toledo interval are the informal names given to a complex sequence of epiclastic sediment and tephra of mixed provenance (Broxton and Reneau 1995, 049726, p. 11). This unit includes well-stratified tuffaceous sandstones and siltstones, primary ash-fall and pumice-fall deposits, and dacite-rich gravel and boulder deposits. The Cerro Toledo deposits, which vary in thickness from 0 to more than 100 ft (30 m), likely, were deposited episodically with unevenly distributed local deposits. Some sediments are deposited in drainage channels developed on top of the Otowi Member before deposition of the Tshirege Member. Other blanket-type fallout deposits were deposited across the plateau, including on paleotopographic drainage divides. Erosion and possible redeposition of the Cerro Toledo interval sediment and possibly the underlying Otowi Member occurred in places before deposition of the Tshirege Qbt 1 unit, which may have contributed to locally variable thickness. The Cerro Toledo interval is approximately 140 ft (43 m) thick in borehole SHB-1 (Gardner et al. 1993, 012582, p. 9) and approximately 80 ft (24 m) thick in borehole 35-2028 located in Ten Site Canyon (LANL 1996, 054422, p. 2-3).

3.2.1.5 Tshirege Member of the Bandelier Tuff

The Tshirege Member includes a number of subunits that can be recognized based on differences in physical and weathering properties. This work plan follows the nomenclature of (Broxton and Reneau 1995, 049726, p. 8), which was adopted for use as a standard by the former ER Project. Both Purtymun and Kennedy (1971, 004798) and Rogers (1995, 054419) applied different systems of stratigraphic nomenclature to subunits of the Tshirege Member.

Tsankawi Pumice Bed

The Tsankawi Pumice Bed (Qbtt) is the basal pumice outfall deposit of the Tshirege Member. It is composed of angular to subangular clast-supported pumice lapilli up to 2.4 in. in diameter.

Tshirege Member Unit 1g

Tshirege Member unit 1g (Qbt 1g) is the lowermost unit in the thick ignimbrite sheet that makes up most of the Tshirege Member. Qbt 1g is a porous, nonwelded, poorly sorted, vitric ignimbrite. It is poorly indurated but nonetheless forms steep cliffs because a resistant bench near the top of the unit forms a protective cap over the softer underlying tuff.

Tshirege Member Unit 1v

Tshirege Member unit 1v (Qbt 1v) is a series of cliff- and slope-forming outcrops composed of porous, nonwelded, devitrified ignimbriter. The base of the unit is a thin, horizontal zone of preferential weathering that marks the abrupt transition from vitric tuff below to devitrified tuff above. The lower part of Qbt 1v is a resistant orange brown colonnade tuff (Qbt 1v-c) that forms a distinctive low cliff characterized by columnar jointing. The colonnade tuff is overlain by a distinctive white band of slope-forming tuff.

Tshirege Member Unit 2

Unit 2 of the Tshirege Member of the Bandelier Tuff (Qbt 2) forms a distinctive, medium-brown, vertical cliff-forming unit that stands out in marked contrast to the slope-forming, lighter colored tuffs above and below. This unit is devitrified, relatively highly welded, and forms the steep, narrow canyon walls of middle and upper Potrillo and Fence Canyons.

Tshirege Member Unit 3

Unit 3 of the Tshirege Member of the Bandelier Tuff (Qbt 3) is a nonwelded to partially welded, devitrified ignimbrite. The basal part of Qbt 3 consists of a soft, nonwelded tuff that forms a broad, gently sloping bench on the top of Qbt 2 in canyon wall exposures and on broad canyon floors. The upper part of Qbt 3 is a partially welded tuff that forms the caprock on mesas adjacent to upper and middle portions of canyons. This unit is more densely welded to the west and locally contains apparent horizontal bedding and/or fracturing.

3.2.1.6 Alluvium

Alluvium of Pleistocene and Holocene age rests unconformably on the Bandelier Tuff in canyons at the Laboratory. The alluvium in the canyons is derived from weathering of the Bandelier Tuff, which forms the steep walls on the sides of the canyon. The alluvium also contains sediment derived from eolian sources and fallout pumice deposits. In the upper parts of the canyons, the alluvium is thin and consists of gravels, sand, silt, and clay (Devaurs and Purtymun 1985, 007415, p. 11). The sand consists mainly of fine- to coarse-grained crystals of quartz and sanidine. The gravel fraction of the alluvium is composed mostly of low-density tuff clasts that are soft and relatively easily pulverized, and dark, resistant, angular-to-subangular volcanic clasts that are present in the tuff as lithic fragments, and which remain in the alluvium after tuff weathering (Reneau and McDonald 1996, 055538, p. 46).

The alluvium is relatively thin in the upper and middle parts of the canyons but generally widens and thickens downstream. Large boulders of Tschicoma Formation dacite are present within the Cerro Toledo interval. The alluvium downstream from these outcrops may contain some reworked boulders and sediment from this unit.

3.2.2 Hydrogeology

The hydrogeology of the Pajarito Plateau is generally separable in terms of mesas and canyons forming the plateau. Mesas are generally devoid of water, both on the surface and within the rock forming the mesa. Canyons range from wet to relatively dry; the wettest canyons contain continuous streams and contain perennial groundwater in the canyon-bottom alluvium. Dry canyons have only occasional stream flow and may lack alluvial groundwater. Intermediate perched groundwater has been found at certain locations on the plateau at depths ranging between 100 and 400 ft. The regional aquifer is found at depths of about 600 to 1200 ft.

The hydrogeologic conceptual site model for the Laboratory (Collins et al. 2005, 092028) shows that, under natural conditions, relatively small volumes of water move beneath mesa tops because of low rainfall, high evaporation, and efficient water use by vegetation. Atmospheric evaporation may extend into mesas, further inhibiting downward flow.

The hydrogeology of the south canyons watersheds is explained in this subsection in terms of infiltration of surface water; and the type, location, and movement of groundwater. Hydrogeology is described in detail in the Laboratory's Interim Facility-Wide Groundwater Monitoring Plan (IFGMP) (LANL 2008, 101897).

Infiltration is expected to be highly variable spatially and temporally and governed primarily by the location, persistence, and volume of surface water, alluvial storage, and subsurface stratigraphy.

Surface water occurs as snowmelt and rainfall runoff and spring discharge. Rainfall runoff is typically very short-lived, generally lasting from a few hours to several days, and can extend through the full length of a watershed. Snowmelt runoff can be short-lived, associated with abrupt snowmelt events typical of late fall or late winter events, or can extend for several weeks or months associated with snowmelt of deeper snowpack in the upper portions of the watersheds. Springs in the south canyons are often seasonally persistent and create localized surface-water occurrences.

Surface water is hydrologically directly connected to the alluvial groundwater system. Studies elsewhere at the Laboratory indicate that surface water either recharges the alluvium in canyons or can be the expression of alluvial groundwater levels that locally intercept the stream channel elevation (LANL 2004, 087390). Alluvial groundwater is most extensive and persistent in canyons that contain perennial springs or that experience extended periods of snowmelt runoff or effluent discharges, such as Cañon de Valle. Alluvial groundwater loss is likely to be spatially variable and dependent largely on the hydrologic properties of suballuvium stratigraphy. Percolation through the underlying vadose zone likely occurs as matrix flow and possibly through fractures.

3.2.2.1 Groundwater

In the Los Alamos area, groundwater occurs as (1) water in shallow alluvium in some of the larger canyons, (2) intermediate perched groundwater (a perched groundwater body lies above a less permeable layer and is separated from the underlying aquifer by an unsaturated zone), and (3) the regional aquifer. Numerous wells have been installed at the Laboratory and in the surrounding area to investigate the presence of groundwater in these zones and to monitor groundwater quality. The locations of the existing wells within the vicinity of the Potrillo and Fence Canyons Aggregate Area are shown on Plate 1.

3.2.2.1.1 Alluvial Groundwater

Intermittent and ephemeral stream flow in the canyons of the Pajarito Plateau have deposited alluvium that can be as thick as 100 ft. The alluvium in canyons of the Jemez Mountains is generally composed of sand, gravel, pebbles, cobbles, and boulders derived from the Tschicoma Formation and Bandelier Tuff. The alluvium in canyons at the Laboratory is finer grained, consisting of clay, silt, sand, and gravel derived from the Bandelier Tuff.

In contrast to the underlying volcanic tuff and sediment, alluvium is relatively permeable. Ephemeral runoff in some canyons infiltrates the alluvium until downward movement is impeded by the less permeable tuff and sediment, which results in the buildup of a shallow alluvial groundwater body. Depletion by evapotranspiration and movement into the underlying rock limit the horizontal and vertical extent of the alluvial water (Purtymun et al. 1977, 011846). The limited saturated thickness and extent of the alluvial groundwater preclude its use as a viable source of water for municipal and industrial needs. Lateral flow of the alluvial perched groundwater is in an easterly, downcanyon direction (Purtymun et al. 1977, 011846).

There is only one known occurrence of alluvial groundwater in Potrillo Canyon. It was detected during the installation of moisture access hole POTM-2 in 1989 in the upper-middle part of the canyon (Becker 1991, 015317). Several other boreholes have been drilled near this area to define the extent of the groundwater found in POTM-2 but all are dry. Information about the occurrence of alluvial groundwater in Potrillo Canyon is limited to the part of the canyon from 0.2 mi upstream of the discharge sink to 1 mi downstream of the discharge sink (LANL 1998, 059599). No other investigations have been conducted to date. Potrillo Canyon has been the focus of some of the most detailed near-surface characterization activities at the Laboratory. A partial list of subsurface instrumentation already installed within or adjacent to the discharge sink includes three neutron moisture access tube clusters and two multi-level observation wells. These stations monitor the vertical moisture movement and the occurrence of saturation within the discharge sink (the observation wells have remained dry since their installation in 1991). Monitoring results from these holes and data from additional surface water and sediment monitoring activities will be evaluated to guide the design, placement, and number of additional wells needed to characterize this site (LANL 1998, 059599).

In 1989, three shallow moisture-access holes (POTM-1, POTM-2, and POTM-3) were drilled in Potrillo Canyon near the Lower Slobbovia firing site to investigate the infiltration of surface water into the alluvium in an area where the channel stops (a discharge sink) (Becker 1993, 015317). POTM-1 and POTM-3 were located upgradient and downgradient, respectively, of this area and typically encountered low moisture levels (Plate 1). POTM-2 was located within the area where surface water is lost to infiltration; moisture logs following runoff events showed nearly uniform moisture content with depth, indicating very rapid infiltration perhaps on the order of hours (Becker 1993, 015317, p. 51). Moisture did not appear to be retained in the profile down to 49 ft but appeared to be percolating to deeper depths. A 1989 seismic survey revealed a subsurface feature interpreted to be an underlying fault and a possible cause of the loss of water in this area (Becker 1993, 015317, p. 228), although no faults are visible in adjacent outcrops. Two deeper holes were cored in Potrillo Canyon in 1991 and completed as observation wells (Purtymun 1995, 045344, p. 331). One well had three zones at various depths (POTO-4A, POTO-4B, and POTO-4C) separated from each other by bentonite and cement. The second well was constructed with two zones (POTO-5A and POTO-5B). The zones were packed with sand. The moisture-access holes and wells were completed as part of a study to determine whether there was recharge to the alluvium and underlying tuff and transport of depleted uranium from the intermittent stream in Potrillo Canyon in TA-36 (Becker 1993, 015317). The wells were installed to study the chemistry and radiochemistry of infiltrating water at different depths (Purtymun 1995, 045344, p. 331). Borehole PCTH-1 was drilled in Potrillo Canyon near NM 4 in October 1989 as a Special Conditions requirement of the Laboratory's Hazardous Waste Facility Permit (HWFP) for the monitoring of perched groundwater zones. PCTH-1 was cored to a depth of 74 ft below ground surface (bgs) and penetrated a thin soil zone and a thick section of weathered to unweathered tuff. The entire section was dry and indicated no presence of past water. The hole was abandoned and plugged (Purtymun and Stoker 1990, 007508, pp. 1, 6).

A single alluvial well, FCO-1, was installed in the Fence Canyon watershed near NM 4 as a special conditions requirement of the Laboratory's HWFP for monitoring perched groundwater zones (Plate 1). It was drilled in August 1989 to a depth of 29 ft and completed to a depth of 15 ft (Purtymun and Stoker 1990, 007508, pp. 1, 7; Purtymun 1995, 045344, p. 150). To date, water has not been encountered in well FCO-1 (LANL 2006, 093713, pp. 74–76).

3.2.2.1.2 Perched Intermediate Waters

Observations of perched intermediate water are rare on the Pajarito Plateau. Perched intermediate waters are thought to form mainly at horizons where medium properties change dramatically, such as at paleosol horizons containing clay or caliche. It is not known whether perched intermediate water bodies are isolated or connected and to what degree they may influence travel times and pathways for contaminants in the vadose zone.

No perched intermediate groundwater has been encountered to date in Potrillo and Fence Canyons (LANL 2006, 093713, pp. 70–76).

3.2.2.1.3 Regional Groundwater

The regional aquifer is the only aquifer capable of large-scale municipal water supply in the Los Alamos area (Purtymun 1984, 006513). The surface of the regional aquifer rises westward from the Rio Grande within the Santa Fe Group into the lower part of the Puye Formation beneath the central and western part of the Pajarito Plateau. The depths to groundwater below the mesa tops range between about 1200 ft along the western margin of the plateau and about 600 ft at the eastern margin. The location of wells and generalized water-level contours on top of the regional aquifer are described in the 2007 General Facility Information report (LANL 2007, 095364). The regional aquifer is typically separated from the alluvial groundwater and intermediate perched zone groundwater by 350 to 620 ft of tuff, basalt, and sediment.

The regional aquifer is a complex, heterogeneous system that includes confined and unconfined zones. The degree of hydraulic communication between these zones is thought to be spatially variable. The shallow portion of the regional aquifer (near the water table) is predominantly under phreatic (unconfined) conditions and has limited thickness (approximately 30 to 50 m [98 to 164 ft]). Groundwater flow and contaminant transport directions in this zone generally follow the gradient of the regional water table; the flow is generally east/southeastward. The direction and gradient of flow at the regional water table are predominantly controlled by areas of recharge (e.g., the Sierra de los Valles and variably within some Pajarito Plateau canyons) and discharge (White Rock Canyon springs and the Rio Grande). The deep portion of the regional aquifer is predominantly under confined conditions, and it is stressed by Pajarito Plateau water-supply pumping. The pumping likely has a small impact on the flow directions in the phreatic zone because of poor hydraulic communication (LANL 2007, 098938, p. 7).

Actively monitored regional aquifer wells in the south canyons system include wells CdV-15-3, CdV-37-2, R-19, R-18, R-25, R-26, and R-27 in the Water Canyon and Cañon de Valle watersheds, and test wells DT-5A, DT-9, and DT-10 in the Ancho Canyon watershed. Locations of the regional aquifer wells are shown on Plate 1.

Regional characterization well R-19 is located on Potrillo Mesa between Threemile and Potrillo Canyons, east of the I-J Firing Site at TA-36 and is designed to provide water-quality and water-level data for potential intermediate-depth perched zones and for the regional aquifer downgradient of HE release sites at TA-16 (Plate 1). The regional water table was found at a depth of 1178 ft, 60 ft deeper than expected (Broxton et al. 2001, 071254, pp. xi, 37). Notable differences between the predicted and as-drilled stratigraphy are the greater thickness of the Cerro Toledo interval (266 ft), the lesser thickness of the Otowi Member of the Bandelier Tuff (194 ft), the thinner sequence of Cerros del Rio basalts (135 ft), the absence of axial facies river gravels (Totavi) at the base of the Puye Formation, and the occurrence of unassigned pumiceous sedimentary deposits in lieu of Santa Fe Group sedimentary deposits (Broxton et al. 2001, 071254, pp. 7–8). The most significant observation from well R-19 for the conceptual hydrologic model is that the thick perched zone of saturation encountered at well R-25 was not present at either well R-19 or well CdV-R-15-3. In fact, the occurrence of any perched water at these wells is uncertain. If such saturation is present, it is markedly thinner than at well R-25, which indicates limited potential for transport through perched water from the well R-25 area across the area of well R-19. Head data collected within the regional zone of saturation at well R-19 indicate a downward vertical gradient, confirming the existing conceptual model that well R-19 is located in a recharge area. Hydrologic testing of pre-Puye Formation deposits (not previously available) yielded hydraulic conductivity values that are consistent with those for medium sand or silty sand (Broxton et al. 2001, 071254, p. 56).

Well CdV-R-15-3 is located at TA-15 near the head of Potrillo Canyon, approximately 800 ft east of the northeast rim of Cañon de Valle (Plate 1). Well CdV-R-15-3 was drilled in the spring of 2000 as part of the corrective measures study for Consolidated Unit 16-021(c)-99 to determine if the HE contamination that has been detected in the perched and regional aquifers of well R-25 (located in TA-16) extends to the east (Kopp et al. 2002, 073179). The top of the regional zone of saturation was found to lie at a depth of 1245 ft bgs in the Puye Formation fanglomerate (Kopp et al. 2002, 073179, p. xii). Unanticipated stratigraphic features at well CdV-R-15-3 included a thick (220 ft) Cerro Toledo interval and the absence of axial river gravels of the Puye Formation and Santa Fe Group sediments, similar in trend to the stratigraphic observations at well R-19. In addition, well CdV-R-15-3 provided the westernmost known occurrence of the Cerros del Rio basalts beneath the Pajarito Plateau. The unexpected occurrence of a basaltic debris flow beneath the Cerros del Rio lava indicates very active erosional processes along the western margin of the Cerros del Rio volcanic field. The Puye Formation is much thicker and more varied beneath this portion of the Pajarito Plateau than had been previously suspected (Kopp et al. 2002, 073179, p. xi).

4.0 SITE DESCRIPTIONS AND PROPOSED INVESTIGATION ACTIVITIES

The following sections present site descriptions, summaries of previous investigation activities, proposed sampling activities, and proposed remedial activities. Table 4.0-1 summarizes the investigation strategy for each SWMU or AOC, including the analytical methods for site-characterization activities proposed in this work plan.

The Potrillo and Fence Canyons Aggregate Area has been disturbed as a result of many years of new construction and demolition of former structures and historical and on-going firing-site activities. Before sampling is conducted, geodetic and geophysical methods in conjunction with radiological surveys may be used to verify specific SWMU and AOC boundaries. The sampling locations proposed in this work plan may be relocated as a result of these surveys; however, the overall sampling strategy will remain the same.

Eleven sites [SWMUs 15-002, 15-004(b), 15-004(c), 15-004(f), 15-009(e), 36-003(b), and 36-005 and AOCs 15-005(b), C-15-004, C-15-005, and C-15-006] are proposed for characterization. Five sites [SWMUs 15-007(a), 15-008(a), 15-010(a), 36-001, and 36-006] are proposed for cleanup under this investigation work plan. Cleanup levels proposed for the sites to be remediated are presented in Table 2.3-1.

A limited sampling campaign is proposed for SWMUs 15-003, 15-006(a), and 36-004(d) and AOCs 15-008(f), 36-004(a), 36-004(b), and 36-004(e). These SWMUs and AOCs are deferred sites listed on Table IV-2 of the Consent Order. Continued explosives testing at AOCs 36-004(c), C-36-001, and C-36-006(e) makes any determination of nature and extent obsolete as soon as the next firing activity occurs. AOC 36-004(c) is also an active open detonation (OD) site. Therefore, it is proposed that full characterization of these three sites be delayed until firing operations cease. At that time, the collection of definitive data is possible and will allow for the selection of the most appropriate corrective action for these sites. This work plan proposes an interim sampling strategy to determine if contaminants are migrating from any of the deferred or delayed sites.

One sample will be collected at each SWMU and AOC where PCB and/or dioxin/furan analysis is not already proposed and will be submitted for analysis of PCBs and dioxins/furans (Table 4.0-1). The sample selection will be based on field screening and location relative to potential contaminant sources. Section 5.3 describes the criteria for collecting the additional samples.

The approved South Canyons investigation work plan addresses sources of contamination and the nature and extent of contamination in sediment, surface water of active stream channels, and groundwater beneath canyon floors (LANL 2006, 093713; NMED 2007, 095490). The South Canyons investigation includes sampling and analysis of media from the watersheds associated with Potrillo and Fence Canyons and representative sections of their reaches. Four reaches have been identified in Fence Canyon (F-1, F-2, F-3, and FS-1) and five reaches have been identified in Potrillo Canyon (PO-1, PO-2, PO-3, PO-4, and POS-1) (Plate 1). (Reaches F-3 in Fence Canyon and PO-4 in Potrillo Canyon are located directly north of NM 4 in the drainage channel for each canyon; because these locations are approximately 1 mi east of the Potrillo and Fence Canyons Aggregate Area, they are not shown on Plate 1.) For the Potrillo and Fence Canyons Aggregate Area, the South Canyons investigation work plan proposes collecting 10 sediment samples in each reach. If necessary, subsequent sampling is generally limited to chemicals of potential concern (COPCs) identified during the initial sampling and analysis. Subsequent investigations may include additional sampling in previously investigated reaches or full investigations of new reaches, contingent on the results of the initial sampling and analysis. Analytical suites for these reaches include perchlorate, target analyte list (TAL) metals, cyanide, pesticides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbon (PAHs), semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), radionuclides, and explosive compounds (LANL 2006, 093713, p. 14). Sediment sampling for the South Canyons approved work plan will begin in 2010 and data from Potrillo and Fence Canyons will be reported in the Potrillo and Fence Canyons investigation report, due to NMED in August 2011. Canyons investigation sediment data from reaches downstream of sites where investigation has been deferred per Table IV-2 of the Consent Order available at the time the Potrillo and Fence Canyons Aggregate Area investigation report is being prepared will be provided and evaluated to determine the extent of contaminants migrating from these sites. In addition, available stormwater data collected in Potrillo and Fence Canyons under the Laboratory's National Pollution Discharge Elimination System Individual Permit relevant to Potrillo and Fence Canyons Aggregate Area sites will be included in the investigation report.

4.1 TA-15

TA-15, also known as R-Site, occupies portions of Threemile Mesa on the Pajarito Plateau near the southwestern boundary of the Laboratory in a roughly rectangular area approximately 1.3 mi wide by 1.5 mi long. TA-15 is bounded by TA-66 and TA-67 to the north, TA-14, TA-16, TA-37, and TA-49 to the west and south, and TA-36 to the east. The eastern portion of TA-15 is located within the Potrillo and Fence Canyons Aggregate Area; Potrillo Canyon intersects the eastern half of TA-15 (Plate 1). Sites to be investigated at TA-15 include drainages downgradient of active firing sites, one inactive landfill, two surface disposal sites, four former firing sites, two former septic systems, one former storage area, one former transformer platform, and two former building locations.

Samples collected for TA-15 and analyses requested for decision-level data are presented in Table 4.1-1. Decision-level data are presented in Tables 4.1-2, 4.1-3, and 4.1-4. All laboratory analytical data (both decision-level and screening-level) are also provided in Appendix B of the HIR (LANL 2009, 105251).

Figures 4.1-1 to 4.1-31 include base maps, maps showing inorganic chemicals and radionuclides detected or detected above BVs/FVs and detected organic chemicals, and maps showing the proposed sampling locations for the TA-15 sites.

4.1.1 SWMU 15-002, Burn Pit

Site Description

SWMU 15-002 is described in the 1990 SWMU report as an inactive burn pit west of E-F Firing Site (LANL 1990, 007512, p. 88). The burn pit was surrounded on three sides by a 3-ft-high, 10-ft-diameter earthen berm (LANL 1993, 020946, p. 8-28). A recent review of engineering drawings and aerial photographs demonstrates that SWMU 15-002 actually consists of two former burn pits. The burn pit originally identified in the 1990 SWMU report is located south of building 15-0534 (Figure 4.1-1). The second burn pit is located east of former buildings 15-0001 and 15-0023. Together with SWMU 15-007(a), this SWMU comprises Consolidated Unit 15-002-00 (Table 1.1-1).

The originally identified pit is shown on a 1948 engineering drawing (ENG C-15208) and aerial photographs taken between 1946 and 1974 (LASL 1946, 015400; LASL 1948, 105275; LASL 1958, 015825; LASL 1974, 017204). The 1948 aerial photograph shows a bermed area surrounding the pit on three sides (north, west, and south). A small dirt road led to this bermed area. Aerial photographs taken in 1958 still show the bermed area; however, in the photograph the road appears not to have been used for some time and is overgrown with vegetation, indicating the burn site was no longer used (LASL 1958, 015825). Although former employees were not able to provide the exact location for this pit, they described this burn pit as sites used to burn oil/uranium mixtures and HE (DOE 1986, 036409, p. TA15-7).

Engineering drawings ENG-C 1481 and SK-1301 show a second burn pit east of former buildings 15-0001 and 15-0023 (LASL 1951, 105277; LASL 1951, 105278).

Previous Investigations

An aerial radiological survey conducted in 1982 by EG&G Energy Measurements detected no radionuclides at levels above background at the location of the originally identified burn pit south of building 15-0534 (LANL 1993, 020946, p. 8-28).

A Phase I RFI was conducted at the location of the burn pit south of building 15-0534 in 1995 and 1996. Phase I activities consisted of performing a radiological survey of the site and collecting a surface (0 to 0.5 ft bgs) and subsurface (1.5 to 2.0 ft bgs) sample at each of two locations from within the pit (LANL 1996, 054977, pp. 5-6–5-8). All four samples were analyzed for uranium, metals, and SVOCs, and the two subsurface samples were also analyzed for VOCs. All data collected during the Phase I RFI are screening-level data and are not presented in this work plan; however, the data showed isotopic thorium detected above BVs, inorganic chemicals above BVs, and detected VOCs. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251).

Proposed Activities

The extent of contamination has not been defined at this site. Fifteen samples will be collected from five locations at each former burn pit, one in the center of each pit and four step-out locations around each pit, to define nature and extent of contamination (Figure 4.1-2). The samples will be collected from three depths at each location (0 to 1.0 ft, 3.0 to 4.0 ft, and 6.0 to 7.0 ft bgs). Samples collected from SWMU 15-002 will be field screened for radioactivity, VOCs, and explosive compounds. If field-screening results indicate elevated levels in the deepest sample, sampling will continue until field-screening results show no elevated levels. Samples will be analyzed for VOCs, SVOCs, dioxins/furans, metals, cyanide, nitrate, perchlorate, explosives compounds, isotopic uranium, isotopic thorium, and total petroleum hydrocarbons (TPH). Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.2 SWMU 15-007(a), MDA N

Site Description

SWMU 15-007(a) is an inactive landfill known as Material Disposal Area (MDA) N. MDA N is located west of buildings 15-0563 and 15-0565 and east of R-Site Road (Figure 4.1-3). Together with SWMU 15-002, this SWMU comprises Consolidated Unit 15-002-00 (Table 1.1-1). MDA N is approximately 300 ft long × 30 ft wide (LASL 1974, 038450). MDA N was used for the disposal of debris from the demolition of buildings 15-0001 and 15-0007 between 1962 and 1965 (LANL 1993, 020946, p. 9-2). Building 15-0001 housed a laboratory and shop, and building 15-0007 housed a control room and darkroom. Hazardous materials known to be present in these buildings included thorium in building 15-0001 and mercury and photographic chemicals in building 15-0007. Based on a 1965 aerial photograph, MDA N was closed by 1965 (LASL 1965, 016374).

Previous Investigations

An aerial radiological survey of SWMU 15-007(a) was conducted in 1982. The survey identified no radiation above background at this site (LANL 1993, 020946, p. 9-2).

A Phase I RFI was conducted at SWMU 15-007(a) in 1995 and 1996. Sampling was preceded by a surface radiological survey and geophysical surveys (magnetometry, electromagnetic [EM], and resistivity) intended to define the boundaries of the landfill. One surface and two subsurface samples were collected from each of seven locations identified based on the results of the geophysical surveys (LANL 1996, 054977, pp. 5-11, 5-16). Twenty-two samples were collected from seven locations from depth intervals ranging from 0 to 0.5 to 50.0 to 56.0 ft bgs. Thirteen samples were analyzed for isotopic thorium, uranium, metals, VOCs, and SVOCs. Phase I RFI data were determined to be screening-level data and are not presented in this work plan. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251).

Based on a review of the 1951 TA-15 Structure Location Plan and engineering drawing ENG-R4470, MDA N was determined to be located east-southeast of former building 15-0023, not to the north as concluded from the previous geophysical survey (LASL 1951, 105389; LASL 1974, 038450). Therefore, the 1995 and 1996 RFI sampling for MDA N was conducted at the incorrect location, and the samples are not representative of this site.

Proposed Activities

SWMU 15-007(a) is proposed for remediation. Preliminary site activities will include a surface radiological survey and geophysical surveys (magnetometry, EM, and resistivity), followed by the excavation of test pits and trenches to locate and define the landfill boundaries. Remediation activities will involve waste characterization, waste and soil/fill excavation, segregation, containerization, transportation, off-site disposal, confirmation sampling, and backfilling and site restoration. The methodology to meet waste disposition requirements is described in Appendix B and will be further detailed in the investigation report. Proposed cleanup activities are summarized in section 5.8 of this work plan. Historical information and dimensions of similar landfills indicate the waste from the demolition of former buildings 15-0001 and 15-0007 is buried in a trench that is likely between 10 ft and 12 ft deep. Once located and characterized, all visible waste and stained soil and/or tuff will be removed from the landfill and the bottom and sides of the excavation and surveyed for radiation, explosive compounds, metals, and VOCs. Additional media will be excavated until field-screening results indicate no elevated levels.

Confirmation samples will be collected within and next to the excavation boundaries to confirm cleanup and to define the nature and extent of any residual contamination. Proposed sampling locations are shown in Figure 4.1-4. Eight samples will be collected from two depths (0 to 1.0 ft and 4.0 to 5.0 ft) at four locations beneath the bottom of the excavation. Twelve characterization samples will be collected from depths of 4.0 to 5.0 ft and 14.0 to 15.0 ft bgs (assuming a total landfill excavation depth of 12 ft bgs) at two step-out sampling locations on each side of the landfill excavation and one step-out sampling location at each end of the landfill excavation. Step-out sampling locations will be 6 ft from the edge of the landfill excavation. Samples will be analyzed for isotopic uranium, isotopic thorium, cyanide, nitrate, perchlorate, VOCs, SVOCs, explosive compounds, and metals; the final analytical suite will be confirmed and supplemented, if necessary, with waste characterization data. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.3 SWMU 15-003, PHERMEX Steel Firing Pad

Site Description

SWMU 15-003, a steel firing pad located within the PHERMEX firing site [SWMU 15-006(a)] (Figure 4.1-5), is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). Together with SWMU 15-006(a) (also deferred), this SWMU comprises Consolidated Unit 15-003-00. SWMU 15-003 consists of a 6-in.-thick steel pad approximately 12 ft wide × 24 ft long (LANL 1990, 007512, p. 68).

Although the SWMU 15-003 steel firing pad was originally intended for the treatment of hazardous explosive waste by OD and had been granted a RCRA interim status designation under hazardous waste regulations, the steel pad was never actually used to treat hazardous explosives waste. Additionally, the operating division determined that this unit was not needed for future waste-treatment activities. Therefore, in 1998, the Laboratory requested that this unit be withdrawn from the Laboratory's Part B application as an OD site, and NMED concurred (LANL 1998, 087452; DOE 1999, 063048; NMED 1999, 065076).

The steel pad was used for nontreatment-related experimental test shots (LANL 1998, 087452). The exact dates of use of the steel pad are not known; however, operations at the PHERMEX facility began in approximately 1961 (LANL 1993, 020946, p. 6-3).

Previous Investigations

Past environmental surveys at the PHERMEX firing site include an aerial radiological survey conducted in 1982 that identified elevated levels of uranium-238. A 1991 surface radiation survey identified elevated contact exposure rates believed to be associated with chunks of DU at the PHERMEX firing site (LANL 1993, 020946, p. 6-5). No RFI sampling has been conducted at SWMU 15-003.

Proposed Activities

Although SWMU 15-003 is deferred for investigation per Table IV-2 of the Consent Order, 10 samples will be collected from sediment catchments at five locations in the drainage downgradient of the site to determine if contaminants are migrating from the site (Figure 4.1-6). The samples will be collected from two depths (0 to 1.0 ft and 2.0 to 3.0 ft bgs) and analyzed for cyanide, nitrate, perchlorate, metals, explosive compounds, VOCs, SVOCs, isotopic uranium, isotopic plutonium, and gamma spectroscopy. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.4 SWMU 15-006(a), PHERMEX Firing Site

Site Description

SWMU 15-006(a), the PHERMEX firing site (Figure 4.1-5), is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). Together with SWMU 15-003 (also deferred), this SWMU comprises Consolidated Unit 15-003-00. The PHERMEX firing site consists of a firing chamber (structure 15-0184) and related equipment. The PHERMEX firing site and associated facilities were built in the early 1960s (LANL 1993, 020946, p. 2-3).

Previous Investigations

Past environmental surveys at the PHERMEX firing site include an aerial radiological survey conducted in 1982 that identified elevated levels of uranium-238. A 1991 surface radiation survey identified elevated contact exposure rates believed to be associated with chunks of DU at the PHERMEX firing site (LANL 1993, 020946, p. 6-5). No RFI sampling has been conducted at SWMU 15-006(a).

Proposed Activities

Stormwater runoff from SWMUs 15-003 and 15-006(a) flows to the same drainage; therefore, data from the 10 sediment samples to be collected for SWMU 15-003 will be used to determine if contaminants are migrating from SWMU 15-006(a) (see section 4.1.3).

4.1.5 SWMUs 15-004(b) and 15-004(c), Firing Sites A and B

Site Description

SWMU 15-004(b) is inactive Firing Site A located approximately 400 ft southeast of building 15-0183, and SWMU 15-004(c) is inactive Firing Site B located approximately 600 ft southeast of building 15-0183 (Figure 4.1-7). Both SWMUs comprise Consolidated Unit 15-004(b)-99 (Table 1.1-1). Firing Sites A and B are located approximately 100 ft apart. Firing site A was among the first firing sites to be used at the Laboratory and operated from 1945 to 1953. Aerial photographs taken in 1958 show that the areas of land cleared of vegetation and affected by explosives at these two firing sites were relatively small and located approximately 400 ft south of the bunker (former structure 15-0014) and control building (former building 15-0074) associated with Firing Sites A and B (LASL 1958, 015826). Both firing sites and associated structures were decommissioned and the ground surface was regraded in 1967. Before they were decommissioned, the bunker (former structure 15-0014) and the control building (former building 15-0074) were surveyed and were found to contain no detectable levels of HE or radionuclides (Buckland 1965, 005305; Courtright 1965, 005282).

Information is limited concerning the materials used in tests at Firing Sites A. Most of the experiments conducted at SWMU 15-004(b) involved small amounts of HE (i.e., up to 50 lb). Tests involving larger quantities of HE were conducted at Firing Site B, SWMU 15-004(c) (LANL 1995, 050294, p. 4-3). Other materials used as Firing Sites A and B include natural uranium, beryllium, lead, mercury, and HE. The amount of uranium used in any one test was a few kilograms (LANL 1993, 020946, p. 8-5).

Previous Investigations

Past environmental surveys at this site include an aerial radiological survey conducted in 1982 that identified background levels of radiation (LANL 1993, 020946, p. 8-5).

Because of their close proximity, SWMUs 15-004(b) and 15-004(c) were investigated as a combined area during the 1994/1995 Phase I RFI (LANL 1995, 050294, pp. 4-3–4-12). Four samples were collected from two depths (0 to 0.5 ft and 1.5 to 2.0 ft bgs) from two locations at SWMU 15-004(b), and four samples were collected from two depths (0 to 0.5 ft and 1.5 to 2.0 ft bgs) from two locations at SWMU 15-004(c); the samples were analyzed for uranium and metals. Based on the analytical results, the RFI report recommended that an expedited cleanup be implemented at SWMU 15-004(b) to remove lead contamination (LANL 1996, 054977, p. 4-12). The data collected during the 1994/1995 investigation activities are screening-level data and are not presented in this work plan; however, RFI activities and results were presented in the RFI report (LANL 1995, 050294, pp. 4-3–4-12). Screening-level data showed inorganic chemicals detected above BVs and cesium-137 and europium-152 detected or detected above the FVs.

A voluntary corrective action (VCA) was conducted at SWMU 15-004(b) in 1996 to determine the extent of lead contamination at the site and to remove soil with lead above the Laboratory-adopted lead preliminary remediation goal (PRG) of 1000 mg/kg (LANL 1996, 055046). A photograph discovered after the Operable Unit (OU) 1086 RFI work plan was submitted indicated the firing site was located farther west than the location described in the work plan (LANL 1993, 020946, p. 8-6). The VCA sampling locations were adjusted to reflect the revised location of the site. The VCA consisted of x-ray fluorescence (XRF) sampling to determine the extent of lead contamination and HE spot testing. Based upon these results and the Phase I RFI results, soil was removed until the lead concentrations met the 1000 mg/kg PRG. Five confirmation soil samples were collected and submitted for laboratory analysis of metals, HE and isotopic uranium; one sample also was analyzed for toxicity characteristic leaching procedure (TCLP) metals for waste characterization purposes (LANL 1996, 055046, p. 8). Confirmation samples collected following the 1996 VCA and the analyses requested are presented in Table 4.1-1.

Decision-level data from the VCA are presented in Table 4.1-2, which shows inorganic chemicals detected above BVs or having detection limits above BVs. Sampling locations and results for inorganic chemicals detected above BVs are shown in Figure 4.1-8.

Inorganic chemicals detected above BVs included barium, cadmium, cobalt, copper, lead, and zinc. Barium was detected above the maximum soil background concentration (410 mg/kg; LANL 1998, 059730) in two samples and above the soil BV but below the maximum soil background concentration in one sample. Cadmium was detected above the soil BV but below the maximum soil background concentration (2.6 mg/kg; LANL 1998, 059730) in two samples and above the maximum soil background concentration in one sample. Cobalt was detected above the soil BV but below the maximum soil background concentration (9.5 mg/kg; LANL 1998, 059730) in one sample. Copper was detected above the maximum soil background concentration (16 mg/kg; LANL 1998, 059730) in three samples, and lead was detected above the maximum soil background concentration (28 mg/kg; LANL 1998, 059730) in four samples. Zinc was detected above the soil BV but below the maximum soil background concentration

(75.5 mg/kg; LANL 1998, 059730) in two samples. Antimony, mercury, silver, and thallium were not detected above the soil BVs but had detection limits above BVs.

Review of historical aerial photographs during the preparation of the HIR and this work plan revealed that the locations of Firing Sites A and B [SWMUs 15-004(b) and 15-004(c)] are south of the areas investigated during the 1995 and 1996 RFIs and the 1996 VCA (LANL 2009, 105251). The RFI and VCA were conducted near the former control building (former building 15-0074) and former bunker (former structure 15-0014), approximately 400 ft north of the actual locations of the two former firing sites. Therefore, the results from samples collected during the 1995 and 1996 RFIs and 1996 VCA are not representative of the former firing site locations.

Proposed Activities

The nature and extent of contamination have not been defined at the two former firing sites or around the former control room and bunker. The sites of former Firing Sites A and B will be located in the field based on historical aerial photographs. A grid (100 ft × 100 ft grid points) will be established over the entire area around the former control building and bunker locations (north to the road, east across the road, and west past the fence) and south to include the two firing points and the area around the firing points to the mesa edge approximately 200 ft south of the firing points (Figure 4.1-9). Radiological, XRF, and D TECH HE surveys will be conducted at grid locations across the site. Samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at a minimum of 12 random locations across the site, at locations with elevated screening results, and from one location at each of the former firing sites. The samples will be analyzed for cyanide, nitrate, perchlorate, metals, explosive compounds, VOCs, SVOCs, isotopic uranium, gamma spectroscopy, and americium-241. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.6 SWMU 15-004(f), E-F Firing Site

Site Description

SWMU 15-004(f) is an inactive firing site, E-F Firing Site, that consists of three inactive firing points (D, E, and F) covering a total area of approximately 60 acres (Figure 4.1-10). Together with SWMU 15-008(a), SWMU 15-004(f) comprises Consolidated Unit 15-004(f)-99 (Table 1.1-1). E-F Firing Site began operating in 1946 and was last used in 1981. It was operated extensively from 1947 to 1973 and was the largest firing site at the Laboratory (LANL 1993, 020946, p. 7-3).

Originally, E-F Firing Site consisted of a single firing point (D) that was built in 1946 and that ceased to operate in 1949 (LANL 1990, 007512, p. 69). In 1947, the firing area was expanded to include Firing Point E, which was used for large-scale shots containing up to 2500 lb of HE, and Firing Point F, which was used for smaller-scale shots. Firing Points E and F were approximately 800 ft apart and were wired to an underground control bunker (structure 15-0027). Tests at the two firing points were conducted on the ground and created depressions in the ground. After test shots, the firing points were either regraded or backfilled with gravel to fill in any depressions. Eventually, soil mounds were constructed on two sides of Firing Point E to protect TA-15 structures from shrapnel (LANL 1993, 020946, pp. 7-3–7-5).

Tests at E-F Firing Site involved HE, uranium, beryllium, lead, and mercury (LANL 1993, 020946, p. 7-8).

Previous Investigations

The site was surveyed in 1982 by EG&G Energy Measurements with radiological detectors mounted in a helicopter as part of a survey of the entire Laboratory. Results of this effort identified elevated levels of radiation at the site (LANL 1993, 020946, p. 7-3).

A Phase I RFI was conducted at SWMU 15-004(f) in 1994 (LANL 1995, 050294, pp. 4-23–4-57). Surface samples (0 to 0.5 ft bgs) were collected from 85 locations from selected grid points and subsurface samples (1.5 to 2.0 ft bgs) were collected from a subset of 35 of the sampling locations. Samples were field screened for radioactivity, metals, and HE. Based on the field-screening results, 43 surface samples and 17 subsurface samples collected from 53 locations were submitted for analysis of radionuclides and metals (LANL 1995, 050294, pp. 4-23–4-57). Samples collected during the 1994 RFI with decision-level data and the analyses requested are presented in Table 4.1-1. Figure 4.1-10 shows all previous RFI sampling locations.

In 1999, the former ER Project submitted to NMED a plan for a technology feasibility demonstration project at SWMU 15-004(f) (LANL 1999, 063100). An environmental pilot treatment study was conducted in 2001 at E-F Firing Site. The process was designed to selectively remove uranium by precipitation. The soil was sluiced to separate large uranium aggregates, heaped into containers, and leached with a sodium bicarbonate solution. The soil was then placed on a drying tray, and the leachate was pumped into a settling tank, where its pH was adjusted to 6.5 using phosphoric acid, followed by passage through a container of apatite mineral (DOE 2001, 070068, p. 6). Although the pilot treatment study was implemented, a report was never produced.

Decision-level data from the RFI are presented in Tables 4.1-2 and 4.1-4, which show inorganic chemicals detected above BVs or having detection limits above BVs and radionuclides detected or detected above BVs/FVs, respectively. Sampling locations and the results for inorganic chemicals detected above BVs and radionuclides detected or detected above BVs/FVs are shown in blue on Plates 2 and 3, respectively. Sampling locations with screening-level data are also provided on both plates in green font to help determine proposed sampling locations.

Inorganic chemicals detected above soil BVs included aluminum, barium, beryllium, cadmium, calcium, copper, lead, mercury, nickel, potassium, silver, sodium, uranium, and zinc. Aluminum was detected above the BV but below the maximum soil background concentration (61,500 mg/kg; LANL 1998, 059730) in one sample. Barium was detected above the maximum soil background concentration (410 mg/kg) in two samples and above the soil BV but below the maximum background concentration in two samples. Beryllium was detected above the soil BV but below the maximum background concentration (3.95 mg/kg; LANL 1998, 059730) in one sample. Cadmium was detected above the soil BV but below the maximum background concentration (2.6 mg/kg) in three samples and above the maximum soil background concentration in one sample. Calcium was detected above the soil BV, but below the maximum background concentration (14,000 mg/kg; LANL 1998, 059730) in one sample. Copper was detected above the maximum soil background concentration (16 mg/kg) in eight samples and above the soil BV but below the maximum background concentration in one sample. Lead was detected above the maximum soil background concentration (28 mg/kg) in four samples and above the soil BV but below the maximum background concentration in two samples. Mercury was detected above the soil BV in nine samples. Nickel was detected above the maximum soil background concentration (29 mg/kg; LANL 1998, 059730) in one sample. Potassium was detected above the soil BV but below the maximum background concentration (6850 mg/kg; LANL 1998, 059730) in one sample. Sodium was detected above the soil BV but below the maximum background concentration (1800 mg/kg; LANL 1998, 059730) in four samples. Silver was detected above the soil BV in one sample. Uranium was detected above the maximum soil background concentration (3.6 mg/kg; LANL 1998, 059730) in 18 samples and above the soil BV but below the maximum background concentration in one sample. Zinc was detected above the soil BV but below the maximum background concentration (75.5 mg/kg) in one sample and above the maximum soil background concentration in one sample. Antimony, cobalt, and thallium were not detected above BVs but had detection limits above soil BVs. Cesium-137 was detected in two samples collected at a depth of 1.5 to 2.0 ft bgs. Europium-152 was detected in two surface samples; there is no BV/FV for this radionuclide.

Proposed Activities

SWMU 15-004(f) will be characterized to support corrective actions design to recover DU and determine if residual contamination poses an unacceptable risk based on industrial land use. Decision-level data from the 1994 RFI are presented in Tables 4.1-2 and 4.1-4, and screening-level data from the 1994 RFI are presented in Tables 4.1-5, 4.1-6, and 4.1-7. Sampling locations and the results for the combined RFI data set are shown on Plate 2 (inorganic chemicals detected above BVs) and Plate 3 (radionuclides detected or detected above BVs/FVs), respectively. Tetryl was the only organic chemical detected at two sampling locations (15-02239 and 15-02243) (Table 4.1-6); therefore, a figure showing these VOC screening-level data was not prepared. In addition, sampling locations 15-02239 and 15-02243 are associated with the northern the SWMU 15-008(a) debris mound, which will be remediated (see section 4.1.7).

The 1994 RFI grid sampling locations will be reestablished across the site (Plate 4). Forty-two samples will be collected from one depth (3 to 4 ft bgs) at 42 RFI sampling locations with screening-level and decision-level data showing inorganic chemicals detected above soil BVs and/or radionuclides detected or detected above BVs/FVs (Plates 2 and 3). Characterization samples will be analyzed for metals, explosive compounds, and isotopic uranium. These 42 RFI sampling locations are listed in Table 4.1-8.

XRF surveys (for barium, copper, lead and uranium), D TECH HE screening, and radiological surveys (using a Field Instrument for Detecting Low Energy Radiation [FIDLER], or equivalent, instrument) will be conducted at the 51 RFI grid sampling locations where no inorganic chemicals were detected above BVs and/or no radionuclides were detected or detected above BVs/FVs (Plates 2 and 3) and at locations outside the RFI grid sampling locations to ensure all areas with elevated DU and metals are identified (LANL 1998, 058844.107, pp. 4-33-4-43). Samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at any of these 51 RFI grid sampling locations without data and locations outside the RFI sampling grid with elevated XRF screening, HE screening, and/or radiological survey results. The objective of the investigation at SWMU 15-004(f) is not to determine the nature and extent of contamination but rather to identify the areas and depths of soil requiring corrective action. Characterization samples will be analyzed for metals, explosive compounds, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

The two earthen mounds will be characterized to determine disposition requirements and if any portion of the soil could be spread over the site as a part of site restoration following future corrective actions. Fifty-four samples will be collected from three depths (0 to 1 ft, 6 to 7 ft, and 9 to 10 ft bgs) at a minimum of three locations on each side (two sides per mound) of the two mounds and at three locations on top of each mound (inset on Plate 4). The core will be field screened for metals and radioactivity to guide sample collection and borehole depth. RFI decision-level and screening-level data from sampling locations associated with the two earthen mounds (15-02290, 15-02244, 15-02248, 15-02246, 15-02247, 15-02291, 15-02249, and 15-02245) will be used to guide new sampling locations and support characterization of the soil. Characterization samples collected from the earthen mounds will be analyzed for metals, explosive compounds, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

Samples will be collected from the head of Portillo Canyon and from the drainage directly downgradient and south of SWMU 15-004(f) to determine if contaminants are migrating from the site. Ten samples will be collected from in sediment catchments at five locations in the drainage directly downgradient of the SWMU 15-004(f), and two samples will be collected from one sampling location at the head of Potrillo Canyon southwest of the site. Samples will be collected from two depths (0 to 1.0 ft and 2.0 to 3.0 ft bgs) (Plate 4). Data from samples to be collected in the drainage downgradient of SWMU 15-009(e) will address potential contaminant migration in the drainage west of SWMU 15-004(f) (Figure 4.1-21). Data from samples to be collected in the drainage downgradient of AOC 15-008(f) will address potential contaminant migration in the drainage east of SWMU 15-004(f) (Figure 4.1-17). South Canyons Reach (PO-1) is located directly downgradient of SWMU 15-004(f); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490) along with data collected from stormwater monitoring stations PT-SMA-0.5 and PT-SMA-1 (Plate 1). Drainage samples will be analyzed for cyanide, nitrate, perchlorate, metals, explosive compounds, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.7 SWMU 15-008(a), Two Surface Disposal Areas at E-F Firing Site

Site Description

SWMU 15-008(a) consists of two small surface disposal areas located on the edge of Potrillo Canyon directly south of E-F Firing Site [SWMU 15-004(f)] (Figure 4.1-11). Together with SWMU 15-004(f), SWMU 15-008(a) comprises Consolidated Unit 15-004(f)-99 (Table 1.1-1). The disposal areas are located within 200 ft of each other, with each disposal area having dimensions of approximately 8 ft in diameter × 2 ft high. Both areas were used to dispose of debris from tests conducted at the E-F Firing Site, including soil, rock, pebbles, metal fragments, plastic, electrical cable, electrical accessories. The exact period of operation of the surface disposal sites is not known but probably falls within the period of operation for E-F Firing Site (1946 to 1981) (LANL 1993, 020946, p. 7-20).

Previous Investigations

An aerial radiological survey conducted in 1982 identified no areas of elevated levels of radioactivity at SWMU 15-008(a) (LANL 1993, 020946, p. 7-3).

A Phase I RFI was conducted at SWMU 15-008(a) in 1994 (LANL 1995, 050294, pp. 4-23–4-57). Three surface samples (0 to 0.5 ft bgs) were collected from each of the two debris piles and four surface samples (0 to 0.5 ft bgs) were collected from nearby drainages. The samples were field screened for radioactivity, metals, and HE and submitted for laboratory analysis of radionuclides, metals, and uranium (LANL 1995, 050294, pp. 4-23–4-57). The samples collected in 1994 and the analyses requested are presented in Table 4.1-1.

Decision-level data from the RFI are presented in Table 4.1-2, which shows inorganic chemicals detected above BVs or having detection limits above BVs. Sampling locations and results for inorganic chemicals detected above BVs are shown in Figure 4.1-12.

Inorganic chemicals detected above soil BVs included barium, copper, lead, mercury, nickel, uranium, and zinc. Barium, copper, lead, mercury, nickel, uranium, and zinc were each detected above the maximum soil background concentration in one sample (410 mg/kg, 16 mg/kg, 28 mg/kg, 0.1 mg/kg, 29 mg/kg, 3.6 mg/kg and 75.5 mg/kg, respectively). Antimony and cadmium were not detected above BVs but had detection limits above soil BVs.

Proposed Activities

SWMU 15-008(a) is proposed for remediation. The debris piles will be characterized, containerized, and disposed of in accordance with applicable Laboratory waste management requirements. The methodology to meet waste disposition requirements is described in Appendix B and will be further detailed in the investigation report. Proposed cleanup activities are summarized in section 5.8 of this work plan. Following removal of the debris piles, the area beneath and directly adjacent to the debris piles will be surveyed for radiation, explosive compounds, metals, and VOCs. Additional media will be excavated until field-screening results indicate no elevated levels. A total of eight confirmation samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at two locations beneath each debris pile. In addition, a total of 16 samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at four step-out locations around each debris pile based on field-screening results (Figure 4.1-13). Samples will be analyzed for metals, cyanide, nitrate, perchlorate, VOCs, SVOCs, explosive compounds, PCBs, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites. Stormwater runoff from SWMUs 15-008(a) and 15-004(f) flow to the same drainage; therefore, sediment samples collected from the drainage downgradient of SWMU 15-004(f) will determine if any contaminants have migrated from SWMU 15-008(a) (see section 4.1.7 and Plate 4). South Canyons Reach (PO-1) is located directly downgradient of the site; therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713) along with data collected from stormwater monitoring station PT-SMA-1 (NMED 2007, 095490).

4.1.8 AOC 15-005(b), Storage Area

Site Description

AOC 15-005(b) is a former storage area located inside an HE make-up building (15-0242) (Figure 4.1-14). This area was used to store containers of waste HE. Experiments were assembled, approved adhesives were used during the assembly process, and solvents may have been used to clean some of the parts. The period of operation of this site and the quantities of wastes stored are not known (LANL 1993, 020946, p. 9-12).

Previous Investigations

During the Phase I RFI conducted at AOC 15-005(b) from June 1995 to March 1996, three surface samples (0 to 0.5 ft bgs) and two subsurface (1.5 to 2.0 ft bgs) samples were collected from two locations immediately outside building 15-0242 (LANL 1996, 054977, pp. 5-72–5-75). Samples were field screened for radioactivity, metals, and HE and submitted for analysis of uranium and metals (LANL 1996, 054977, pp. 5-72–5-75). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals detected above BVs.

Proposed Activities

The nature and extent of contamination have not been defined at this site. Eight samples will be collected from two depths (0 to 1.0 ft and 4.0 to 5.0 ft bgs) at four locations around building 15-0242 (Figure 4.1-15). Sampling locations will be outside of the soil that covers three sides and the roof of building 15-0242 and not on the asphalt driveway at the entrance to the building. Samples will be analyzed for metals, cyanide, nitrate, explosive compounds, perchlorate, VOCs, and SVOCs. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.9 AOC 15-006(e), Projectile Test Area, Duplicate of AOC C-36-006(e)

Site Description

AOC 15-006(e) is a duplicate of AOC C-36-006(e) (see section 4.2.11). AOC 15-006(e) will be proposed for no further action in the investigation report.

4.1.10 AOC 15-008(f), Sand Mounds at I-J Firing Site (TA-36)

Site Description

AOC 15-008(f) consists of several sand mounds located adjacent to the I-J Firing Site [SWMU 36-004(e)] (Figure 4.1-16). AOC 15-008(f) is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). The I-J Firing Site is located on a mesa overlooking Potrillo Canyon and was originally located in TA-15 when it was constructed in 1948, although it is now part of TA-36 (LANL 1993, 015313, pp. 5-39–5-40, 5-43).

Previous Investigations

Previous environmental investigations at AOC 15-008(f) include a surface radiological survey in 1991 that identified localized areas of elevated radiation levels (LANL 1993, 015313, pp. 5-43).

Elevated radiological readings were observed in surface soil samples collected along the surface water runoff pathways from I-J Firing Site and from the AOC 15-008(f) sand mounds during remediation of a septic tank [SWMU 36-003(b)] at the I-J Firing Site (LANL 1997, 062453, p. 1). No RFI sampling has been conducted at this site.

Proposed Activities

Although AOC 15-008(f) is deferred for investigation per Table IV-2 of the Consent Order, 10 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) from five locations within sediment catchments in the drainage downgradient of the western sand mounds, and 10 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) from five locations within sediment catchments in the drainage downgradient eastern sand mounds to determine if contaminants are migrating from the site (Figure 4.1-17). Note that the proposed sampling locations shown in this figure will also address potential migration from AOCs 36-004(e) and C-36-006(e). Samples will be analyzed for cyanide, nitrate, perchlorate, metals, explosive compounds, VOCs, SVOC, isotopic uranium, isotopic plutonium, and gamma spectroscopy. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.11 SWMU 15-009(e), Septic Tank

Site Description

SWMU 15-009(e) is a decommissioned 1500-gal. septic tank (structure 15-0072) at E-F Firing Site [SWMU 15-004(f)] (Figure 4.1-18). The septic tank was constructed in 1947 and received sanitary waste from the E-F Firing Site control building (15-0027), located approximately 175 ft northeast of the tank; the drainline goes around structure 15-0463, which is a transportable used for storage. The septic tank is constructed of 4- to 6-in. reinforced concrete and is 5 ft long × 9 ft deep × 7 ft wide (LANL 1993, 020946, pp. 7-21, 10-20). The septic tank was used until 1981 when E-F Firing Site last operated. Discharges from the septic tank flowed through a vitrified clay pipe to an outfall located approximately 30 ft from the tank at the edge of Potrillo Canyon (LANL 1997, 074091, p. 1).

Previous Investigations

A Phase I RFI was conducted at SWMU 15-009(e) in 1994 to characterize the contents of the septic tank (structure 15-0072) (LANL 1995, 050294, pp. 4-23–4-57). Two samples of liquid were collected from the tank and submitted for analysis of radionuclides, metals, VOCs, and SVOCs. Based on the results of the Phase I RFI, which showed inorganic chemicals detected above BVs, a VCA was recommended for SWMU 15-009(e) (LANL 1995, 050294, pp. 4-23–4-57).

A VCA was conducted at SWMU 15-009(e) in 1997 to remove the contents of the tank and to determine the nature and extent of contamination. The interior of the septic tank was pressure-washed, concrete-chip samples were collected from the interior of the tank to demonstrate the adequacy of the corrective action, and a rinsate sample was collected for waste characterization purposes (LANL 1997, 074091, p. 15). Twelve soil samples were collected from beneath the inlet and outlet drainlines, next to and below the septic tank, and from the drainage channel and outfall area (LANL 1997, 074091, pp. 1–3). The samples were submitted for analysis of HE and metals, and a subset of the samples was analyzed for VOCs and SVOCs. The tank and drainlines were filled and plugged with expandable concrete and left in place. The samples collected for the 1997 VCA and the analyses requested are presented in Table 4.1-1.

Decision-level data from the VCA are presented in Tables 4.1-2 and 4.1-3, which show inorganic chemicals detected above BVs or with detection limits above BVs and detected organic chemicals. Sampling locations and results for inorganic chemicals detected above BVs and detected organic chemicals are shown in Figures 4.1-19 and 4.1-20, respectively.

Inorganic chemicals detected above soil BVs included antimony, cadmium, calcium, copper, lead, silver, and uranium. Antimony was detected above the maximum soil background concentration (1 mg/kg; LANL 1998, 059730) in two samples. Cadmium was detected above the soil BV but below the maximum soil background concentration (2.6 mg/kg) in one sample. Calcium was detected above the soil BV but below the maximum soil background concentration (14,000 mg/kg) in one sample. Copper was detected above the soil BV but just below the maximum soil background concentration (16 mg/kg) in one sample. Lead was detected above the maximum soil background concentration (28 mg/kg) in one sample. Silver was detected above the soil BV in two samples. Uranium was detected above the maximum soil background concentration (3.6 mg/kg) in one sample and above the soil BV but below the maximum background concentration in two samples. Acetone and benzo(b)fluoranthene were detected in two samples.

Proposed Activities

The vertical and lateral extent of contamination have not been determined for SWMU 15-009(e). Since the septic tank contents were removed and the tank pressure-washed and filled with expandable concrete, it will be left in place. Six samples will be collected from two depths (0 to 1 ft and 3 to 4 ft below structures) from three locations: next to the tank inlet, next to the tank outlet, and on the east side of the tank. Four samples will be collected from two depths (0 to 1 ft and 3 to 4 ft beneath the drainline) at two locations along the inlet drainline. Six samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) in sediment catchments at three locations at the outfall and in the drainage below the outfall (Figure 4.1-21). Samples will be analyzed for metals, VOCs, SVOCs, isotopic uranium, explosive compounds, perchlorate, cyanide, and nitrate. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.12 SWMU 15-010(a), Septic Tank

Site Description

SWMU 15-010(a) is a decommissioned septic tank (structure 15-0080) located east of former buildings 15-0001 and 15-0023 at R-Site (Figure 4.1-22). The septic tank is constructed of reinforced concrete and measures approximately 8 ft long × 5 ft wide × 3 ft wide with a 900-gal. capacity (LANL 1996, 054977, p. 5-79). The septic tank was constructed in 1944 and was connected to a laboratory and shop (former building 15-0001) that were removed in 1962. The septic tank was later connected to relocated laboratory storage building 15-0023 (LANL 1996, 054977, p. 5-79). A 1965 memorandum (Michel 1965, 005292) states the septic tank was reactivated after 1961 to provide sanitary facilities to former building 15-0007, which housed a photography laboratory (AOC C-15-006). Engineering records show that building 15-0007 was destroyed in 1962, and no engineering drawings document the connection of the septic tank to building 15-0007 (LANL 1983, 094948). The septic tank was surveyed in 1965 and found to be free of HE and radioactivity (LANL 1996, 054977, p. 5-84). The septic tank was filled with sand and left in place (LANL 1996, 054977, p. 5-84).

Previous Investigations

A Phase I RFI was conducted at SWMU 15-010(a) from June 1995 to March 1996 (LANL 1996, 054977, pp. 5-82–5-84). Originally, the RFI was to have included soil sampling at the location of the SWMU 15-010(a) septic tank. However, because the septic tank was found to be in place, the RFI was modified to characterize the contents of the septic tank. The top of the tank was damaged, and the tank had been backfilled with sand. Two sand samples were collected from two depths at one location within the septic tank. The samples were field screened for radioactivity, inorganic chemicals, and HE and submitted for analysis of radionuclides, inorganic chemicals, organic chemicals, and HE (LANL 1996, 054977, pp. 5-79–5-80). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals detected above BVs.

Due to mercury concentrations detected in the sand samples, the Phase I RFI report recommended Phase II sampling to better characterize SWMU 15-010(a), and Phase II sampling was conducted in 1997. Four tuff samples were collected from four subsurface locations: three samples at depth intervals of 8.0 to 8.5 ft, 8.5 to 9.0 ft, and 9.0 to 9.5 ft bgs and one sample at a depth interval of 9.0 to 9.5 ft bgs (LANL 1997, 058499, pp. 17–20). Samples were submitted for analysis of HE, metals and SVOCs. Samples collected during the 1997 Phase II RFI and the analyses requested are presented in Table 4.1-1.

Decision-level data from the Phase II RFI are presented in Tables 4.1-2 and 4.1-3, which show inorganic chemicals detected above BVs or having detection limits above BVs and detected organic chemicals. Sampling locations and results for inorganic chemicals detected above BVs and detected organic chemicals are shown in Figures 4.1-23 and 4.1-24, respectively.

Inorganic chemicals detected above Qbt 2 BVs included barium, calcium, chromium, cobalt, copper, lead, mercury, silver, uranium, and vanadium. Barium, copper, and lead were detected above the maximum Qbt 2 background concentrations (51.6 mg/kg, 6.2 mg/kg, and 15.5 mg/kg, respectively; LANL 1998, 059730) in four samples. Calcium was detected above the maximum Qbt 2 background concentration (2230 mg/kg; LANL 1998, 059730) in three samples. Chromium was detected above the maximum Qbt 2 background concentration (13 mg/kg; LANL 1998, 059730) in one sample and above the Qbt 2 BV but below the maximum background concentration in three samples. Cobalt was detected above the Qbt 2

BV in four samples. Mercury was detected above the Qbt 2 BV in four samples. Silver was detected above the Qbt 2 BV in two samples. Uranium was detected above the Qbt 2 BV but below the maximum background concentration (5 mg/kg; LANL 1998, 059730) in four samples. Vanadium was detected above the Qbt 2 BV but below the maximum background concentration (21 mg/kg; LANL 1998, 059730) in one sample. Antimony and selenium were not detected above Qbt 2 BVs but had detection limits above BVs. Bis(2-ethylhexyl)phthalate and di-n-butylphthalate were each detected in four tuff samples. HE was not detected.

Proposed Activities

SWMU 15-010(a) is proposed for remediation. Although the septic tank contents have been removed, the tank was not pressure-washed and was filled only with sand. Therefore, the septic tank (including the sand in the tank) will be excavated, characterized, removed, and disposed of in accordance with applicable Laboratory waste management requirements. The inlet and outlet drainlines will be plugged. The methodology to meet waste disposition requirements is described in Appendix B and will be further detailed in the investigation report. Proposed cleanup activities are summarized in section 5.8 of this work plan. Following removal of the septic tank, the excavation will be surveyed for radiation, explosive compounds, metals, and VOCs. Additional media will be excavated until field-screening results indicate no elevated levels. Six confirmation samples will be collected from two depths (0 to 1 ft and 3 to 4 ft below the structures) from three locations: beneath the tank inlet, within the tank excavation, and beneath the tank outlet. Four samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) beneath the drainline at two locations along the inlet drainline from former building 15-0001, and two samples will be collected from two depths (0 to 1 ft and 3 to 4 ft) beneath the drainline at one location along the inlet drainline from former building 15-0023. Eight samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at four locations in the outfall area (Figure 4.1-25). Samples will be analyzed for metals, VOCs, SVOCs, isotopic uranium, explosive compounds, perchlorate, cyanide, and nitrate. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.13 AOC C-15-004, Former Transformer Station

Site Description

AOC C-15-004, a former transformer station (former structure 15-0056), was located approximately 30 ft southwest of the former E-F Firing Site control room (building 15-0027) (Figure 4.1-26). Two transformers (18-gal. and 30-gal. capacity) were located on a 5-ft-long wooden platform 10 ft above the ground (LANL 1993, 020946, p. 7-21). Each transformer contained mineral oil with polychlorinated biphenyls (PCBs) of unknown concentration. The date of installation is also not known, but the transformers were removed from the site in 1989 (Francis 1992, 057736, p. 2). No evidence was found of a release on the wooden platform or on the soil beneath the platform (LANL 1993, 020946, p. 7-21).

Previous Investigations

A Phase I RFI was conducted in 1994 at AOC C-15-004 (LANL 1995, 050294, p. 4-25). A surface sample (0 to 0.5 ft bgs) was collected from two locations beneath the former transformer platform. The samples were field screened for radioactivity and submitted for analysis of PCBs (LANL 1995, 050294, p. 4-25). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1994, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed that PCBs were not detected in the RFI samples.

Proposed Activities

Four samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at two locations beneath the former location of the transformer platform to confirm that there is no residual PCB contamination at the site (Figure 4.1-27). All four samples will be analyzed for PCBs. These samples will also be analyzed for metals and isotopic uranium to determine if the site was impacted by the E-F Firing Site. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.14 AOC C-15-005, Potential Soil Contamination from Former Building

Site Description

AOC C-15-005 is an area of potential soil contamination associated with the footprint of a former laboratory and shop (former building 15-0001) (Figure 4.1-28). Former building 15-0001 was constructed in 1944 to support experiments performed at Firing Sites C and D (LANL 1993, 020946, p. 9-2). Engineering records document that building 15-0001 was destroyed by burning in 1962 (LANL 2009, 105251). The remaining debris from the demolition of building 15-0001 was disposed of at MDA N in 1962 [SWMU 15-007(a)] (LANL 1993, 020946, p. 9-2). Information about the use of materials in this building is limited, but thorium contamination was discovered in the building and cleaned up (LANL 1993, 020946, p. 9-2).

Previous Investigations

During the Phase I RFI conducted at AOC C-15-005 from June 1995 to March 1996, four soil samples were collected from two depths (0 to 0.5 ft and 1.5 to 2.0 ft bgs) at two locations within the building footprint. The samples were field screened for radioactivity, VOCs, and HE. One surface sample and both subsurface samples were submitted for analysis of inorganic chemicals, VOCs, SVOCs, isotopic thorium, and uranium (LANL 1996, 054977, pp. 5-16–5-18). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals detected above BVs, detected VOCs, and isotopic thorium detected or detected above BVs.

Proposed Activities

The extent of contamination has not been defined for AOC C-15-005. Twelve samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at six locations within and next to the footprint of former building 15-0001 and analyzed for cyanide, nitrate, perchlorate, VOCs, SVOCs, metals, explosive compounds, isotopic uranium, and isotopic thorium (Figure 4.1-29). Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.15 AOC C-15-006, Potential Soil Contamination from Former Building

Site Description

AOC C-15-006 is an area of potential soil contamination associated with the footprint of a former control building and darkroom (former building 15-0007) (Figure 4.1-30). Former building 15-0007 was constructed in 1944 to support activities performed at Firing Sites C and D (LANL 1993, 020946, p. 9-2). Engineering records document that building 15-0007 was destroyed by burning in 1962 (LANL 1993, 020946, p. 9-2). Debris from the demolition of building 15-0007 was disposed of at MDA N in 1962

[SWMU 15-007(a)] (LANL 1993, 020946, p. 9-2). Information about the use of materials in this building is limited, but mercury and darkroom chemicals were used (LANL 1993, 020946, p. 9-2).

Previous Investigations

A Phase I RFI was conducted at AOC C-15-006 from June 1995 to March 1996 (LANL 1996, 054977, pp. 5-20–5-22). Two soil samples were collected from two depths (0 to 0.5 ft and 1.5 to 2.0 ft bgs) at one location within the footprint of building 15-0007. The samples were field screened for radioactivity, inorganic chemicals, and HE. Only the surface sample was submitted for analysis for inorganic chemicals, SVOCs, isotopic thorium, and uranium (LANL 1996, 054977, pp. 5-20–5-22). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed no inorganic chemicals detected above BVs, no detected VOCs, and no radionuclides detected above BVs.

Proposed Activities

The extent of contamination has not been defined for AOC C-15-006. Twelve samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at six locations within and adjacent to the footprint of former building 15-0007 and analyzed for cyanide, nitrate, perchlorate, VOCs, SVOCs, metals, HE, isotopic uranium, and isotopic thorium (Figure 4.1-31). Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.2 TA-36

TA-36, originally designated as Kappa Site, occupies approximately 3.7 mi^2 in the central-south-central portion of the Laboratory (Plate 1). TA-36 is bounded to the west and northwest by TA-15, to the east by TA-71 and White Rock, and to the south by TA-39 and TA-68. TA-68 and TA-71 are considered buffer areas and have not been used for Laboratory operations. Potrillo Canyon intersects TA-36, and Fence Canyon parallels the southern boundary of TA-36 (Plate 1). Sites to be investigated at TA-36 include a landfill, one septic system, one surface disposal site, a storage area, a former shot-containment-vessel location, a project test area, former burn pits, and an inactive firing site.

Samples collected at TA-36 during previous investigations and corrective actions and analyses requested are presented in Table 4.2-1. Decision-level data are presented in Tables 4.2-2, 4.2-3, and 4.2-4, for inorganic chemicals, organic chemicals, and radionuclides, respectively. All laboratory analytical data are also provided in Appendix B of the HIR (LANL 2009, 105251). Figures 4.2-1 to 4.2-28 include base maps; maps showing inorganic chemicals and radionuclides detected or detected above BVs/FVs and detected organic chemicals; and maps showing the proposed sampling locations for TA-36 sites.

4.2.1 SWMU 36-001, MDA AA

Site Description

SWMU 36-001, an inactive landfill known as MDA AA, is located approximately 300 ft southwest of control bunker (building 36-0120) and 150 ft southwest of the x-ray device (structure 36-0086) (Figure 4.2-1). MDA AA reportedly consists of two disposal trenches containing burned debris from test shots conducted at the Lower Slobbovia Firing Site (LANL 1993, 015313, p. 5-1). The debris consisted of wood and sand contaminated with barium, uranium, other inorganic chemicals, plastics, and HE (LANL 1989, 105232). The dimensions of the north trench are 80 ft × 40 ft × 8 ft to 13 ft deep, and the dimensions of the south trench are 120 ft × 20 ft to 30 ft × 3 ft to 12 ft deep (LANL 1996, 054733, p. 5-3). The debris was transported by truck from the Lower Slobbovia Firing Site, placed in the trenches, and burned. Once a trench was filled, it was covered with approximately 4 ft of soil. The trenches were excavated in the mid-1960s, and the site was closed in 1989 (LANL 1993, 015313, pp. 5-1–5-9).

Previous Investigations

A Phase I RFI was conducted at SWMU 36-001 from 1993 to 1996 (LANL 1996, 054733, pp. 5-1–5-9). Initial RFI activities consisted of geophysical surveys using EM, magnetometer/gradiometer, and ground-penetrating radar (GPR) techniques to define the trenches. Geophysical survey results showed the presence of buried debris but did not delineate the boundaries of discrete disposal trenches. As a result, an exploratory drilling program was conducted to define the extent of buried materials. Approximately 88 boreholes were drilled and ash and/or debris were found at 21 borehole locations, which helped delineate the two disposal trenches. Once the trenches had been delineated, samples were collected from borehole locations with elevated field-screening results. Five boreholes were advanced into the north trench, and four boreholes were advanced into the south trench. Samples were collected at three depth intervals in each borehole. Two of the depth intervals were in the ash/debris zone, and one was approximately 2 ft below the bottom of each trench. In addition, samples of fill/cover material were collected at three of the borehole locations, field screened for VOCs, radioactivity, and HE, and submitted for analysis of inorganic chemicals, isotopic uranium, VOCs, SVOCs, and HE (LANL 1996, 054733, pp. 5-1–5-9). The data collected from seven of the nine sampling locations during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected during the Phase I RFI, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). In addition to the Phase I activities, interim action activities were conducted in 1996 to implement erosion-control measures around SWMU 36-001 (LANL 1996, 054449, pp. 1–7). During the interim action, erosion gullies were stabilized near SWMU 36-001 to prevent encroachment onto the site and erosion of the soil cover over the trenches. The samples collected during the Phase I RFI having decision-level data and the analyses requested are presented in Table 4.2-1.

Decision-level data from the two RFI sampling locations (36-03127 and 36-03131) are presented in Tables 4.2-2, 4.2-3, and 4.2-4, which show inorganic chemicals detected above BVs or having detection limits above BV, detected organic chemicals, and radionuclides detected or detected above BVs/FVs, respectively. Sampling locations and results for inorganic chemicals detected above BVs, detected organic chemicals, and radionuclides detected or detected above BVs/FVs are shown in Figures 4.2-2, 4.2-3, and 4.2-4, respectively.

Inorganic chemicals detected above soil BVs are copper, thallium and zinc. Copper and zinc were each detected above the maximum soil background concentration (16 mg/kg and 75.5 mg/kg, respectively) in one sample. Thallium was detected above the soil BV but below the maximum soil background concentration (1.0 mg/kg) in one sample. Antimony and cadmium were not detected above soil BVs but had detection limits above BVs. Acetone was detected in one soil sample and methylene chloride was detected in two samples. Uranium-238 was detected above the soil BV in one sample.

Proposed Activities

SWMU 36-001 is proposed for remediation. Preliminary site activities will include a surface radiological survey and geophysical surveys (magnetometry, EM, and resistivity), followed by the excavation of test pits and trenches to locate and define the landfill boundaries. Remediation activities will involve waste characterization, waste and soil/fill excavation and removal, segregation, containerization, transportation, off-site disposal, confirmation sampling, and backfilling and site restoration. The methodology to meet waste disposition requirements is described in Appendix B and will be detailed further in the investigation report. Proposed cleanup activities are summarized in section 5.8 of this work plan. Historical information and photographs indicate that the north trench is approximately 13 ft deep and the south trench is approximately 12 ft deep, and both contain primarily potentially contaminated wood and sand from firing-site operations. Once located and characterized, all visible waste and stained soil and/or tuff will be removed from the landfill and the bottom and sides of the excavation surveyed for radiation, explosive compounds, metals, and VOCs. Additional media will be excavated until field-screening results indicate no elevated levels.

Confirmation samples will be collected within and next to the excavation to confirm cleanup and the nature and extent of any residual contamination. Proposed sampling locations are shown in Figure 4.2-5. Eighteen samples will be collected from two depths (0 to 1.0 ft and 4.0 to 5.0 ft) at 9 locations beneath the bottom of the excavation. A total of 16 characterization samples will be collected from two depths (4.0 to 5.0 ft and 15.0 to 16.0 ft bgs), assuming a total landfill excavation depth of 13 ft bgs, at two step-out sampling locations on each side of the landfill excavation. Step-out sampling locations will be 6 ft from the edge of the landfill excavation. Samples will be analyzed for isotopic uranium, isotopic thorium, cyanide, nitrate, perchlorate, VOCs, SVOCs, explosive compounds, metals, and dioxins/furans. The final analytical suite will be confirmed and supplemented, if necessary, with waste characterization data. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites. South Canyons Reach PO-3 is located directly downgradient of the site (Plate 1); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.2 SWMU 36-003(b), Septic System, I-J Firing Site

Site Description

SWMU 36-003(b) is a decommissioned septic system located at the west end of TA-36 (Figure 4.2-6). The septic system consists of a septic tank (structure 36-0061) and its associated drainlines and outfall. The septic tank sits near the edge of Mesita del Potrillo, approximately 100 ft southwest of building 36-0055, the control bunker for the I-J Firing Site (LANL 1993, 015313, p. 5-24). The control bunker housed the electronics and instrumentation used in the operation of the I-J Firing Site [SWMU 36-004(e)] and also contained a toilet, sink, and water fountain, all of which were connected to the septic tank via a 4-in.-diameter clay-tile pipe (LASL 1949, 105276). The septic tank is constructed of reinforced concrete and measures 7 ft long × 3.5 ft wide × 5.73 ft deep with a capacity of 420 gal. The tank has a buried overflow pipe that formerly discharged near the north rim of Potrillo Canyon. The overflow pipe was capped in 1989 to stop its discharge into the canyon. After the overflow pipe was capped, the septic tank continued to be used (LANL 1993, 015313, p. 5-24). Until the early 1990s when the tank was taken out of service, the tank contents were periodically removed and taken to a sanitary wastewater treatment plant for treatment and disposal after the overflow pipe had been capped (LANL 1993, 015313, p. 5-24).

Previous Investigations

The contents of the tank were sampled in 1981 and the analytical data confirmed HE was not present (LANL 1993, 015313, p. 5-27).

A Phase I RFI was conducted at SWMU 36-003(b) in 1994 (LANL 1995, 053985, pp. 5-4–5-12). Two samples of the liquid were collected from one location within the tank, and four sludge samples were collected from three locations within the tank. In addition, five surface soil samples were collected from four locations in the drainage channel downstream of the outfall. The samples were field screened for VOCs, radioactivity, and HE and submitted for analysis for inorganic chemicals, uranium, HE, VOCs, and

SVOCs (LANL 1995, 053985, p. 1-15). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1994, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed detected inorganic chemicals above BVs and detected HE.

The 1996 VCA implemented at SWMU 36-003(b) included removing the septic tank contents, pressure washing the tank, and filling the tank with expanding cement. The tank contents were disposed of as low-level radioactive waste (LLW) at Area G at TA-54 and at the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF). No confirmation samples were collected (LANL 1996, 055072, pp. 1–4).

Proposed Activities

The extent of contamination has not been determined for SWMU 36-003(b). Since the septic tank contents were removed and the tank pressure-washed and filled with expandable concrete, it will be left in place. Six samples will be collected from two depths (0 to 1 ft and 3 to 4 ft below the structures) from three locations: next to the tank inlet, next to the tank outlet, and on the south side of the septic tank. Four samples will be collected from two depths (0 to 1 ft and 3 to 4 ft beneath the drainline) at two locations along the inlet drainline; one of these sampling locations will be adjacent to the drainline connection to building 36-0055. Six samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at three locations at the outfall and below the outfall. Proposed sampling locations are shown in Figure 4.2-7. Samples will be analyzed for metals, VOCs, SVOCs, isotopic uranium, explosive compounds, perchlorate, cyanide, and nitrate. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.2.3 AOC 36-004(a), Eenie Firing Site

Site Description

AOC 36-004(a) is the Eenie Firing Site located on Mesita del Potrillo on the rim of Potrillo Canyon (Figure 4.2-8). AOC 36-004(a) is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). Together with SWMU 36-006, AOC 36-004(a) comprises Consolidated Unit 36-006-99 (Table 1.1-1). AOC 36-004(a) consists of the impact area, a control bunker (building 36-0003), and a make-up building (36-0004) that contains a storage area. Construction of the Eenie Firing Site began in 1949 and was completed in 1951 (LANL 1992, 014987, p. 5-7). Materials used in experimental shots include lead oxide, mercury, copper, nickel, brass, DU, and nitroglycerine. Other activities conducted at the site include shoulder-mounted projectiles fired into targets in the southern portion of the firing site (Kelkar 1992, 012470).

Previous Investigations

No previous investigations have been conducted at AOC 36-004(a).

Proposed Activities

Although AOC 36-004(a) is deferred for investigation per Table IV-2 of the Consent Order, samples will be collected from drainages downgradient of the site to determine if contaminants are migrating from the site. Most of the downgradient drainage sampling locations will be addressed by the investigation and remediation of the SWMU 36-006 surface disposal site, located directly downgradient of AOC 36-004(a) (section 4.2.4). Two additional samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at one location in the drainage northwest and downgradient of the site (Figure 4.2-9). The samples will be analyzed for cyanide, nitrate, perchlorate, metals, explosive compounds, isotopic uranium, and gamma spectroscopy. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.2.4 SWMU 36-006, Surface Disposal Site

Site Description

SWMU 36-006 consists of an inactive surface disposal area located on the southern slope of Potrillo Canyon, approximately 100 ft north of the Eenie Firing Site [AOC 36-004(a)] (Figure 4.2-10). Together with AOC 36-004(a), SWMU 36-006 comprises Consolidated Unit 36-006-99 (Table 1.1-1).
SWMU 36-006 was used to dispose of cables, metal, concrete, and other similar debris from the TA-36 firing sites (LANL 1993, 015313, p. 5-63). The majority of the debris covers an approximately 75-ft-wide area that extends approximately 100 ft down the south canyon slope. The remainder of the debris is scattered laterally 300 ft along the south canyon slope. This debris was dumped into the canyon from trucks. SWMU 36-006 was used from 1955 to 1970. Although the TA-36 firing sites are still active, SWMU 36-006 is no longer used as a surface disposal area (LANL 1996, 054733, p. 5-36).

Previous Investigations

A Phase I RFI was conducted at SWMU 36-006 during 1995 (LANL 1996, 054733, pp. 5-39–5-43). Surface (0 to 0.5 ft bgs) and subsurface samples (1.5 ft to 2.0 ft bgs) were collected from 19 locations around the disposal area and field screened for inorganic chemicals, radioactivity, VOCs, and HE to bias sampling locations. Most of the field screening showed background levels, although some elevated lead and uranium concentrations were noted. Based on these results, four locations were selected for sampling. Surface samples (0 to 0.33 ft bgs) were collected from a location upgradient of the debris area and in the first sediment catchments downgradient of the debris area. In addition, one surface sample (0 to 0.33 ft bgs) and one subsurface sample (1.33 to 1.5 ft bgs) were collected from each of two locations at the base of the debris area. All six samples were submitted for analysis for metals, HE, VOCs, and SVOCs (LANL 1996, 054733, pp. 5-39–5-43). Samples collected during the 1995 Phase I RFI and the analyses requested are presented in Table 4.2-1.

Decision-level data from the RFI are presented in Tables 4.2-2 and 4.2-3, which show inorganic chemicals detected above BVs or having detection limits above BVs and detected organic chemicals, respectively. Sampling locations and results for inorganic chemicals detected above BVs and detected organic chemicals are shown in Figures 4.2-11 and 4.2-12, respectively.

Inorganic chemicals detected above soil BVs are barium, cadmium, calcium, chromium, copper, lead, mercury, nickel, and zinc. Barium and cadmium were each detected above the soil BV but below the maximum soil background concentration (410 mg/kg, 2.6 mg/kg, respectively) in one sample. Chromium, mercury, nickel, and zinc were each detected above the maximum soil background concentration (36.5 mg/kg, 0.1 mg/kg, 29 mg/kg, and 75.5 mg/kg, respectively) in one sample. Copper and lead were each detected above the maximum soil background concentration (16 mg/kg and 28 mg/kg, respectively) in two samples. Calcium was detected above the BV in two samples and above the maximum background concentration (14,000 mg/kg) in the sample. Antimony, silver, and thallium were not detected above soil BVs but had detection limits above BVs. Methylene chloride was detected in one sample.

Proposed Activities

SWMU 36-006 is proposed for remediation. Remediation activities will involve waste characterization, removal, segregation, containerization, transportation, off-site disposal, confirmation sampling, and site restoration. The methodology to meet waste disposition requirements is described in Appendix B and will be further detailed in the investigation report. Proposed cleanup activities are summarized in section 5.8 of this work plan. The extent of the debris area will be confirmed, surveyed, and mapped. Waste, including cables, metal, concrete, and other similar debris, will be removed from the sides and bottom of Potrillo Canyon using hand tools and placed into bags and gunnysacks for removal from locations near the mesa top. Field technicians will use rappelling equipment to safely collect debris from the steeper portions of the debris field. Equipment similar to a skyline yarder may be brought to the site to haul the debris to the mesa top where it will be loaded into rolloff bins. The skyline yarder is a piece of equipment primarily used for logging operations that allows materials to be brought up steep slopes with the use of a motorized carriage attached to a skyline. A skyline yarder could be run from the top of a 40-ft mast near the firing site to an anchor at the bottom of the canyon where debris-filled bags can be placed in a cargo net attached to the carriage of the skyline yarder with a retractable cable, called a hayline. The carriage will bring the cargo net to the surface where the material will be dumped into rolloff bins. Once all visible waste along with any stained soil and/or tuff has been removed, the area will be surveyed for radiation, explosive compounds, metals, and VOCs. Additional media will be excavated until field-screening results indicate no elevated levels.

Twenty-two confirmation samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at six locations beneath the former debris pile and at five step-out locations around the debris pile (Figure 4.2-13). The samples will be analyzed samples for metals, cyanide, nitrate, perchlorate, VOCs, SVOCs, explosive compounds, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.2.5 AOC 36-004(b), Meenie Firing Site

Site Description

AOC 36-004(b) is the Meenie Firing Site located in a flat area at the head of Fence Canyon (Figure 4.2-14). AOC 36-004(b) is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). This firing site consists of the firing point, a control bunker (building 36-0006), and a magazine and make-up building (36-0005). Construction of the Meenie Firing Site began in 1949 and was completed in 1950 (LANL 1993, 020946, p. 5-37). The site has been extensively used for gun firing, with shots fired into a cliff north of the firing area and into an embankment south of the firing area. Shots fired at this site have involved up to 300 lb of HE, and at least one shot involved detonating 60 gal. of nitromethane in a sealed aluminum container. Lead bricks were often used as part of shots until 1971 and were sometimes pulverized during detonation (Stauffer 1992, 105416).

Previous Investigations

An RFI was conducted at AOC 36-004(b) in 1994 (ICF Kaiser Engineers 1996, 054713, pp. 107–119). Field activities included investigating off-site migration of potential contaminants via major drainage channels. Sediment catchment areas with substantial accumulations of fine particles were identified and eight samples were collected (ICF Kaiser Engineers 1996, 054713, pp. 107–119). Samples were analyzed for metals, radionuclides, VOCs, and SVOCs. Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1994, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals above BVs and sodium-22, cesium-137, europium-152, americium-241, cobalt-60, plutonium 238/239, and ruthenium-106 detected or detected above FVs.

Proposed Activities

Although AOC 36-004(b) is deferred for investigation per Table IV-2 of the Consent Order, 10 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at five locations in sediment catchments in the drainage downgradient of the site toward Fence Canyon to determine if contaminants are migrating from the site (Figure 4.2-15). The samples will be analyzed for cyanide, nitrate, perchlorate, VOCs, SVOCs, metals, explosive compounds, isotopic uranium, and gamma spectroscopy. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites. South Canyons Reach F-1 is located downgradient of AOC 36-004(b) (Plate 1); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.6 AOC 36-004(c), Minie Firing Site

Site Description

AOC 36-004(c) is the Minie Firing Site located near the head of Fence Canyon, approximately 800 ft southeast of the Meenie Firing Site [AOC 36-004(b)] (Figure 4.2-16). AOC 36-004(c) is an active RCRA-regulated OD site and is also used to conduct experiments involving explosives. This firing site consists of the firing point, a control bunker (building 36-0008), a make-up building (36-0007), a firing platform (no structure number), and an x-ray house (no structure number). Construction of the Minie Firing Site began in 1949 and was completed in 1950 (LANL 1993, 020946, p. 5-37). The site has been extensively used to conduct armor-piercing experiments. In these experiments, penetrator jets are directed at targets on the canyon wall to the west of the site. Metal plates are placed behind the targets to stop the penetrators (Kelkar 1992, 012469). AOC 36-004(c) has also been used for OD of scrap HE. Emergency detonation of leaking gas cylinders has also been performed, but very infrequently (LANL 1990, 007513, p. 109).

Previous Investigations

A Phase I RFI was conducted at AOC 36-004(c) in 1994 (ICF Kaiser Engineers 1996, 054713, pp. 107–119). Field activities included investigating off-site migration of potential contaminants via major drainage channels. Sediment catchment areas with substantial accumulations of fine particles were identified, and eight samples were collected (ICF Kaiser Engineers 1996, 054713, pp. 107–119) and analyzed for metals, radionuclides, VOCs and SVOCs. Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1994, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals above BVs and sodium-22, cesium-137, europium-152, americium-241, cobalt-60, plutonium 238/239 and ruthenium-106 detected or detected above FVs.

Proposed Activities

AOC 36-004(c) is an active RCRA-regulated OD site and firing site; therefore, sampling to determine nature and extent is not feasible presently because continued explosives testing makes any determining nature and extent obsolete as soon as the next firing activity occurs. Therefore, it is proposed that full characterization of AOC 36-004(c) be delayed until firing operations cease. This work plan proposes an interim sampling strategy to determine if contaminants are migrating from the site. Fourteen samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at seven locations in sediment catchments in the drainage downgradient of the site (Figure 4.2-17). Samples will be analyzed for cyanide, nitrate, perchlorate, VOCs, SVOCs, metals, explosive compounds, isotopic uranium, and gamma spectroscopy. Table 4.0-1 summarizes proposed sampling locations, depths, and analytical suites. South Canyons Reach FS-1 is located downgradient of AOC 36-004(c) (Plate 1); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.7 SWMU 36-004(d), Skunk Works Firing Site, Lower Slobbovia Firing Site, and Burn Pits

Site Description

SWMU 36-004(d) consists of the Lower Slobbovia Firing Site and the Skunk Works Firing Site, located in Potrillo Canyon, and three burn pits located on the mesa top next to Potrillo Canyon (Figure 4.2-18). AOC 36-004(d) is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1).

The Lower Slobbovia Firing Site consists of two firing points and a control building (36-0012). One of the firing points (structure 36-0013) was constructed in 1950 and is located on top of an approximately 200-ft-diameter sand and dirt pad. The control building (36-0012) was constructed into the side of the pad (LANL 1993, 020946, p. 5-38). The second firing point consisted of a wooden tower (structure 36-0120), constructed in 1986 at the northwest end of a 1000-ft long sled track for conducting drop tests (Kelkar 1992, 012471). Shots fired at the Lower Slobbovia Firing Site primarily involve HE (LANL 1990, 007513, p. 109). Less than 2% of the shots have involved significant amounts of metal (e.g., DU, lead, copper, aluminum, and steel) (Kelkar 1992, 012471). The largest shot fired at Lower Slobbovia used 5000 to 6000 lb of HE (Kelkar 1992, 012469). In addition, underground tests, buried to approximately 100 ft, were conducted at this site (Kelkar 1992, 012469).

The Skunk Works Firing Site, located approximately 0.5 mi northwest of the Lower Slobbovia Firing Site, was used to conduct small-explosives experiments during the 1950s (Kelkar 1992, 012471). These experiments involved gas (acetylene and oxygen), liquid (tetranitromethane), and solid explosives. Beryllium and radioactive materials were not used at the site (LANL 1996, 054733, pp. 5-21–5-28). Structures at the Skunk Works Firing Site included a 5-ft × 5.5-ft × 5-ft belowgrade structure that formerly served as a battery storage room and two buildings (36-0044 and 36-0045) that were moved to the site from TA-15. All the structures have been removed. The Skunk Works firing pad was located next to building 36-0045. A shallow depression, located approximately 100 ft farther up the canyon, was also used as a firing pad (LANL 1996, 054733, pp. 5-21–5-28).

The burn pits were used for burning and disposal of test debris before MDA AA was established in the mid-1960s (LANL 1993, 020946, p. 5-39). These pits are located on Mesita del Potrillo approximately 4000 ft west of the Lower Slobbovia control building (36-0012). The largest pit is a bermed enclosure located north of Potrillo Road and is approximately 40 ft in diameter. Two smaller areas are located south of Potrillo Road (LANL 1996, 054733, p. 5-29–5-31). Debris was transported by truck from TA-36 firing sites to the pits, placed in the pits, and burned. The debris consisted of wood, nails, other metal fragments, plastics, and sand contaminated with barium, uranium, and HE (LANL 1996, 054733, pp. 5-29–5-36).

Previous Investigations

Previous environmental investigations at SWMU 36-004(d) include sampling performed during the 1988 DOE environmental survey. This effort involved collecting five composite surface samples from the Lower Slobbovia Firing Site and analyzing these samples for inorganic chemicals and radionuclides. The results indicated elevated levels of copper, lead, uranium, and zinc (DOE 1992, 030081, pp. 55–56).

A Phase I RFI investigation was conducted from 1994 to 1996 at the Skunk Works Firing Site and the burn pits (LANL 1996, 054733, pp. 5-27–5-28, 5-35–5-36). Phase I RFI activities at the Skunk Works Firing Site included a radiological survey of the site and field screening for inorganic chemicals, VOCs, and HE. Based on field-screening results, a surface (0 to 0.5 ft bgs) and a subsurface soil sample (1.5 to 2.0 ft bgs) were collected at three locations, including the former firing pad next to building 36-0045, the depression to the northwest of building 36-0045, and the former battery storage room. A surface sample (0 to 0.5 ft bgs) was also collected from the drainage channel receiving surface runoff from the site. The samples were field screened for radioactivity, VOCs, and HE and submitted for analysis of metals, isotopic uranium, HE, VOCs, and SVOCs (LANL 1996, 054733, pp. 5-21–5-28). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected during the RFI, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed detected inorganic chemicals above BVs, detected VOCs and SVOCs, and radionuclides, including sodium-22, cesium-137, europium-152, americium-241, cobalt-60, plutonium-238/239, ruthenium-106, and isotopes of uranium detected above BVs.

Phase I RFI activities at the burn pits included radiological and geophysical surveys to determine the pit locations; however, the survey results were inconclusive, and additional historical research was conducted to determine the locations of the burn pits. The pits were discovered along Potrillo Road. Ash was found within the bermed area of the north pit (LANL 1996, 054733, pp. 5-30–5-33). Subsurface soil samples were collected at three locations within the north pit. Samples were collected from one depth (3.33 ft to 4.17 ft bgs) at one location), two depths (0.33 ft to 1.08 ft bgs and 3.17 ft to 3.67 ft bgs) from one location, and three depths (2 ft to 2.58 ft, 4.42 ft to 5.08 ft, and 5.58 ft to 6.33 ft bgs) at one location at the north pit. Subsurface samples were also collected from two depths at each of two locations at the two south pit areas from depth ranging from (0.5 to 1.08 ft and 2 to 2.75 ft bgs). The samples were field screened for radioactivity, VOCs, and HE and submitted for analysis of metals, isotopic uranium, HE, VOCs, SVOCs, and gamma-emitting radionuclides (LANL 1996, 054733, pp. 5-21–5-28). Samples collected during the Phase I RFI of the burn pits and the analyses requested are presented in Table 4.2-1.

Decision-level data from the Phase I RFI at the burn pits are presented in Tables 4.2-2, 4.2-3, and 4.2-4, which show inorganic chemicals detected above BVs or having detection limits above BVs, detected organic chemicals, and radionuclides detected or detected above BVs/FVs, respectively. Sampling locations and results for inorganic chemicals detected above BVs, detected organic chemicals, and radionuclides detected or detected above BVs/FVs are shown in Figures 4.2-19, 4.2-20, and 4.2.21, respectively.

Inorganic chemicals detected above soil or Qbt 2 BVs are aluminum, barium, calcium, cobalt, and nickel. Aluminum, barium, calcium, and nickel were each detected above the maximum Qbt 2 background concentrations (8370 mg/kg, 51.6 mg/kg, 2230 mg/kg, and 7 mg/kg, respectively) in one sample. Cobalt was detected above the Qbt 2 BV in one sample. Nickel was detected above the soil BV but below the maximum background concentration (29 mg/kg) in one sample. Antimony, cadmium, mercury, selenium, silver, and thallium were not detected above soil and/or Qbt 2 BVs but had detection limits above BVs. Methylene chloride, tert-butylbenzene, 1,2-dibromo-3-dichloropropane, 2-hexanone, naphthalene, tetrachloroethene, and toluene were each detected in one sample. Acetone, bis(2-ethylhexyl)phthalate, and 4-isopropyltoluene were each detected in two samples. Cesium-137 was detected in three subsurface samples, and uranium-238 was detected above the soil BV in one sample.

Proposed Activities

Although SWMU 36-004(d) is deferred for investigation per Table IV-2 of the Consent Order, 12 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at six locations in sediment catchments in the drainages downgradient of the two burn pits and six samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at three locations in sediment catchments in the drainage downgradient of the Skunk

Works Firing Site to determine if contaminants are migrating from the site (Figure 4.2-22). The Lower Slobbovia Firing Site is located in the bottom of Potrillo Canyon in an open area. The samples will be analyzed for cyanide, nitrate, perchlorate, VOCs, SVOCs, metals, explosive compounds, isotopic uranium, and gamma spectroscopy. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites. The area downgradient of the Lower Slobbovia Firing Site is virtually flat with no visible signs of runoff or erosion. South Canyons Reach PO-3 is located directly east and downgradient of the Lower Slobbovia Firing Site (Plate 1); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490). In addition, stormwater sampling station PT-SMA-4 is located downgradient of the site. Available stormwater monitoring data from this site will be included in the investigation report.

4.2.8 AOC 36-004(e), I-J Firing Site

Site Description

AOC 36-004(e) is the I-J Firing Site located at the west end of TA-36 on Mesita del Potrillo along the north rim of Potrillo Canyon (Figure 4.2-6 and Plate 1). AOC 36-004(e) is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). The I-J Firing Site consists of two firing points (I and J) and the control building (36-0055). The site was constructed in 1948 and was located in TA-15 until 1981 when the boundary of TA-36 was expanded to encompass the portion of TA-15 that contained the I-J Firing Site. Shots at I-J Firing Site used up to 500 lb of HE and involved a variety of solid and liquid explosives and inorganic chemicals (LANL 1993, 020946, p. 5-40). According to former employees, significant amounts of DU were used at I-J Firing Site in addition to small quantities of mercury and cadmium (Kelkar 1992, 009043). Some shots were fired into iron, copper, or lead targets. Other metals used in shots included aluminum, antimony, various steels, lithium-magnesium alloys, and lithium hydride (Kelkar 1992, 012468). In addition, hydrocarbons, argon, benzene, small amounts of mercury, cadmium, and beryllium were used in shots (Kelkar 1992, 009043; Kelkar 1992, 012468).

All shots involving radioactive materials at the I-J Firing Site were conducted in fully enclosed containment vessels. These vessels were removed from the I-J Firing Site for use at TA-15, although one was later returned to the I-J Firing Site (LANL 1993, 020946, p. 5-40). The returned vessel was identified in the 1990 SWMU report as AOC C-36-001 (LANL 1990, 007513) and was subsequently removed from the site in 1994 and disposed of at MDA G, TA-54 (LANL 1996, 053779, p. 3). Other firing-site activities conducted at I-J Firing Site included tests in which DU projectiles were fired into an embankment. This projectile test area was designated as AOC C-36-006(e) (LANL 1993, 020946, pp. 5-39–5-40).

Previous Investigations

Previous investigations conducted at I-J Firing Site consist of a surface radiological survey conducted in 1991 that identified areas of elevated radioactivity at the time of the survey. Numerous pieces of DU and oxidized DU were present around the site. Based on the presence of visible pieces of DU, an interim action plan was prepared in 1997 that called for removing visible pieces of DU from the firing site and surrounding area and emplacing stormwater controls (LANL 1997, 062453, p. 3-5). However, the plan was not implemented, and AOC 36-004(e) has not been sampled.

Proposed Activities

The I-J Firing Site is deferred for investigation per Table IV-2 of the Consent Order; therefore, no characterization samples are proposed for the site at this time. To determine if contaminants are migrating from the firing site, samples will be collected from sediment catchments in the drainages downgradient of the I-J Firing Site. Drainage sampling will be covered by sampling locations proposed for AOCs 15-008(f) and C-36-006(e) (sections 4.1.10 and 4.2.11, respectively, and Figure 4.1-17). These data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.9 SWMU 36-005, Storage Area

Site Description

SWMU 36-005 is an inactive storage area (known as the “Boneyard”) located near the head of Fence Canyon between the Meenie and Minie Firing Sites [AOCs 36-004(b) and 36-004(c), respectively] (Figure 4.2-23 and Plate 1). This storage area is an undeveloped area, approximately 500 ft × 300 ft, largely covered with grass and ponderosa pine. From the 1950s until the late 1970s, the Boneyard was used as a parking lot for trailers and a storage area for large nonwaste items. From the late 1970s until the late 1980s, the site was used to store large waste items exposed to explosives tests (Kelkar 1992, 012470), including metal drums, cans, cylinders, and scrap metals such as lead sheets, copper, uranium-contaminated steel, and iron (LANL 1993, 020946, p. 5-53).

In the late 1980s, a major cleanup was conducted at the site. Cans labeled isopentane, uranium-contaminated iron and steel, drums, and cylinders were removed during this cleanup effort (LANL 1993, 020946, p. 5-53).

Previous Investigations

Previous environmental investigations at SWMU 36-005 include a radiological survey and sampling performed by the DOE environmental survey in 1988. This effort involved the collection of six grab samples from four locations showing elevated radiation levels and six grab samples from locations showing visible staining or debris (LANL 1993, 015313, pp. 5-55–5-56).

A Phase I RFI conducted at SWMU 36-005 in 1994 included land, geomorphic, and radiological surveys (LANL 1995, 053985, pp. 4-12–4-13). The radiological survey identified no areas of elevated radiation. Thirty-one surface soil samples (0 to 0.5 ft bgs) were collected from 27 locations. Nine of these locations were in the current active storage area; nine were in the drainage channel from the site; and nine were from random locations, including three locations outside the Boneyard. The samples were field screened for VOCs, radioactivity, and HE and submitted for analysis of metals, isotopic uranium, and VOCs. Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1994, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals detected above BVs, detected organic chemicals, and uranium-235 detected above the BV.

On the basis of the Phase I results, the RFI report recommended additional sampling to determine the vertical extent of organic chemical contamination. A sampling and analysis plan (SAP) was prepared that called for collecting subsurface samples at locations where the maximum concentrations of organic chemicals were detected. Phase II RFI activities were conducted in 1997, and four subsurface soil samples were collected from three locations from depths ranging from 1.0 to 1.2 ft, 1.3 to 1.5 ft, 1.7 to 1.8 ft, and 3.2 to 3.3 ft bgs. The samples were submitted for analysis of VOCs. The samples collected during the 1997 Phase I RFI and the analyses requested are presented in Table 4.2-1.

Decision-level data from the Phase II RFI samples are presented in Table 4.2-3, which shows detected organic chemicals. Sampling locations and detected organic chemicals are shown in Figure 4.2-25. Acetone was detected in one soil sample.

Proposed Activities

The extent of contamination has not been determined for SWMU 36-005. Any remaining debris at the site will be screened for HE and radiation and removed from the site. Thirty samples will be collected from 10 previous RFI sampling locations (36-03026, 36-03034, 36-03035, 36-03036, 36-03038, 36-03039, 36-03041, 36-03043, 36-03046, and 36-03051) based on screening-level data provided in Tables 4.2-5, 4.2-6, and 4.2-7 and Figures 4.2-24 and 4.2-25 and decision-level data provided in Table 4.2-3 (Figure 4.2-25). In addition, 18 samples will be collected from 6 new sampling locations around the former RFI sampling locations on the mesa top to define lateral extent. Mesa-top samples will be collected from three depths (0 to 1 ft, 2 to 3 ft and 4 to 5 ft bgs). In addition, 12 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) from three previous drainage sampling locations (36-03018, 36-03022, and 36-03020) in the drainage downgradient of the site (Figure 4.2-27). [Drainage sampling locations for AOC 36-004(c) extend down the drainage into Fence Canyon, which is also downgradient of SWMU 36-005.] Samples will be field screened for VOCs, explosive compounds, and radiation and analyzed for metals, cyanide, explosive compounds, perchlorate, nitrate, VOCs (subsurface samples only), SVOCs, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites. South Canyons Reaches F-1, FS-1, and F-2 are located downgradient of the SWMU 36-005 (Plate 1); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.10 AOC C-36-001, Former Containment Vessel

Site Description

AOC C-36-001 is a former containment vessel that provided secondary containment for explosives tests at TA-36 (Figure 4.2-28). The containment vessel was manufactured in 1970 and located at the PHERMEX test facility at TA-15. The containment vessel was later relocated to the I-J Firing Site and placed south of building 36-0055 where it remained until 1983 when it was removed. The containment vessel consisted of a 19.5-ton steel sphere that was 12 ft in diameter. An explosive device was placed and detonated in a primary containment vessel which, in turn, was placed inside the AOC C-36-001 containment vessel. The explosion gases were vented through a filtration system that captured particulates and did not allow release of the test material (LANL 1993, 020946, p. 5-40). No specific location(s) exists for this site; the location is identified only as the general area south of building 36-0055 (LANL 1996, 053779).

Previous Investigations

In 1994, a VCA was implemented at AOC C-36-001 that involved decontamination and disposal of the vessel. The vessel was taken from TA-36 to building 15-0233 for initial decontamination and was subsequently taken to the decontamination facility at TA-50 for further decontamination. It was then returned to TA-15 pending acceptance for disposal at TA-54, Area G. In October 1994, the containment vessel was disposed of at MDA G, TA-54 (LANL 1996, 053779, p. 3). No confirmation samples were collected during the VCA.

Proposed Activities

The previous location(s) of the former containment vessel used at PHERMEX and at the I-J Firing Site are not known. Therefore, characterization of any releases from AOC C-36-001 will be accomplished by the PHERMEX and I-J Firing Site investigations. Both of these firing sites are deferred for investigation per Table IV-2 of the Consent Order. To determine if contaminants are migrating from either firing site, samples will be collected from sediment catchments in the drainages downgradient of PHERMEX and the I-J Firing Site (sections 4.1.3, 4.1.4, and 4.2.8, respectively, and Figure 4.1-17). These data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.11 AOC C-36-006(e), Projectile Test Area

Site Description

AOC C-36-006(e) is a former projectile test area located within the southern portion of the I-J Firing Site [AOC 36-004(e)] along the north rim of Potrillo Canyon (Figure 4.1-16). AOC C-36-006(e) was formerly used for testing DU projectiles as part of I-J Firing Site activities (LANL 1993, 020946, pp. 5-39 and 5-40). Projectiles were fired from a 120-mm gun into a nearby embankment. Although some projectiles were recovered after an experiment was completed, much of the projectile material remains on site (LANL 1990, 007512, p. 72).

Originally, the I-J Firing Site was located within the boundary of TA-15. In 1981, the boundary of TA-36 was expanded to include portions of TA-15. As part of this expansion, the area in which the I-J Firing Site was located was transferred to TA-36. However, the 1990 SWMU report (LANL 1990, 007514, p. 262) is inconsistent in addressing the SWMUs and AOCs affected by the transfer. Although the SWMU report addresses the I-J Firing Site as SWMU 36-004(e), it addresses the nearby projectile test area (which was also part of the 1981 transfer to TA-36) as AOC 15-006(e). AOC 15-006(e) was renamed AOC C-36-006(e) in the OU 1086 work plan because the projectile test area was within the boundaries of TA-36 when the work plan was written (LANL 1993, 020946, pp. 5-39–5-40).

Previous Investigations

Previous investigations conducted at I-J Firing Site, which encompasses AOC C-36-006(e), consisted of a surface radiological survey conducted in 1991 that identified areas of elevated radioactivity at the time of the survey. Numerous pieces of DU and oxidized DU were present around the site. Based on the presence of visible pieces of DU, an interim action plan was prepared in 1997 that called for removing visible pieces of DU from the firing site and surrounding area, and installing stormwater controls (LANL 1997, 062453, p. 3). However, the plan was not implemented, and AOC C-36-006(e) has not been sampled.

Proposed Activities

AOC C-36-006(e) is encompassed by the I-J Firing Site, which is deferred for investigation per Table IV-2 of the Consent Order. Potential contaminants, including DU, metals, and HE, are indistinguishable between the two sites; therefore, no characterization sampling is proposed for AOC C-36-006(e) at this time. AOC C-36-006(e) will be investigated when I-J Firing Site is investigated. To determine if contaminants are migrating from the site, 10 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at five locations in sediment catchments in the drainage downgradient of the site (Figure 4.1-17). Samples will be analyzed for metals, cyanide, perchlorate, VOCs, SVOCs, explosive compounds, uranium, and gamma spectroscopy. These data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

5.0 INVESTIGATION METHODS

A summary of investigation methods to be implemented is presented in Table 5.0-1. The standard operating procedures (SOPs) used to implement these methods are available at http://www.lanl.gov/environment/all/qa.shtml.

Summaries of the field-investigation methods are provided below. Additional procedures may be added as necessary to describe and document quality-affecting activities.

Chemical and radionuclide analyses will be performed in accordance with the analytical statement of work (LANL 2000, 071233). Accredited contract analytical laboratories will use the most recent EPA- and industry-accepted extraction and analytical methods for analyses of the samples.

5.1 Field Surveys

The following sections describe the field surveys that will be conducted at the Potrillo and Fence Canyons Aggregate Area sites.

5.1.1 Geodetic Surveys

Geodetic surveys will be conducted by a land surveyor in accordance with the latest version of SOP-03.11, Coordinating and Evaluating Geodetic Surveys, to locate historical structures and to document field activities such as sampling and excavation locations. The surveyors will use a Trimble GeoXT hand-held global-positioning system (GPS) or equivalent for the surveys. The coordinate values will be expressed in the New Mexico State Plane Coordinate System (transverse mercator), Central Zone, North American Datum 1983. Elevations will be reported per the National Geodetic Vertical Datum of 1929. All GPS equipment used will meet the accuracy requirements specified in the SOP.

5.1.2 Geophysical Surveys

Geophysical surveys will be performed at selected sites to identify anomalies that would indicate the location of former waste disposal sites including former landfills at TA-15 and TA-36. Geophysical methods employed will include terrain conductivity (EM-31 or equivalent), high-sensitivity metal detection (EM-61 or equivalent), and GPR.

Terrain conductivity and high-sensitivity metal detection data will be recorded at approximately 2-ft intervals along lines spaced approximately 20 ft apart. Higher resolution coverage will be completed, as needed, in selected targeted areas using 5-ft line spacing. Line and station separation may vary depending upon surface obstructions. Geodetic coordinates will be recorded at 1-s intervals using an integrated GPS. A base station free from cultural interference will be occupied at the beginning and end of each survey day to calibrate the instrument and perform system functional tests. During these tests, battery, phasing, and sensitivity checks will be performed.

The GPR survey will be performed using a digital subsurface interface radar system. After initial field tests are conducted to determine maximum penetration and sufficient resolution, an appropriate transducer will be selected to perform the survey. Different transducers may be used in an attempt to provide greater penetration depths. Data will be digitally recorded, displayed, and analyzed during acquisition to allow real-time interpretation. Line locations will be selected based on electromagnetic anomaly and surface obstructions.

5.2 Field Screening

Because sampling is primarily being conducted to finalize nature and extent based on previous investigations, field screening will be conducted mainly for health and safety purposes. However, if elevated field-screening levels are observed for the deepest sample collected from a specific sampling location, sample collection will continue until field-screening results show no elevated readings. The Laboratory's proposed field-screening approach will be to (1) visually examine all samples for evidence of contamination, (2) screen for organic vapors, (3) screen for radioactivity, (4) screen for metals, and (5) screen for HE. The field-screening methods are discussed below.

5.2.1 Volatile Organic Compounds

Based on the previous RFI results, significant VOC contamination is not expected to be encountered, and VOC screening will be conducted primarily for health and safety purposes.

Screening will be conducted using a photoionization detector (PID) capable of measuring quantities as low as 1 ppm. Vapor screening of soils, sediments, and subsurface core for VOCs will be conducted using a PID equipped with an 11.7 eV lamp. All samples will be screened for VOCs in headspace gas in accordance with SOP-06.33, Headspace Vapor Screening with a Photo Ionization Detector.

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."

5.2.2 Radioactivity

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 and will be performed using appropriate field instruments. Instruments will be calibrated in accordance with the Laboratory's Health Physics Operations Group procedures. All instrument calibration activities 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."

A FIDLER or similar instrument will be used at grid locations across SWMU 15-004(f) to provide definitive identification of locations with elevated DU potentially requiring removal.

5.2.3 Metals Field Screening (XRF)

A Spectrace 9000 (or similar make and model) field-portable XRF instrument will used to field screen for a few specific metals (barium, copper, and lead) previously detected at many of the sites and typically associated with firing-site activities in the Potrillo and Fence Canyons Aggregate Area in accordance with the manufacturer's instructions. An elevated detection for XRF analysis is defined as an instrument reading that exceeds 2 times the BV of the sample matrix. The XRF field-screening results will be recorded on the field boring or test pit logs. The instrument will be operated in accordance with the manufacturer's instructions, including collecting and preparing samples and analyzing standard samples. XRF-screening surveys will be performed as described in the proposed activities in section 4.0 of this work plan for SWMUs 15-007(a), 15-004(b), 15-004(c), 15-004(f), 15-008(a), 36-001, 36-005, and 36-006. Sampling locations may be moved, as necessary, if surface obstructions are encountered.

5.2.4 HE Screening

The Strategic Diagnostics, Inc., D TECH RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) immunoassay test kits will be used to field screen quantitatively for RDX and TNT (2,4,6-trinitrotoluene). All assays will be conducted following the manufacturer's instructions, including equipment calibration, equipment use, sample dilution, and reagent storage. An elevated immunoassay result is defined as 2 times the estimated quantitation limit (approximately 2 mg/kg). Immunoassay field-screening results will be recorded on the field boring or test pit logs.

5.3 Sample Collection

The methods for collecting surface, subsurface, and sediment samples are described below, along with the methods for collecting samples from test pits and excavations. One sample from each site (i.e., the most contaminated sample) will be selected for analysis of PCBs and dioxins/furans if samples are not otherwise being analyzed for these constituents based on the operational history of the site. At SWMUs and AOCs where one sample will be collected for analysis of PCB and dioxin/furan, the sample will be selected based on the results of field screening described in section 5.2 above and on the location relative to potential contaminant sources. The sample will be collected from the most contaminated location at each site (based on field screening) or, if field screening is inconclusive, from a location at the site in closest proximity to the potential source of contamination.

5.3.1 Surface Samples

Samples will be placed in appropriate containers in accordance with EP-ERSS-SOP-5056, Sample Container and Preservation. Quality assurance/quality control (QA/QC) samples will include field duplicate samples, equipment blanks, and trip blanks. These samples will be collected following the current version of EP-ERSS-SOP 5059, Field Quality Control Samples, and will comply with a frequency of 10% of total samples collected for field duplicates and rinsate blanks. Trip blanks will be supplied and remain with analytical samples when samples are collected for VOC analysis. QA/QC samples are used to monitor the validity of the sample collection procedures.

Surface and shallow subsurface soil and sediment samples will be collected in accordance with SOP-06.09, Spade and Scoop Method for the Collection of Soil Samples. Stainless-steel shovels, spades, scoops, and bowls will be used for ease of decontamination. Decontamination will be completed using a dry decontamination method with disposable paper towels and an over-the-counter cleaner, such as Fantastik or an equivalent. If the surface location is at bedrock, an axe or hammer and chisel will be used to collect samples.

5.3.2 Subsurface Samples

Subsurface samples will be collected using hand- or hollow-stem auger or direct-push methods, depending on the depth of the samples and the material being sampled. A brief description of these methods is provided below.

5.3.2.1 Hand Auger

Hand augers may be used to bore shallow holes (e.g., 0 to 10 ft). The hand auger is advanced by turning or pounding the auger into the soil until the barrel is filled. The auger is removed and the sample is dumped out into a clean bowl. Hand-auger samples will be collected in accordance with SOP-06.10, Hand Auger and Thin-Wall Tube Sampler.

5.3.2.2 Direct Push

Direct push is a subsurface sampling method that pushes a tool string into the ground using the weight of a truck in combination with a hydraulic ram or hammer. Various tool strings can be used for obtaining discrete samples, continuous samples, both discrete and continuous samples, and groundwater samples. The direct-push core samples collected in this investigation will be continuous. The inside of the continuous sampler is exposed to the subsurface environment while it is advanced to the sampling interval. This is a dual-tube sampler, so named because it uses two sets of rods to collect soil cores. The outer rods receive the driving force from the hydraulic pushing method and provide a sealed hole from which soil samples may be recovered without the threat of cross-contamination or cave-in. The inner set of rods is placed within the outer rods and holds a sampler in place as the outer rods are driven to the sample interval. The inner rods are then retracted to retrieve the soil core. The direct-push methods will follow the American Society of Testing and Materials D18 Subcommittee on Direct Push Sampling (D18.21.01) (ASTM 1997, 057511).

5.3.2.3 Hollow-Stem Auger

Hollow-stem augers will be used to collect subsurface samples where hand-augering is impractical because of the depth of the depth or the material being sampled. The hollow-stem auger consists of a hollow-steel shaft with a continuous spiraled steel flight welded onto the exterior of the stem. The stem is connected to an auger bit; when the auger is rotated, it transports cuttings to the surface. The hollow stem of the auger allows insertion of drill rods, split-spoon core barrels, Shelby tubes, and other samplers through the center of the auger so samples may be retrieved during drilling operations.

During sampling, the auger will be advanced to just above the desired sampling interval. The sample will then be collected by driving a split-spoon sampler into undisturbed soil/tuff to the desired depth in accordance with SOP-06.26, Core Barrel Sampling for Subsurface Earth Materials. Immediately after sampling, boreholes will be abandoned using bentonite chips or a bentonite/concrete mixture. All borehole cuttings will be managed as IDW, as described in Appendix B of this work plan. All borehole abandonment information will be provided in the Potrillo and Fence Canyons Aggregate Area investigation report.

Field documentation will include detailed borehole logs for each borehole drilled. The borehole logs will document the matrix material in detail and will include the results of all field screening; fractures and matrix samples will be assigned unique identifiers. All field documentation will be completed in accordance with the current version of SOP-12.01, Field Logging, Handling, and Documentation of Borehole Materials.

Borehole Abandonment

All hollow-stem auger boreholes will be properly abandoned according to the most recent version of EP-ERSS-SOP-5034, Monitor Well and RFI Borehole Abandonment, which meets the requirements of Section X.D of the Consent Order. Borehole abandonment will use one of the following methods.

- Shallow boreholes, with a total depth of 20 ft or less, will be abandoned by filling the borehole with bentonite chips and then hydrating the chips in 1- to 2-ft lifts. The borehole will be visually inspected while the bentonite chips are being added to ensure bridging does not occur.
- Boreholes greater than 20 ft in depth will be pressure-grouted from the bottom of the borehole to the surface using the tremie pipe method. Acceptable grout materials include cement or bentonite grout, neat cement, or concrete.

The use of backfill materials such as bentonite and grout will be documented in a field logbook with regard to volume (calculated and actual), intervals of placement, and additives used to enhance backfilling. All borehole abandonment information will be presented in the investigation report.

5.3.3 Sediment Samples

Sediment samples will be collected from areas of sediment accumulation that include sediment judged to be representative of the historical period of Laboratory operations. The locations will be selected based on geomorphic relationships in areas likely to have been affected by discharges from Laboratory operations. Preliminary sediment sampling locations have been selected and are shown in section 4 figures. Because sediment systems are dynamic and subject to redistribution by runoff events, however, some locations may need to be adjusted at the time this work plan is implemented. In the course of collecting sediment samples, it may be determined that the selected location is not appropriate because of conditions observed during excavation of the sediment (e.g., the sediment is much shallower than anticipated, the sediment is predominantly coarse-grained, or the sediment shows evidence of being older than the target age). Sediment sampling locations may be adjusted as appropriate. Any changes to sediment sampling locations will be documented as deviations from this work plan in the investigation report.

5.3.4 Test Pit and/or Trench Samples

Excavations or test pits will be completed using a track excavator or backhoe to locate inactive landfills and septic tanks. Excavated soil will be staged a minimum of 3 ft from the edge of the excavation, and excavations deeper than 4 ft bgs will be appropriately benched to allow access and egress, if necessary. After field screening, confirmation sampling, and any necessary over excavation work are completed, the test pits and/or trenches will be backfilled. The soil removed from the excavation will be returned to the excavation provided the sample analysis shows it is not hazardous waste and residential SSLs are not exceeded. Otherwise, the excavations will be backfilled with clean fill material.

5.4 Laboratory Methods

The analytical suites vary by site as specified in section 4 and are summarized in Table 4.0-1. All analytical suites are presented in the statement of work for analytical laboratories (LANL 2000, 071233). The specific analytical methods to be used are specified in Table 4.0-1. Sample collection and analysis will be coordinated with the Sample Management Office.

5.5 Health and Safety

The field investigations described in this investigation work plan will comply with all applicable requirements pertaining to worker health and safety. An integrated work document and a site-specific health and safety plan will be in place before fieldwork is performed.

5.6 Equipment Decontamination

Equipment for drilling and sampling will be decontaminated before and after drilling and sampling activities (as well as between drilling boreholes) to minimize the potential for cross-contamination. Dry decontamination methods are preferred and will be given priority because they do not generate liquid wastes. Residual material adhering to the equipment will be removed using dry decontamination methods, including wire-brushing and scraping, as described in EP-ERSS-SOP-5061, "Field Decontamination of Equipment." Dry decontamination of sampling equipment may include use of a nonphosphate detergent such as Fantastik on a paper towel, and the equipment is wiped so that no liquid waste is generated.

If dry decontamination methods are not effective, equipment may be decontaminated by steam-cleaning or hot water pressure-washing, as described in EP-ERSS-SOP-5061. Wet decontamination methods will be conducted on a high-density polyethylene liner on a temporary decontamination pad. 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.

5.7 Investigation-Derived Waste

IDW generated during field-investigation activities may include, but is not limited to, drill cuttings; contaminated soil; excavated debris; contaminated personal protective equipment (PPE), sampling supplies, and plastic; fluids from the decontamination of PPE and sampling equipment; and all other waste that has potentially come into contact with contaminants.

All IDW generated during field-investigation activities will be managed in accordance with applicable SOPs that incorporate the requirements of all applicable EPA and NMED regulations, DOE orders, and Laboratory implementation requirements. Appendix B presents the IDW management plan.

5.8 Cleanup Activities

SWMUs 15-007(a), 15-008(a), 15-010(a), 36-001, and 36-006 are proposed for remediation under this investigation work plan. Excavation of waste, contaminated media, waste disposition, and confirmation sampling will be completed at these sites. This section summarizes proposed remediation activities. The general sequence of activities for waste excavation, transportation, disposal, and confirmation sampling is summarized below. Specific details are provided for each site in section 4.

5.8.1 Removal of Surficial and Buried Waste, Inactive Units, Contaminated Soil and Sediment

The general sequence of waste-removal activities is as follows:

- Mobilization
    - ❖ Assemble construction documents
    - ❖ Conduct construction readiness assessment
    - ❖ Conduct preconstruction meeting
    - ❖ Construct access roads
    - ❖ Construct staging area
    - ❖ Install temporary field trailers
    - ❖ Determine boundaries of waste. First, the original waste limit coordinates will be surveyed and staked, as determined in the RFI report and reported in the HIR. Next, excavation and potholing, with visual examination using methods described in section 5.1, will be used to establish or to confirm waste boundaries only where the original boundaries are inadequately defined to implement cleanup.
    - ❖ Mobilize heavy equipment to site
    - ❖ Identify underground utilities
- Site preparation
    - ❖ Install fencing
    - ❖ Install stormwater controls
    - ❖ Abandon/relocate utilities
    - ❖ Conduct preexcavation survey
- Removal of waste
    - ❖ Excavate waste
    - ❖ Stockpile and load roll-off container
    - ❖ Characterize for dispositioning
    - ❖ Transport to off-site disposal facility
    - ❖ Survey boundaries of excavation
    - ❖ Confirmation sampling
    - ❖ Establish subgrade and conduct survey
- Backfill
    - ❖ Backfill and compact
    - ❖ Vegetate surface
    - ❖ Survey finished surface
- Demobilize

5.8.2 Waste Management and Disposal

Management of all investigation waste, including waste generated during cleanup, is described in Appendix B.

5.8.3 Transportation

All waste will be hauled in rolloff containers directly to the selected disposal facility.

5.8.4 Confirmation Sampling

Confirmation sampling will be performed at all remediated sites (section 4).

6.0 MONITORING PROGRAMS

Groundwater, sediment, and surface water monitoring is occurring within the Potrillo and Fence Canyons Aggregate Area as part of other environmental activities. This monitoring is described briefly below.

6.1 Groundwater

Section IV.B.5.b.iii of the Consent Order requires monitoring and sampling of all monitoring wells in Potrillo and Fence Canyons. Alluvial monitoring and observation wells in Potrillo and Fence Canyons include POTO-4A, POTO-4B, POTO-4C, POTO-5A, POTO-5B, and FCO-1 (Plate 1). These wells are monitored as part of the IFGMP (LANL 2008, 101897). To date, no regional wells have been located within the Potrillo and Fence Canyons Aggregate Area.

6.2 Stormwater

Monitoring of stormwater in Potrillo and Fence Canyons is being performed under is being performed under the NPDES Multi-Sector General Permit (MSGP) and Federal Facility Compliance Agreement/Administrative Order (FFCA/AO). The MSGP and FFCA/AO are being replaced by a new NPDES Individual Permit (IP). Monitoring under the MSGP, FFC/AO, and IP is performed using site monitoring areas (SMAs), which monitor stormwater runoff from individual SWMUs and AOCs or groups of SWMUs and AOCs. SWMUs and AOCs in the Potrillo and Fence Canyons Aggregate Area that are subject to SMA monitoring under the IP are SWMUs 15-004(f), 15-006(a), 15-008(a), 15-009(e), 36-003(b), 36-004(d), and 36-006 and AOCs 15-008(f), C-15-004, 36-004(a), 36-004(c), 36-004(e), and C-36-006(e). The monitoring requirements for each SMA are contained in a Site Drainage Pollution Prevention Plan (SDPPP) for SWMUs and AOCs and the Storm Water Monitoring Plan, which is updated annually and submitted to EPA. The SDPPP also contains the SMA results.

The six SMAs located within Potrillo Canyon include PT-SMA-0.5, PT-SMA-1, PT-SMA-1.7, PT-SMA-2, PT-SMA-3, and PT-SMA-4.2; no decision-level data are yet reported for these locations. SMAs located in Fence Canyon includes F-SMA-2, which monitors active firing site Minie [AOC 36-004(c)]. The SMA monitoring program was initiated in 2005. One round of sampling has been conducted at F-SMA-2, and five rounds have been conducted at PT-SMA-1. Two stormwater gauging stations (E266 and E267) are located in Potrillo Canyon and one stormwater gauging station (E267.5) is located in Fence Canyon (Plate 1). Data from these stations, if available, will be included in the investigation report.

7.0 SCHEDULE

The scheduled notice date for NMED to approve this investigation work plan is August 13, 2009. Field work will not proceed until the work plan is approved. The expected duration of field activities is 18 mo. The investigation report for Potrillo and Fence Canyons Aggregate Area will be submitted within 3 mo after completion of field activities. Therefore, a submittal date of no later than May 15, 2011, is proposed for the investigation report.

8.0 REFERENCES AND MAP DATA SOURCES

8.1 References

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

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8.2 Map Data Sources

Potential Release Sites; Los Alamos National Laboratory, Waste and Environmental Services Division, Environmental Data and Analysis Group, EP2009-0137; 1:2,500 Scale Data; 13 March 2009; Modified PRS boundaries contained within WES GIS Team project folder, 09-0039, until change control complete.

Canyon Reaches; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2002-0592; 1:24,000 Scale Data; Unknown publication date; Additional reach data contained in WES GIS Team project folder 09-0039

Aggregate Areas; Los Alamos National Laboratory, ENV Environmental Remediation & Surveillance Program, ER2005-0496; 1:2,500 Scale Data; 22 September 2005.

Former Structures of the Los Alamos Site; Los Alamos National Laboratory, Waste and Environmental Services Division, EP2008-0441; 1:2,500 Scale Data; 08 August 2008; Additional former structures contained within WES GIS Team project folder, 09-0039.

Primary Electric Grid; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Primary Gas Distribution Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Paved Parking; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 12 August 2002; as published 15 January 2009.

Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Road Centerlines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 15 December 2005; as published 15 January 2009.

Sewer Line System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Storm Drain Line Distribution System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Water Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Hypsography, 2, 10, 20, & 100 Foot Contour Intervals; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1991.

Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 04 December 2008.

WQH Drainage_arc; Los Alamos National Laboratory, ENV Water Quality and Hydrology Group; 1:24,000 Scale Data; 03 June 2003; Additional drainage data contained within WES GIS Team project folder 08-0030.

Point Feature Locations of the Environmental Restoration Project Database; Los Alamos National Laboratory, Waste and Environmental Services Division, EP2009-0162; 13 March 2009; Proposed sampling and modified/new point feature data contained within WES GIS Team project folder 09-0039.

Individual Permit (IP) Site Monitoring Area (SMA) Samplers; Los Alamos National Laboratory, Water Stewardship Program; Currently unpublished 2009 data contained within WES GIS Team project folder 07-0142.

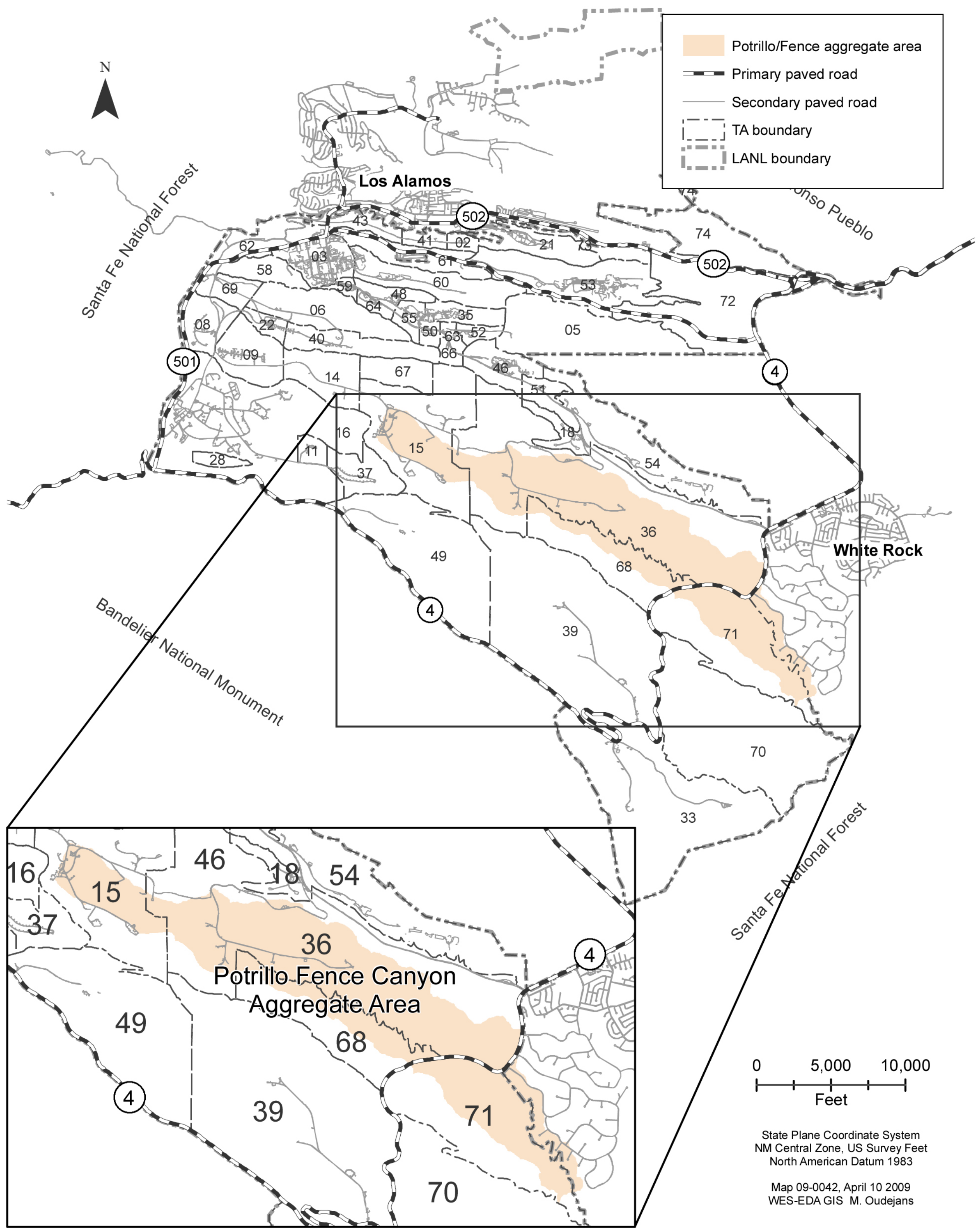


Figure 1.0-1 Potrillo and Fence Canyons Aggregate Area with respect to Laboratory TAs and surrounding land holdings

Bandelier Tuff	Tshirege Member	Qbt 4	Ash-Flow Units
		Qbt 3	
		Qbt 2	
		Qbt 1v	
		Qbt 1g	
		Tsankawi Pumice Bed	
Cerro Toledo Interval		Volcaniclastic Sediments and Ash-Falls	
Bandelier Tuff	Otowi member	Ash-Flow Units	
		Guaje Pumice Bed	
Puye Formation	Fanglomerate	Fanglomerate Facies includes sand, gravel, conglomerate, and tuffaceous sediments	
	Basalt and Andesite	Cerros del Rio Basalts intercalated within the Puye Formation, includes up to four interlayered basaltic flows. Andesites of the Tschicoma Formation present in western part of plateau	
	Fanglomerate	Fanglomerate Facies includes sand, gravel, conglomerate, and tuffaceous sediments; includes “Old Alluvium”	
	Axial facies deposits of the ancestral Rio Grande	Totavi Lentil	
Santa Fe Group	Coarse Sediments	Coarse-Grained Upper Facies (formerly called the “Chaquehui Formation” by Purtymun 1995, 045344)	
	Basalt		
	Coarse Sediments		
	Basalt		
	Coarse Sediments		
	Basalt		
	Coarse Sediments		
	Arkosic clastic sedimentary deposits	Undivided Santa Fe Group (includes Chamita[?] and Tesuque Formations)	

Note: Source: LANL 1999, 064617. Modified by NWI 03/21/08.

Figure 3.2-1 Generalized stratigraphy of bedrock units

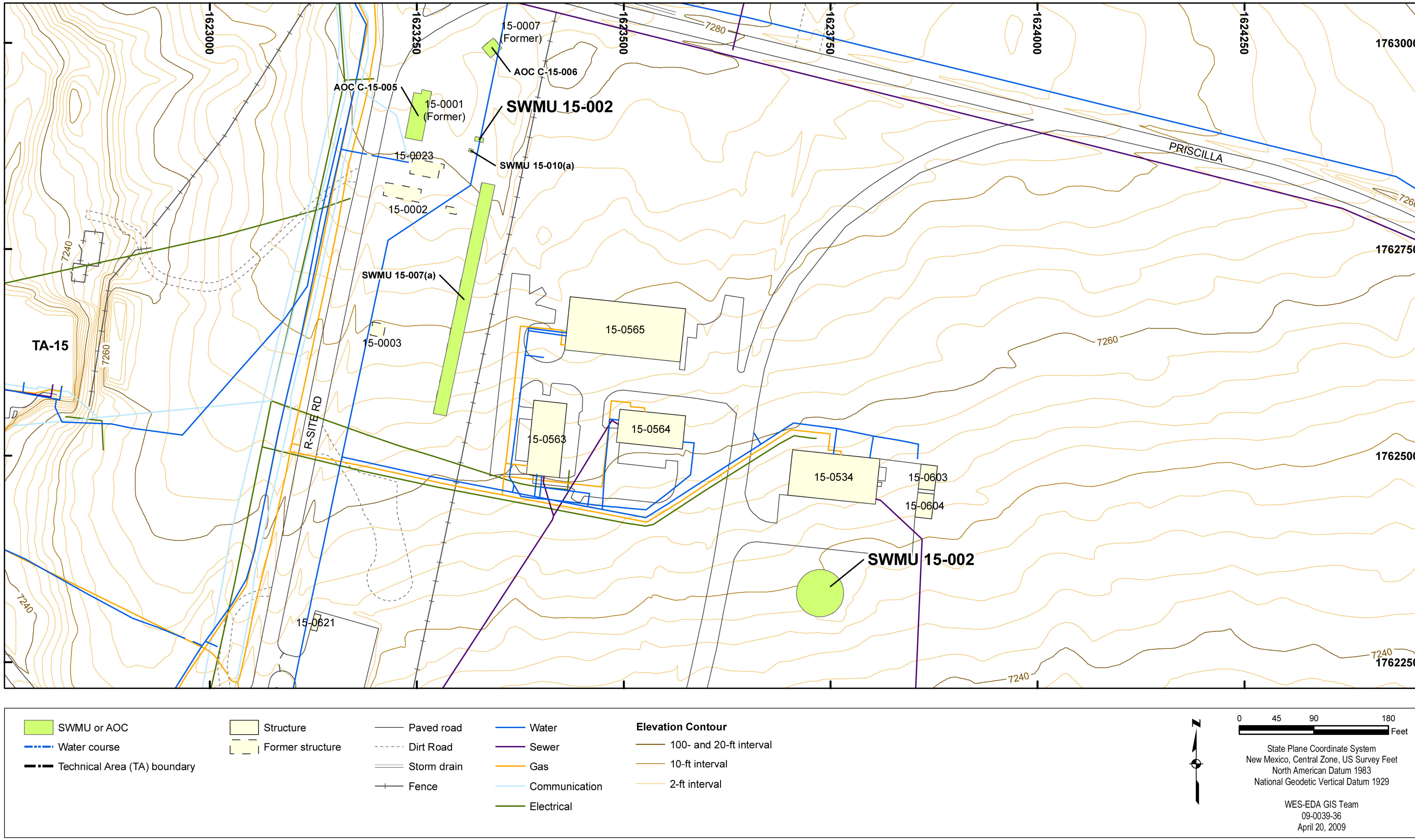


Figure 4.1-1 Site features for SWMU 15-002

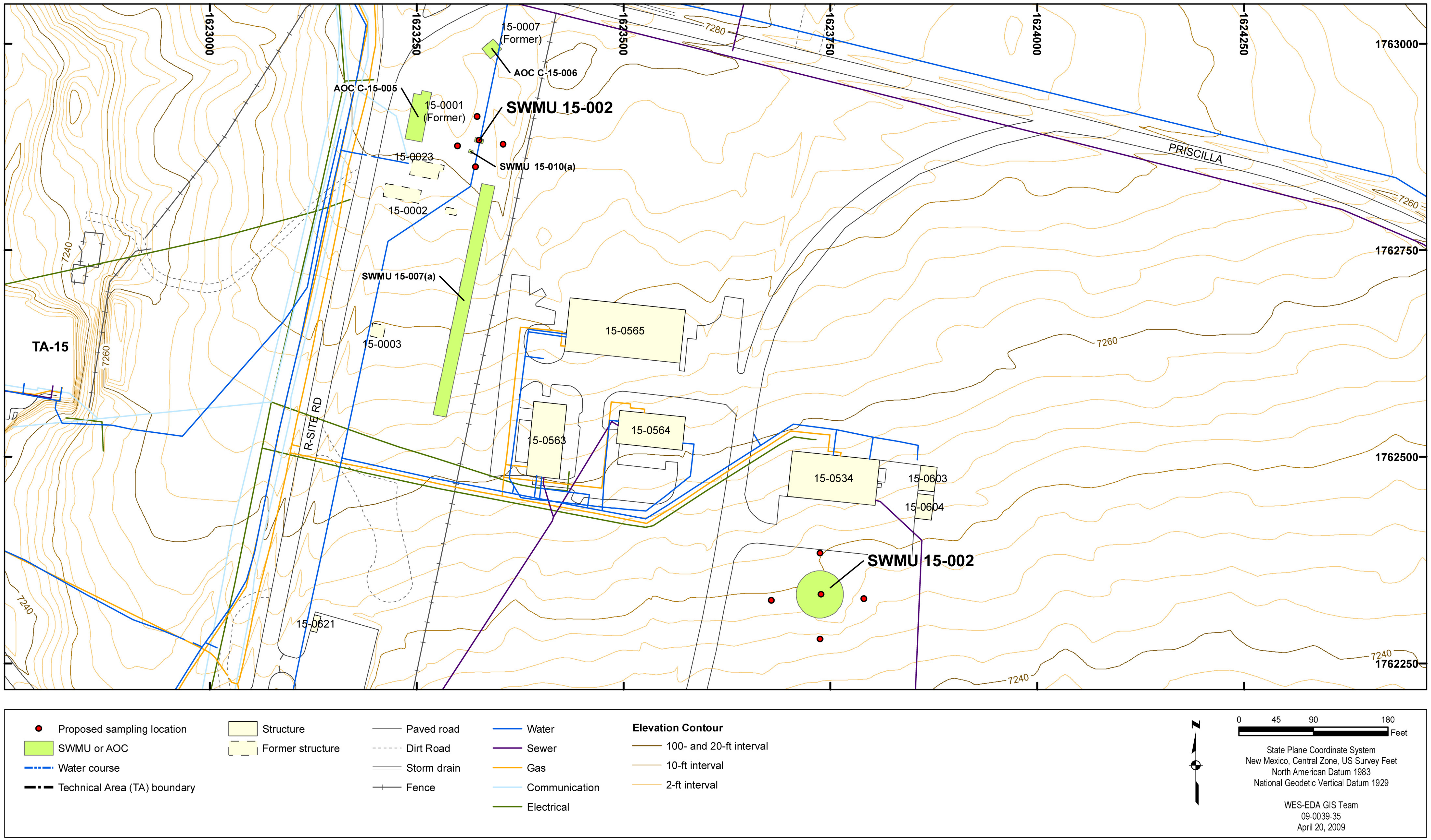


Figure 4.1-2 Proposed sampling locations at SWMU 15-002

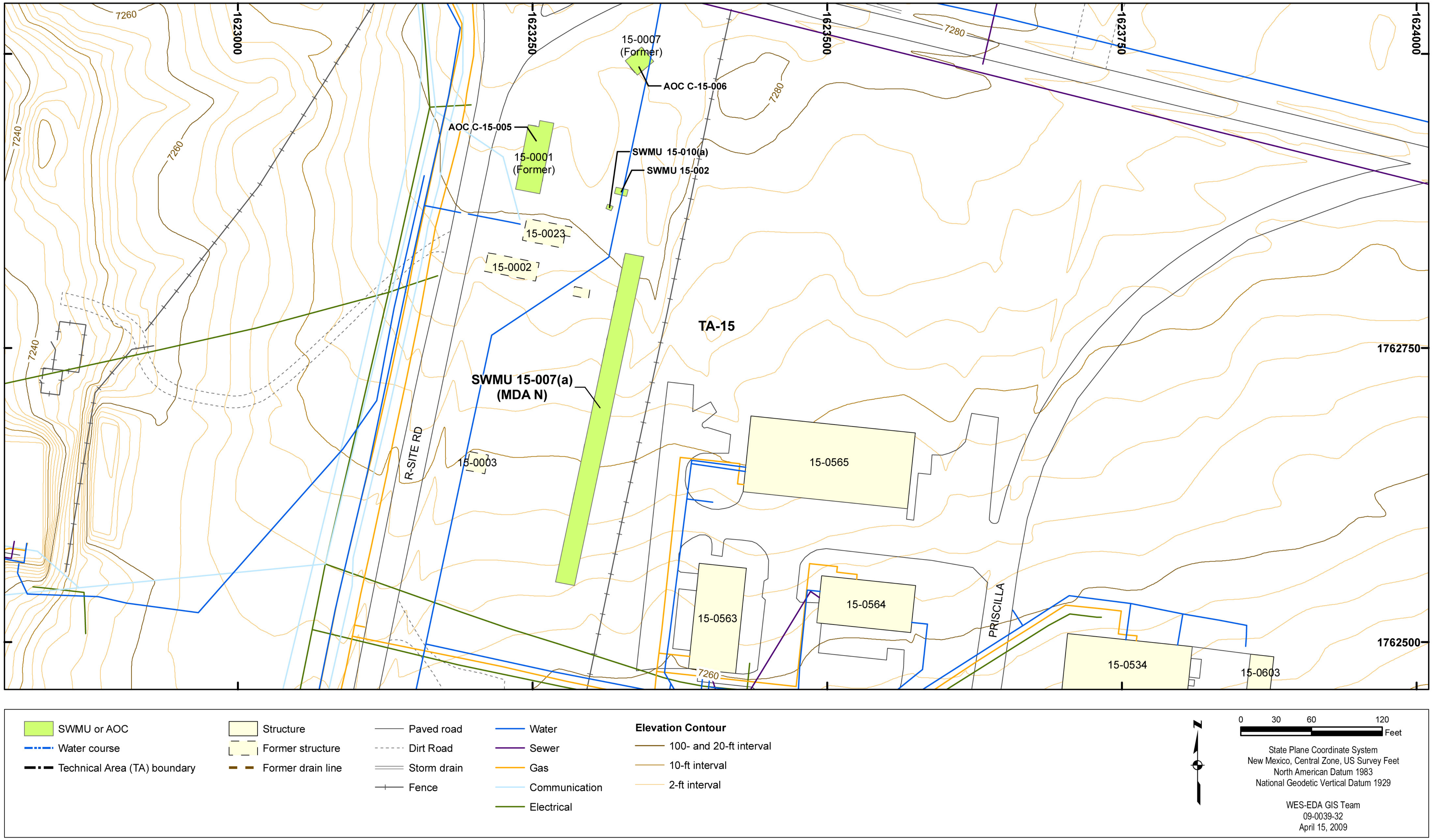


Figure 4.1-3 Site features for SWMU 15-007(a)

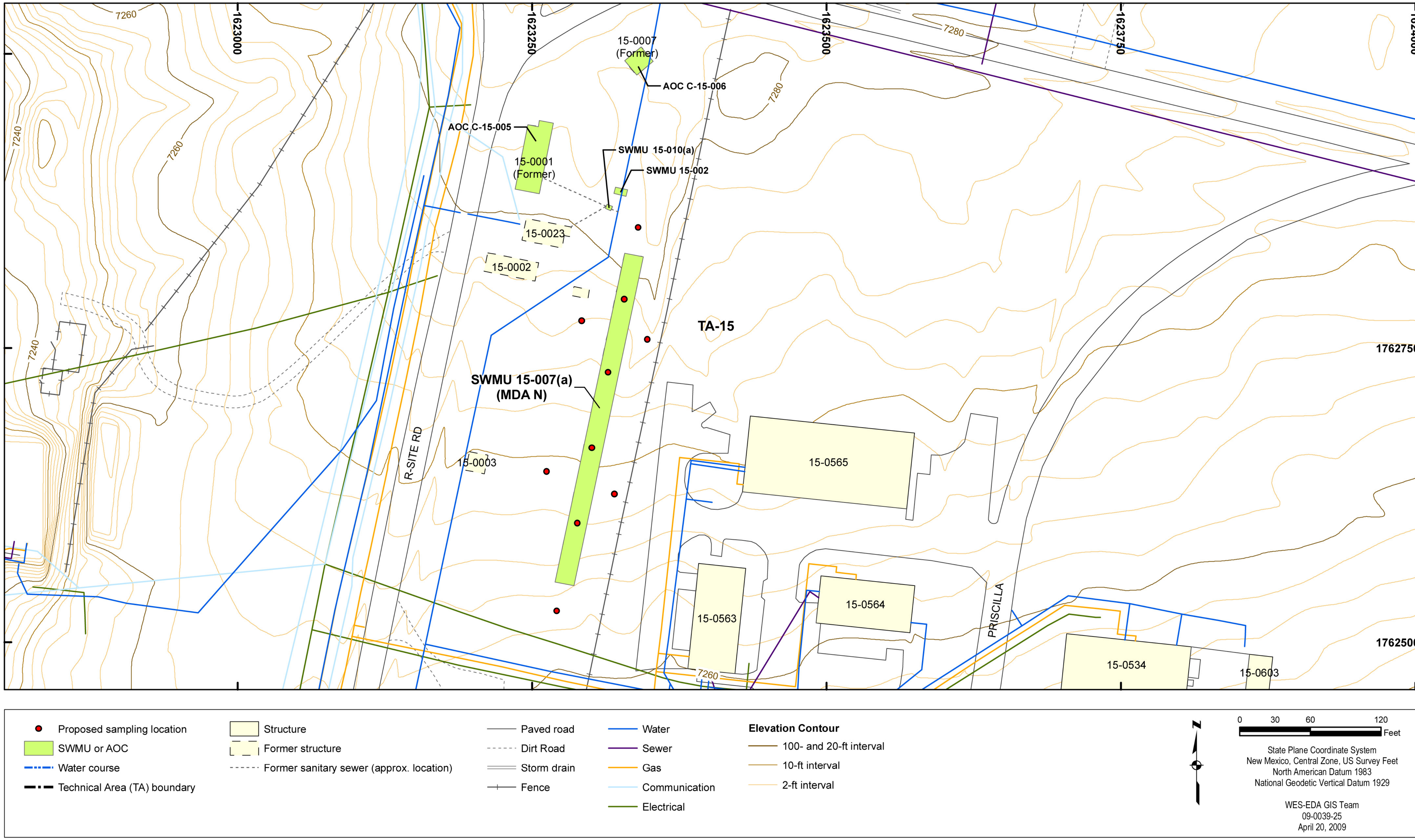


Figure 4.1-4 Proposed sampling locations at SWMU 15-007(a)

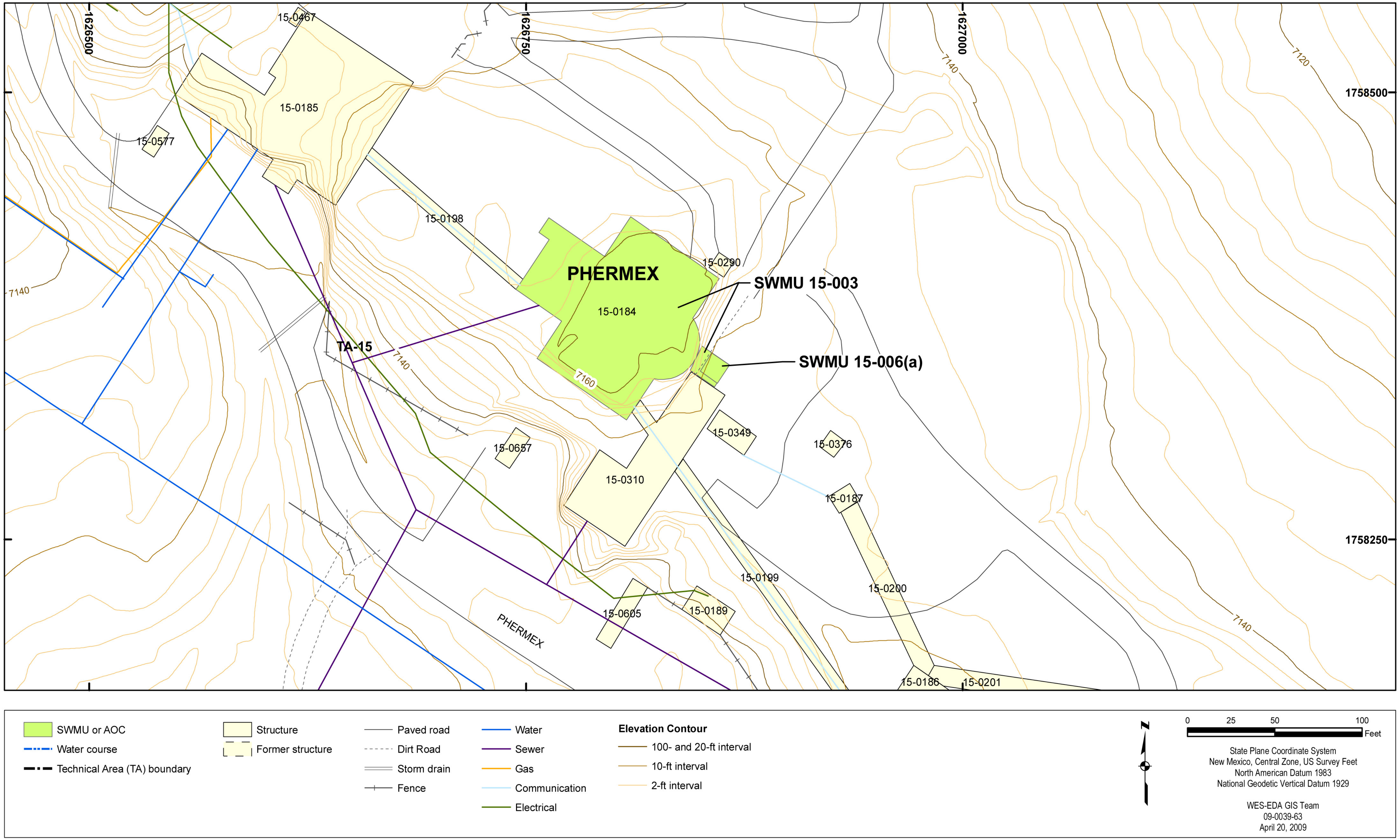


Figure 4.1-5 Site features for SWMUs 15-003 and 15-006(a)

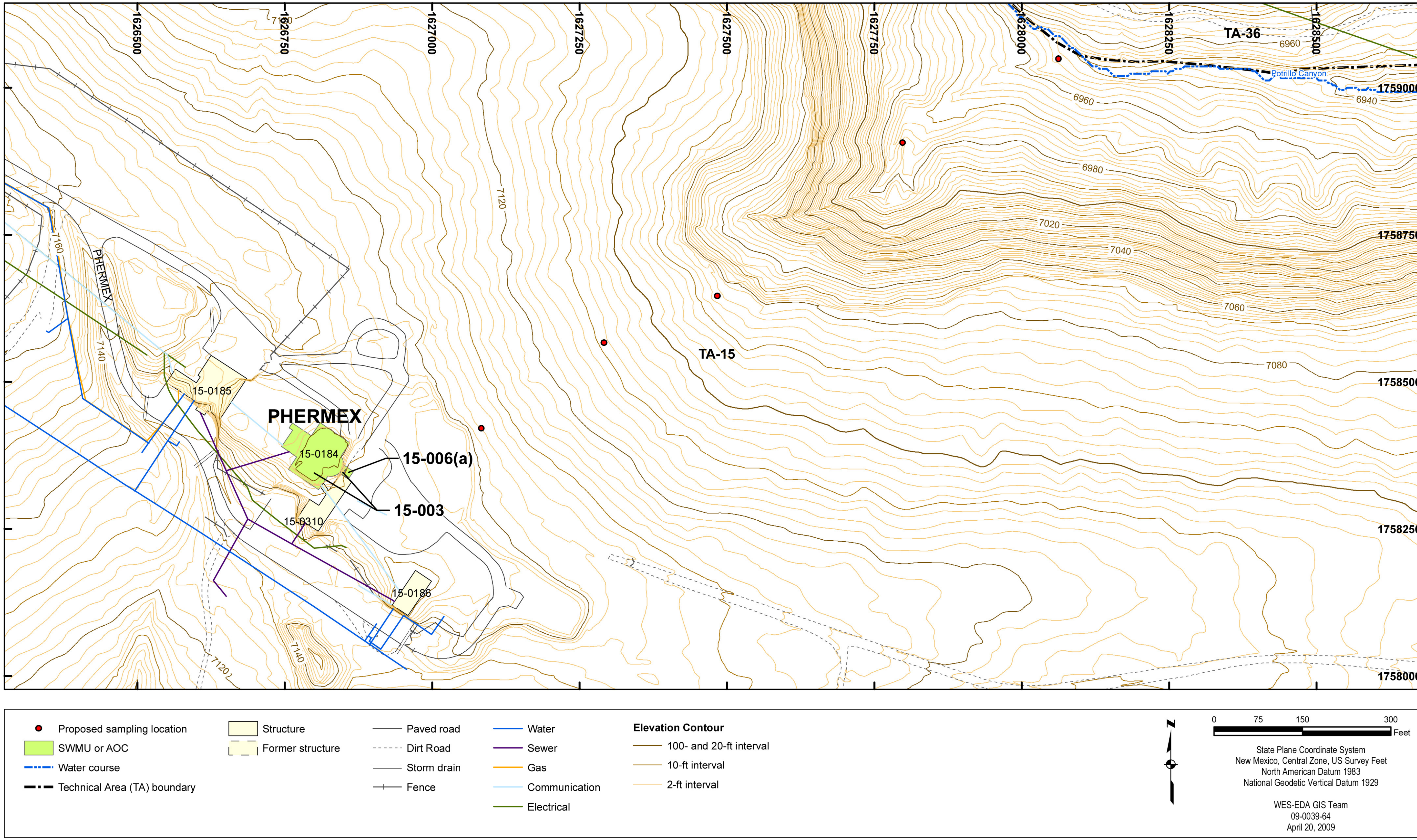


Figure 4.1-6 Proposed sampling locations at SWMUs 15-003 and 15-006(a)

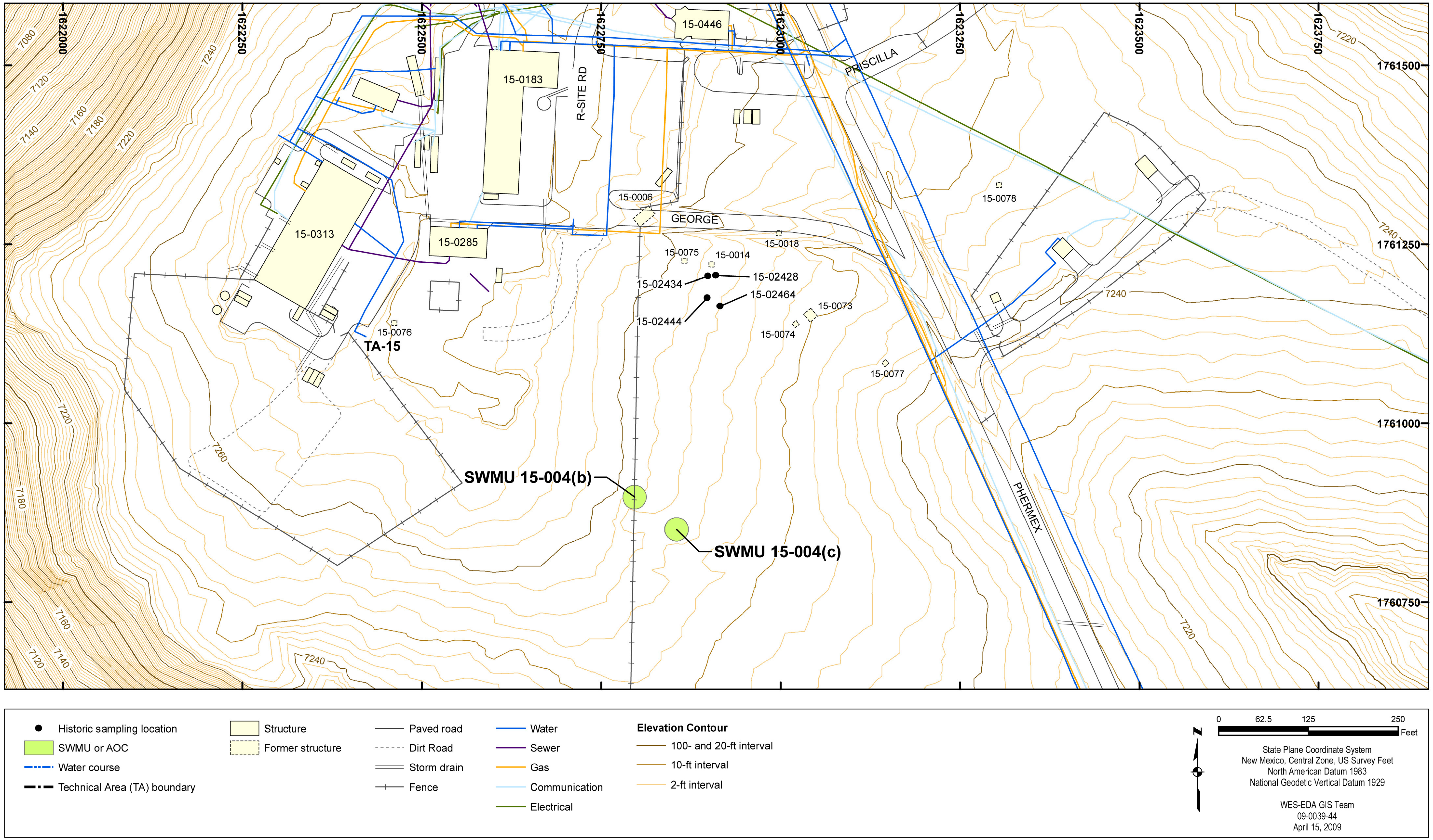


Figure 4.1-7 Site features and historical sampling locations for SWMUs 15-004(b) and 15-004(c)

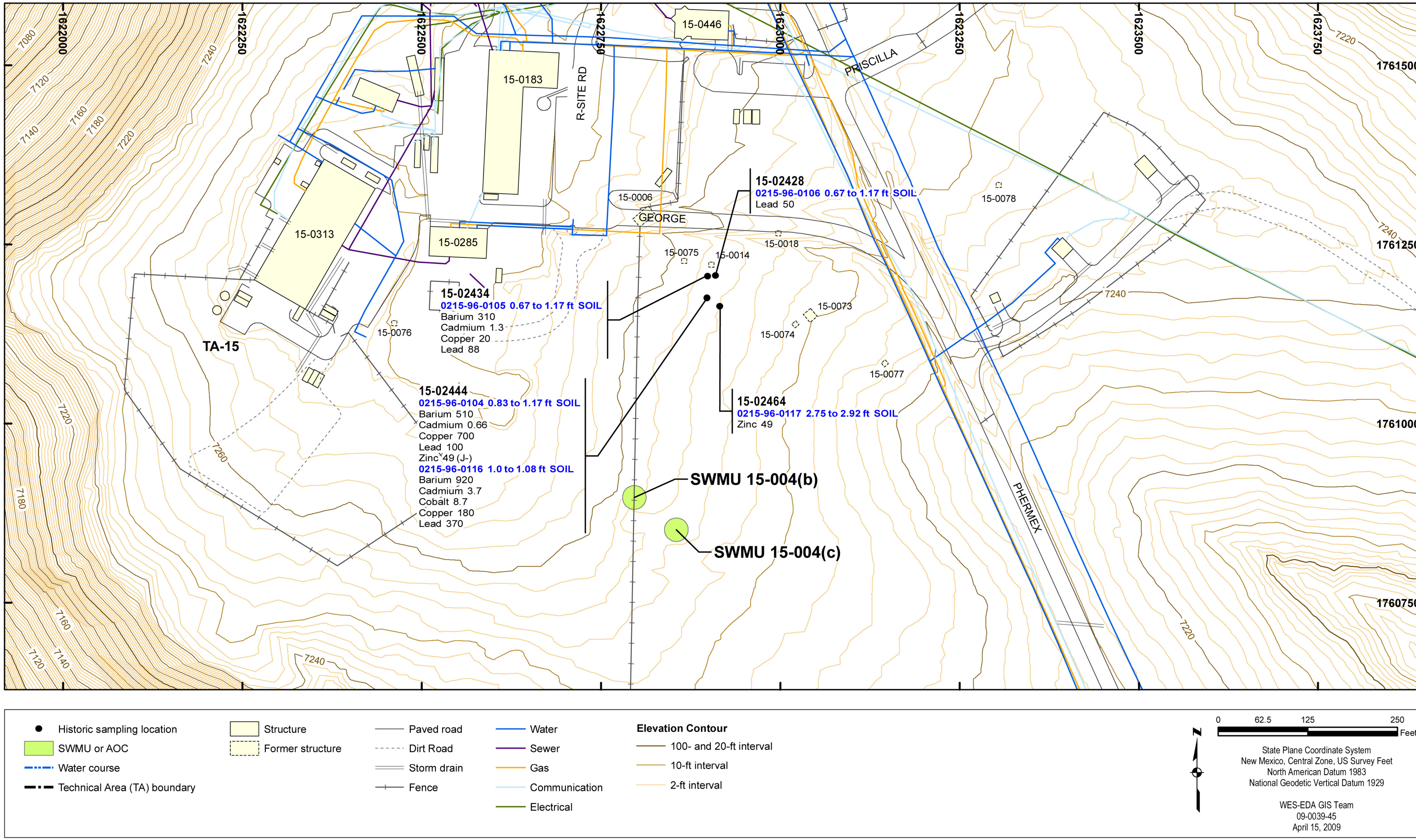


Figure 4.1-8 Inorganic chemicals detected above BVs at SWMUs 15-004(b)

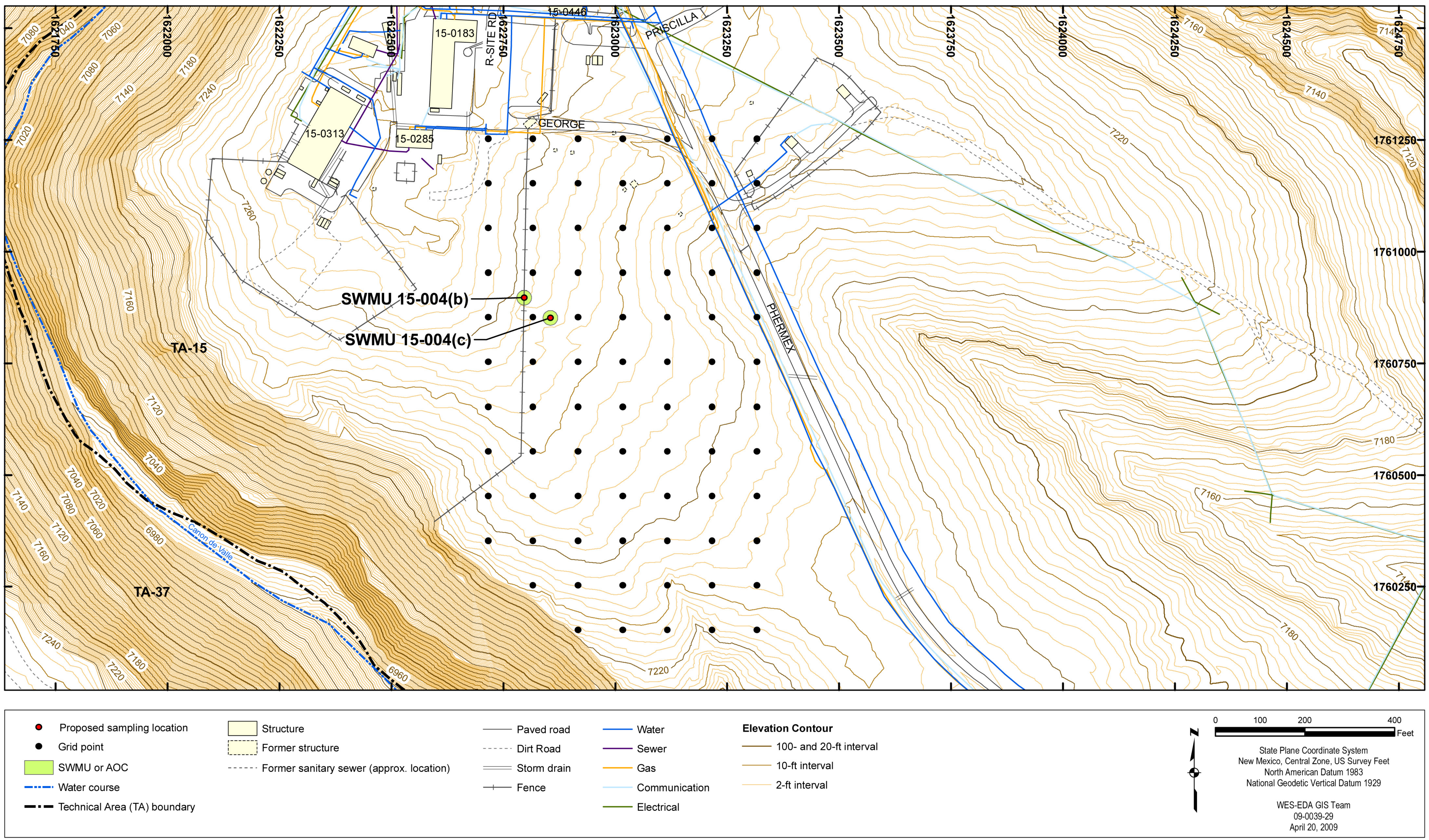


Figure 4.1-9 Proposed grid and sampling locations at SWMUs 15-004(b) and 15-004(c)

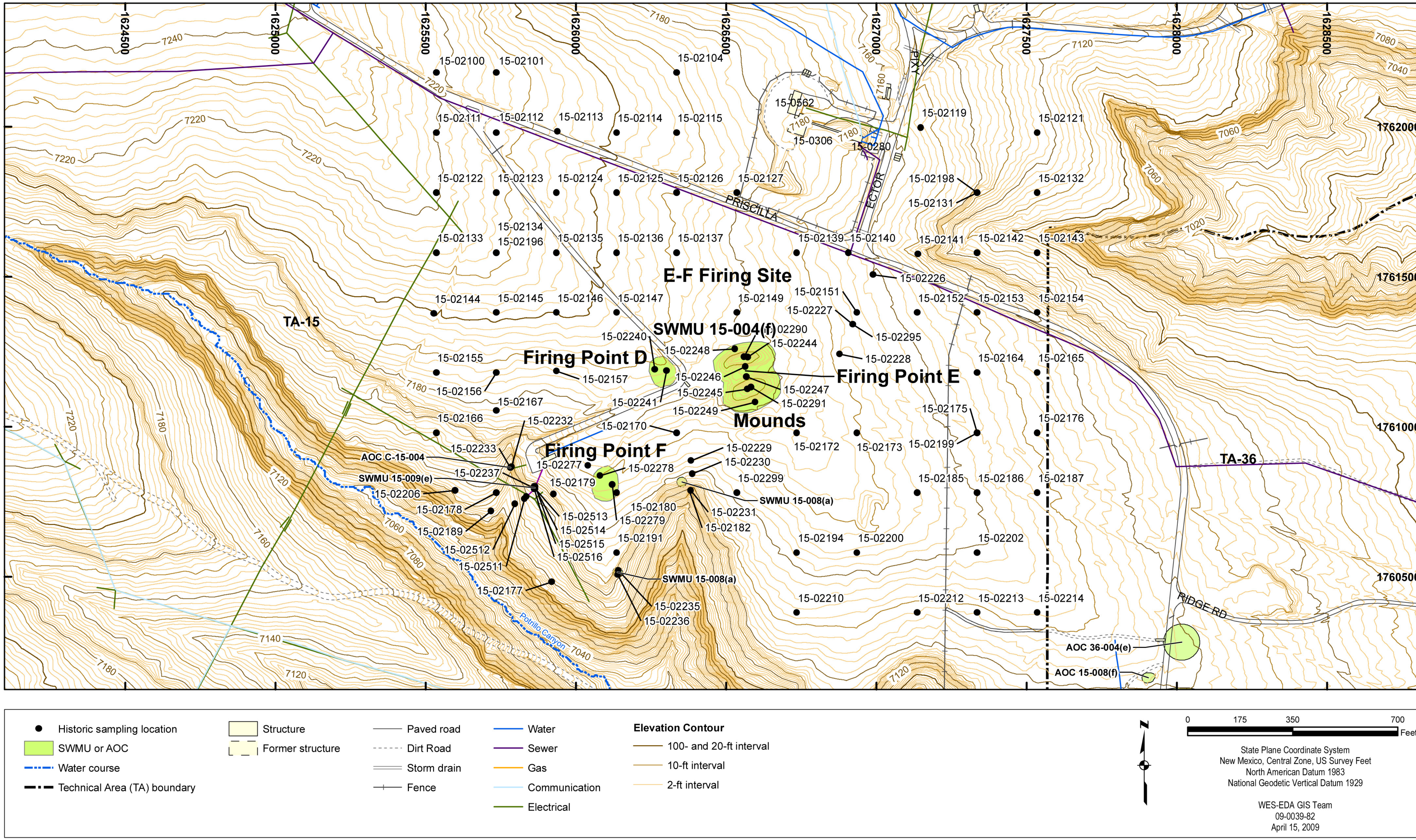


Figure 4.1-10 Site features and historical sampling locations for SWMU 15-004(f)

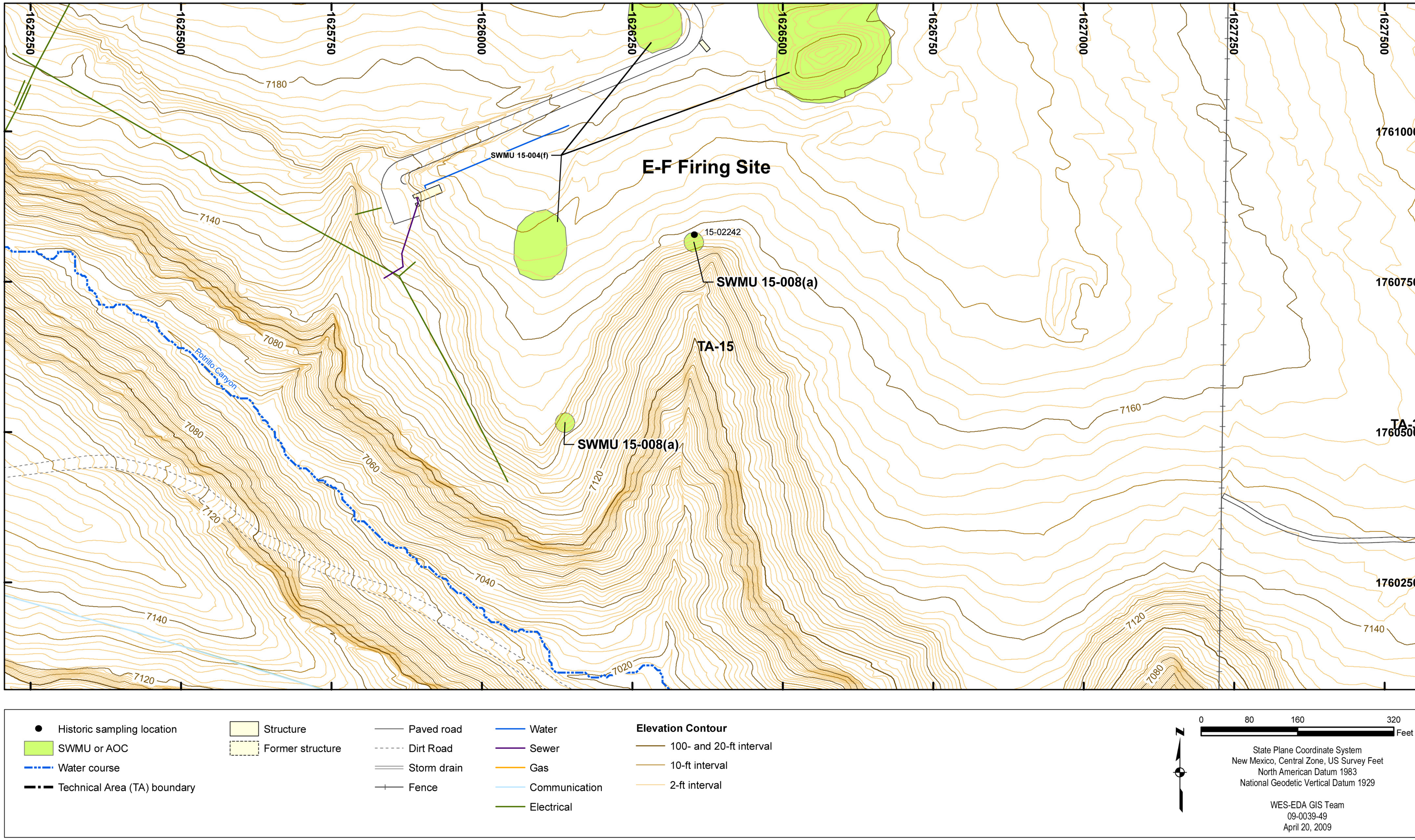


Figure 4.1-11 Site features and historical sampling locations for SWMU 15-008(a)

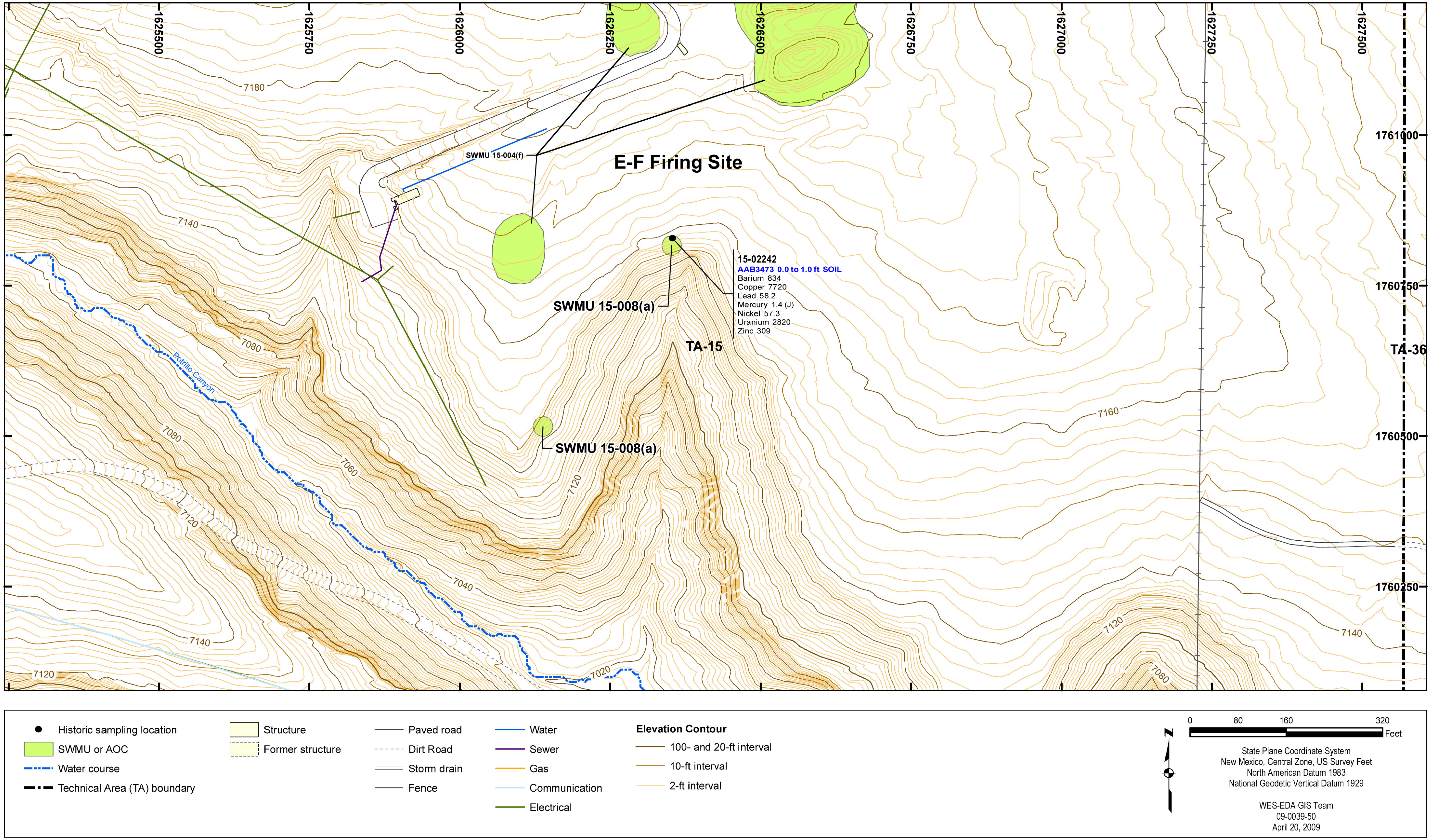


Figure 4.1-12 Inorganic chemicals detected above BVs at SWMU 15-008(a)

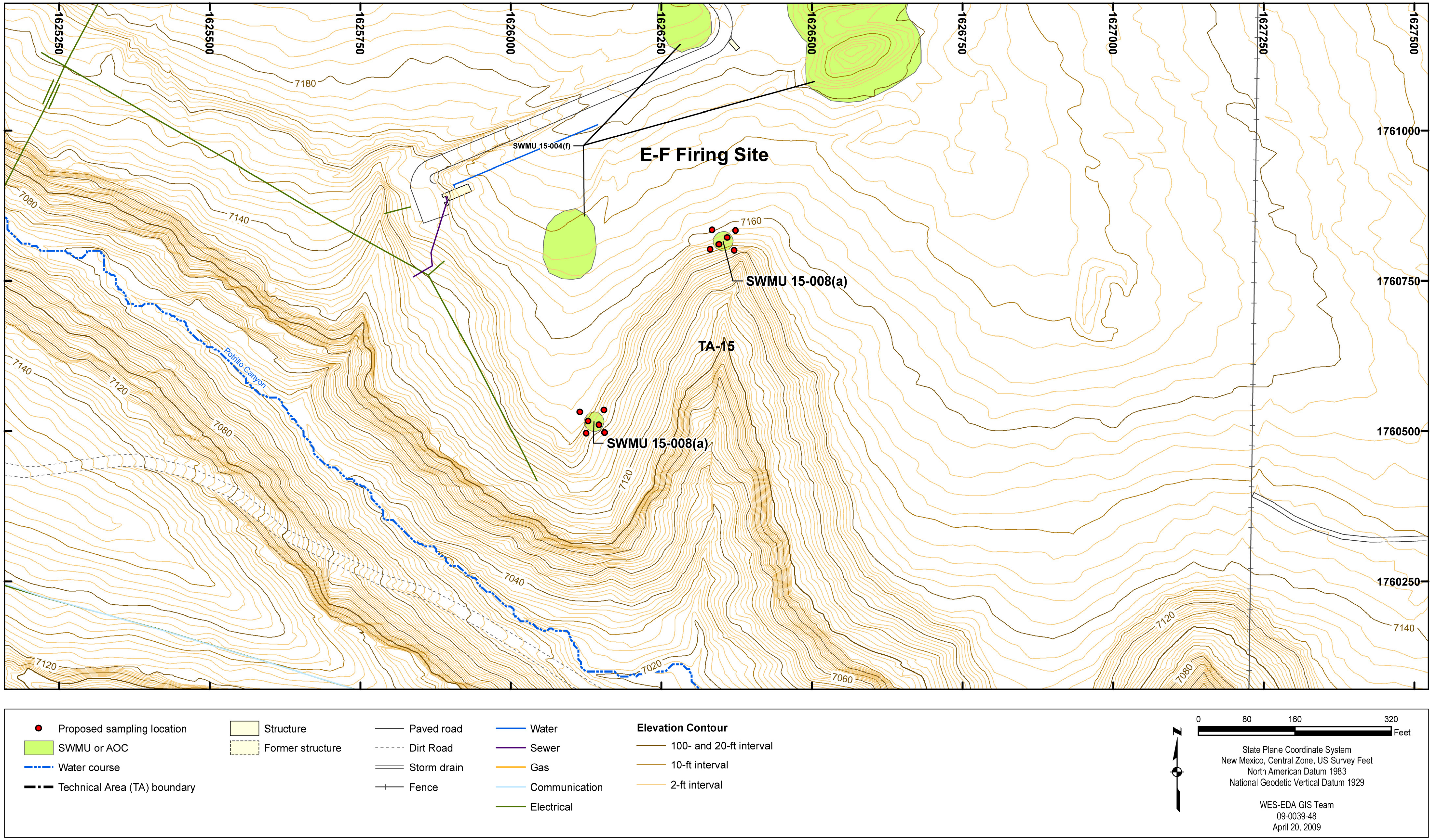


Figure 4.1-13 Proposed sampling locations at SWMU 15-008(a)

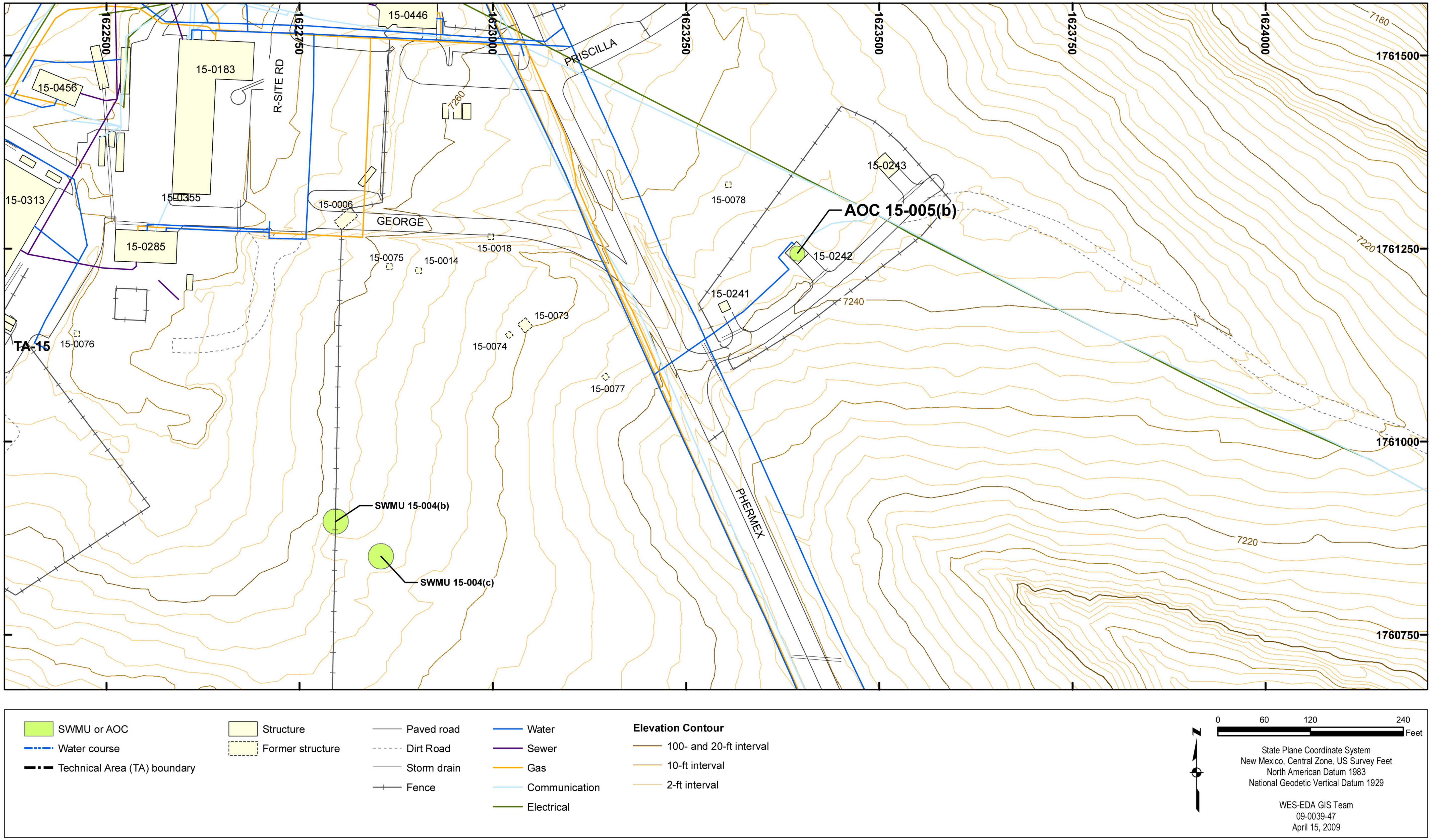


Figure 4.1-14 Site features for AOC 15-005(b)

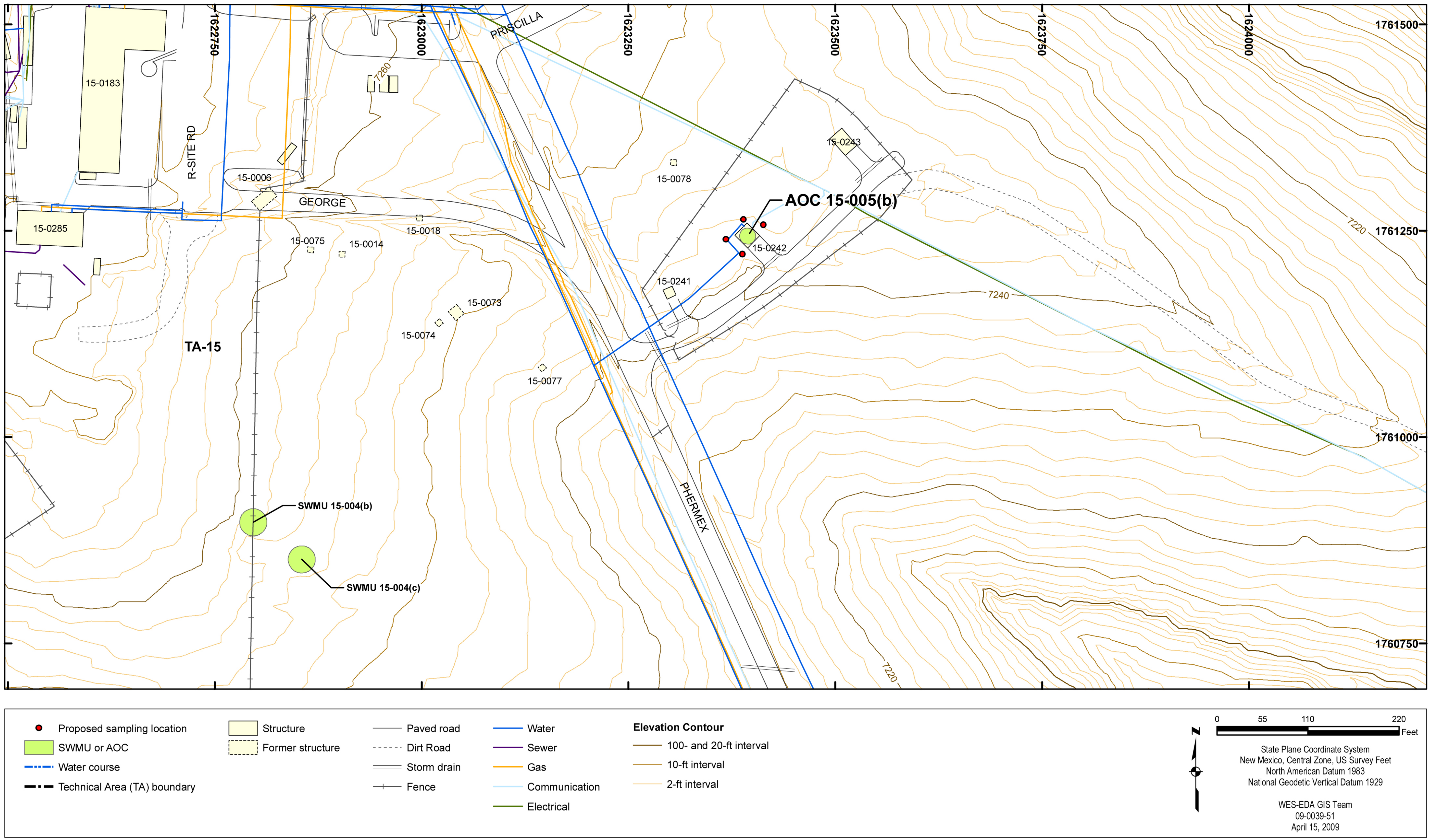


Figure 4.1-15 Proposed sampling locations at AOC 15-005(b)

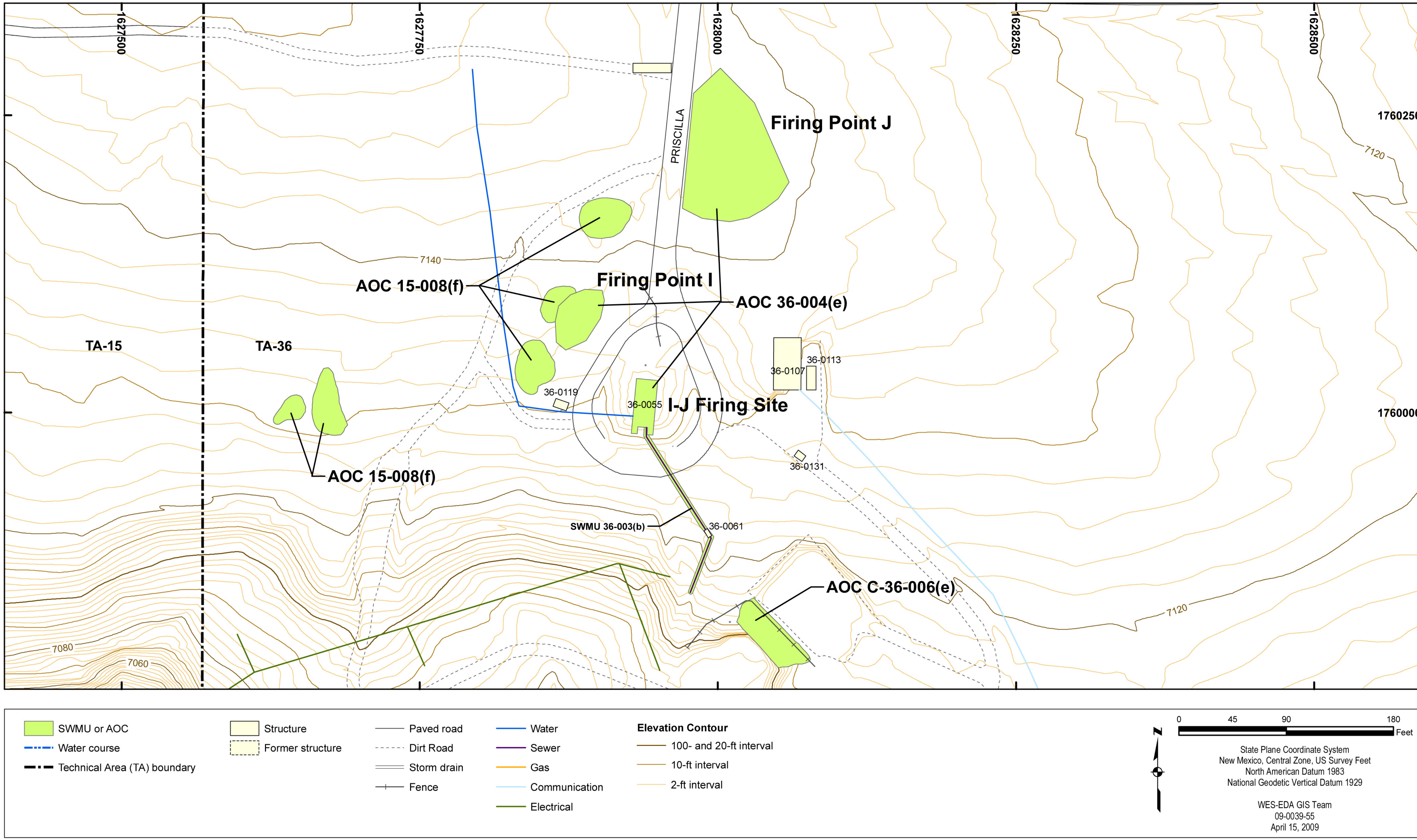


Figure 4.1-16 Site features for AOCs 15-008(f), 36-004(e), and C-36-006(e)

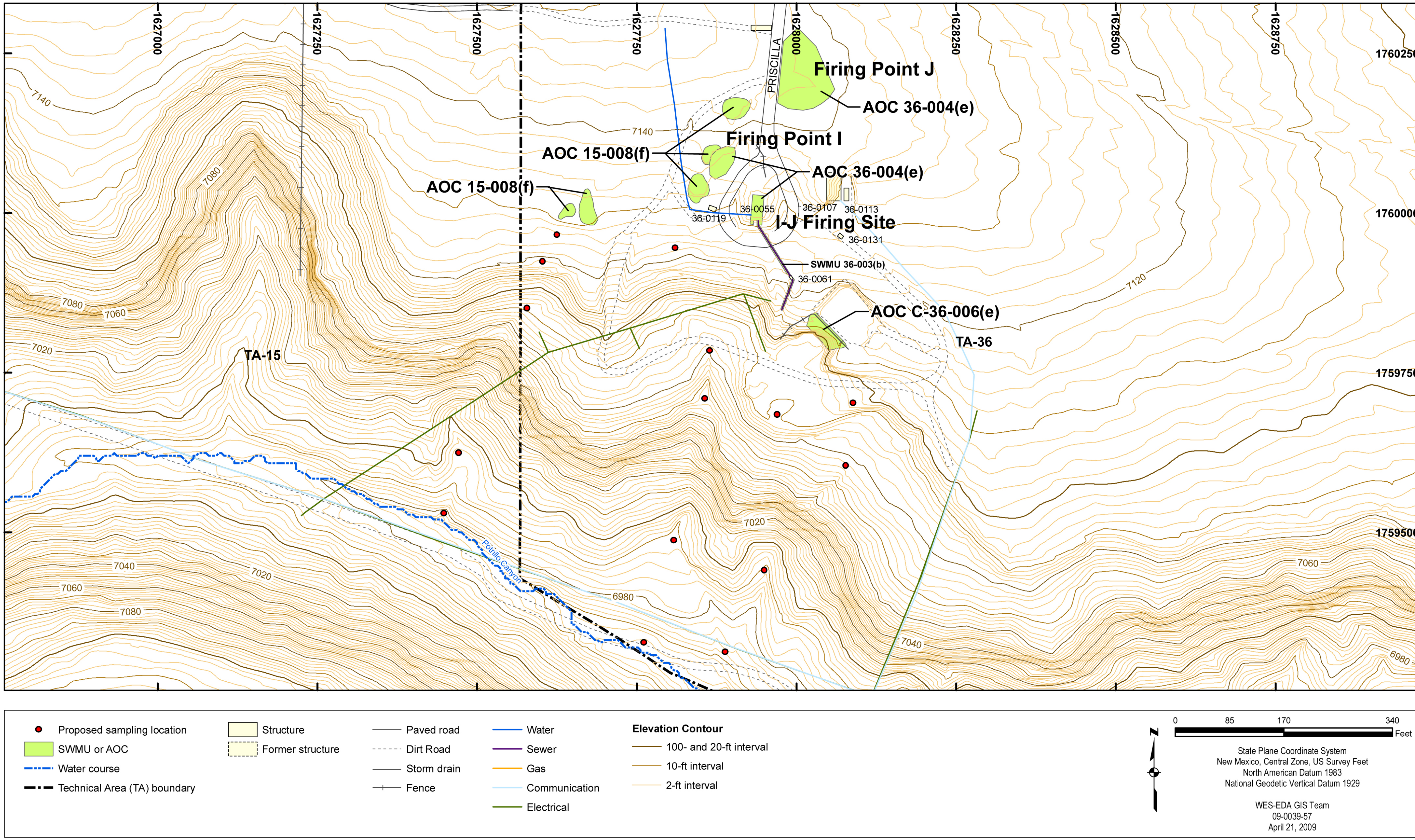


Figure 4.1-17 Proposed sampling locations at AOCs 15-008(f), 36-004(e), and C-36-006(e)

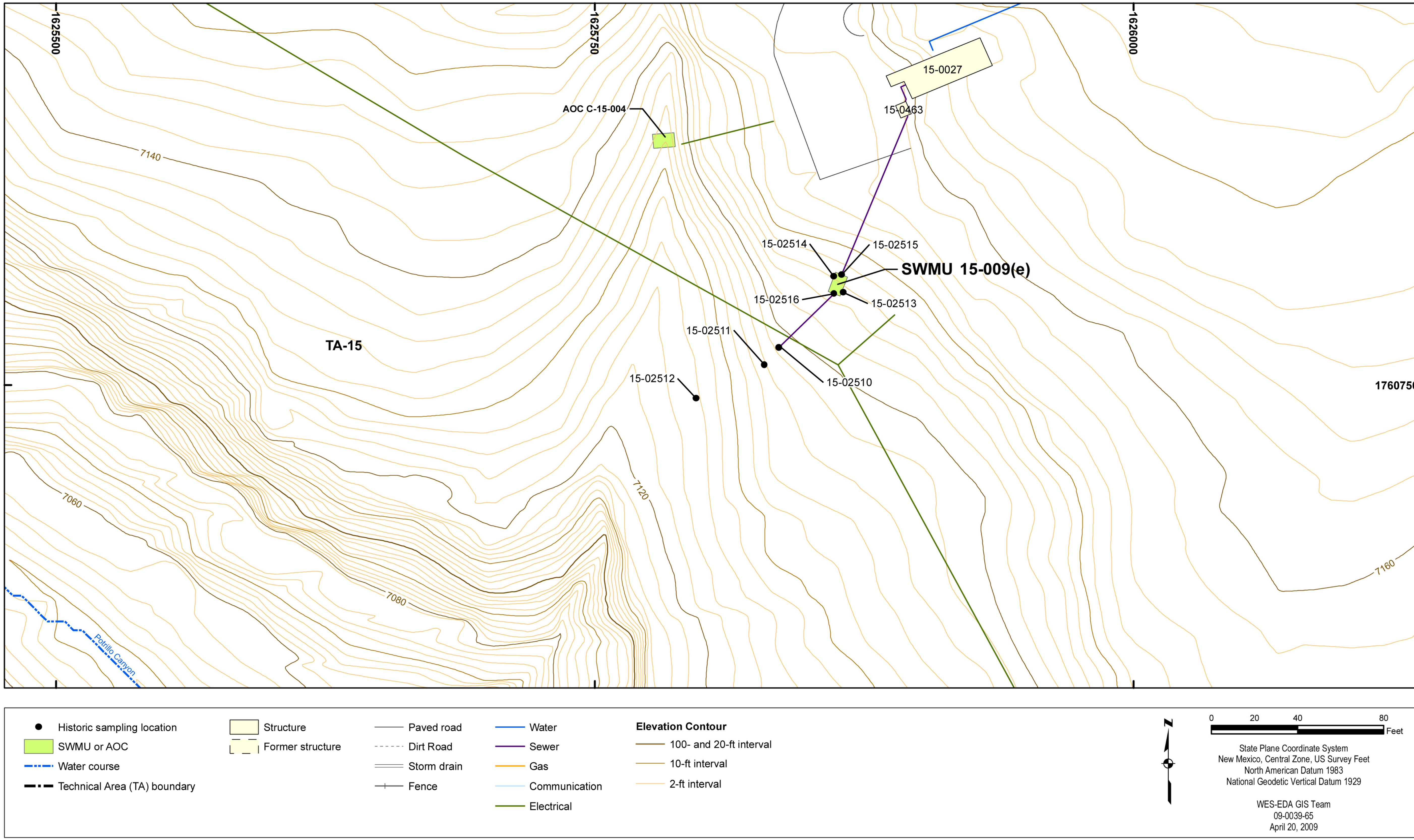


Figure 4.1-18 Site features and historical sampling locations for SWMU 15-009(e)

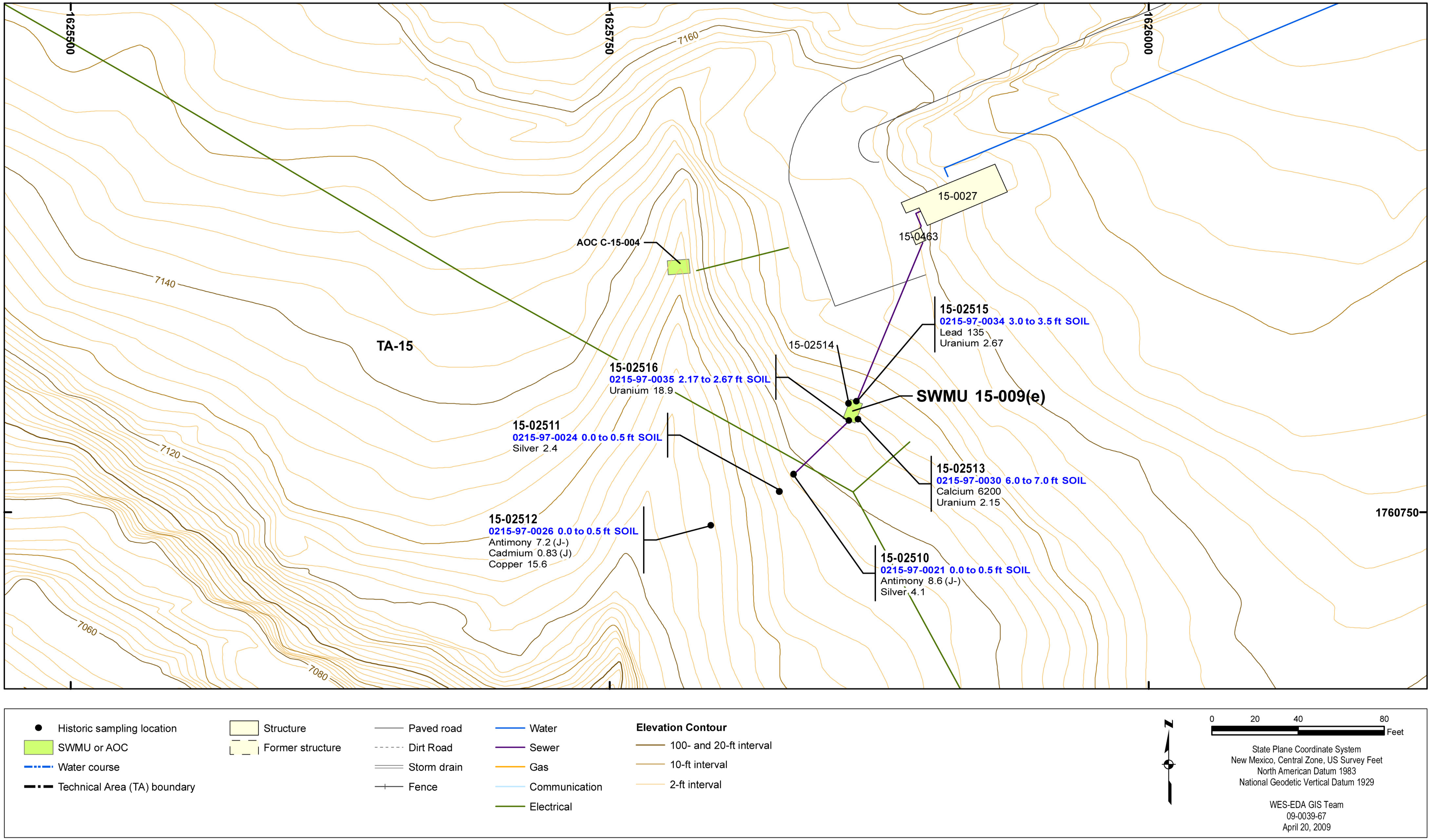


Figure 4.1-19 Inorganic chemicals detected above BVs at SWMU 15-009(e)

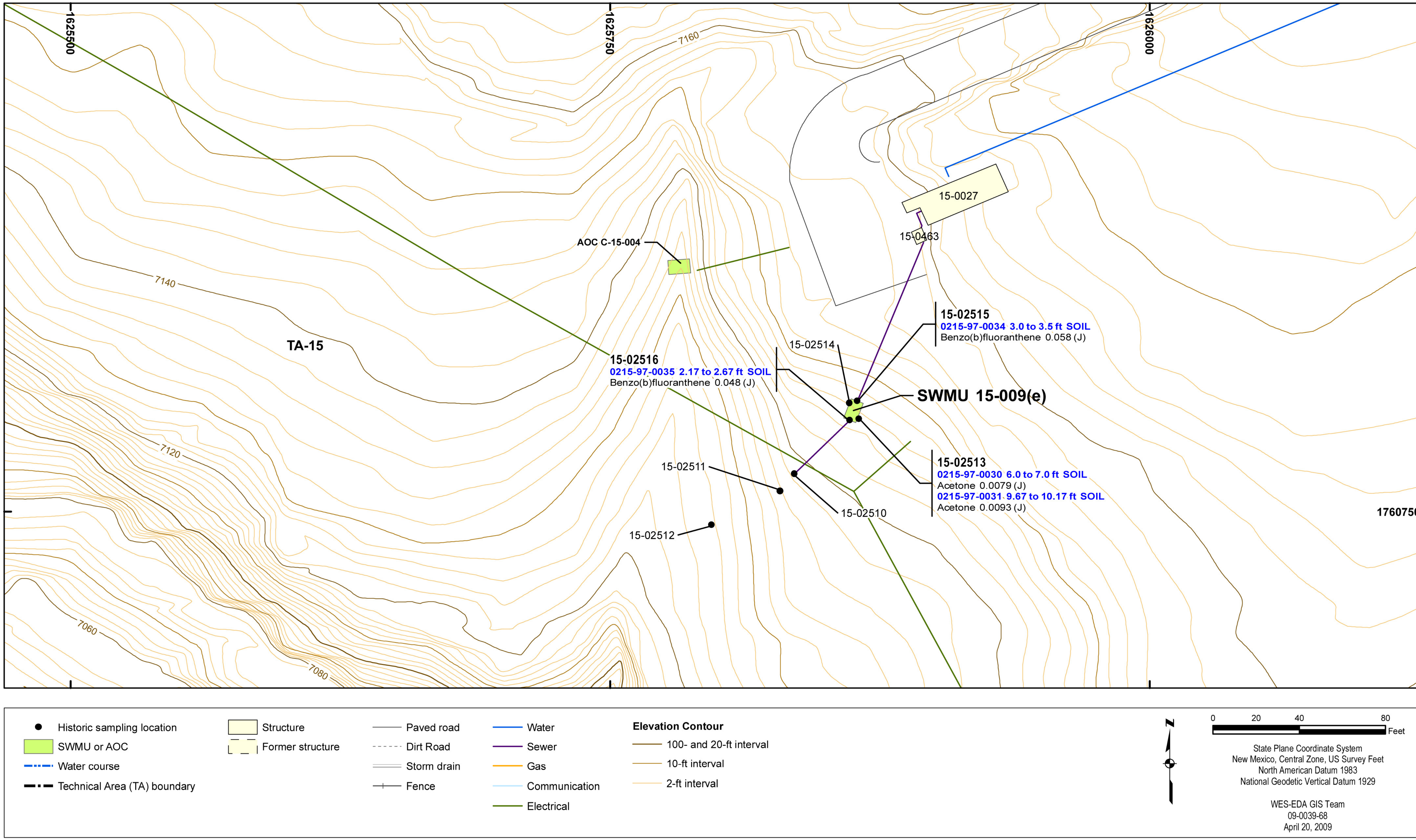


Figure 4.1-20 Organic chemicals detected at SWMU 15-009(e)

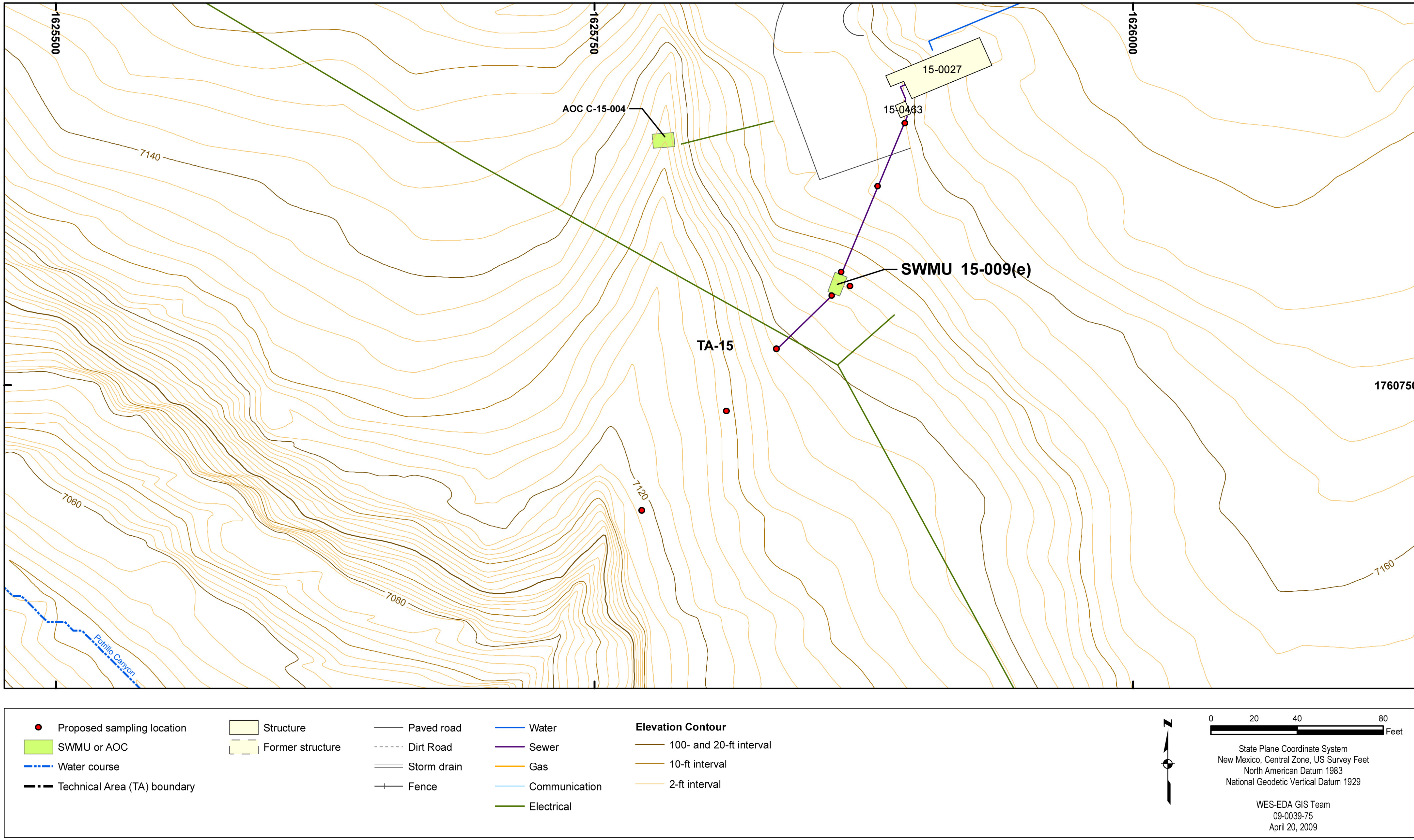


Figure 4.1-21 Proposed sampling locations at SWMU 15-009(e)

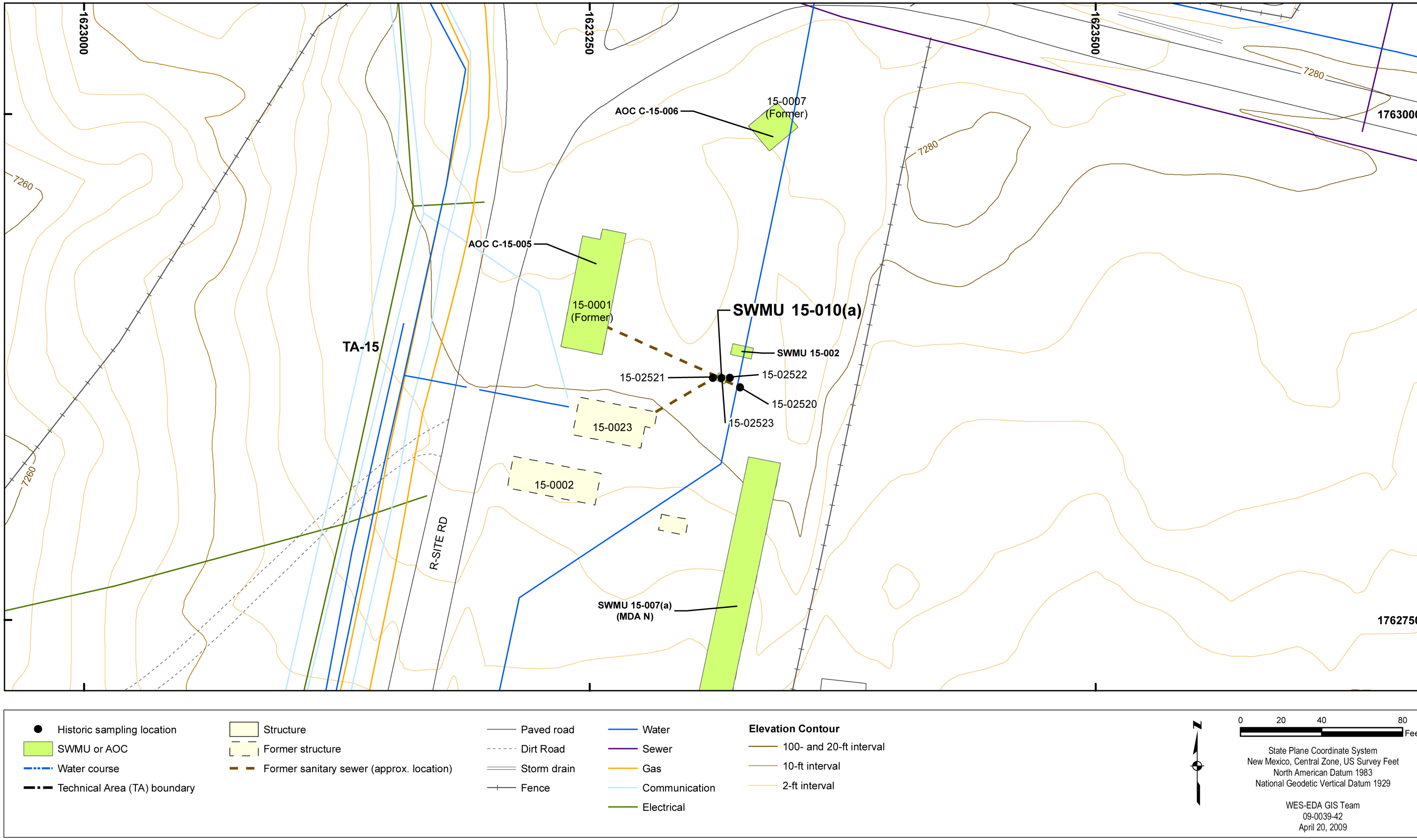


Figure 4.1-22 Site features and historical sampling locations for SWMU 15-010(a)

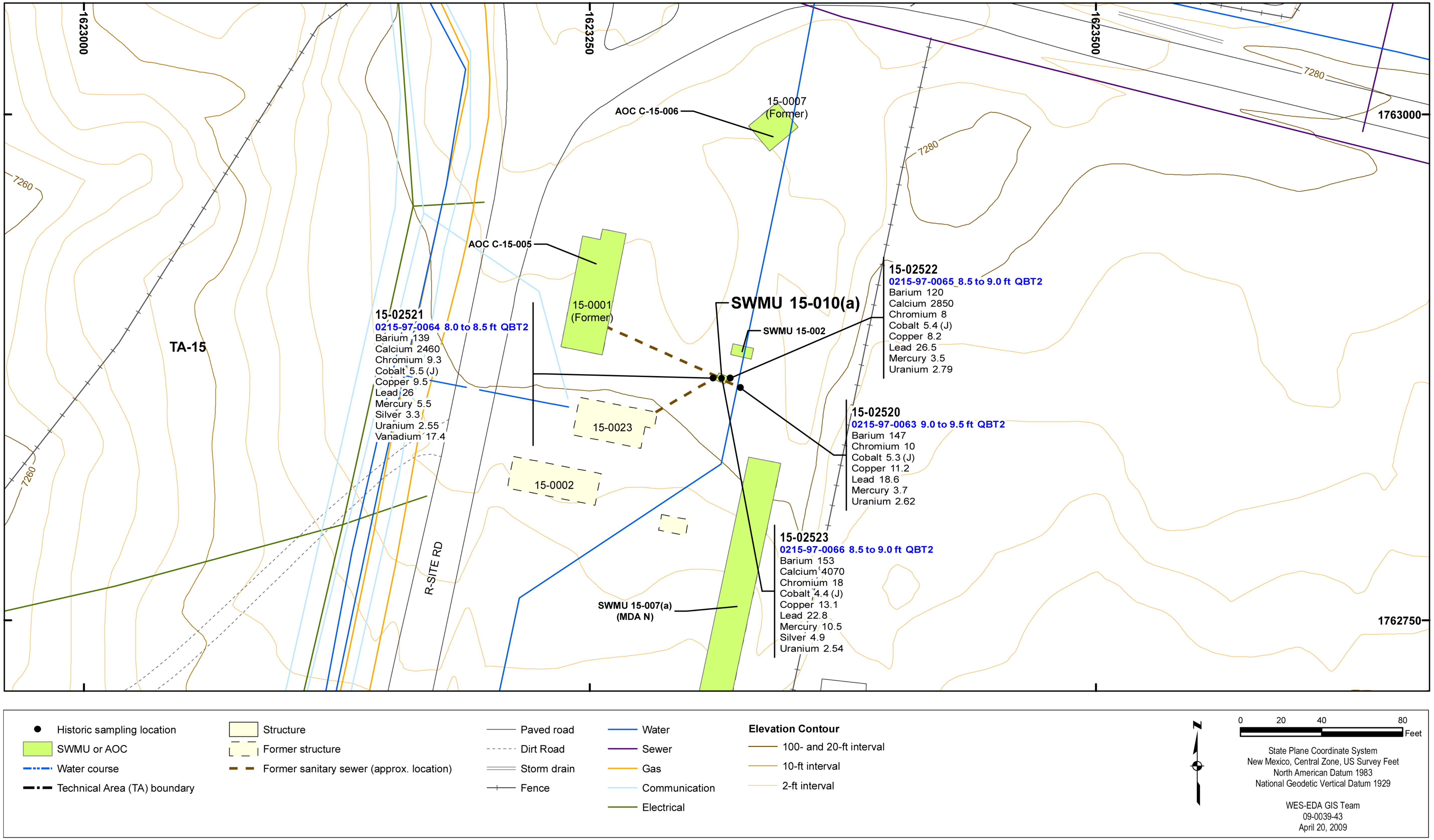


Figure 4.1-23 Inorganic chemicals detected above BVs at SWMU 15-010(a)

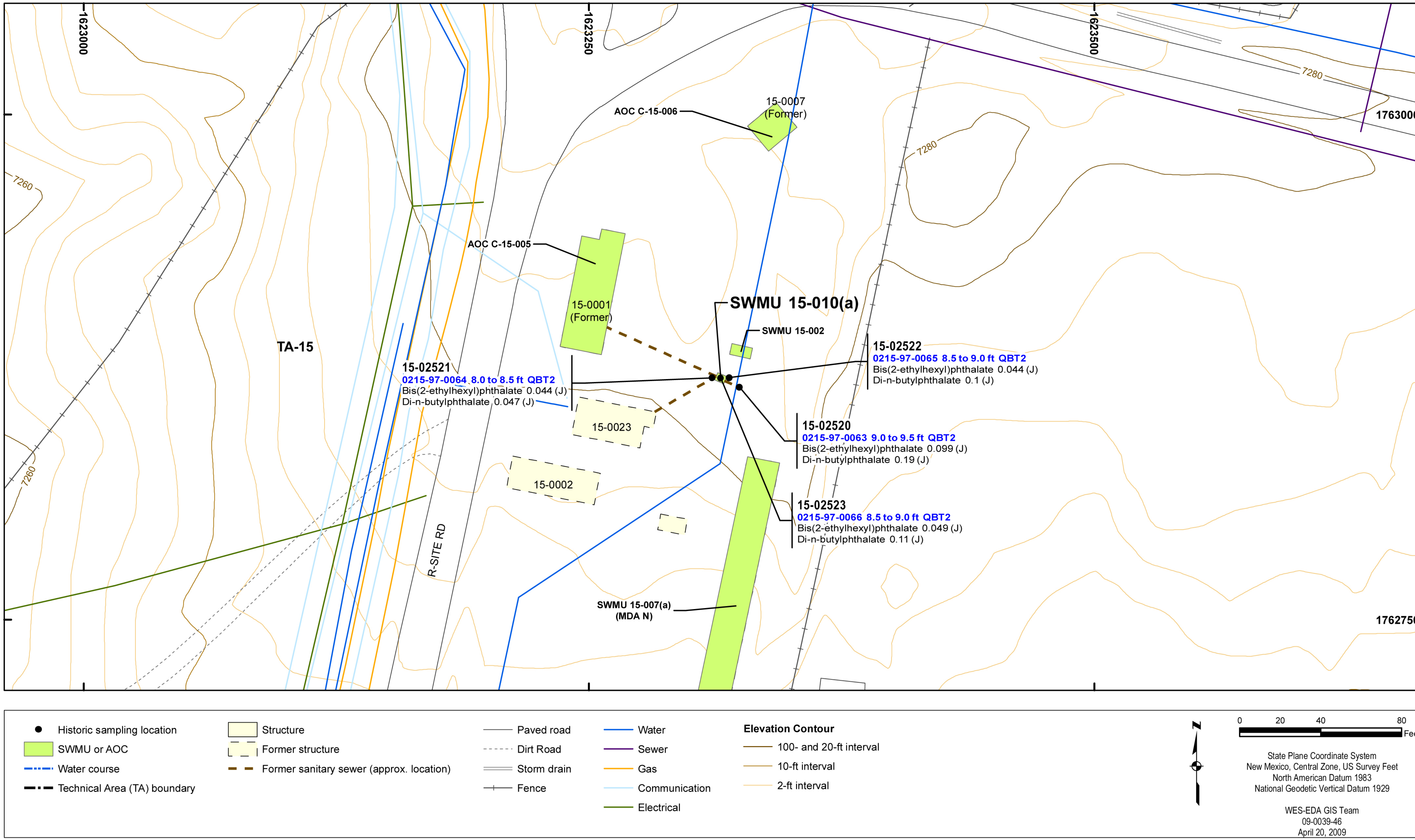


Figure 4.1-24 Organic chemicals detected at SWMU 15-010(a)

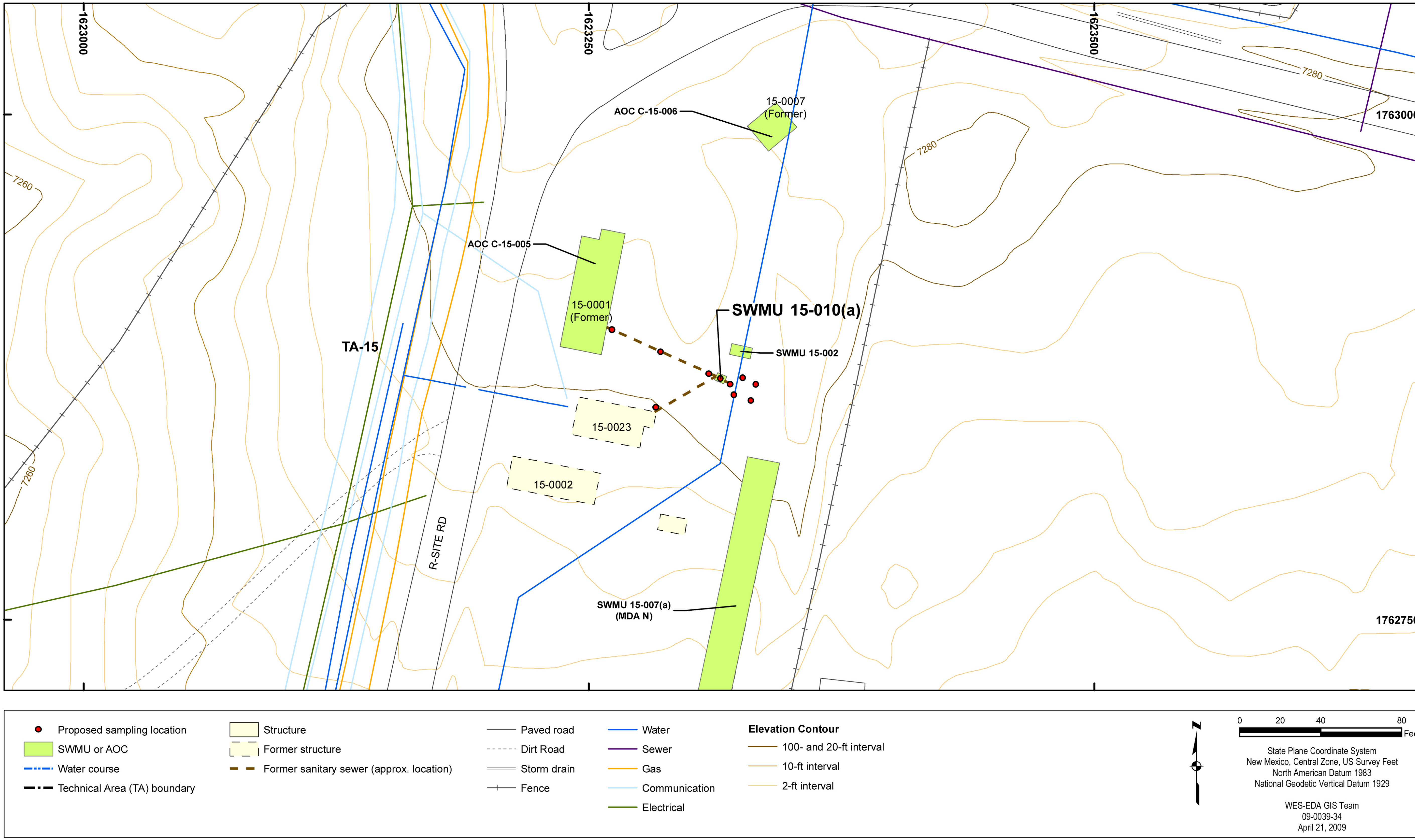


Figure 4.1-25 Proposed sampling locations at SWMU 15-010(a)

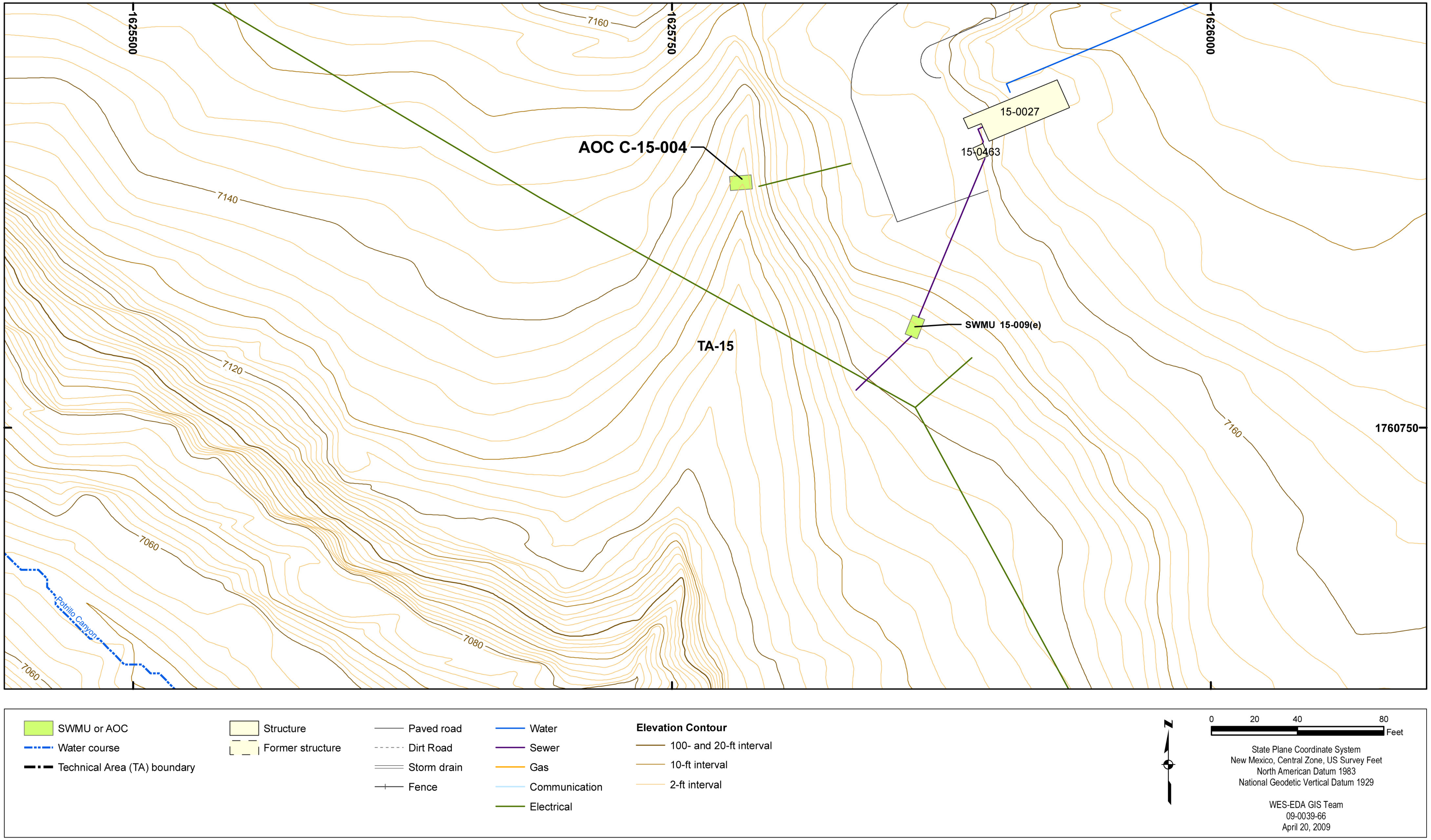


Figure 4.1-26 Site features for AOC C-15-004

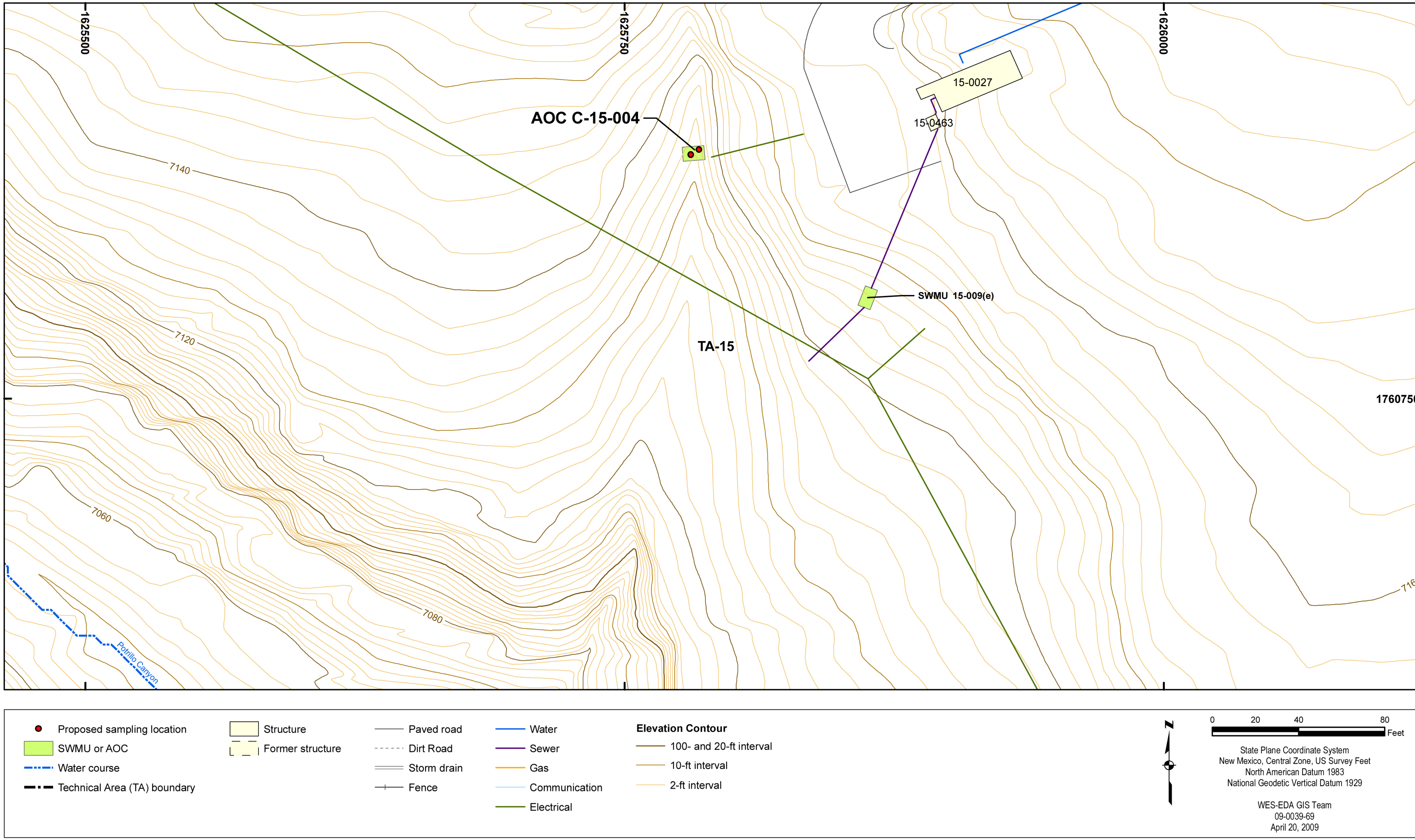


Figure 4.1-27 Proposed sampling locations at AOC C-15-004

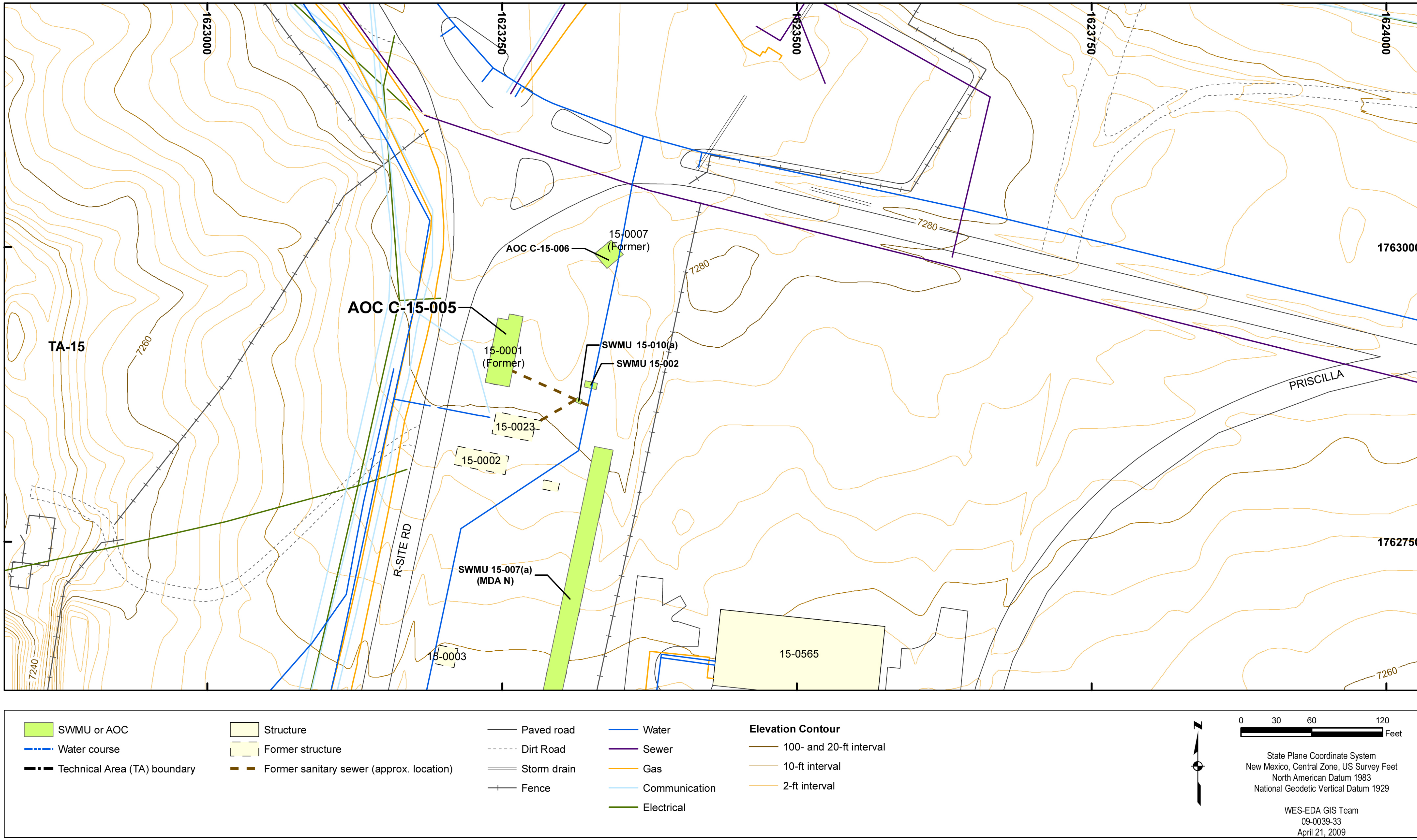


Figure 4.1-28 Site features for AOC C-15-005

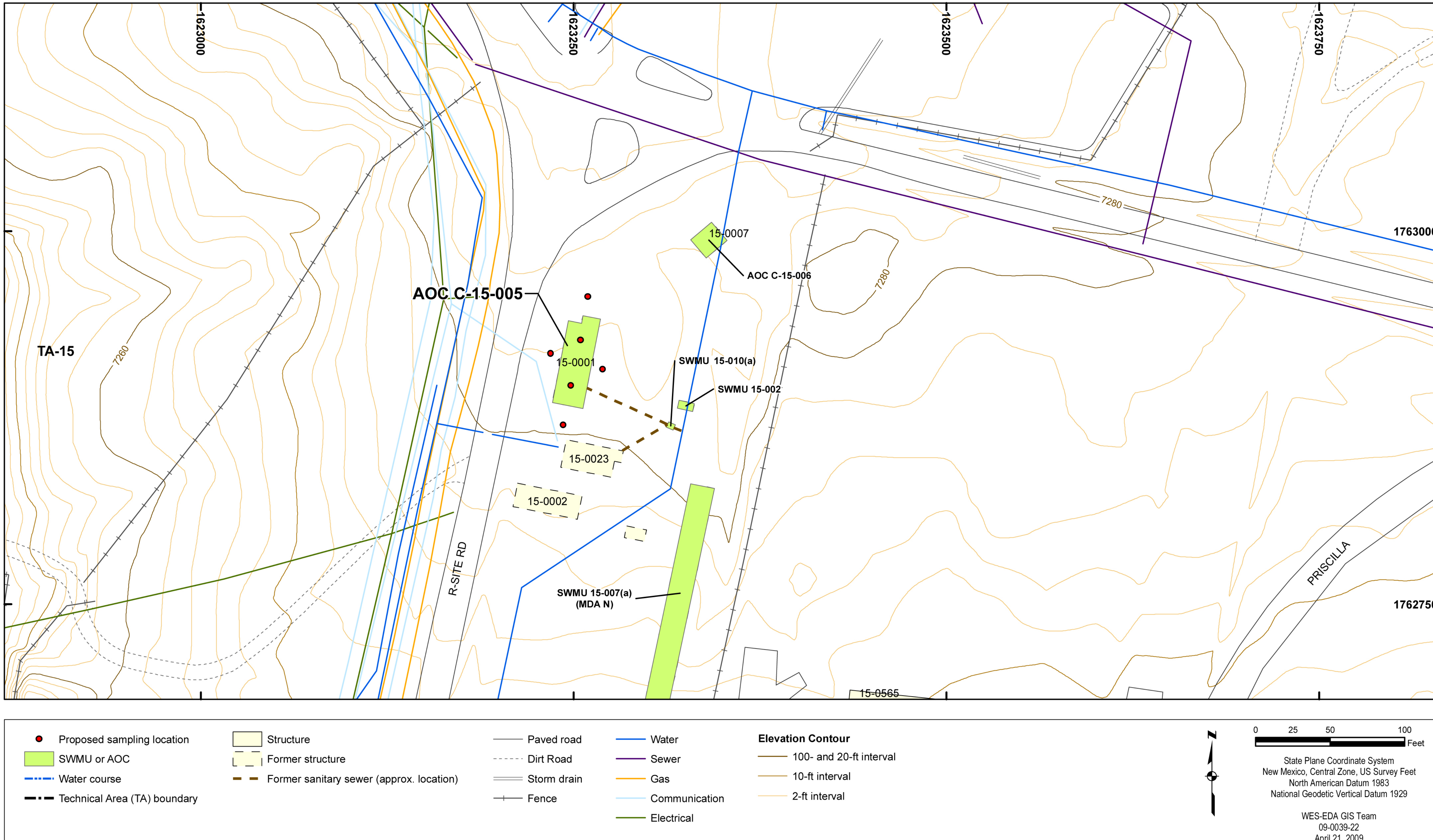


Figure 4.1-29 Proposed sampling locations at AOC C-15-005

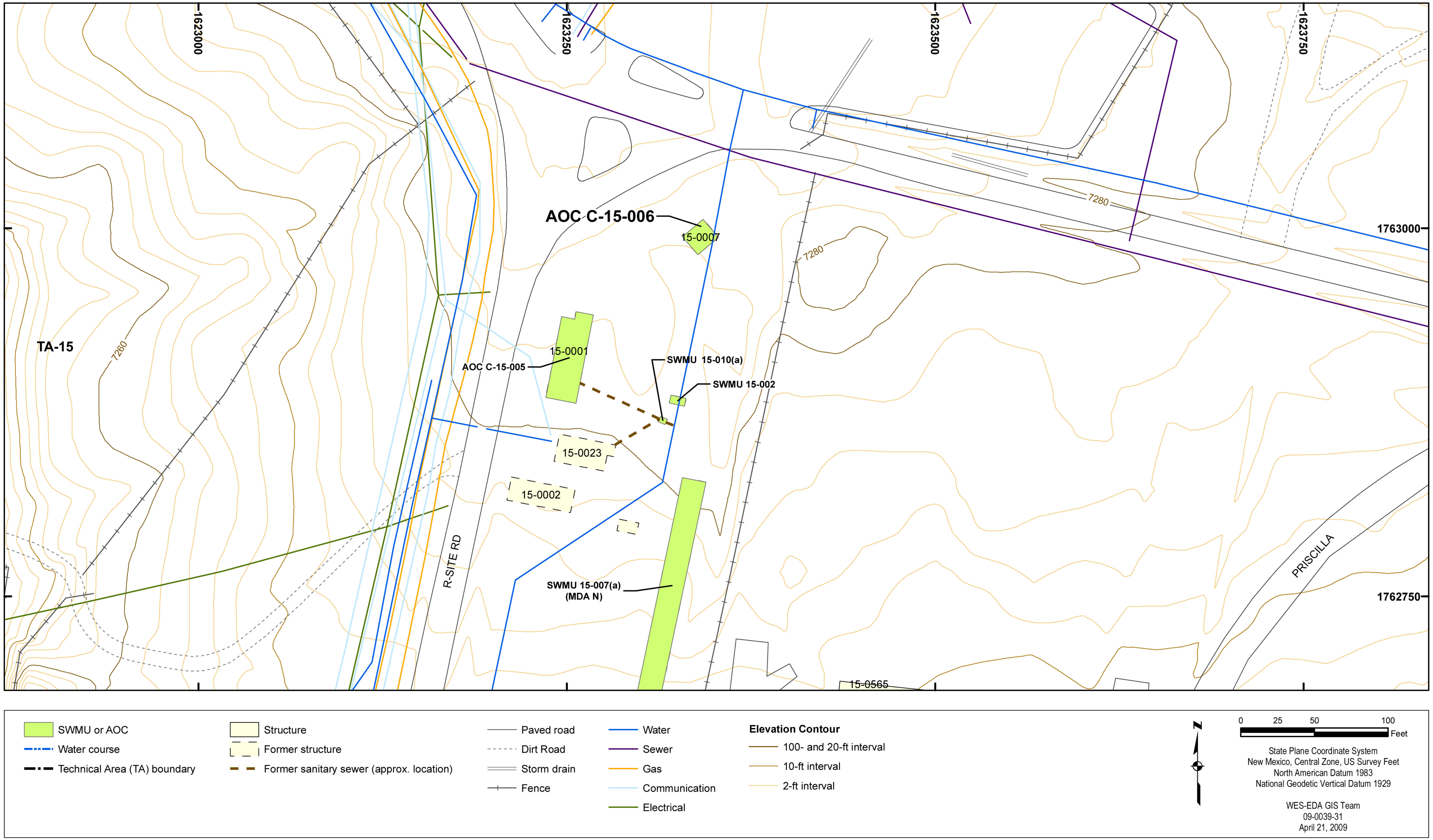


Figure 4.1-30 Site features for AOC C-15-006

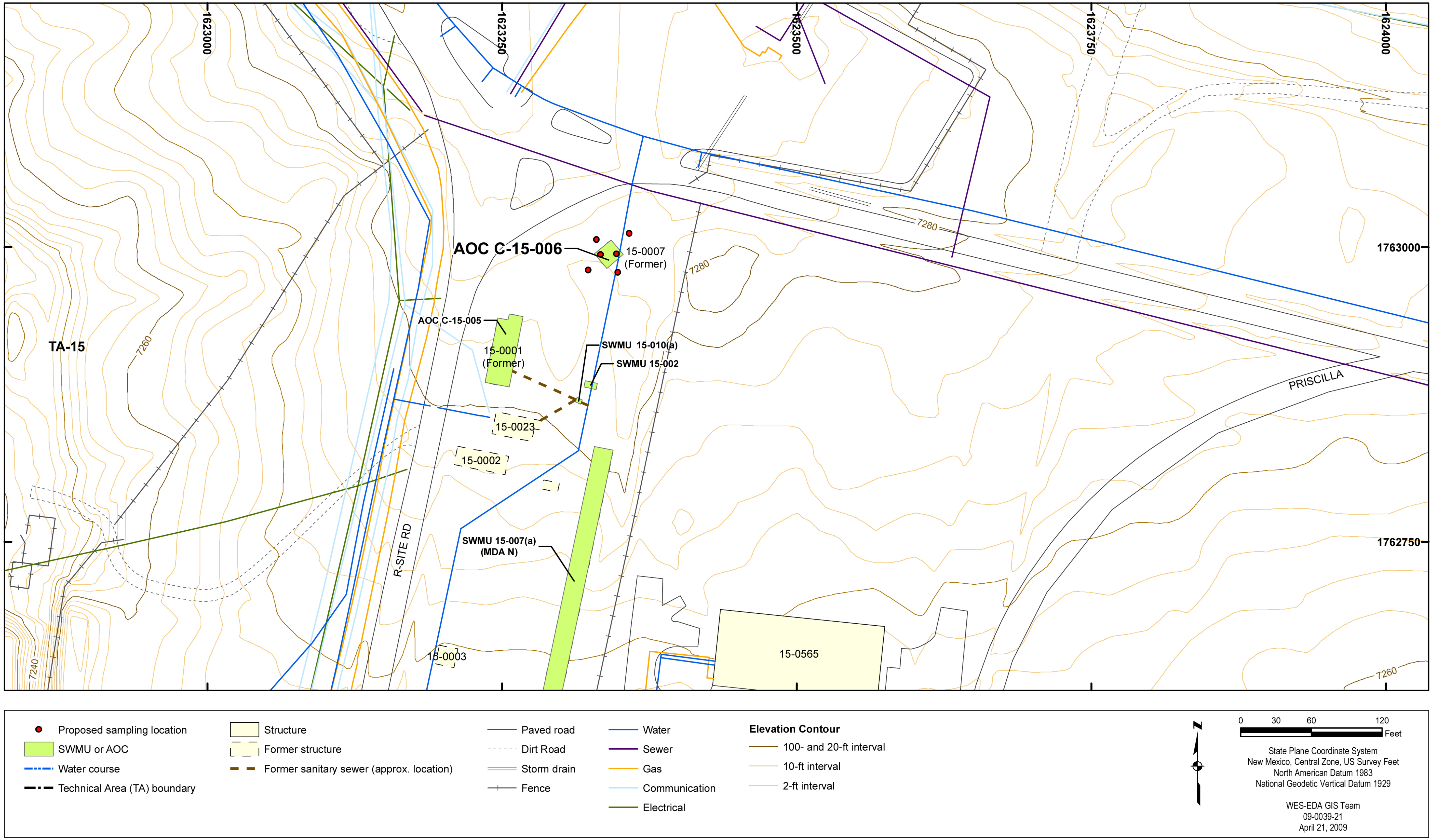


Figure 4.1-31 Proposed sampling locations at AOC C-15-006

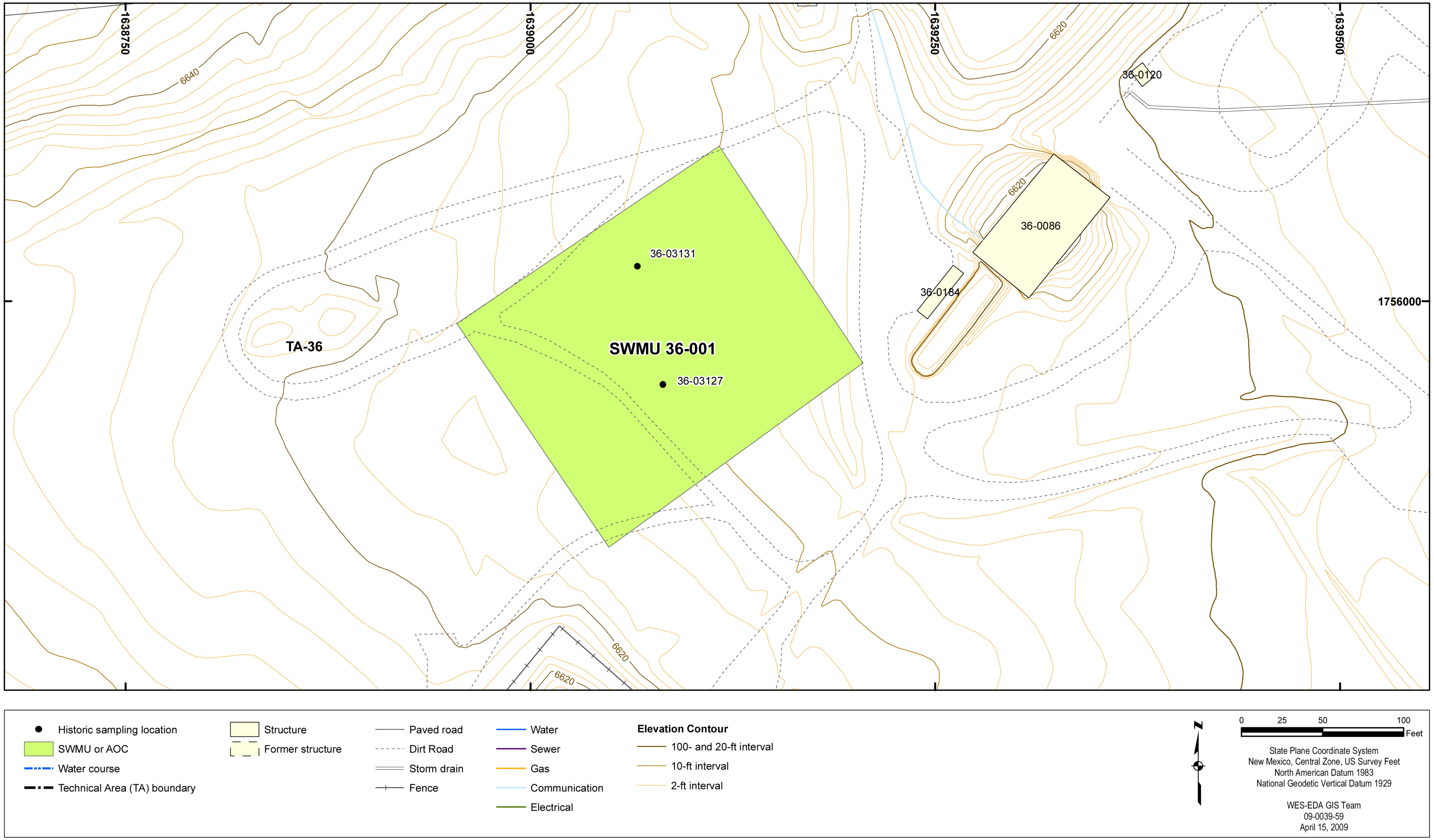


Figure 4.2-1 Site features and historical sampling locations for SWMU 36-001

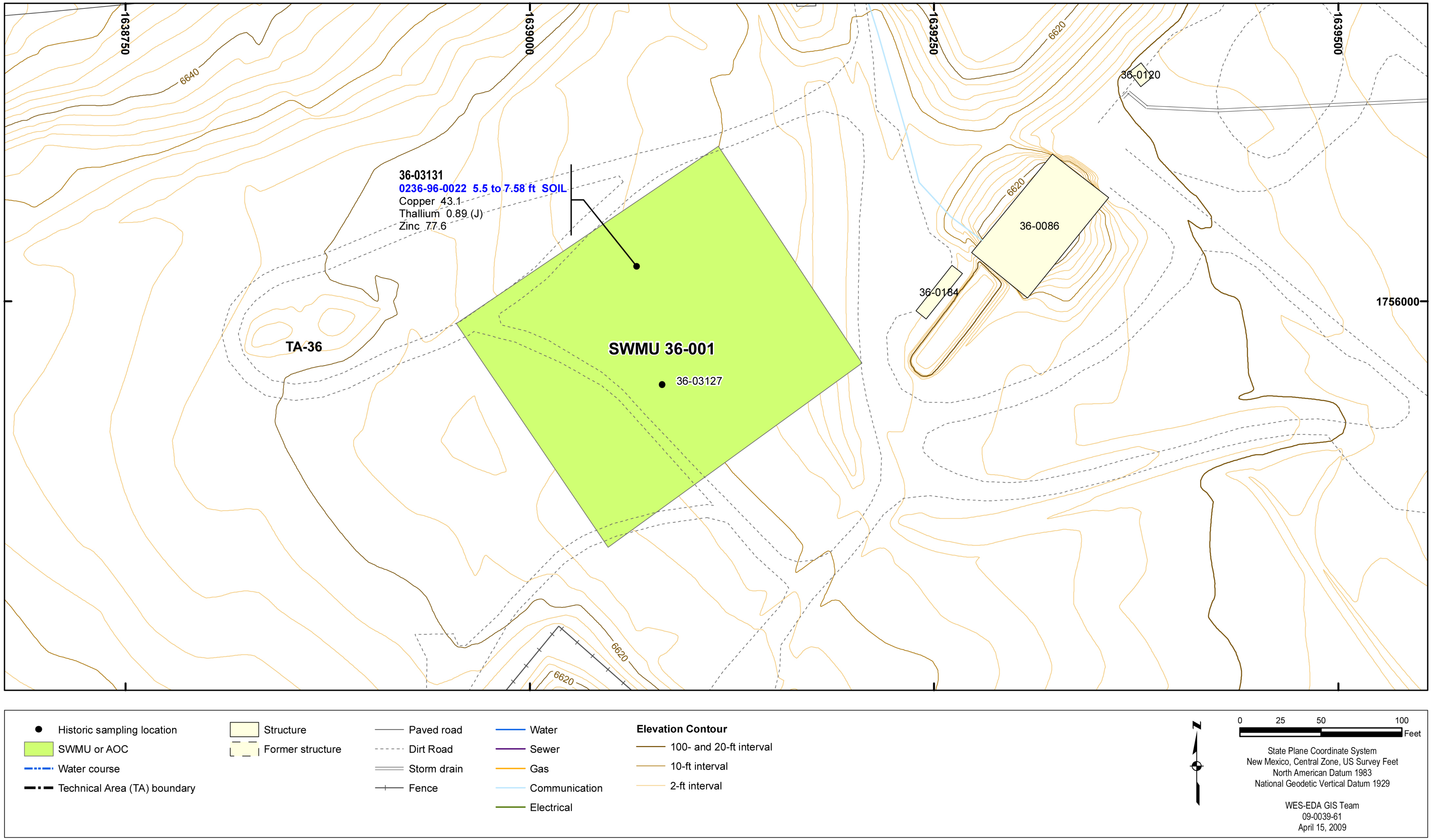


Figure 4.2-2 Inorganic chemicals detected above BVs at SWMU 36-001

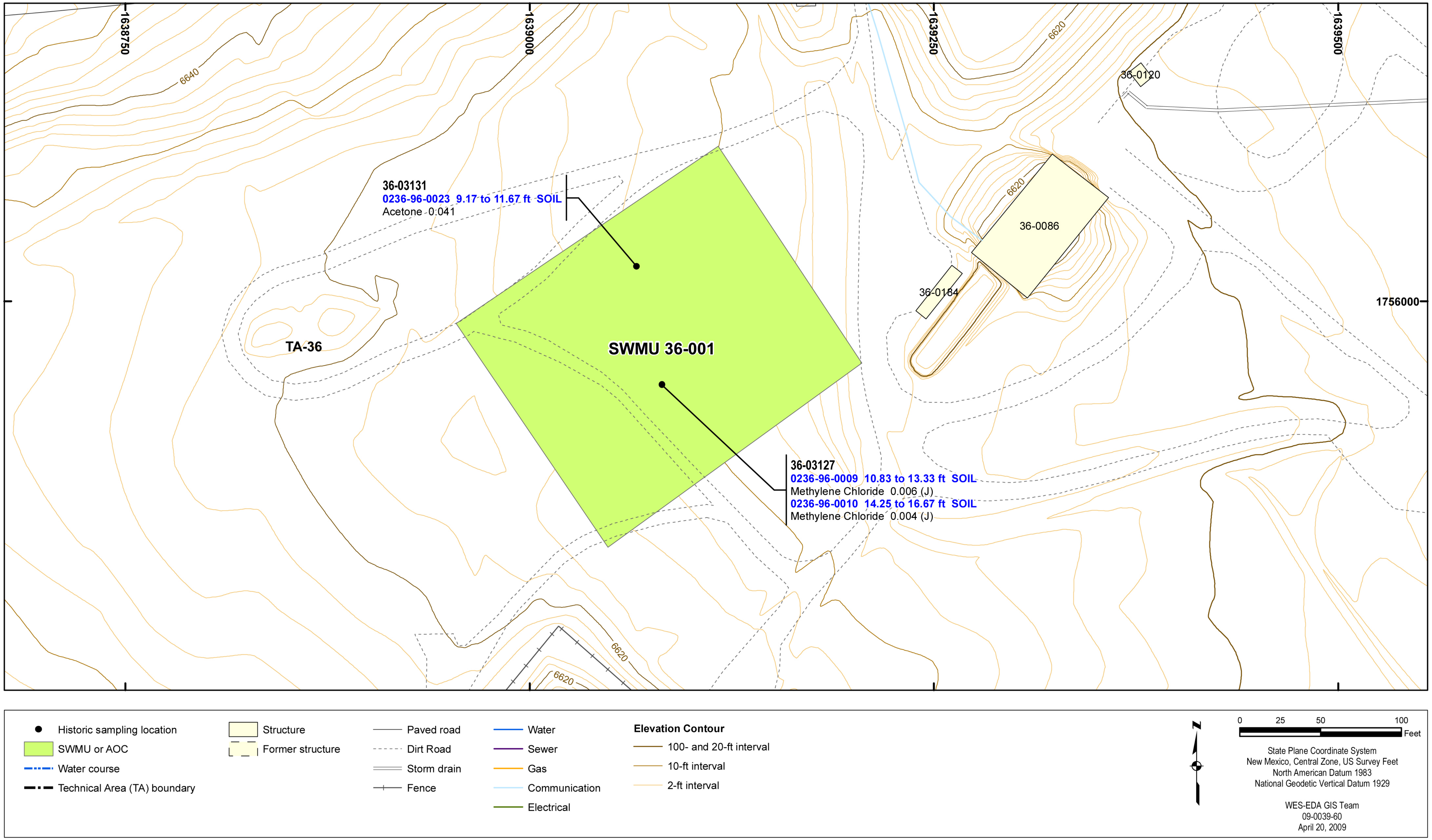


Figure 4.2-3 Organic chemicals detected at SMWU 36-001

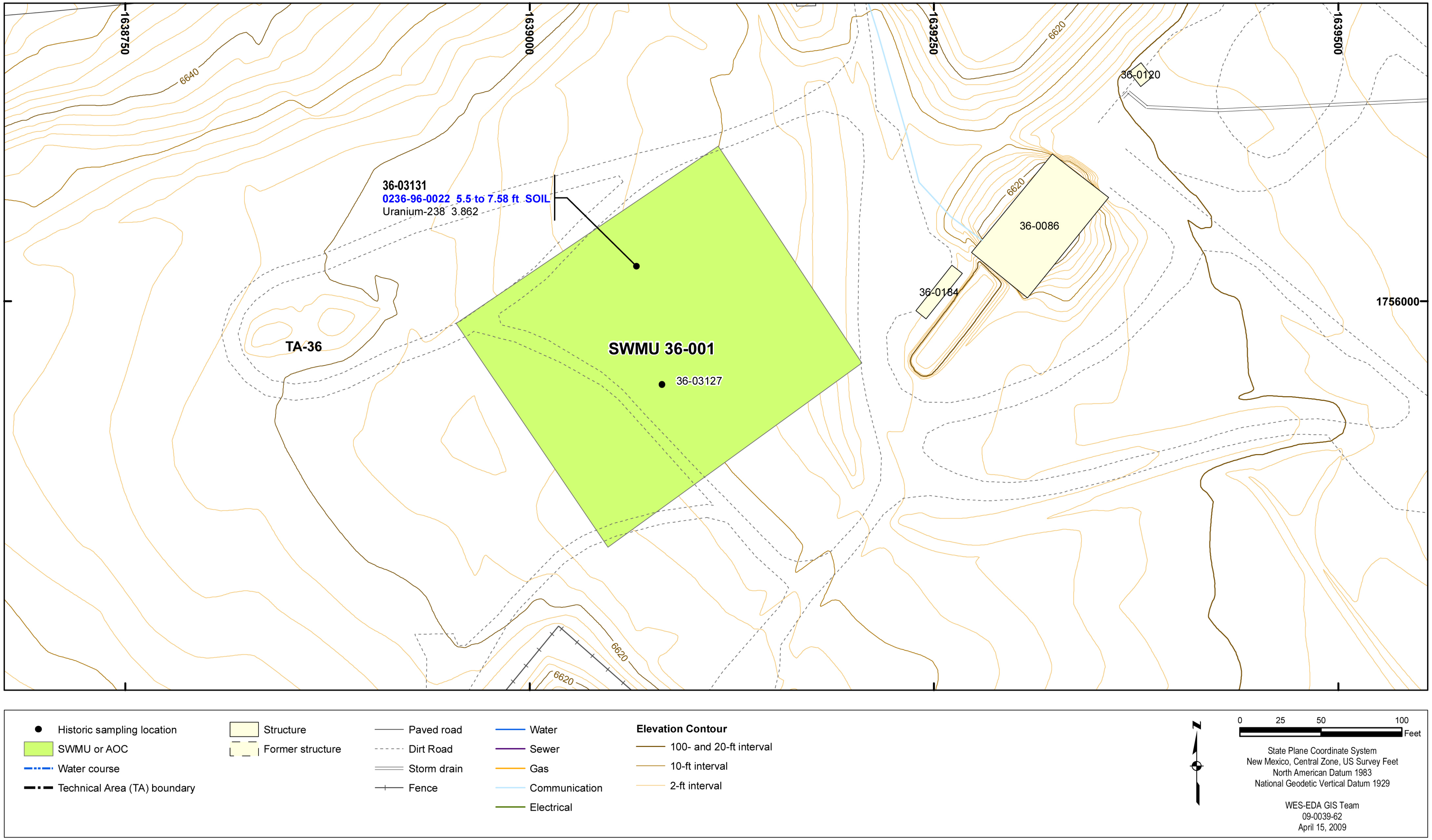


Figure 4.2-4 Radionuclides detected or detected above BVs/FVs at SWMU 36-001

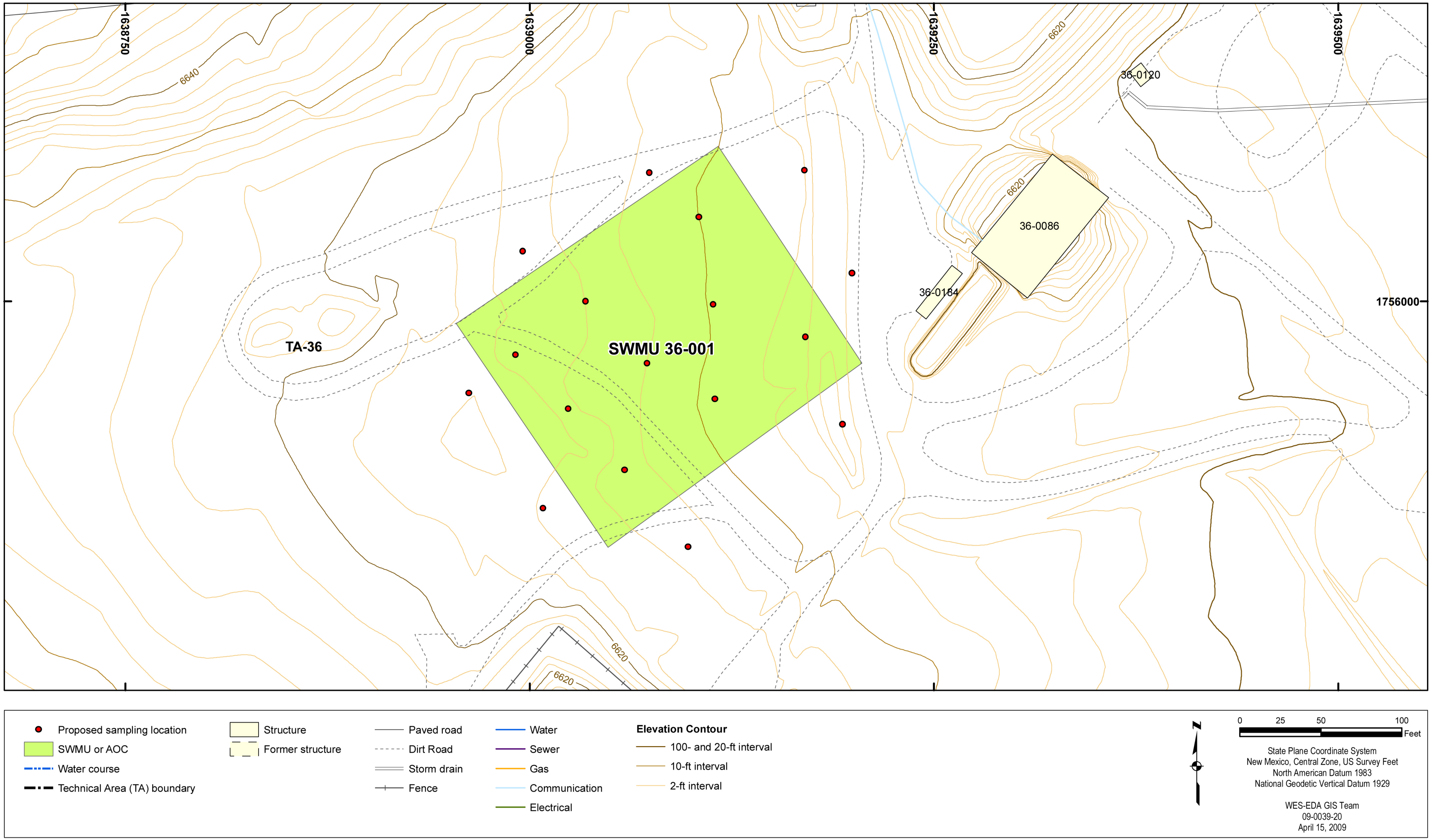


Figure 4.2-5 Proposed sampling locations at SWMU 36-001

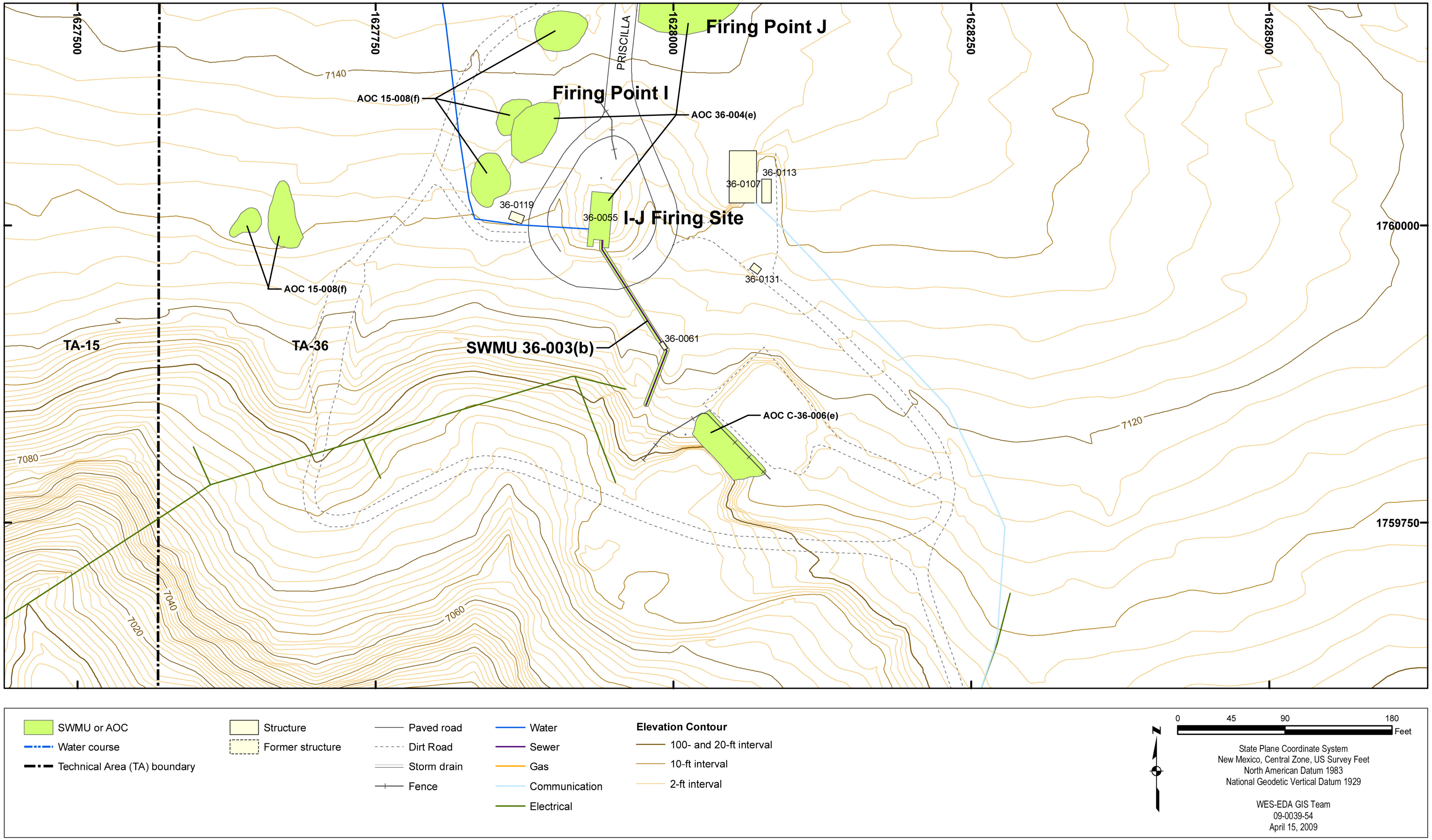


Figure 4.2-6 Site features for SWMU 36-003(b)

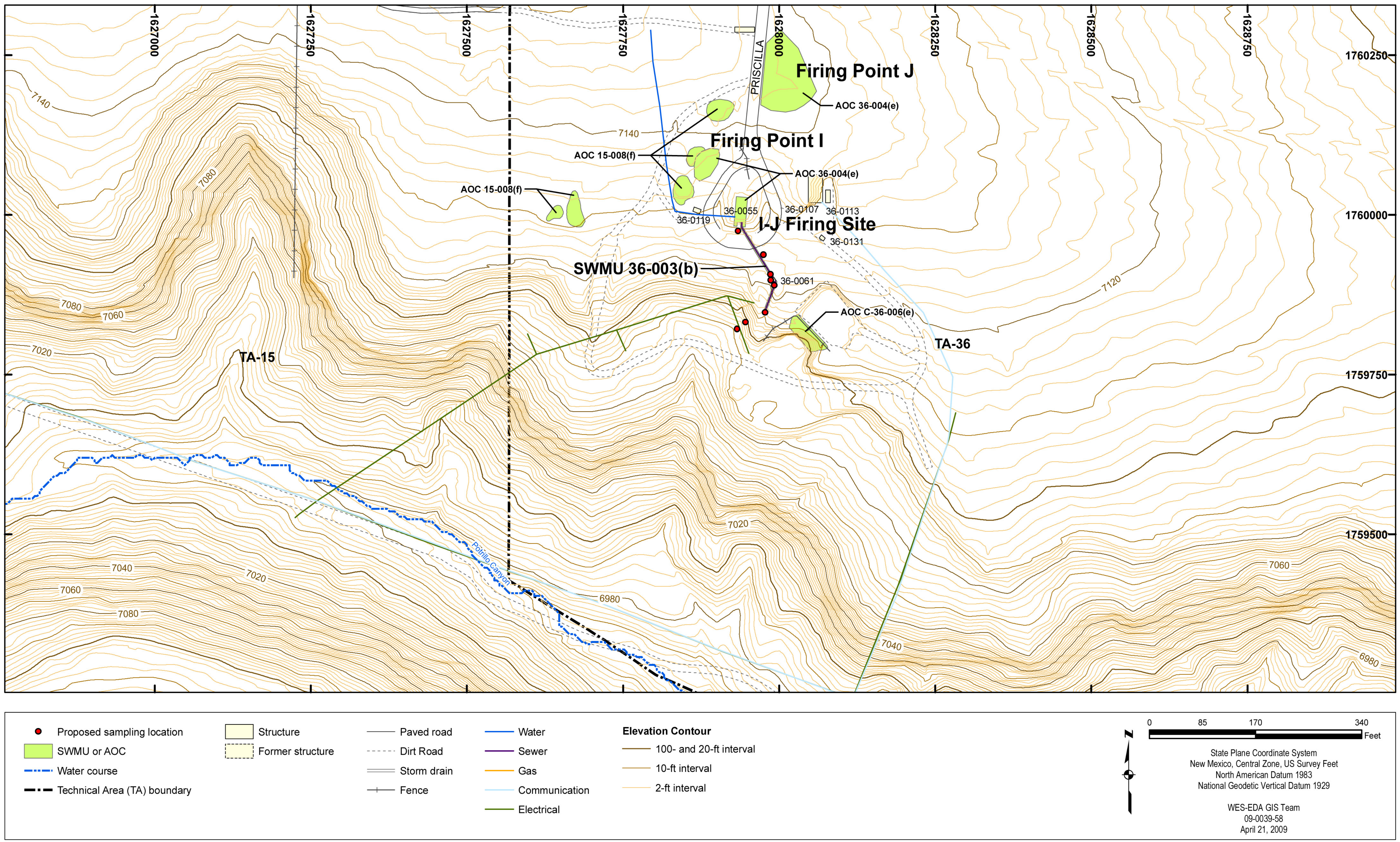


Figure 4.2-7 Proposed sampling locations at SWMU 36-003(b)

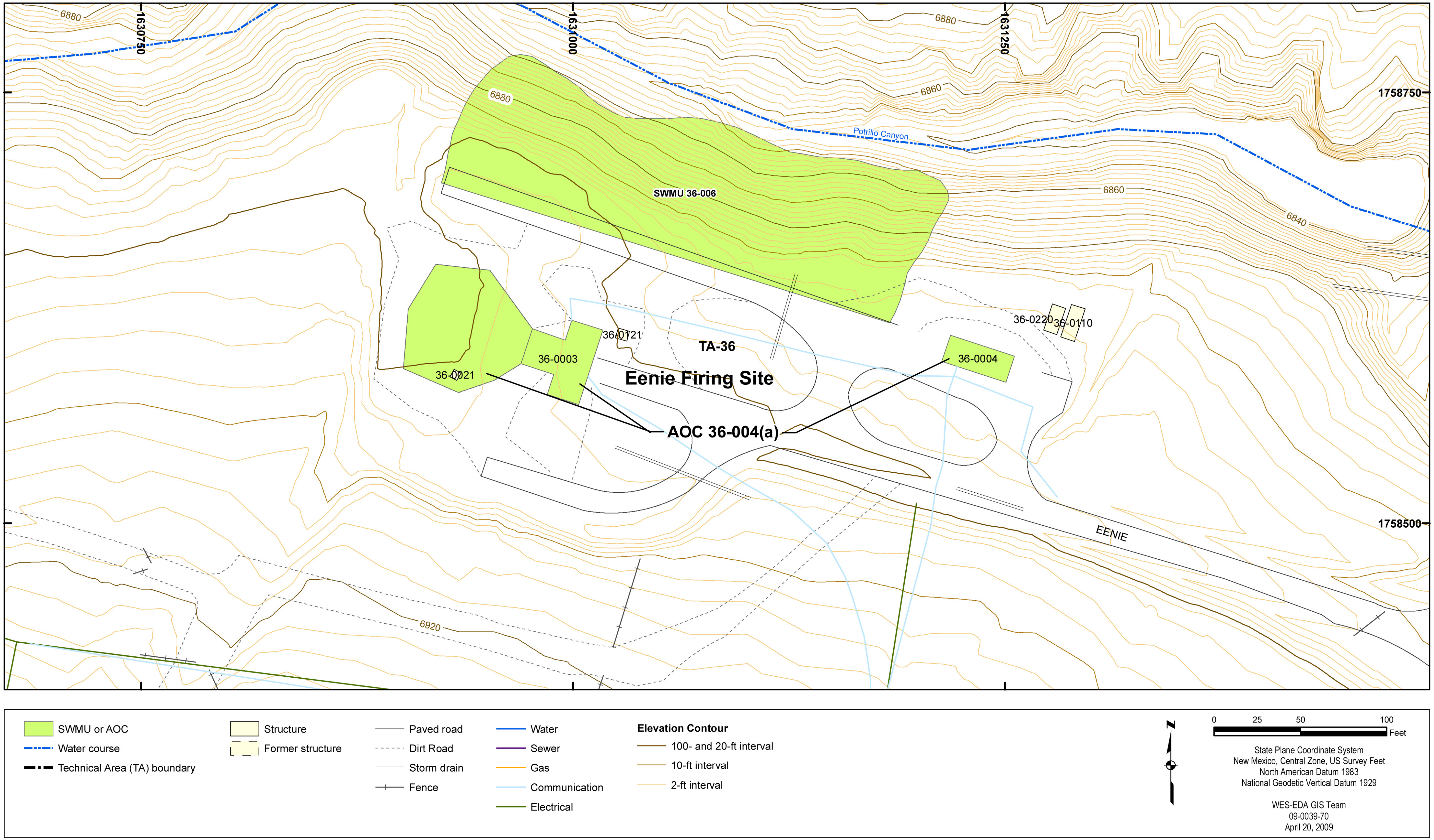


Figure 4.2-8 Site features for AOC 36-004(a)

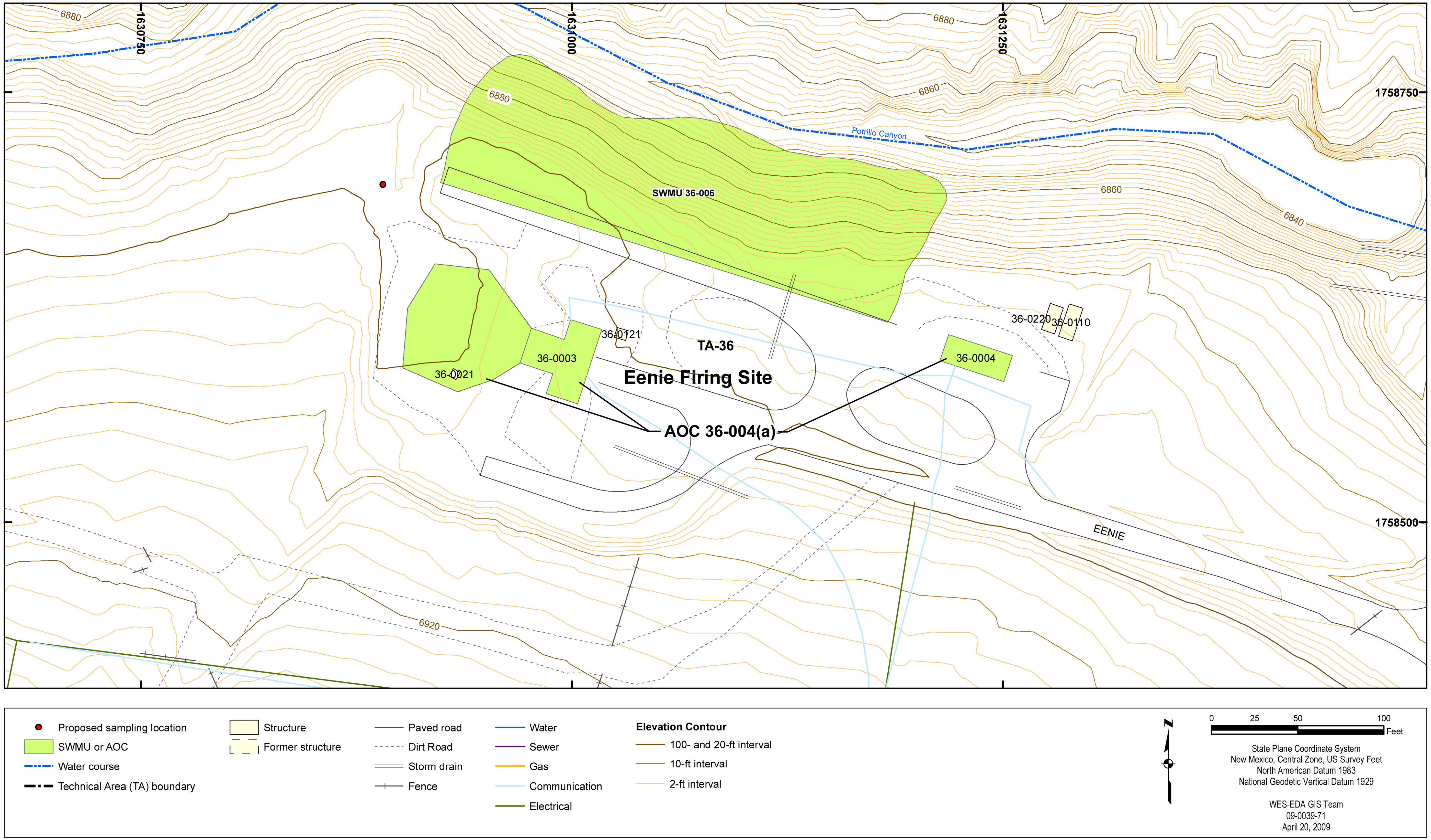


Figure 4.2-9 Proposed sampling locations at AOC 36-004(a)

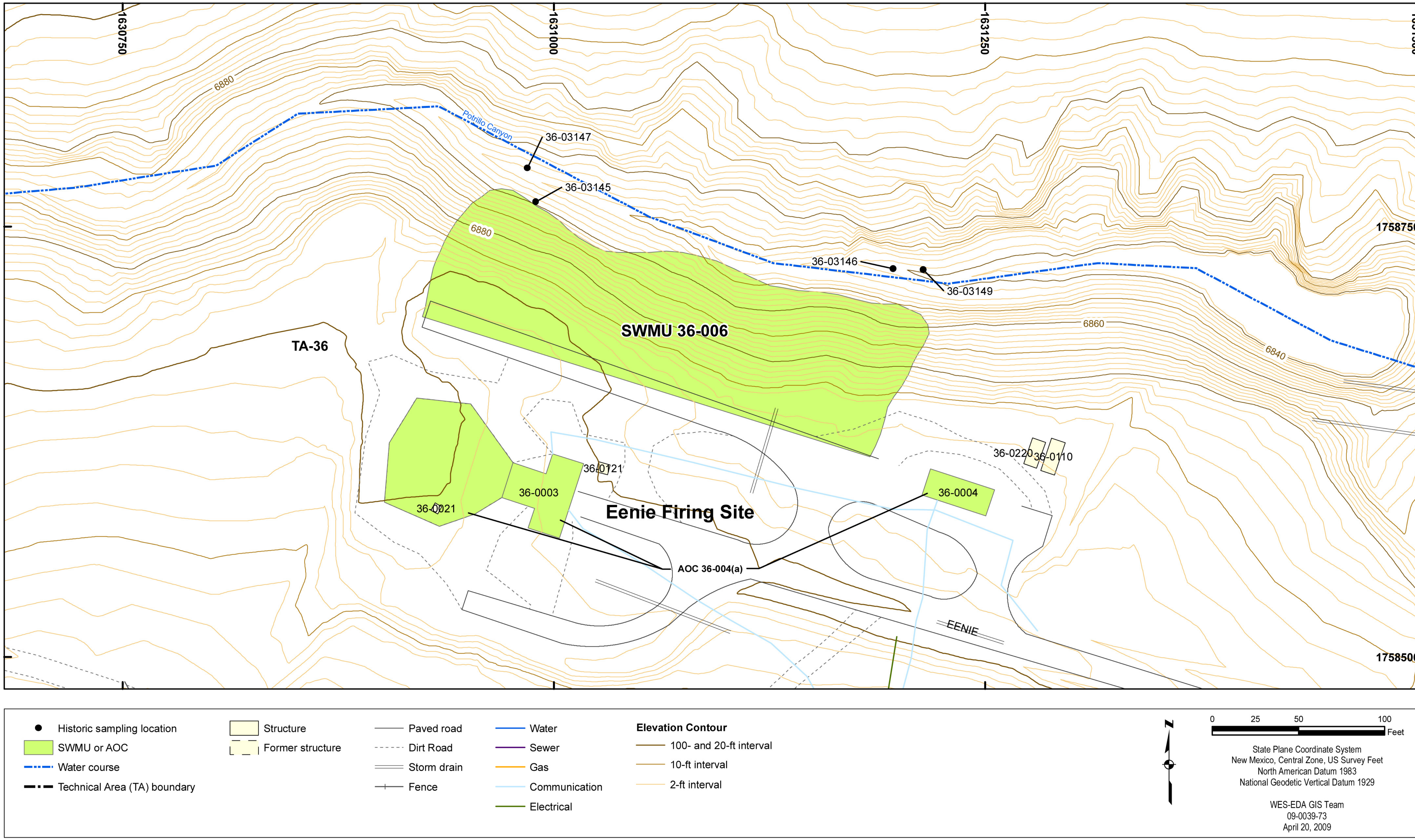


Figure 4.2-10 Site features and historical sampling locations for SWMU 36-006

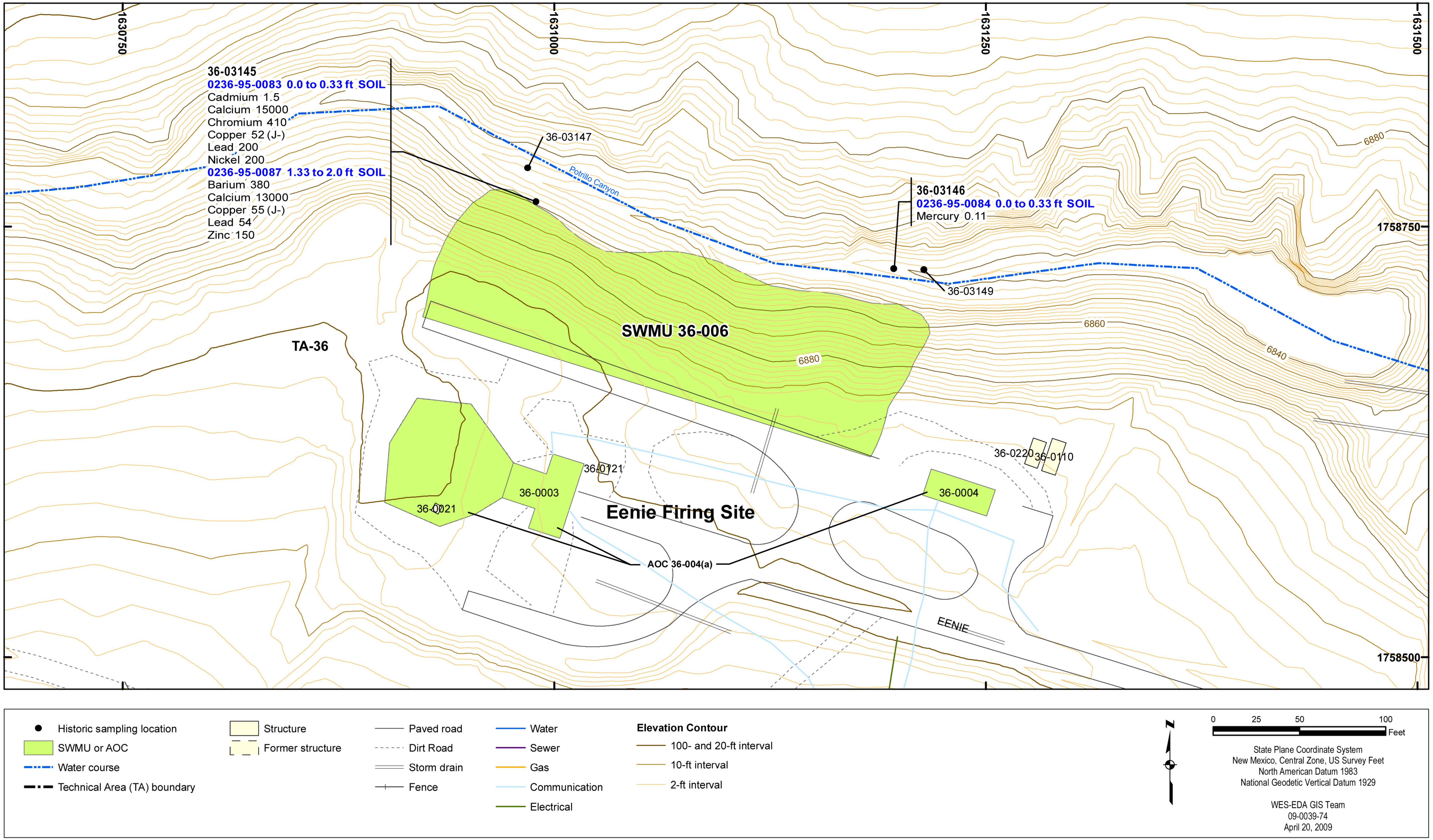


Figure 4.2-11 Inorganic chemicals detected above BVs at SWMU 36-006

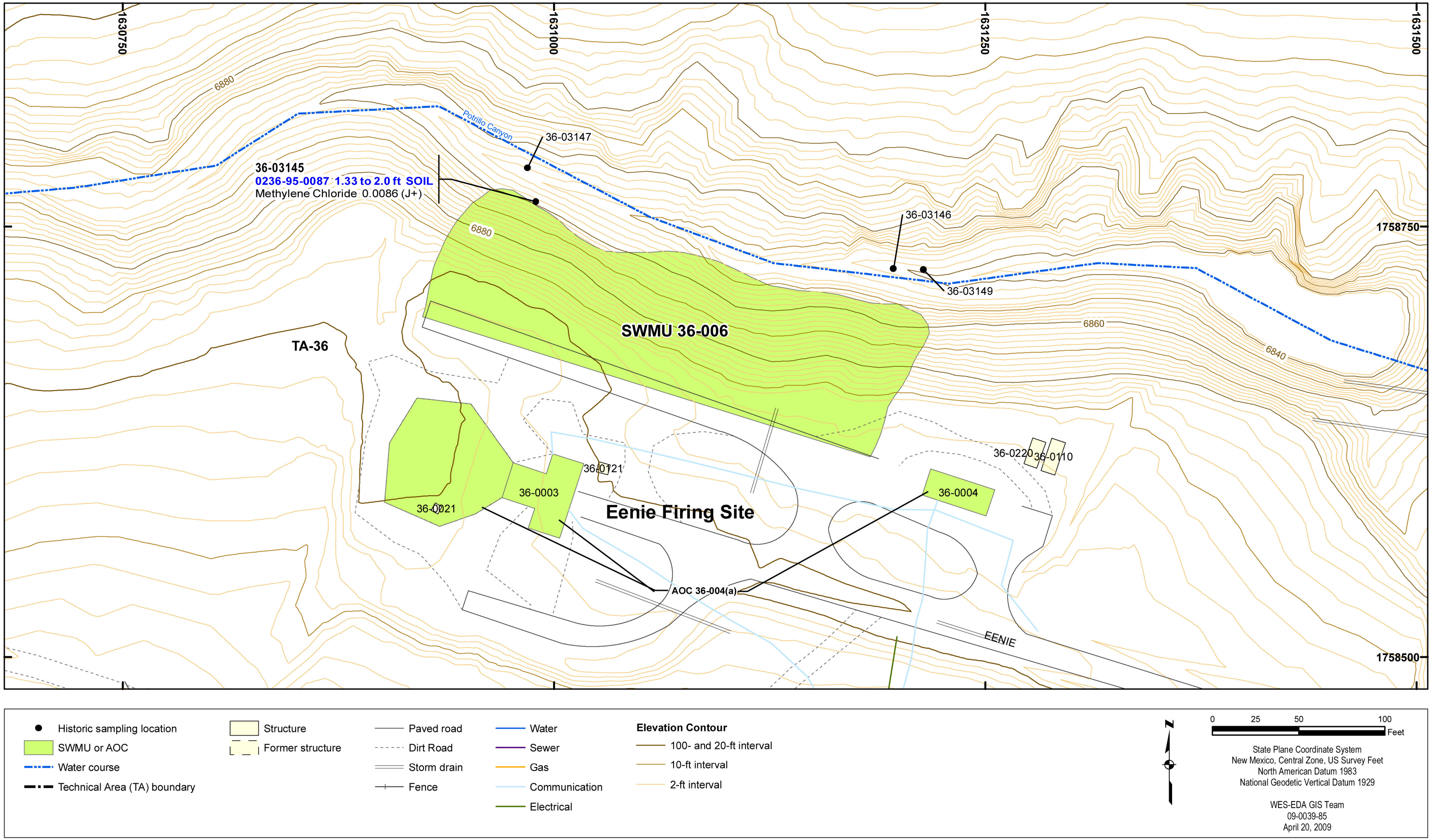


Figure 4.2-12 Organic chemicals detected at SWMU 36-006

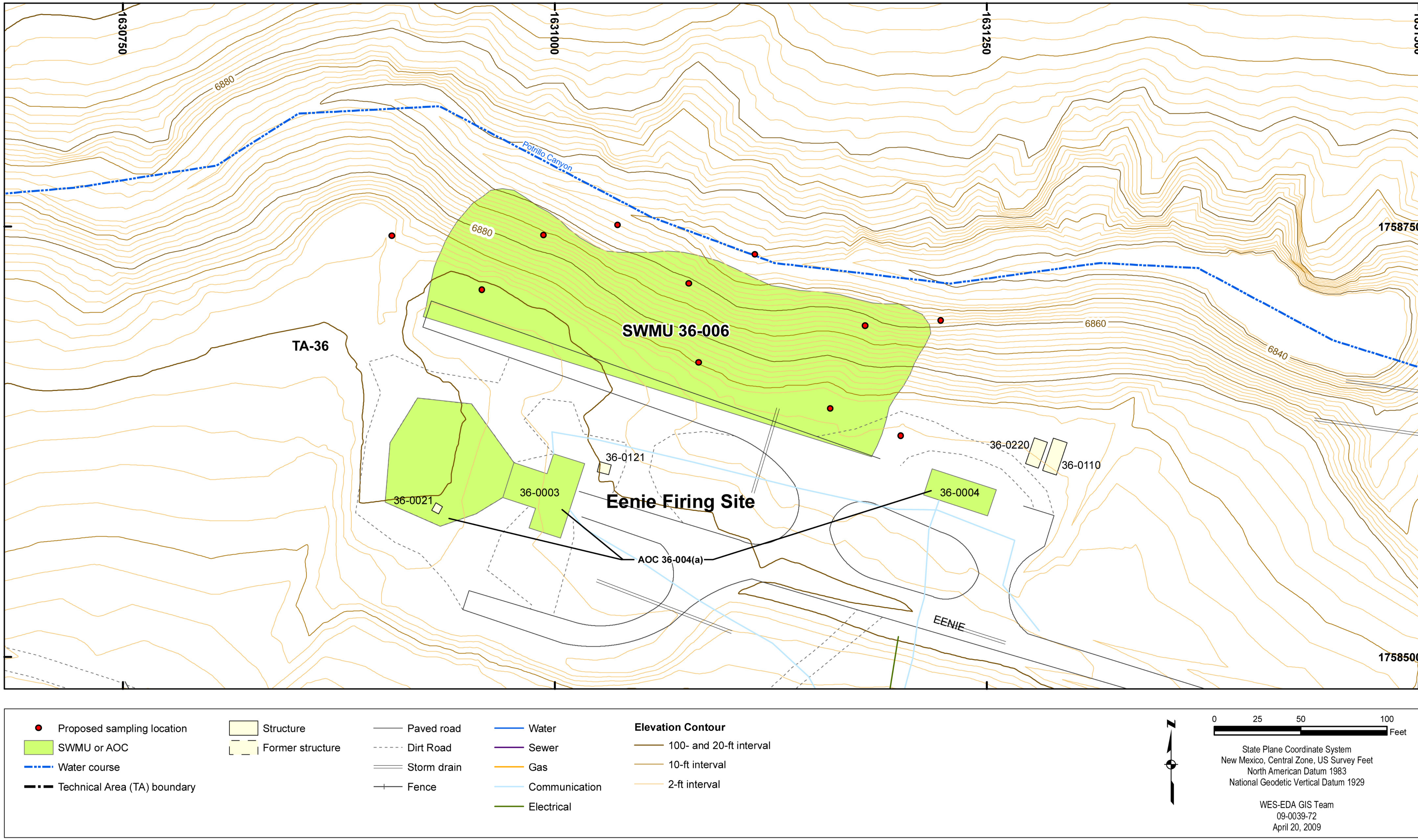


Figure 4.2-13 Proposed sampling locations at SWMU 36-006

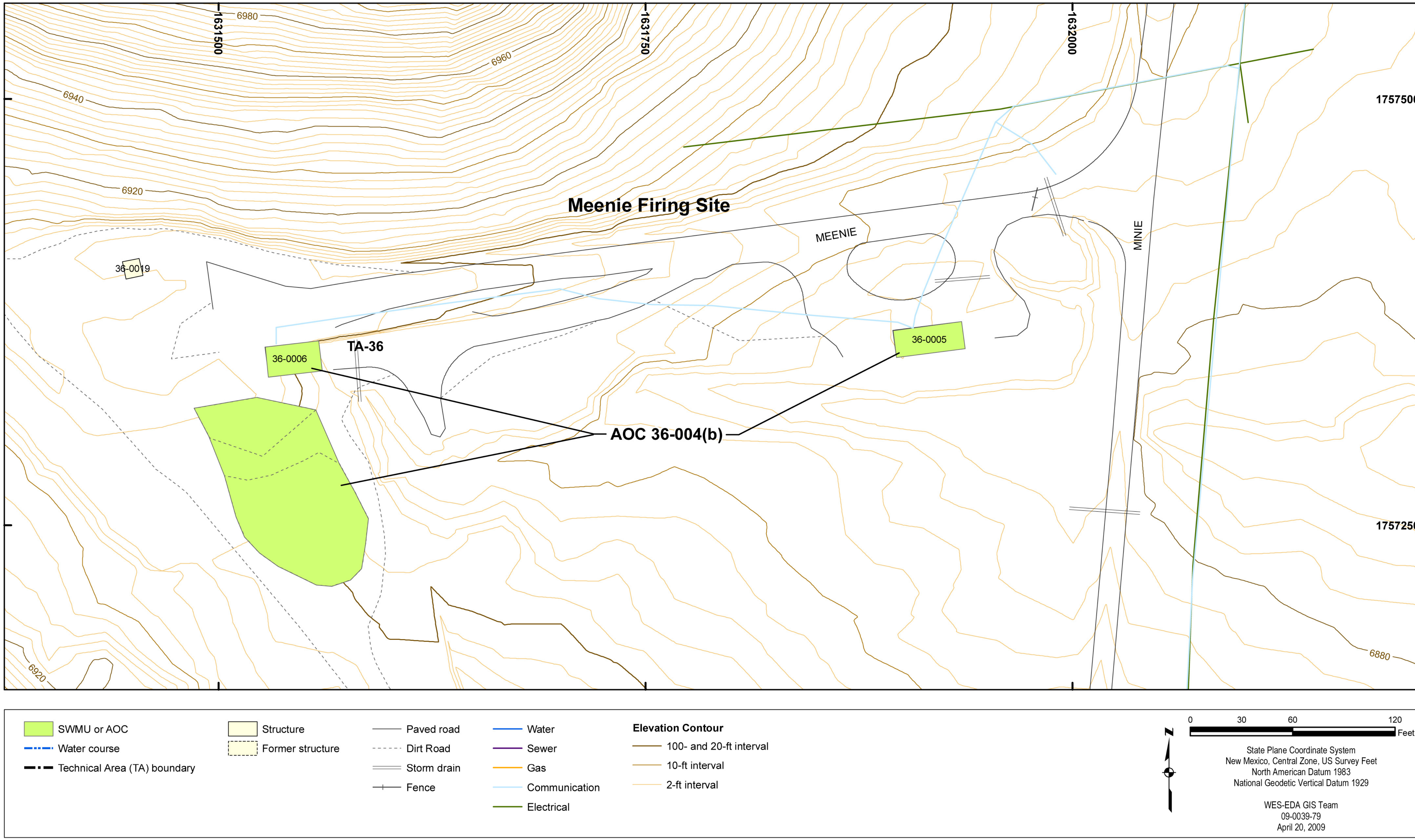


Figure 4.2-14 Site features for AOC 36-004(b)

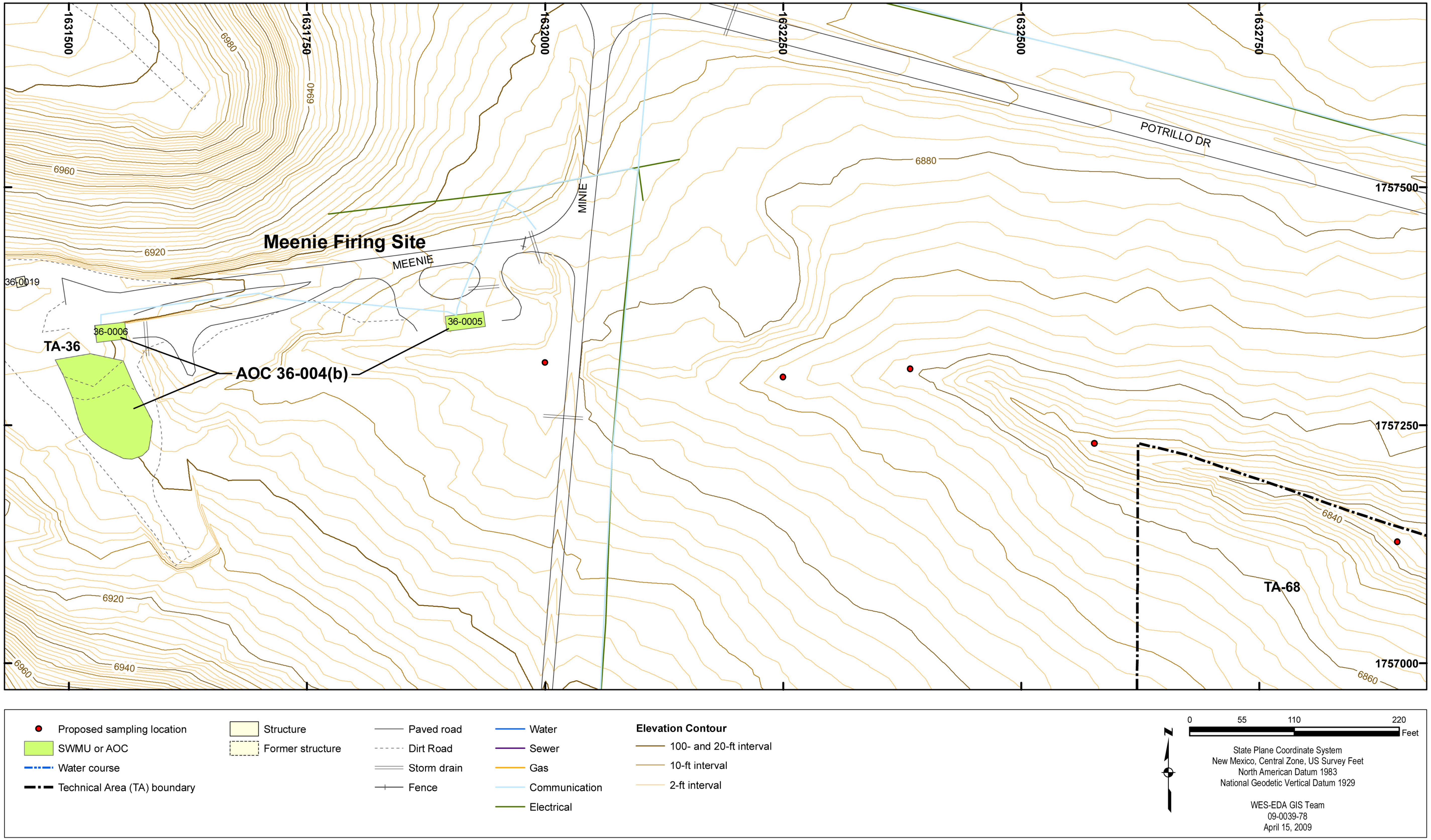


Figure 4.2-15 Proposed sampling locations at AOC 36-004(b)

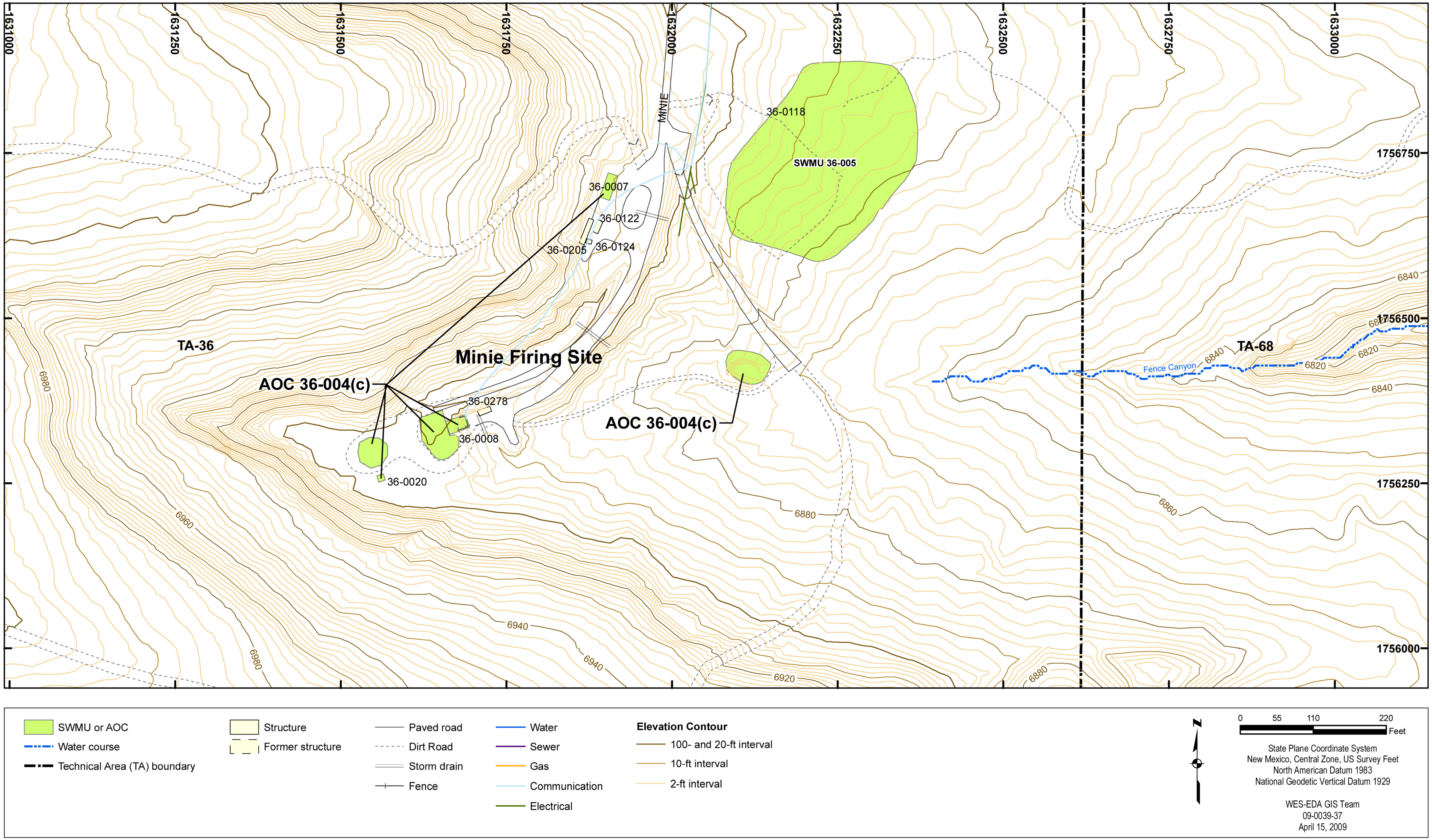


Figure 4.2-16 Site features for AOC 36-004(c)

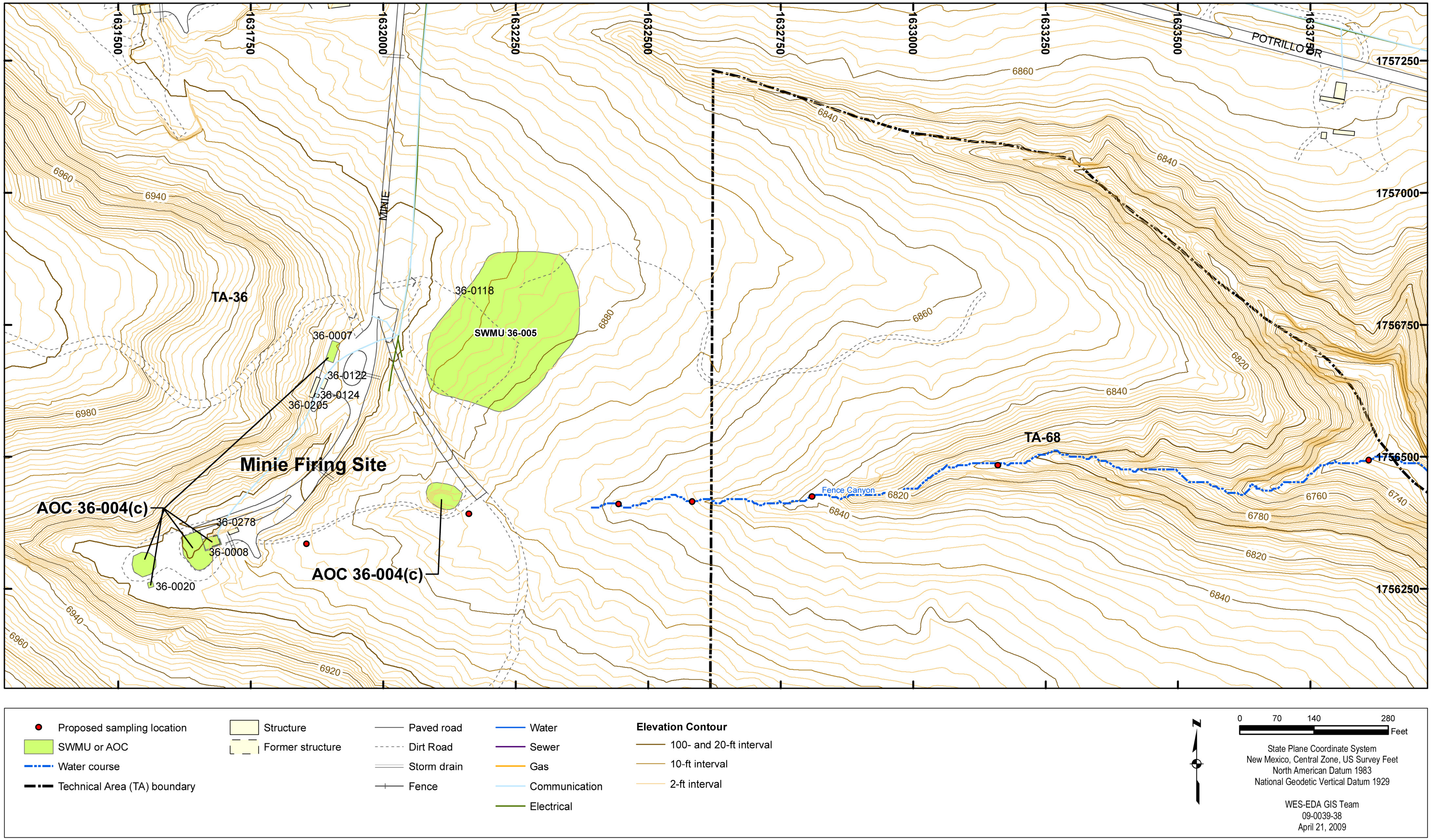


Figure 4.2-17 Proposed sampling locations at AOC 36-004(c)

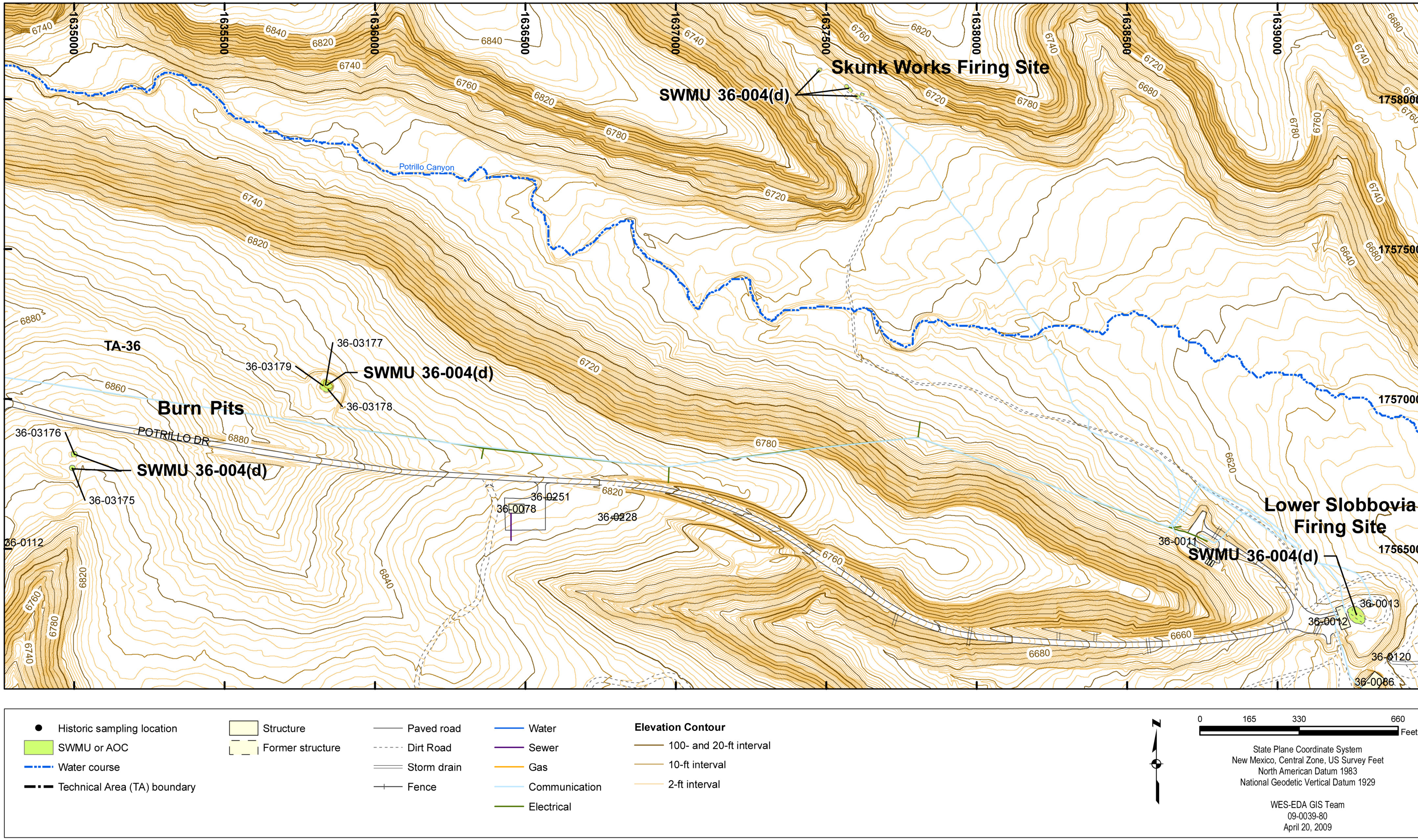


Figure 4.2-18 Site features and historical sampling locations for SWMU 36-004(d)

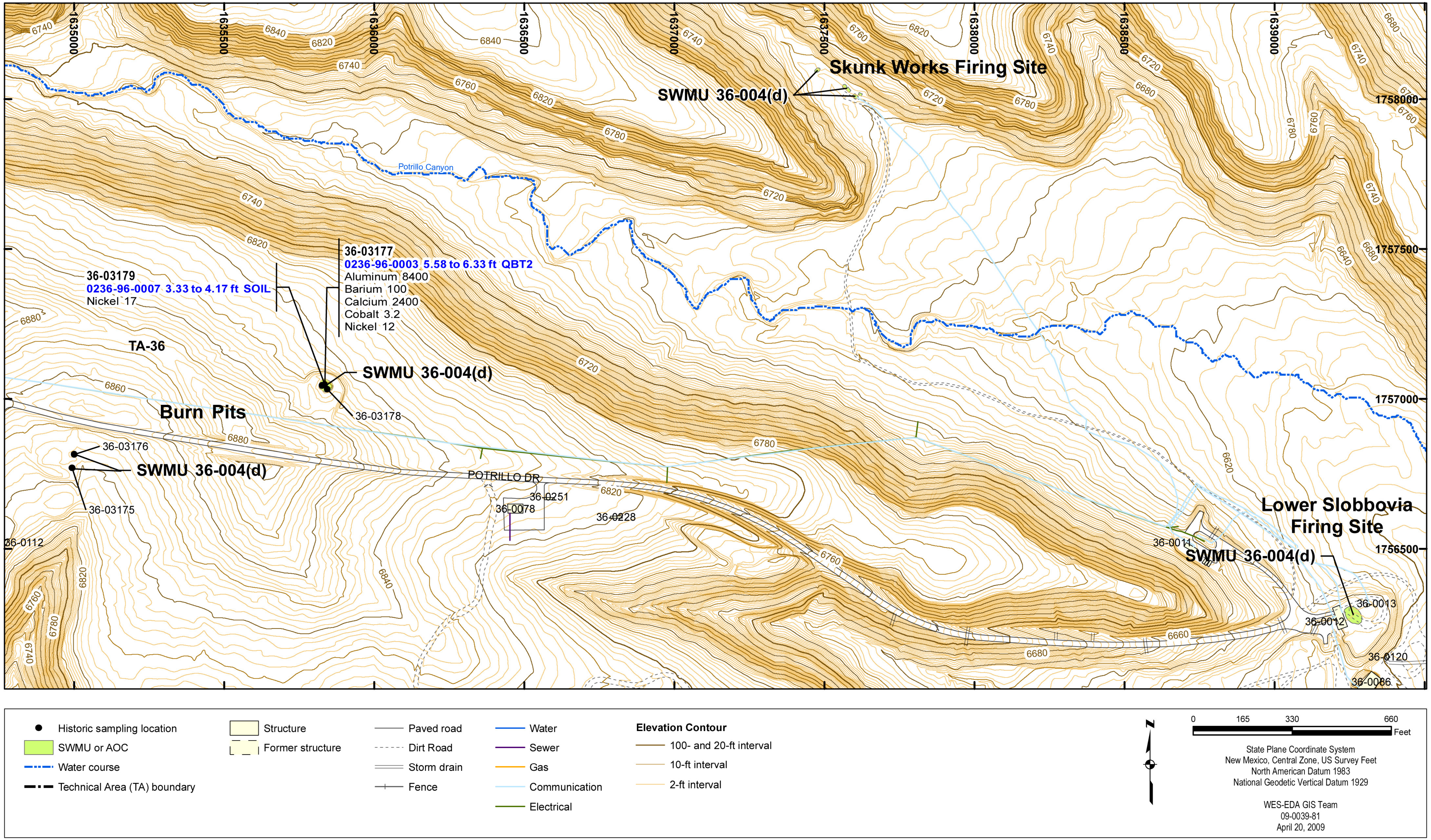


Figure 4.2-19 Inorganic chemicals detected above BVs at SWMU 36-004(d)

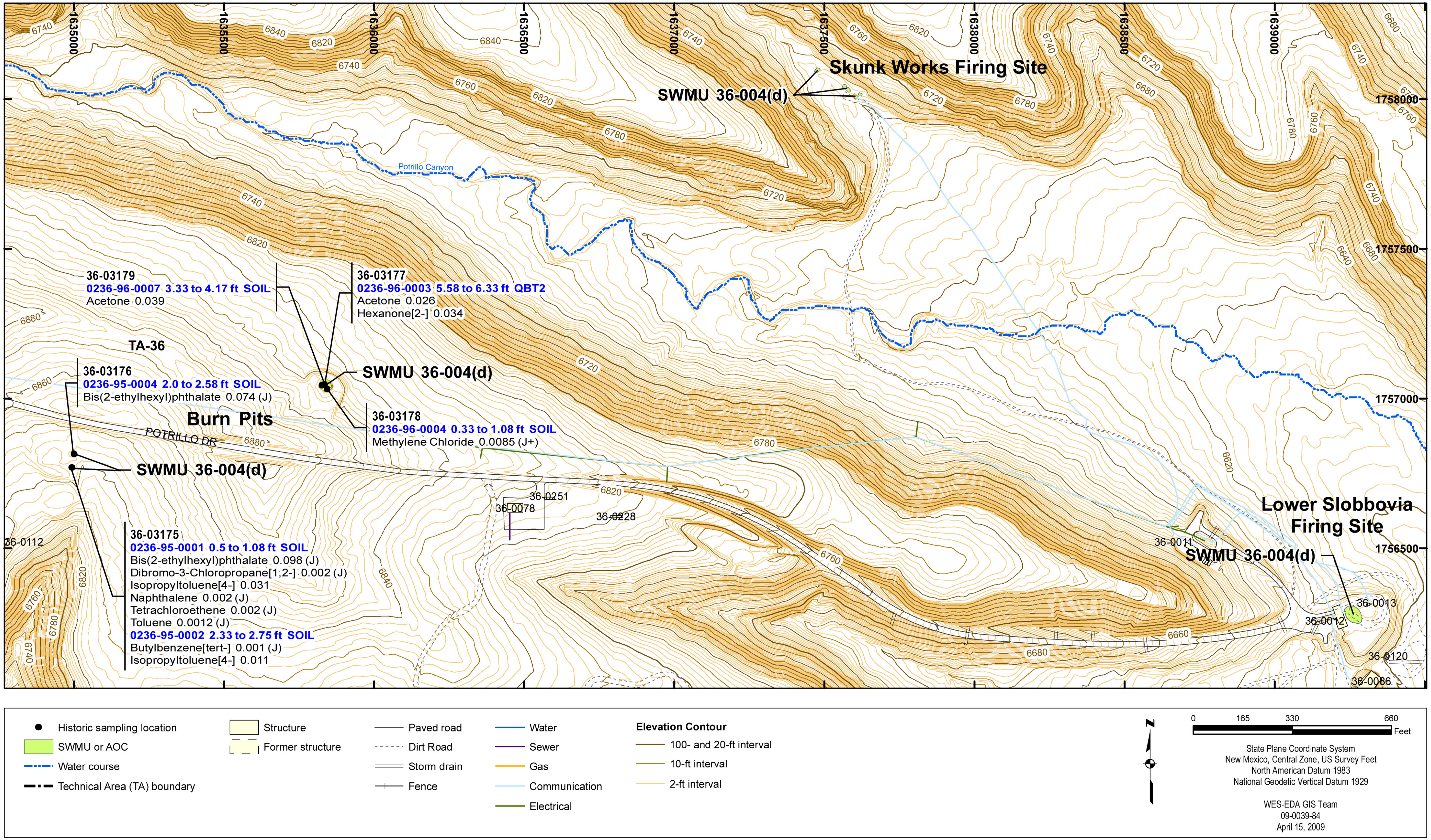


Figure 4.2-20 Organic chemicals detected at SWMU 36-004(d)

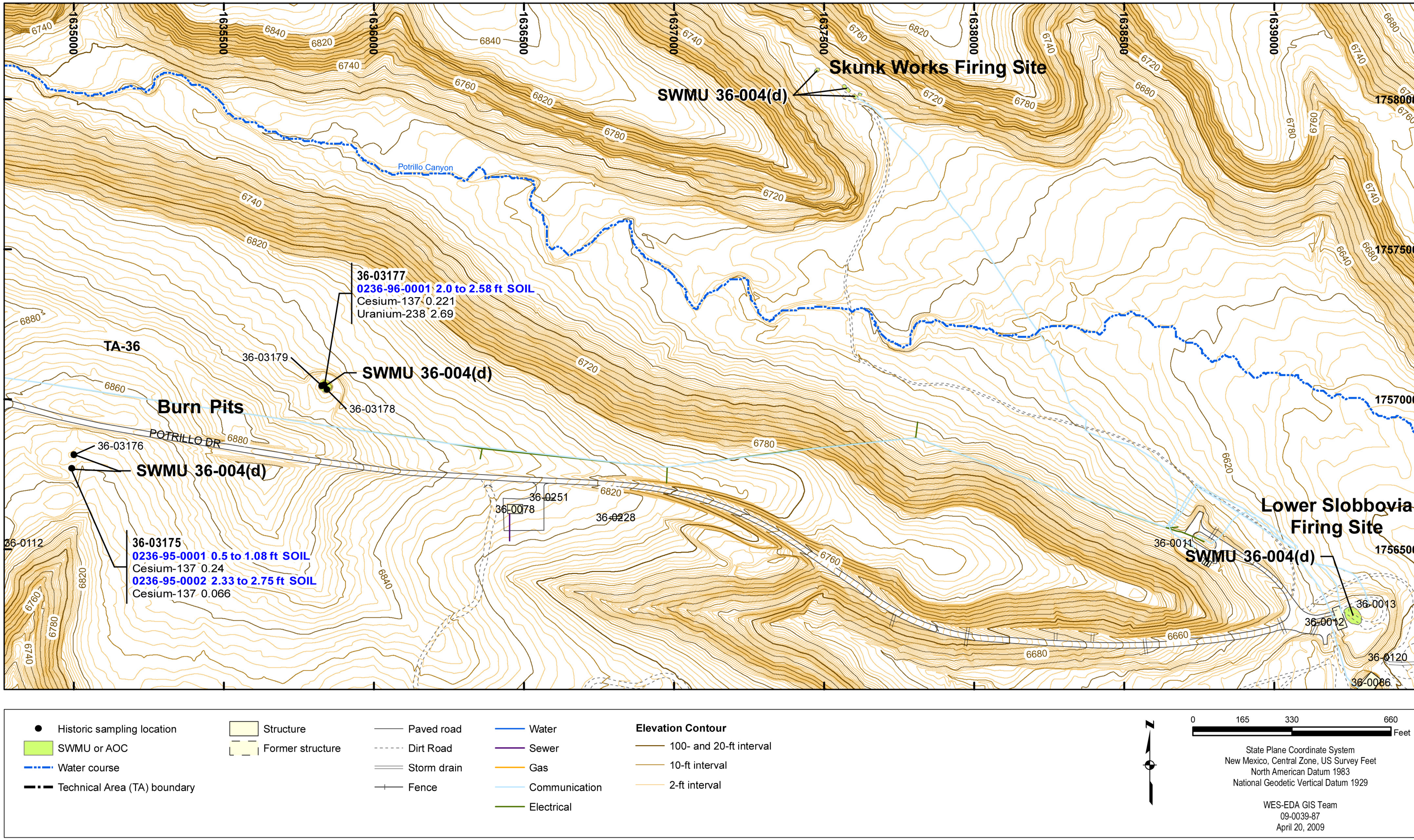


Figure 4.2-21 Radionuclides detected or detected above BVs/FVs at SWMU 36-004(d)

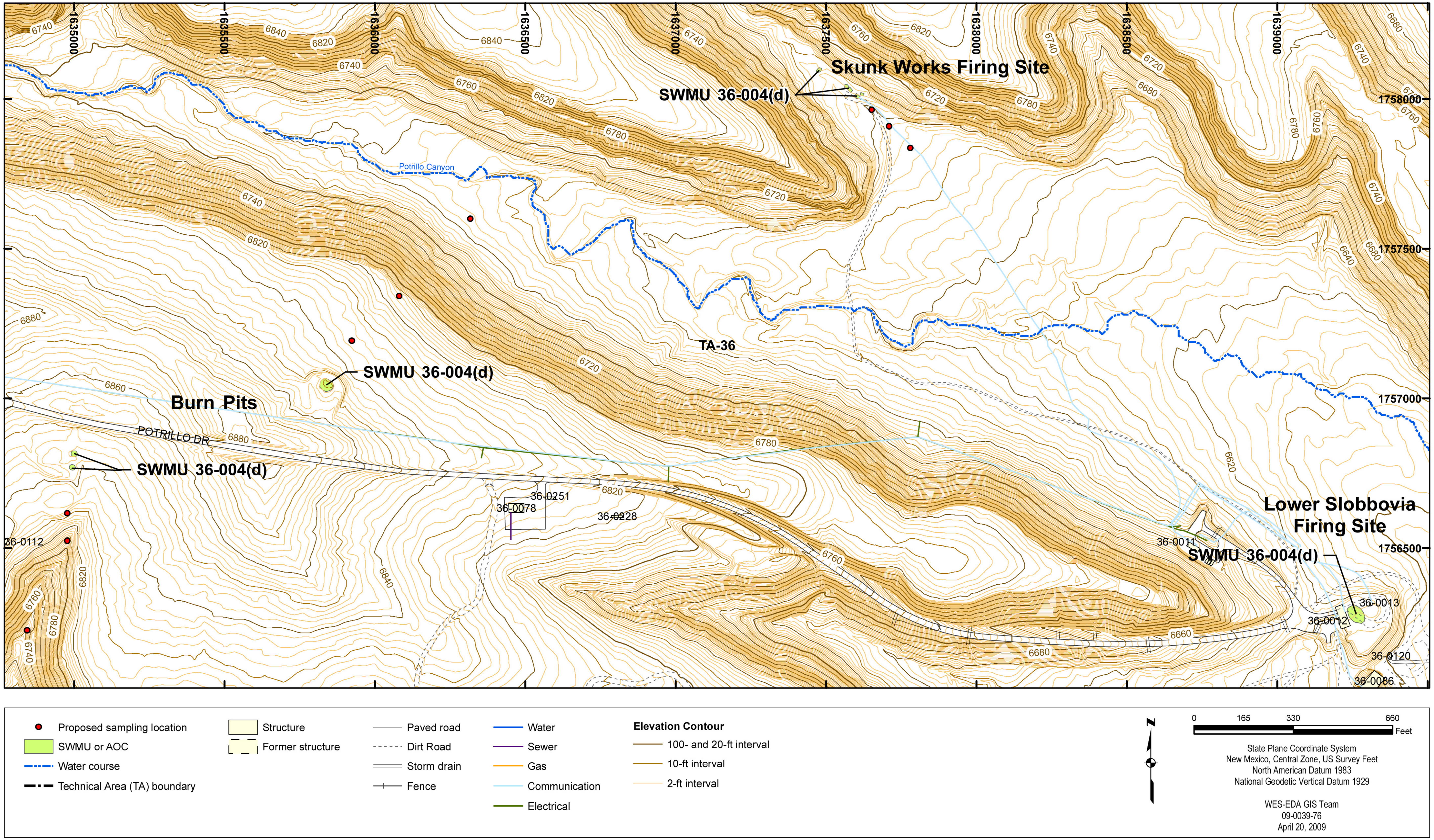


Figure 4.2-22 Proposed sampling locations at SWMU 36-004(d)

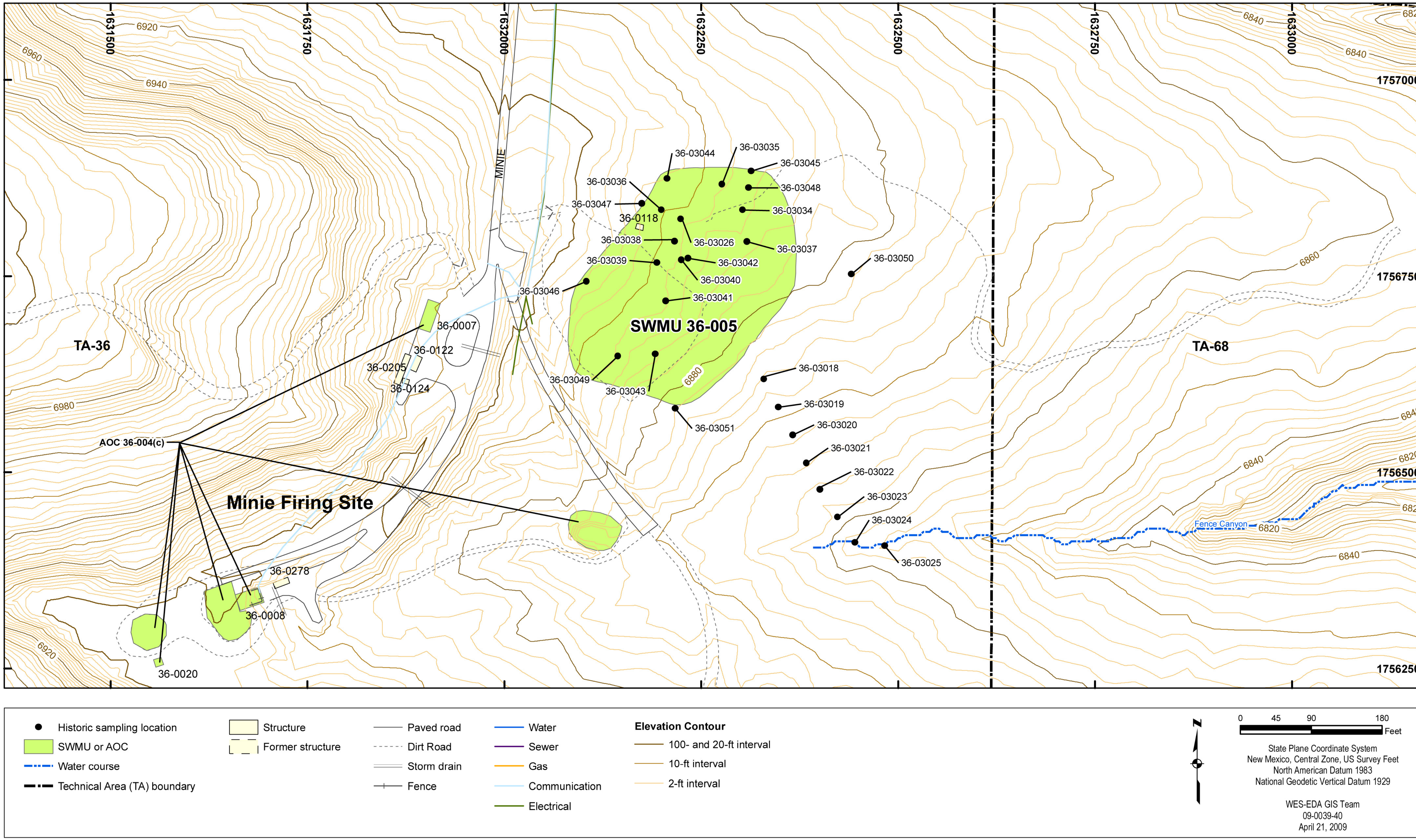


Figure 4.2-23 Site features and historical sampling locations for SWMU 36-005

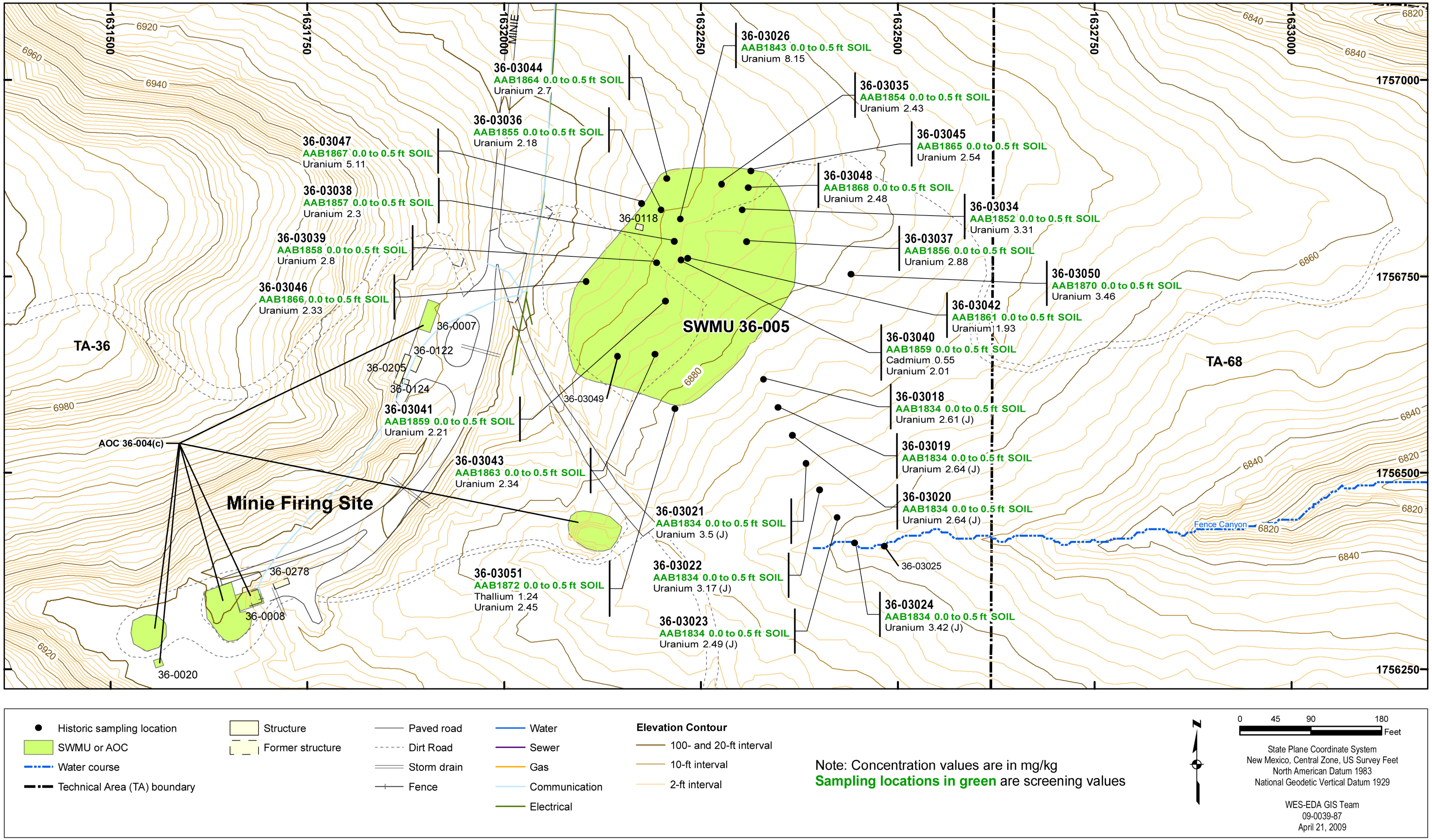


Figure 4.2-24 Screening-level inorganic chemicals detected above BVs at SWMU 36-005

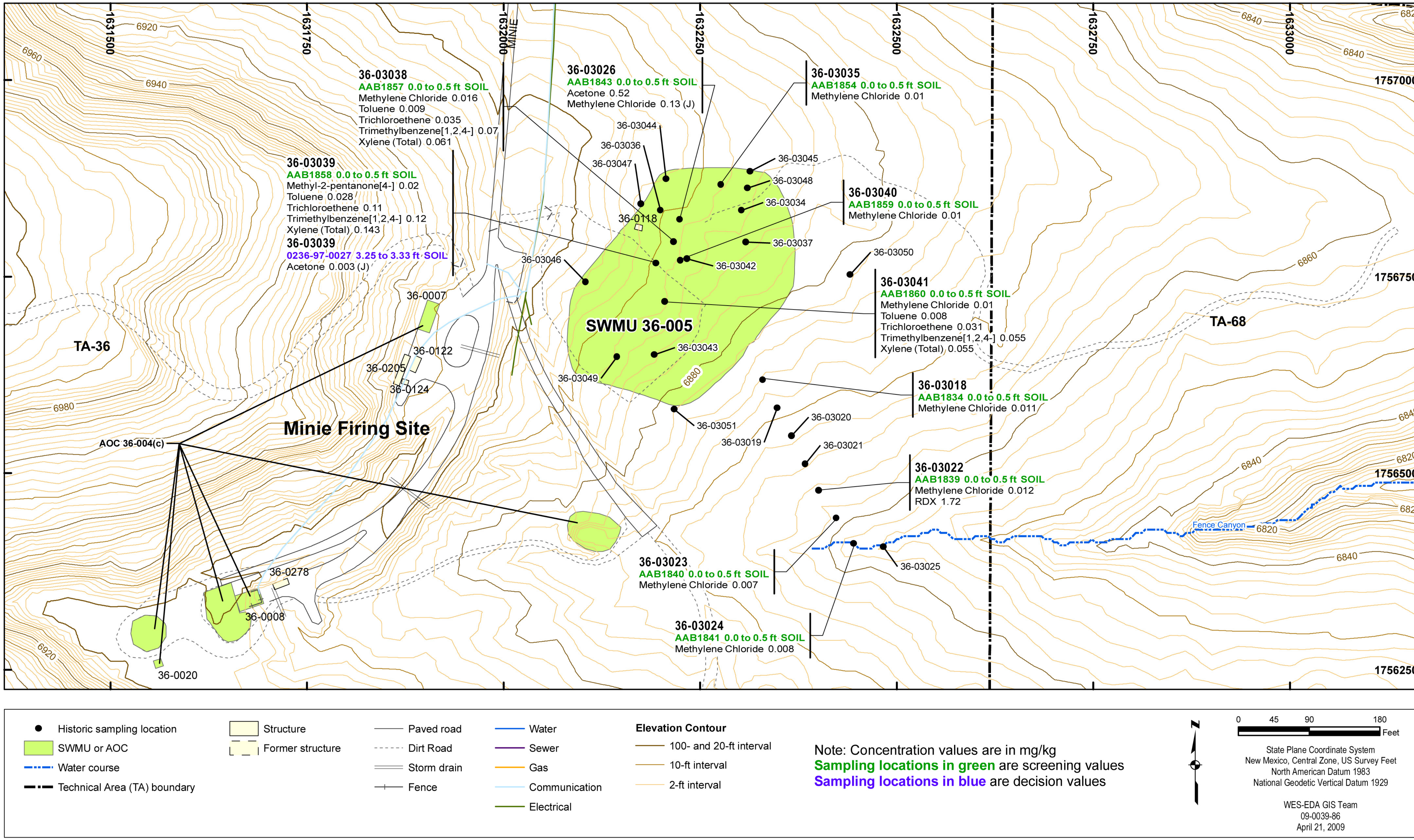


Figure 4.2-25 Screening- and decision-level organic chemicals detected at SWMU 36-005

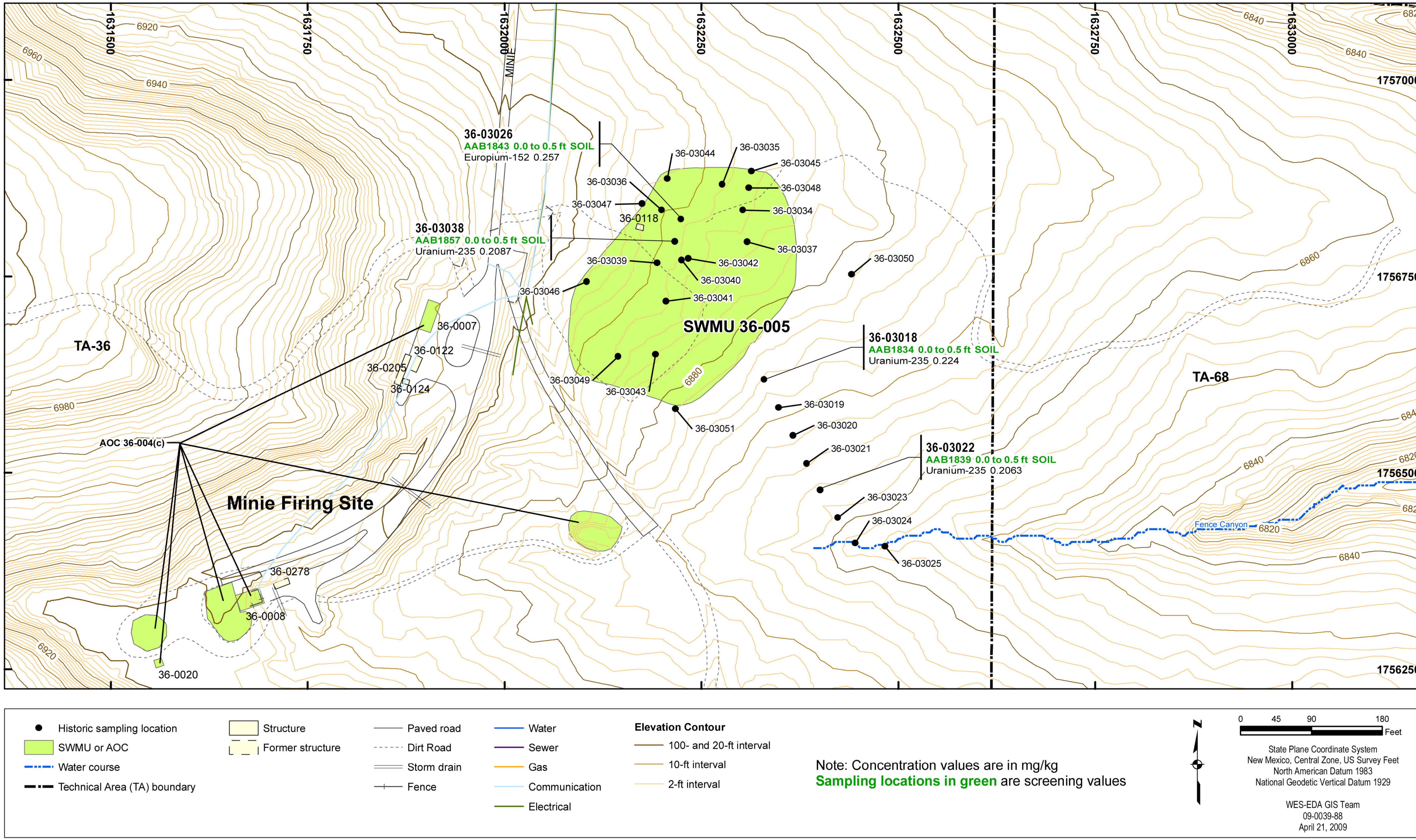


Figure 4.2-26 Radionuclides detected or detected above BVs/FVs at SWMU 36-005

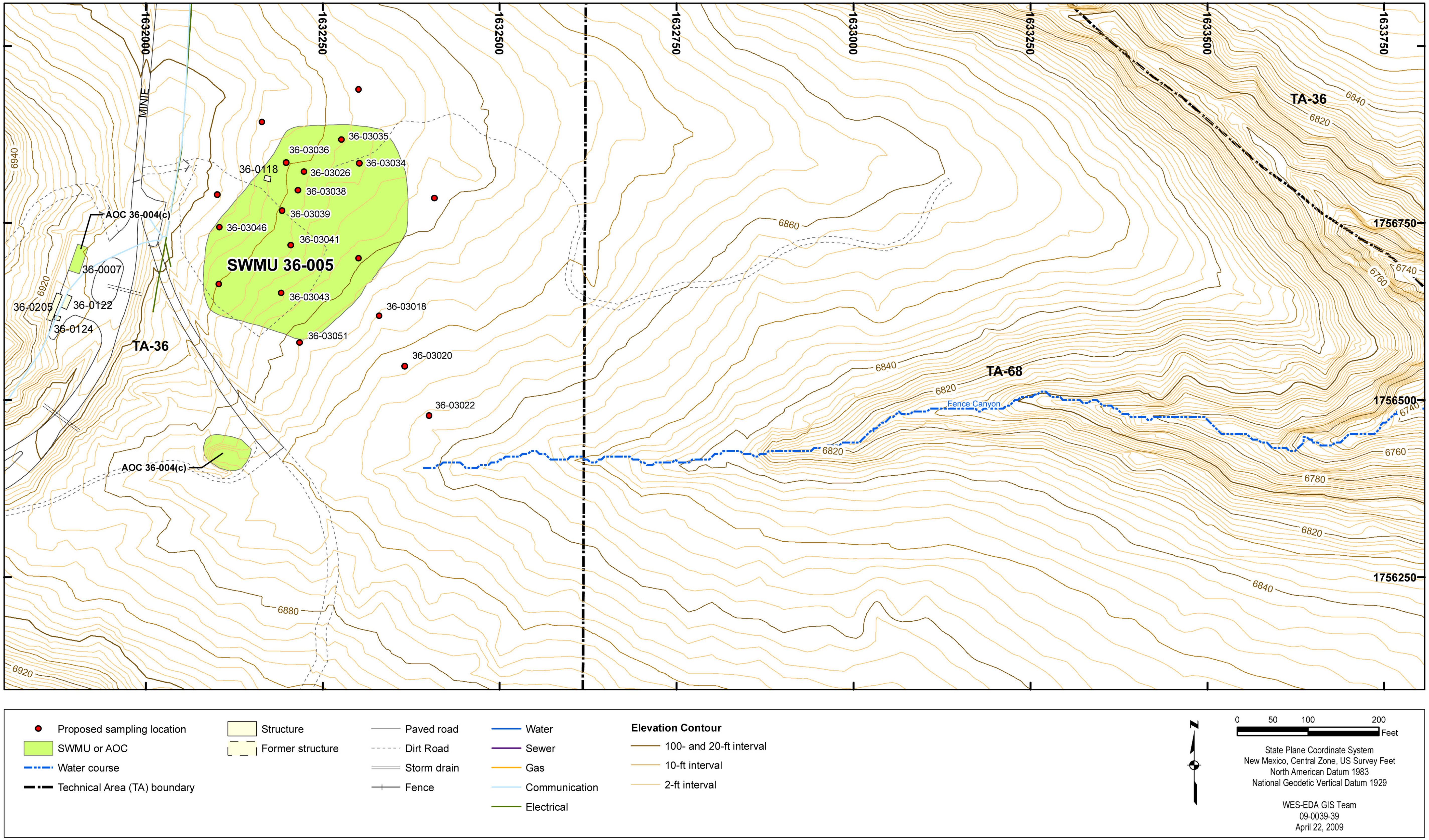


Figure 4.2-27 Proposed sampling locations at SWMU 36-005

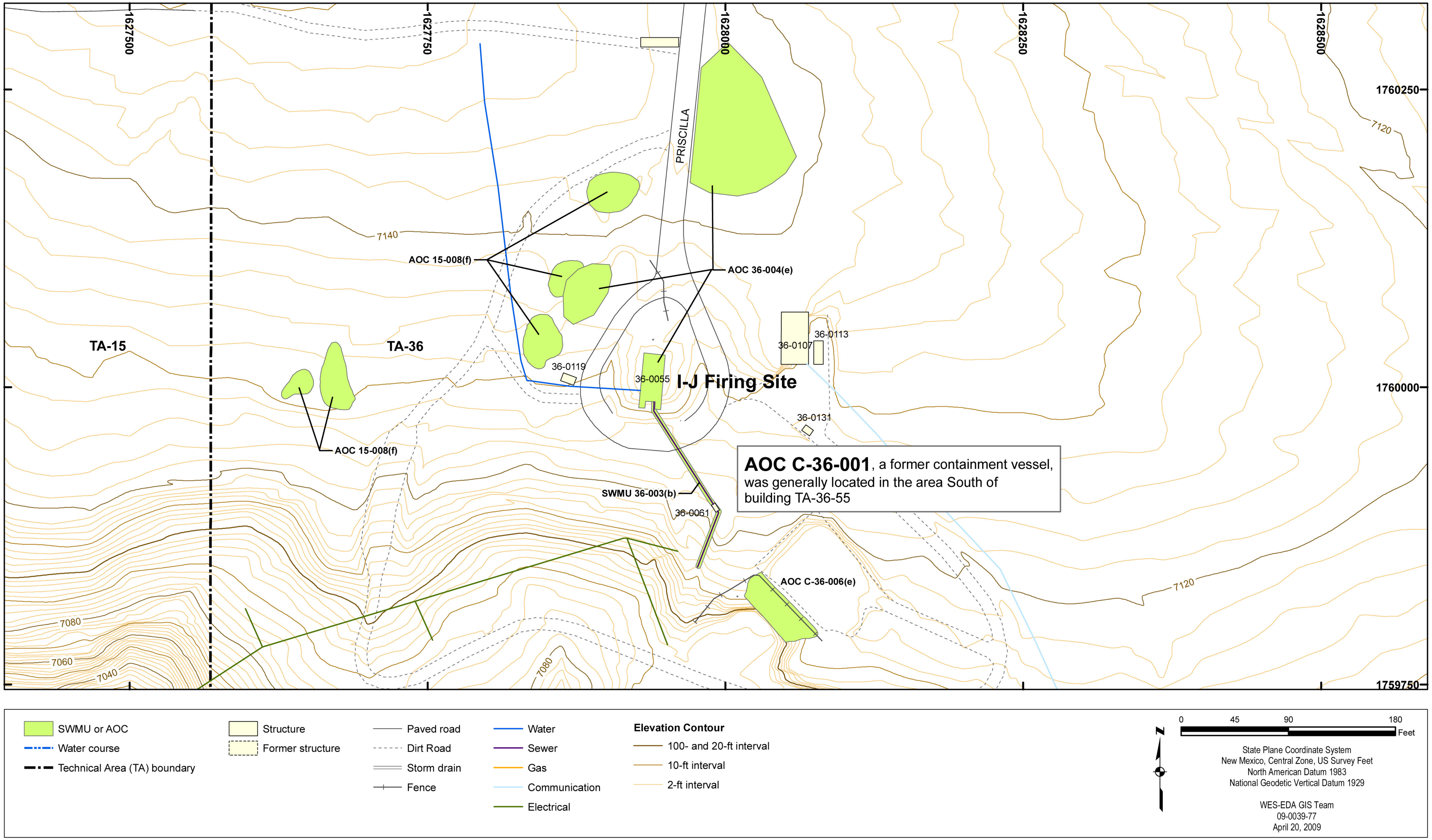


Figure 4.2-28 Site features for AOC C-36-001

Table 1.1-1
Status of SWMUs and AOCs in Potrillo and Fence Canyons Aggregate Area

Consolidated Unit	Site ID	Brief Description	Site Status	Reference
TA-15				
15-002-00	SWMU 15-002	Burn Pit	Under Investigation	Work plan section 4.1.1
	SWMU 15-007(a)	MDA N	Under Investigation	Work plan section 4.1.2
15-003-00	SWMU 15-003	PHERMEX Steel Firing Pad	Deferred per Table IV-2 of the Consent Order	Work plan section 4.1.3
	SWMU 15-006(a)	PHERMEX Firing Site	Deferred per Table IV-2 of the Consent Order	Work plan section 4.1.4
	AOC C-15-004	Former Transformer Station	Under Investigation	Work plan section 4.1.13
15-004(b)-99	SWMU 15-004(b)	Firing Site A	Under Investigation	Work plan section 4.1.5
	SWMU 15-004(c)	Firing Site B	Under Investigation	Work plan section 4.1.5
15-004(f)-99	SWMU 15-004(f)	E-F Firing Site	Under Investigation	Work plan section 4.1.6
	SWMU 15-008(a)	Two Surface Disposal Sites at E-F Firing Site	Under Investigation	Work plan section 4.1.7
	AOC C-15-005	Potential Soil Contamination from Former Building	Under Investigation	Work plan section 4.1.14
	AOC 15-005(b)	Storage Area	Under Investigation	Work plan section 4.1.8
	AOC C-15-006	Potential Soil Contamination from Former Building	Under Investigation	Work plan section 4.1.15
	AOC 15-006(e)	Projectile Test Area, Duplicate of AOC C-36-006(e)	Under Investigation	Work plan section 4.1.9
	AOC 15-008(f)	Sand Mounds at I-J Firing Site (TA-36)	Deferred per Table IV-2 of the Consent Order	Work plan section 4.1.10
	SWMU 15-009(e)	Septic Tank	Under Investigation	Work plan section 4.1.11
	SWMU 15-009(j)	Septic System	Removed from the Module VIII of the Laboratory's Hazardous Waste Facility Permit (HWPF), 11/09/01	NMED 2001, 072819
	SWMU 15-010(a)	Septic Tank	Under Investigation	Work plan section 4.1.12
	AOC C-15-012	Underground Storage Tank	No Further Action Approved, 01/21/05	EPA 2005, 088464
	SWMU 15-012(b)	Former Wash Area	Removed from the Module VIII of the Laboratory's Hazardous Waste Facility Permit (HWPF), 11/09/01	NMED 2001, 072819
	AOC C-15-013	Underground Storage Tank	No Further Action Approved, 01/21/05	EPA 2005, 088464

Table 1.1-1 (continued)

Consolidated Unit	Site ID	Brief Description	Site Status	Reference
	AOC 15-013(b)	Underground Storage Tank	No Further Action Approved, 01/21/05	EPA 2005, 088464
	AOC 15-014(c)	Sink Drain	No Further Action Approved, 01/21/05	EPA 2005, 088464
TA-36				
	SWMU 36-001	MDA AA	Under Investigation	Work plan section 4.2.1
	AOC C-36-001	Former Containment Vessel	Under Investigation	Work plan section 4.2.10
	AOC C-36-002	Borrow Pit	No Further Action Approved, 01/21/05	EPA 2005, 088464
	SWMU 36-003(b)	Septic System, I-J Firing Site	Under Investigation	Work plan section 4.2.2
	SWMU 36-003(c)	Septic System	Removed from the Module VIII of the Laboratory's Hazardous Waste Facility Permit (HWPF), 12/23/98	NMED 1998, 063042
36-006-99	AOC 36-004(a)	Eenie Firing Site	Deferred per Table IV-2 of the Consent Order	Work plan section 4.2.3
	SWMU 36-006	Surface Disposal Site	Under Investigation	Work plan section 4.2.4
	AOC 36-004(b)	Meenie Firing Site	Deferred per Table IV-2 of the Consent Order	Work plan section 4.2.5
	AOC 36-004(c)	Minie Firing Site	Active RCRA-Regulated OD Site (Interim Status)	Work plan section 4.2.6
	SWMU 36-004(d)	Skunk Works Firing Site, Lower Slobbovia Firing Site, and Burn Pits	Deferred per Table IV-2 of the Consent Order	Work plan section 4.2.7
	AOC 36-004(e)	I-J Firing Site	Deferred per Table IV-2 of the Consent Order	Work plan section 4.2.8
	AOC 36-004(f)	Firing Site	No Further Action Approved, 01/21/05	EPA 2005, 088464
	SWMU 36-005	Storage Area	Under Investigation	Work plan section 4.2.9
	AOC C-36-006(e)	Projectile Test Area	Under Investigation	Work Plan section 4.2.11
	AOC 36-007(a)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464
	AOC 36-007(b)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464
	AOC 36-007(c)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464
	AOC 36-007(d)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464
	AOC 36-007(e)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464

Table 1.1-1 (continued)

Consolidated Unit	Site ID	Brief Description	Site Status	Reference
	AOC 36-007(f)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464

Note: Shading denotes NFA approved or complete with controls.

Table 2.3-1
Industrial SSLs and SALs

Chemical	Industrial SSL[a] (inorganic and organic chemicals) or Industrial SAL[b] (radionuclides)
Inorganic Chemicals (mg/kg)	
Aluminum	100,000
Antimony	454
Barium	100,000
Beryllium	2250
Cadmium	564
Chromium	14,000[c]
Cobalt	20,500
Copper	45400
Lead	800
Manganese	48,400
Mercury	310[c]
Nickel	22700
Silver	5680
Thallium	74.9
Uranium	3100[c]
Zinc	100000
Organic Chemicals (mg/kg)	
Acetone	100,000
Benzo(b)fluorathene	23.4
Bis(2-ethylhexyl)phthalate	1370
Tert-Butylbenzene	106
Di-n-butylphthalate	68400
1,2-Dibromo-3-chloropropane	9.68
2-Hexanone	n/a[d]
HMX	34,200
4-Isopropyltoluene	n/a
Methylene Chloride	490
Naphthalene	300
Tetrachloroethene	31.6
Toluene	252

Table 2.3-1 (continued)

Chemical	Industrial SSL[a] (inorganic and organic chemicals) or Industrial SAL[b] (radionuclides)
Radionuclides (pCi/g)	
Cesium-137	23
Europium-152	11
Uranium-235	87
Uranium-238	430

[a] SSLs from NMED (2006, 092513), unless otherwise noted.

[b] SALs from LANL (2005, 088493).

[c] SSL is from the EPA Regional Screening Table (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/composite_sl_table_run_12SEP2008.pdf)

[d] n/a = Not available.

Table 4.0-1
Summary of Proposed Samples and Analyses

Site	Sampling Justification	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Cyanide (EPA SW-846:9012A)	Nitrate (EPA 300)	Perchlorate (EPA SW-846:6850)	VOCs (EPA SW-846:8260B)	SVOCs (EPA SW-846:8270C)	Explosive Compounds (EPA SW-846:8321A_MOD)	Dioxins/Furans (EPA SW-846:8280)	PCBs (EPA SW-846:8082)	Total Petroleum Hydrocarbons (EPA SW-846 8440)	Isotopic Uranium, (HASL-300)	Isotopic Thorium (HASL-300)	Isotopic Plutonium (HASL 300)	Gamma Spectroscopy (EPA 901.1M)	Americium-241 (HASL-300)
TA-15																		
SWMU 15-002	Collect 15 samples from 3 depths at 5 locations at each burn pit, 1 in the center of each pit and 4 step-out locations around each pit to define nature and extent at both burn pits.	0–1, 3–4, 6–7	Soil, tuff	X[a]	X	X	X	X	X	X	X	X[b]	X	X	X	—[c]	—	—
SWMU 15-007(a)	Collect 8 confirmation samples from 2 depths at 4 locations beneath bottom of landfill excavation to confirm cleanup and define extent of any residual contamination.	0–1, 4–5 (below bottom of landfill excavation)	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	X	—	—	—
	Collect 12 samples from 2 depths at 2 step-out locations on each side of the landfill and 4 samples from 2 depths at 1 step-out location at each end of the landfill to define lateral extent.	4–5, 14–15	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	X	—	—	—
SWMUs 15-003 and 15-006(a) (Deferred)	Collect 10 samples from 2 depths at 5 locations in the drainage downgradient of both sites to determine if contaminants are migrating from the sites. NOTE: Runoff from both sites flows to the same drainage.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	X	X	—
SWMUs 15-004(b) and 15-004(c)	Collect 2 samples from 2 depths at one location within Firing Site A and one location within Firing Site B.	0-1, 3-4	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	X	X
	Collect 24 samples from 2 depths at 12 locations across the site and at additional locations with elevated screening results.	0–1, 3–4	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	X	X
SWMU 15-004(f)	Collect 42 samples from one depth at the 42 RFI grid locations across the site to supplement RFI data and to identify the areas and depths of soil requiring corrective action. The objective of this investigation is not to determine nature and extent of contamination, but to identify the areas and depths of soil requiring corrective action.	3–4	Soil, tuff	X	—	—	—	—	—	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 102 samples from two depths at 51 previous RFI grid locations with no RFI data and at new locations identified by elevated field screening results. The objective of this investigation is not to determine nature and extent of contamination, but to identify the areas and depths of soil requiring corrective action.	0-1, 3–4	Soil, tuff	X	—	—	—	—	—	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 54 samples from 3 depths at 3 locations on each side of both mounds and from 3 locations across the top of each mound to identify the areas and depths of soil requiring corrective action.	0–1, 6–7, 9–10	Soil, tuff	X	—	—	—	—	—	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 10 samples from 2 depths at 5 locations in the drainage downgradient of the site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	—	—	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 2 samples from 2 depths at 1 location at the head of Potrillo Canyon to determine if there is contaminant migration.	0-1, 2-3	Sediment	X	X	X	X	—	—	X	X[b]	X[b]	—	X	—	—	—	—
SWMU 15-008(a)	Collect 8 samples from 2 depths at 2 locations beneath **each** debris pile to confirm cleanup and define extent.	0–1, 3–4	Soil, tuff	X	X	X	X	X	X	X	X[b]	X	—	X	—	—	—	—
	Collect 16 samples from 2 depths at 4 step-out locations around both debris piles to determine extent.	0–1, 3–4	Soil, tuff	X	X	X	X	X	X	X	X[b]	X	—	X	—	—	—	—

Table 4.0-1 (continued)

Site	Sampling Justification	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Cyanide (EPA SW-846:9012A)	Nitrate (EPA 300)	Perchlorate (EPA SW-846:6850)	VOCs (EPA SW-846:8260B)	SVOCs (EPA SW-846:8270C)	Explosive Compounds (EPA SW-846:8321A_MOD)	Dioxins/Furans (EPA SW-846:8280)	PCBs (EPA SW-846:8082)	Total Petroleum Hydrocarbons (EPA SW-846 8440)	Isotopic Uranium, (HASL-300)	Isotopic Thorium (HASL-300)	Isotopic Plutonium (HASL 300)	Gamma Spectroscopy (EPA 901.1M)	Americium-241 (HASL-300)
AOC 15-005(b)	Collect 8 samples from 2 depths at 4 locations around Building 15-0242 to define extent. Avoid asphalt driveway.	0–1, 4–5	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	—	—	—	—	—
AOC 15-006(e)	No sampling; duplicate of AOC C-36-006(e).	n/a[d]	n/a	—	—	—	—	—	—	—	X[b]	X[b]	—	—	—	—	—	—
AOC 15-008(f) (Deferred)	Collect 20 samples from 2 depths at 5 locations in the drainage south of the west Sand Mounds and at 5 locations in the drainage south of the east Sand Mounds to determine if contaminants are migrating from the site.	0–1, 2–3	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	X	X	—
SWMU 15-009(e)	Collect 6 samples from 2 depths at 3 locations: adjacent to the tank inlet, adjacent to the tank outlet, and on one side of the tank to define extent.	0–1, 3–4 (below bottom of tank and tank inlet and outlet)	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 4 samples from 2 depths at 2 locations along the inlet drain line to define extent.	0–1, 3–4 (below drain line)	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 6 samples from 2 depths at 3 locations within outfall area to define extent.	0–1, 3–4 (within outfall area and drainage)	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	—	—
SWMU 15-010(a)	Collect 6 samples from 2 depths at 3 locations: below tank inlet, below tank outlet, and within the tank excavation to define extent.	0–1, 3–4 (below bottom of tank and tank inlet and outlet)	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 6 samples from 2 depths at 3 locations along the two inlet drain lines to define extent.	0–1, 3–4 (below drain line)	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 8 samples from 2 depths at 4 locations within outfall area to define extent.	0–1, 3–4 (within outfall area)	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	—	—
AOC C-15-004	Collect 4 samples from 2 depths at 2 locations to define extent.	0–1, 2–3	Soil ,tuff	X	—	—	—	—	—	—	X[b]	X	—	X	—	—	—	—
AOC C-15-005	Collect 12 samples from 2 depths at 6 locations within and adjacent to building footprint.	0–1, 2–3	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	X	—	—	—
AOC C-15-006	Collect 12 samples from 2 depths at 6 locations within and adjacent to building footprint.	0–1, 2–3	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	X		—	
TA-36																		
SWMU 36-001	Collect 18 confirmation samples from 2 depths at 9 locations beneath bottom of landfill excavation to confirm cleanup and define extent of any residual contamination.	0–1, 4–5 (below bottom of landfill excavation)	Soil, tuff	X	X	X	X	X	X	X	X	X[b]	—	X	X	—	—	—
	Collect 16 samples from 2 depths at 2 step-out locations on each side of the landfill excavation (8 total step-out locations).	4–5, 15–16	Soil, tuff	X	X	X	X	X	X	X	X	X[b]	—	X	X	—	—	—

Table 4.0-1 (continued)

Site	Sampling Justification	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Cyanide (EPA SW-846:9012A)	Nitrate (EPA 300)	Perchlorate (EPA SW-846:6850)	VOCs (EPA SW-846:8260B)	SVOCs (EPA SW-846:8270C)	Explosive Compounds (EPA SW-846:8321A_MOD)	Dioxins/Furans (EPA SW-846:8280)	PCBs (EPA SW-846:8082)	Total Petroleum Hydrocarbons (EPA SW-846 8440)	Isotopic Uranium, (HASL-300)	Isotopic Thorium (HASL-300)	Isotopic Plutonium (HASL 300)	Gamma Spectroscopy (EPA 901.1M)	Americium-241 (HASL-300)
SWMU 36-003(b)	Collect 6 samples from 2 depths at 3 locations: adjacent to the tank inlet, adjacent to the tank outlet, and on one side of the tank to define extent.	0–1, 3–4 (below bottom of tank and tank inlet and outlet)	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 4 samples from 2 depths at 2 locations along drain line to define extent.	0–1, 3–4 (below bottom drain line)	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 6 samples from 2 depths at 3 locations at the outfall to define extent.	0–1, 3-4	Soil, tuff	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	—	—
AOC 36-004(a) (Deferred)	Collect 2 samples from 1 location in the drainage northwest and downgradient of the site. NOTE: Most drainage sampling locations will be addressed by the investigation and remediation of the SWMU 36-006 surface disposal site located directly downgradient of this site.	0–1, 2–3	Sediment	X	X	X	X	—	—	X	X[b]	X[b]	—	X	—	—	X	—
SWMU 36-006	Collect 12 samples from 2 depths at 6 locations beneath debris pile to confirm cleanup and define extent.	0–1, 2–3	Soil, tuff, sediment	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 10 samples from 2 depths at 5 step-out locations around debris pile to define extent.	0–1, 2–3	Soil, tuff, sediment	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	—	—
AOC 36-004(b) (Deferred)	Collect 10 samples from 2 depths at 5 locations in the drainages downgradient of the Burn Pits to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	X	—
	Collect 6 samples from 2 depths at 3 locations in the drainage downgradient of the Skunk Works Firing Site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	X	—
AOC 36-004(c)	Collect 14 samples from 2 depths at 7 locations in the drainage downgradient of the site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	X	—
SWMU 36-004(d) (Deferred)	Collect 12 samples from 2 depths at 6 locations in the drainages downgradient of the site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—		X	
	Collect 6 samples from 2 depths at 3 locations in the drainage downgradient of the Skunk Works Firing Site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	X[b]	X[b]	—	X	—	—	X	—
AOC 36-004(e) (Deferred)	No sampling proposed. Drainage sampling will be covered by drainage sample locations for AOCs 15-008(f) and C-36-006(e).	n/a	n/a	—	—	—	—	—	—	—	X[b]	X[b]	—	—	—	—	—	—
SWMU 36-005	Collect 30 samples from 3 depths at 10 previous RFI location based on screening data to define vertical extent.	0–1, 2–3, 4–5	Soil, tuff	X	X	X	X	X[e]	X	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 18 samples from 3 depths at 6 additional locations on the mesa top to define lateral extent.	0–1, 2–3, 4–5	Soil, tuff	X	X	X	X	X[e]	X	X	X[b]	X[b]	—	X	—	—	—	—
	Collect 6 samples from 2 depths at 3 locations in the drainage downgradient of the site to define extent.	0–1, 2–3	Sediment	X	X	X	X	X[e]	X	X	X[b]	X[b]	—	X	—	—	—	—
AOC C-36-001	No sampling. Site will be sampled as part of I-J Firing Site [SWMU 36-004(e)].	n/a	n/a	—	—	—	—	—	—	—	X[b]	X[b]	—	—	—	—	—	—

Table 4.0-1 (continued)

Site	Sampling Justification	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Cyanide (EPA SW-846:9012A)	Nitrate (EPA 300)	Perchlorate (EPA SW-846:6850)	VOCs (EPA SW-846:8260B)	SVOCs (EPA SW-846:8270C)	Explosive Compounds (EPA SW-846:8321A_MOD)	Dioxins/Furans (EPA SW-846:8280)	PCBs (EPA SW-846:8082)	Total Petroleum Hydrocarbons (EPA SW-846 8440)	Isotopic Uranium, (HASL-300)	Isotopic Thorium (HASL-300)	Isotopic Plutonium (HASL 300)	Gamma Spectroscopy (EPA 901.1M)	Americium-241 (HASL-300)
AOC C-36-006(e)	Collect 10 samples from 2 depths at 5 locations in the drainage downgradient of the site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	—	X	X	X	X	X[b]	X[b]	—	X	—	—	X	—

[a] X = Analysis proposed.

[b] One sample (i.e., the most contaminated sample) from each site where PCB and dioxin/furan analyses are not proposed based on the operational history of the site will be analyzed for PCBs and dioxins/furans. Sample selection will be based on field screening and sample location relative to potential contaminant sources.

[c] — = Analysis will not be performed.

[d] n/a = Not applicable.

[e] VOCs in subsurface samples only.

Table 4.1-1
Summary of Historical Samples Collected and Analyses Requested at TA-15

Sample ID	Location ID	Depth (ft)	Media	Gamma Spectroscopy	High Explosives	Isotopic Uranium	Metals	SVOCs	Uranium	VOCs
SWMU 15-004(b)										
0215-96-0106	15-02428	0.67–1.17	SOIL	—[a]	2535[b]	2530	2529	—	—	—
0215-96-0105	15-02434	0.67–1.17	SOIL	—	2535	2530	2529	—	—	—
0215-96-0104	15-02444	0.83–1.17	SOIL	—	2535	2530	2529	—	—	—
0215-96-0116	15-02444	1.0–1.08	SOIL	—	2558	2562	2560	—	—	—
0215-96-0117	15-02464	2.75–2.92	SOIL	—	2558	2562	2560	—	—	—
SWMU 15-004(f)										
AAB3451	15-02100	1.5–2.0	SOIL	19509	—	—	18681	—	19509	—
AAB3461	15-02112	0.0–0.5	SOIL	19509	—	—	18681	—	19509	—
AAB3476	15-02114	0.0–0.5	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3340	15-02127	1.5–2.0	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3332	15-02137	1.5–2.0	SOIL	19509	—	—	18681	—	19509	—
AAB3304	15-02153	1.0–1.0	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3342	15-02166	0.0–0.33	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3477	15-02172	1.5–2.0	SOIL	19509	—	—	18681	—	19509	—
AAB3336	15-02178	0.0–0.5	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3470	15-02182	1.5–2.0	SOIL	19509	—	—	18681	—	19509	—
AAB3485	15-02198	0.0–0.5	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3295	15-02206	0.0–0.33	SOIL	19509	—	—	18681, 20993	—	19509	—
AAB3298	15-02240	0.0–0.5	SOIL	19509	—	—	18681	—	19509	—
AAB3473	15-02242	0.0–1.0	SOIL	19509	—	—	18681	—	19509	—
AAB3445	15-02246	0.0–0.5	SOIL	19509	—	—	18681, 20982	—	19509	—
AAB3321	15-02277	0.0–0.42	SOIL	19509	—	—	18681	—	19509	—
AAB3525	15-02279	0.0–0.42	SOIL	19509	—	—	18681	—	19509	—
AAB3325	15-02295	0.0–0.5	SOIL	19509	—	—	18681	—	19509	—
AAB3480	15-02299	1.5–2.0	SOIL	19509	—	—	18681	—	19509	—
SWMU 15-008(a)										
AAB3473	15-02242	0.0–1.0	SOIL	19509	—	—	18681	—	19509	—

Table 4.1-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Gamma Spectroscopy	High Explosives	Isotopic Uranium	Metals	SVOCs	Uranium	VOCs
SWMU 15-009(e)										
0215-97-0021	15-02510	0.0–0.5	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0023	15-02510	0.83–1.17	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0024	15-02511	0.0–0.5	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0025	15-02511	0.83–1.0	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0026	15-02512	0.0–0.5	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0027	15-02512	0.83–1.0	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0030	15-02513	6.0–7.0	SOIL	—	3606R	—	3607R	3605R	—	3605R
0215-97-0031	15-02513	9.67–10.17	SOIL	—	3606R	—	3607R	3605R	—	3605R
0215-97-0032	15-02514	6.0–6.67	SOIL	—	3606R	—	3607R	3605R	—	3605R
0215-97-0033	15-02514	9.67–10.08	SOIL	—	3606R	—	3607R	3605R	—	3605R
0215-97-0034	15-02515	3.0–3.50	SOIL	—	3606R	—	3607R	3605R	—	3605R
0215-97-0035	15-02516	2.17–2.67	SOIL	—	3606R	—	3607R	3605R	—	3605R
SWMU 15-010(a)										
0215-97-0063	15-02520	9.0–9.5	QBT2	—	3492R	—	3493R, 3494R	3491R	—	—
0215-97-0064	15-02521	8.0–8.5	QBT2	—	3492R	—	3493R, 3494R	3491R	—	—
0215-97-0065	15-02522	8.5–9.0	QBT2	—	3492R	—	3493R, 3494R	3491R	—	—
0215-97-0066	15-02523	8.5–9.0	QBT2	—	3492R	—	3493R, 3494R	3491R	—	—

[a] — = Analysis not requested.

[b] Request number.

Table 4.1-2
Inorganic Chemicals Detected above BVs at TA-15

Sample ID	Location ID	Depth (ft bgs)	Media	Aluminum	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc
Soil/Fill BV[a]				29200	0.83	295	1.83	0.4	6120	19.3	8.64	14.7	22.3	671	0.1	15.4	3460	1.52	1	915	0.73	1.82	39.6	48.8
Qbt 2 BV				7340	0.5	46	1.21	1.63	2200	7.14	3.14	4.66	11.2	482	0.1	6.58	3500	0.3	1	2770	1.1	2.4	17	63.5
SWMU 15-004(b)																								
0215-96-0106	15-02428	0.67–1.17	SOIL	—[b]	11 (UJ)	—	—	0.53 (U)	—	—	—	—	50	—	NA[c]	—	—	—	2.1 (U)	—	1.3 (U)	NA	—	—
0215-96-0105	15-02434	0.67–1.17	SOIL	—	11 (U)	310	—	1.3	—	—	—	20	88	—	0.11 (U)	—	—	—	2.1 (U)	—	1.3 (U)	NA	—	—
0215-96-0104	15-02444	0.83–1.17	SOIL	—	11 (UJ)	510	—	0.66	—	—	—	700	100	—	0.11 (U)	—	—	—	2.2 (U)	—	1.3 (U)	NA	—	49 (J-)
0215-96-0116	15-02444	1.0–1.08	SOIL	—	12 (U)	920	—	3.7	—	—	8.7	180	370	—	0.12 (U)	—	—	—	2.4 (U)	—	1.2 (U)	NA	—	—
0215-96-0117	15-02464	2.75–2.92	SOIL	—	11 (U)	—	—	0.53 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.1 (U)	—	1.1 (U)	NA	—	49
SWMU 15-004(f)																								
AAB3451	15-02100	1.5–2.0	SOIL	—	3.9 (U)	—	—	1 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	—	—	—	3.17	—	—
AAB3461	15-02112	0.0–0.5	SOIL	—	3.8 (U)	—	—	0.96 (U)	—	—	—	49.4	48.5	—	0.27 (J)	—	—	—	—	—	—	66.3	—	—
AAB3476	15-02114	0.0–0.5	SOIL	—	3.7 (U)	—	—	1.1	—	—	—	17.3	—	—	0.65 (J)	—	—	—	—	—	—	21.1	—	—
AAB3340	15-02127	1.5–2.0	SOIL	—	4 (U)	—	—	1 (U)	—	—	—	—	—	—	—	—	—	—	—	—	—	3.93	—	—
AAB3332	15-02137	1.5–2.0	SOIL	30700	4 (U)	650	—	1 (U)	10000	—	11.1 (U)	—	—	—	0.14 (J)	—	—	—	—	1340 (J)	—	6.47	—	—
AAB3304	15-02153	1.0–1.0	SOIL	—	3.9 (U)	—	—	0.79 (U)	—	—	—	—	—	—	0.28 (J)	—	—	—	—	—	—	21.7	—	—
AAB3342	15-02166	0.0–0.33	SOIL	—	3.7 (U)	—	—	0.68 (U)	—	—	—	15.4	—	—	—	—	—	—	—	—	—	49.2	—	—
AAB3477	15-02172	1.5–2.0	SOIL	—	4.3 (U)	—	—	1 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	—	1240 (J)	0.75 (U)	10.3	—	—
AAB3336	15-02178	0.0–0.5	SOIL	—	3.7 (U)	—	—	0.6 (U)	—	—	—	—	—	—	0.53 (J)	—	—	—	—	—	—	46.1	—	—
AAB3470	15-02182	1.5–2.0	SOIL	—	4 (U)	387	—	1.2	—	—	—	—	—	—	1.8 (J)	—	3940	—	—	1290 (J)	—	15.2	—	—
AAB3485	15-02198	0.0–0.5	SOIL	—	3.7 (U)	—	—	0.87 (U)	—	—	—	—	23.3	—	—	—	—	—	—	—	—	21.6	—	—
AAB3295	15-02206	0.0–0.33	SOIL	—	3.7 (U)	—	—	0.78 (U)	—	—	—	—	—	—	0.11 (J)	—	—	—	—	—	—	12.1	—	—
AAB3298	15-02240	0.0–0.5	SOIL	—	3.9 (U)	—	—	0.76 (U)	—	—	—	53.1	—	—	0.21 (J)	—	—	—	—	—	—	47.5	—	—
AAB3473	15-02242	0.0–1.0	SOIL	—	3.8 (U)	834	—	0.59 (U)	—	—	—	7720	58.2	—	1.4 (J)	57.3	—	—	—	—	—	2820	—	309
AAB3445	15-02246	0.0–0.5	SOIL	—	3.9 (U)	—	2.5	0.43 (U)	—	—	—	147	23.6	—	0.11 (U)	—	—	—	—	—	—	2763	—	52.1
AAB3321	15-02277	0.0–0.42	SOIL	—	3.8 (U)	—	—	3.2	—	—	—	43.9	91.2	—	0.11 (U)	—	—	—	—	—	—	41.1	—	—
AAB3525	15-02279	0.0–0.42	SOIL	—	3.7 (U)	—	—	1.4	—	—	—	22.2	30.1	—	—	—	—	—	—	—	—	39.1	—	—
AAB3325	15-02295	0.0–0.5	SOIL	—	3.7 (U)	—	—	1 (U)	—	—	—	40.9	—	—	—	—	—	—	4.1 (J)	—	—	190	—	—
AAB3480	15-02299	1.5–2.0	SOIL	—	4 (U)	315	—	0.98 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	—	1160 (J)	—	12.7	—	—
15-008(a)																								
AAB3473	15-02242	0.0–1.0	SOIL	—	3.8 (U)	834	—	0.59 (U)	—	—	—	7720	58.2	—	1.4 (J)	57.3	—	—	—	—	—	2820	—	309
SWMU 15-009(e)																								
0215-97-0021	15-02510	0.0–0.5	SOIL	—	8.6 (J-)	—	—	0.63 (U)	—	—	—	—	—	—	—	—	—	—	4.1	—	—	33.5 (U)	—	—
0215-97-0023	15-02510	0.83–1.17	SOIL	—	7.1 (UJ)	—	—	0.62 (U)	—	—	—	—	—	—	—	—	—	—	1.8 (U)	—	—	26.8 (U)	—	—
0215-97-0024	15-02511	0.0–0.5	SOIL	—	7.2 (UJ)	—	—	0.62 (U)	—	—	—	—	—	—	—	—	—	—	2.4	—	—	67.8 (U)	—	—
0215-97-0025	15-02511	0.83–1.0	SOIL	—	7.4 (UJ)	—	—	0.64 (U)	—	—	—	—	—	—	—	—	—	—	1.8 (U)	—	—	34.9 (U)	—	—

Table 4.1-2 (continued)

Sample ID	Location ID	Depth (ft bgs)	Media	Aluminum	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc
Soil/Fill BV[a]				29200	0.83	295	1.83	0.4	6120	19.3	8.64	14.7	22.3	671	0.1	15.4	3460	1.52	1	915	0.73	1.82	39.6	48.8
Qbt 2 BV				7340	0.5	46	1.21	1.63	2200	7.14	3.14	4.66	11.2	482	0.1	6.58	3500	0.3	1	2770	1.1	2.4	17	63.5
0215-97-0026	15-02512	0.0–0.5	SOIL	—	7.2 (J-)	—	—	0.83 (J)	—	—	—	15.6	—	—	—	—	—	—	1.7 (U)	—	—	61.3 (U)	—	—
0215-97-0027	15-02512	0.83–1.0	SOIL	—	7.6 (UJ)	—	—	0.66 (U)	—	—	—	—	—	—	—	—	—	—	1.9 (U)	—	—	29.4 (U)	—	—
0215-97-0030	15-02513	6.0–7.0	SOIL	—	—	—	—	—	6200	—	—	—	—	—	—	—	—	—	—	—	—	2.15	—	—
0215-97-0034	15-02515	3.0–3.5	SOIL	—	—	—	—	—	—	—	—	—	135	—	—	—	—	—	—	—	—	2.67	—	—
0215-97-0035	15-02516	2.17–2.67	SOIL	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	18.9	—	—
SWMU 15-010(a)																								
0215-97-0063	15-02520	9.0–9.5	QBT2	—	6.6 (UJ)	147	—	—	—	10	5.3 (J)	11.2	18.6	—	3.7	—	—	0.55 (U)	1.9 (U)	—	—	2.62	—	—
0215-97-0064	15-02521	8.0–8.5	QBT2	—	6.7 (UJ)	139	—	—	2460	9.3	5.5 (J)	9.5	26	—	5.5	—	—	0.55 (U)	3.3	—	—	2.55	17.4	—
0215-97-0065	15-02522	8.5–9.0	QBT2	—	6.7 (UJ)	120	—	—	2850	8	5.4 (J)	8.2	26.5	—	3.5	—	—	0.49 (U)	2 (U)	—	—	2.79	—	—
0215-97-0066	15-02523	8.5–9.0	QBT2	—	6.5 (UJ)	153	—	—	4070	18	4.4 (J)	13.1	22.8	—	10.5	—	—	0.35 (U)	4.9	—	—	2.54	—	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] — = Result was not detected or was below the BV.

[c] NA = Not analyzed.

Table 4.1-3
Organic Chemicals Detected at TA-15

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Butylbenzene[tert-]	Di-n-butylphthalate	Dibromo-3-Chloropropane[1,2-]	Hexanone[2-]	HMX	Isopropyltoluene[4-]	Methylene Chloride	Naphthalene	Tetrachloroethene	Toluene
SWMU 15-009(e)																
0215-97-0030	15-02513	6.0–7.0	SOIL	0.0079 (J)	—[a]	—	—	—	—	—	—	—	—	—	—	—
0215-97-0031	15-02513	9.67–10.17	SOIL	0.0093 (J)	—	—	—	—	—	—	—	—	—	—	—	—
0215-97-0034	15-02515	3.0–3.5	SOIL	—	0.058 (J)	—	—	—	—	—	—	—	—	—	—	—
0215-97-0035	15-02516	2.17–2.67	SOIL	—	0.048 (J)	—	—	—	—	—	—	—	—	—	—	—
SWMU 15-010(a)																
0215-97-0063	15-02520	9.0–9.5	QBT2	NA[b]	—	0.099 (J)	NA	0.19 (J)	NA	NA	—	NA	NA	—	NA	NA
0215-97-0064	15-02521	8.0–8.5	QBT2	NA	—	0.044 (J)	NA	0.047 (J)	NA	NA	—	NA	NA	—	NA	NA
0215-97-0065	15-02522	8.5–9.0	QBT2	NA	—	0.044 (J)	NA	0.1 (J)	NA	NA	—	NA	NA	—	NA	NA
0215-97-0066	15-02523	8.5–9.0	QBT2	NA	—	0.049 (J)	NA	0.11 (J)	NA	NA	—	NA	NA	—	NA	NA

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] — = Result was not detected.

[b] NA = Not analyzed.

Table 4.1-4
Radionuclides Detected or Detected above BVs/FVs at TA-15

Sample ID	Location ID	Depth (ft bgs)	Media	Cesium-137	Europium-152
Soil BV/FV[a]				**1.65**	**na[b]**
SWMU 15-004(f)					
AAB3461	15-02112	0.0–0.5	SOIL	—[c]	0.223
AAB3470	15-02182	1.5–2.0	SOIL	0.13	—
AAB3325	15-02295	0.0–0.5	SOIL	—	0.178
AAB3480	15-02299	1.5–2.0	SOIL	0.06	—

Note: Units are pCi/g.
[a] BVs/FVs from LANL (1998, 059730).
[b] na = Not available.
[c] — = Result was not detected or was below the BV/FV.

Table 4.1-5
Screening-Level Inorganic Chemicals Detected above BVs at SWMU 15-004(f)

Sample ID	Location ID	Depth (ft bgs)	Media	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Potassium	Silver	Sodium	Thallium	Uranium	Zinc
SOIL BV[a]				0.83	295	1.83	0.4	6120	19.3	8.64	14.7	21500	22.3	671	0.1	15.4	3460	1	915	0.73	1.82	48.8
AAB3333	15-02100	0.0–0.5	SOIL	—[b]	—	—	—	—	—	—	15.4 (J)	—	—	—	—	—	—	—	—	—	23.6	—
AAB3317	15-02101	0.0–0.5	SOIL	NA[c]	NA	—	NA	NA	NA	NA	NA	NA	26	NA	—	NA	NA	NA	NA	NA	45.6 (J)	NA
AAB3487	15-02114	1.5–2.0	SOIL	—	—	—	1.4 (J)	—	—	—	—	—	—	—	0.11 (J)	—	—	—	—	1 (U)	2.75	—
AAB3306	15-02115	0.0–0.5	SOIL	NA	NA	—	NA	NA	NA	NA	NA	NA	—	NA	—	NA	NA	NA	NA	NA	23.7 (J)	NA
AAB3484	15-02119	0.0–0.25	SOIL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25.5 (J)	NA
AAB3521	15-02123	0.0–0.5	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.14 (J)	—	—	—	—	1 (U)	14	—
AAB3339	15-02125	0.0–0.5	SOIL	NA	NA	—	NA	NA	NA	NA	NA	NA	—	NA	—	NA	NA	NA	NA	NA	60.5 (J)	NA
AAB3334	15-02131	0.0–0.5	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.19 (J)	—	—	—	—	—	26.9	—
AAB3450	15-02134	0.0–0.5	SOIL	NA	NA	—	NA	NA	NA	NA	NA	NA	—	NA	—	NA	NA	NA	NA	NA	5.46 (J)	NA
AAB3312	15-02139	1.42–1.92	SOIL	—	—	—	—	6620 (J)	—	—	23.8 (J)	—	—	—	—	—	—	—	1290	0.94 (U)	26.9	—
AAB3515	15-02141	0.0–0.33	SOIL	—	—	—	1.8 (J)	—	—	—	93.8 (J)	—	42.3	—	—	—	—	—	—	1.4 (U)	173	66.4 (J)
AAB3341	15-02144	0.0–0.5	SOIL	NA	NA	—	NA	NA	NA	NA	NA	NA	—	NA	—	NA	NA	NA	NA	NA	20.2 (J)	NA
AAB3452	15-02145	0.0–0.5	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.16 (J)	—	—	—	—	1.1 (U)	200	—
AAB3343	15-02147	1.5–2.0	SOIL	—	393 (J)	—	—	18700 (J)	—	—	—	—	—	—	—	—	—	—	—	0.99 (U)	13	—
AAB3327	15-02149	0.25–0.75	SOIL	—	—	—	—	—	—	—	89.1 (J)	—	51.7	—	0.11 (U)	—	—	—	—	—	131	—
AAB3466	15-02151	1.5–2.0	SOIL	—	—	—	—	—	—	—	14.9 (J)	—	—	—	—	—	—	—	—	1.1 (U)	9	—
AAB3458	15-02152	0.0–0.42	SOIL	—	—	—	1.5 (J)	—	—	—	44.3 (J)	—	—	—	0.25 (J)	—	—	—	—	0.84 (U)	169	—
AAB3344	15-02153	0.0–0.42	SOIL	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.74 (U)	533	—
AAB3528	15-02154	0.0–0.25	SOIL	NA	NA	—	NA	NA	NA	NA	NA	NA	—	NA	—	NA	NA	NA	NA	NA	23.4 (J)	NA
AAB3307	15-02157	1.5–2.0	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.11 (U)	—	—	—	—	0.97 (U)	4.34	—
AAB3300	15-02167	0.0–0.5	SOIL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.2 (J)	NA
AAB3323	15-02170	1.5–2.0	SOIL	—	434 (J)	—	1.4 (J)	—	—	—	16.4 (J)	—	—	—	—	—	3860	—	—	1 (U)	5.77	—
AAB3324	15-02173	1.5–2.0	SOIL	—	—	—	—	8270 (J)	—	—	—	—	—	—	0.2 (J)	—	—	—	—	2 (U)	7.6	—
AAB3318	15-02177	0.0–0.5	SOIL	—	—	—	—	—	—	—	18.9 (J)	—	—	—	—	—	—	—	—	—	112	—
AAB3472	15-02179	0.0–0.33	SOIL	—	—	—	—	—	—	—	17 (J)	—	26.5	—	0.11 (U)	—	—	—	—	0.89 (U)	34.8	—
AAB3520	15-02180	0.5–1.0	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.18 (J)	—	—	—	—	1.1 (U)	23.7	—
AAB3527	15-02191	0.0–0.50	SOIL	—	359 (J)	—	—	—	—	—	1150 (J)	—	23.1	—	0.14 (J)	—	—	—	—	—	535	217 (J)
AAB3478	15-02226	0.0–0.5	SOIL	3.9 (U)	—	—	2.4	—	—	—	50.1	—	34	—	—	—	—	—	—	—	170	—
AAB3518	15-02227	0.0–0.5	SOIL	3.8 (U)	—	—	2.2	—	—	—	39.7	—	25.2	—	—	—	—	—	—	—	185	—
AAB3320	15-02228	0.0–0.5	SOIL	3.8 (U)	546	7.9	3.2	—	—	—	526	—	155	—	—	—	—	8.2	—	—	1720	130
AAB3326	15-02229	0.0–0.33	SOIL	3.9 (U)	—	—	2.2	—	—	—	796	—	23.2	—	0.11 (U)	—	—	—	—	—	208	—
AAB3302	15-02230	0.0–0.25	SOIL	4.1 (U)	—	—	2	—	—	—	86.1	—	25.1	—	0.11 (U)	—	—	—	—	—	217	—
AAB3328	15-02231	0.0–0.42	SOIL	3.9 (U)	—	2.3	1.8	—	—	—	223	—	31.5	—	—	—	—	—	—	—	691	78
AAB3516	15-02239	0.0–1.0	SOIL	—	915 (J)	2.3	12.8 (J)	—	—	9.2 (U)	4140 (J)	30100	57.5	—	0.11 (U)	16.9	—	—	—	0.97 (U)	1918	224 (J)

Table 4.1-5 (continued)

Sample ID	Location ID	Depth (ft bgs)	Media	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Potassium	Silver	Sodium	Thallium	Uranium	Zinc
AAB3330	15-02241	0.0–0.5	SOIL	—	397 (J)	—	—	—	—	—	46.8 (J)	—	—	—	—	—	—	—	—	0.9 (U)	34.4	—
AAB3331	15-02243	0.0–1.0	SOIL	—	—	—	1.6 (J)	—	—	—	66.5 (J)	—	—	—	—	—	—	—	—	0.87 (U)	244	—
AAB3523	15-02244	0.0–0.5	SOIL	—	—	—	—	—	—	—	1710 (J)	—	—	—	0.25 (J)	—	—	—	—	—	192	—
AAB3526	15-02245	0.0–0.5	SOIL	—	—	—	—	—	—	—	23.4 (J)	—	—	—	0.24 (J)	—	—	—	—	2.2 (U)	168	—
AAC0342	15-02245	14.0–15.0	SOIL	—	—	—	1.3	—	—	—	54.1	—	—	—	—	—	—	—	—	—	366 (J)	—
AAC0339	15-02246	1.83–2.33	SOIL	—	—	—	0.84 (U)	—	—	—	94.7	—	—	—	—	—	—	—	—	0.75 (U)	37.7 (J)	—
AAB3420	15-02247	0.0–0.5	SOIL	—	1070 (J)	2.3	—	—	—	—	833 (J)	—	44.9	—	—	—	—	—	—	—	3131	251 (J)
AAC0346	15-02247	1.75–2.25	SOIL	—	—	—	—	—	—	—	18.4	—	—	—	—	—	—	—	—	0.91 (U)	114	—
AAB3447	15-02248	0.0–0.5	SOIL	—	984 (J)	—	—	—	—	—	606 (J)	—	53.4	—	—	—	—	—	—	—	977	113 (J)
AAB3449	15-02249	0.0–0.5	SOIL	—	335 (J)	3.6	1.1 (J)	—	—	—	850 (J)	—	190	—	—	—	—	24.1	—	—	971	73.5 (J)
AAC0341	15-02249	2.92–3.42	SOIL	—	349	—	1.2	—	—	10.1 (U)	1510	—	28	729	—	—	—	—	—	0.76 (U)	349 (J)	64.8
AAB3294	15-02278	0.0–0.5	SOIL	—	314 (J)	—	5.7 (J)	—	—	—	22.7 (J)	—	167	—	—	—	—	—	—	—	10.1	—
AAC0328	15-02290	0.0–0.5	SOIL	—	—	—	1.5	—	—	8.7 (U)	60.1	—	—	—	—	16.4	—	—	—	0.77 (U)	229 (J)	57.4
AAC0327	15-02290	9.0–10.0	SOIL	—	—	—	—	—	—	—	58.2	—	—	—	—	—	—	—	—	0.9 (U)	48.9	—
AAC0326	15-02290	16.0–17.0	SOIL	—	—	—	—	—	31.6	—	101	—	26.4	—	—	—	—	—	—	0.9 (U)	162	—
AAC0336	15-02291	0.0–0.5	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.11 (U)	—	—	—	—	0.95 (U)	24.6	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] — = Result was not detected or was below the BV.

[c] NA = Not analyzed.

Table 4.1-6
Screening-Level Organic Chemicals Detected at SWMU 15-004(f)

Sample ID	Location ID	Depth (ft bgs)	Media	Tetryl
AAB3516	15-02239	0.0–1.0	SOIL	0.092
AAB3331	15-02243	0.0–1.0	SOIL	0.093

Note: Units are mg/kg.

Table 4.1-7
Screening-Level Radionuclides Detected or Detected above BVs/FVs at SWMU 15-004(f)

Sample ID	Location ID	Depth (ft bgs)	Media	Americium-241	Cesium-137	Europium-152	Ruthenium-106	Uranium-234	Uranium-235	Uranium-238
Soil BV/FV[a]				**0.013**	**1.65**	**na**[b]	**na**	**2.59**	**0.2**	**2.29**
AAB3317	15-02101	0.0–0.5	SOIL	NA[c]	—[d]	NA	NA	NA	0.4029	NA
AAB3306	15-02115	0.0–0.5	SOIL	NA	—	NA	NA	NA	0.6634	NA
AAB3484	15-02119	0.0–0.25	SOIL	NA	NA	NA	NA	NA	NA	NA
AAB3339	15-02125	0.0–0.5	SOIL	NA	—	NA	NA	NA	0.7885	NA
AAB3450	15-02134	0.0–0.5	SOIL	NA	NA	NA	NA	NA	0.3652	NA
AAB3312	15-02139	1.42–1.92	SOIL	—	0.079	—	—	NA	NA	NA
AAB3327	15-02149	0.25–0.75	SOIL	—	0.226	—	—	NA	NA	NA
AAB3458	15-02152	0.0–0.42	SOIL	—	—	0.164	—	NA	NA	NA
AAB3344	15-02153	0.0–0.42	SOIL	—	—	0.263	0.664	NA	NA	NA
AAB3528	15-02154	0.0–0.25	SOIL	NA	—	NA	NA	NA	NA	NA
AAB3475	15-02155	0.0–0.33	SOIL	3.9	—	NA	NA	1652.33	86.59	1687.3
AAB3300	15-02167	0.0–0.5	SOIL	NA	NA	NA	NA	NA	0.5598	NA
AAB3478	15-02226	0.0–0.5	SOIL	NA	NA	NA	NA	NA	2.17	NA
AAB3518	15-02227	0.0–0.5	SOIL	NA	—	NA	NA	NA	2.74	NA
AAB3320	15-02228	0.0–0.5	SOIL	—	NA	NA	NA	NA	18.89	NA
AAB3326	15-02229	0.0–0.33	SOIL	NA	NA	NA	NA	NA	2.74	NA
AAB3302	15-02230	0.0–0.25	SOIL	NA	—	NA	NA	NA	2.72	NA
AAB3328	15-02231	0.0–0.42	SOIL	NA	—	NA	NA	NA	11.05	NA
AAB3516	15-02239	0.0–1.0	SOIL	—	0.352	—	—	NA	NA	NA
AAB3331	15-02243	0.0–1.0	SOIL	—	0.294	—	—	NA	NA	NA
AAC0342	15-02245	14.0–15.0	SOIL	—	—	NA	—	NA	8.23	NA

Table 4.1-7 (continued)

Sample ID	Location ID	Depth (ft bgs)	Media	Americium-241	Cesium-137	Europium-152	Ruthenium-106	Uranium-234	Uranium-235	Uranium-238
Soil BV/FV[a]				**0.013**	**1.65**	**na[b]**	**na**	**2.59**	**0.2**	**2.29**
AAC0339	15-02246	1.83–2.33	SOIL	1.04	—	NA	—	NA	4.91	NA
AAB3420	15-02247	0.0–0.5	SOIL	—	—	0.354	—	NA	NA	NA
AAC0341	15-02249	2.92–3.42	SOIL	—	—	NA	—	NA	4.61	NA
AAB3294	15-02278	0.0–0.5	SOIL	—	—	0.124	—	NA	NA	NA
AAC0328	15-02290	0.0–0.5	SOIL	—	—	NA	—	NA	0.891	NA
AAC0326	15-02290	16.0–17.0	SOIL	—	—	0.239	—	NA	NA	NA

Note: Units are pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] NA = Sample was not analyzed for this radionuclide.

[d] — = Result was not detected or was below the BV/FV.

Table 4.1-8
Proposed Sampling Locations at SWMU 15-004(f) with Inorganic Chemicals and/or Radionuclides Detected above BVs/FVs

15-02100	15-02141	15-02226	15-02172	15-02179	15-02157
15-02101	15-02139	15-02151	15-02149	15-02277	15-02144
15-02114	15-02137	15-02152	15-02182/-02299	15-02178	15-02147
15-02115	15-02125	15-02153	15-02231	15-02206	15-02240
15-02127	15-02112	15-02227	15-02180	15-02166	15-02241
15-02119	15-02123	15-02228	15-02191	15-02167	15-02170
15-02131/-02198*	15-02134	15-02173	15-02177	15-02278	15-02155

*Sample location IDs share a single location.

Table 4.2-1
Summary of Historical Samples Collected and Analyses Requested at TA-36

Sample ID	Location ID	Depth (ft)	Media	Gamma Spectroscopy	High Explosives	Isotopic Uranium	Metals	SVOCs	Uranium	VOCs
SWMU 36-001										
0236-96-0009	36-03127	10.83–13.33	SOIL	—[a]	1808[b]	1810	1809	1808	—	1808
0236-96-0010	36-03127	14.25–16.67	SOIL	—	1808	1810	1809	1808	—	1808
0236-96-0022	36-03131	5.5–7.58	SOIL	—	1791	1793	1792	1791	—	1791
0236-96-0023	36-03131	9.17–11.67	SOIL	—	1791	1793	1792	1791	—	1791
SWMU 36-004(d)										
0236-95-0001	36-03175	0.5–1.08	SOIL	1700	1698	1700	1699	1698	—	1698
0236-95-0002	36-03175	2.33–2.75	SOIL	1700	1698	1700	1699	1698	—	1698
0236-95-0003	36-03176	0.5–1.0	SOIL	1700	1698	1700	1699	1698	—	1698
0236-95-0004	36-03176	2.0–2.58	SOIL	1700	1698	1700	1699	1698	—	1698
0236-96-0001	36-03177	2.0–2.58	SOIL	1728	1727	1728	1726	1725	—	-
0236-96-0002	36-03177	4.42–5.08	SOIL	1728	1727	1728	1726	1725	—	1725
0236-96-0003	36-03177	5.58–6.33	QBT2	1728	1727	1728	1726	1725	—	1725
0236-96-0004	36-03178	0.33–1.08	SOIL	1728	1727	1728	1726	1725	—	1725
0236-96-0005	36-03178	3.17–3.67	SOIL	1728	1727	1728	1726	1725	—	1725
0236-96-0007	36-03179	3.33–4.17	SOIL	1728	1727	1728	1726	1725	—	1725
SWMU 36-005										
0236-97-0023	36-03026	1.67–1.83	SOIL	—	—	—	—	—	—	3076R
0236-97-0024	36-03038	1.0–1.17	SOIL	—	—	—	—	—	—	3076R
0236-97-0026	36-03039	1.33–1.5	SOIL	—	—	—	—	—	—	3076R
0236-97-0027	36-03039	3.25–3.33	SOIL	—	—	—	—	—	—	3076R
SWMU 36-006										
0236-95-0083	36-03145	0.0–0.33	SOIL	—	1711	—	1713	1712	—	1712
0236-95-0087	36-03145	1.33–2.0	SOIL	—	1711	—	1713	1712	—	1712
0236-95-0084	36-03146	0.0–0.33	SOIL	—	1711	—	1713	1712	—	1712
0236-95-0123	36-03146	1.33–2.0	SOIL	—	1711	—	1713	1712	—	1712
0236-95-0086	36-03147	0.0–0.33	SOIL	—	1711	—	1713	1712	—	1712
0236-95-0088	36-03149	0.0–0.33	SOIL	—	1711	—	1713	1712	—	1712

[a] — = Analysis not requested.
[b] Request number.

Table 4.2-2
Inorganic Chemicals Detected above BVs at TA-36

Sample ID	Location ID	Depth (ft bgs)	Media	Aluminum	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt 2 BV[a]				7340	0.5	46	1.21	1.63	2200	7.14	3.14	4.66	11.2	482	0.1	6.58	3500	0.3	1	2770	1.1	2.4	17	63.5
Soil BV				29200	0.83	295	1.83	0.4	6120	19.3	8.64	14.7	22.3	671	0.1	15.4	3460	1.52	1	915	0.73	1.82	39.6	48.8
SWMU 36-001																								
0236-96-0009	36-03127	10.83–13.33	SOIL	—[b]	5.6 (U)	—	—	0.56 (U)	—	—	—	—	—	—	—	—	—	—	—	—	—	NA[c]	—	—
0236-96-0010	36-03127	14.25–16.67	SOIL	—	5.7 (U)	—	—	0.57 (UJ)	—	—	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
0236-96-0022	36-03131	5.5–7.58	SOIL	—	0.87 (UJ)	—	—	—	—	—	—	43.1	—	—	—	—	—	—	—	—	0.89 (J)	NA	—	77.6
0236-96-0023	36-03131	9.17–11.67	SOIL	—	0.85 (UJ)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
SWMU 36-004(d)																								
0236-96-0001	36-03177	2.0–2.58	SOIL	—	11 (UJ)	—	—	0.56 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.2 (U)	—	1.5 (UJ)	NA	—	—
0236-96-0002	36-03177	4.42–5.08	SOIL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11 (U)	NA	NA	—	NA	NA	1.4 (UJ)	NA	NA	NA
0236-96-0003	36-03177	5.58–6.33	QBT2	8400	11 (UJ)	100	—	—	2400	—	3.2	—	—	—	0.11 (U)	12	—	1.1 (UJ)	2.2 (U)	—	1.4 (UJ)	NA	—	—
0236-96-0004	36-03178	0.33–1.08	SOIL	—	11 (UJ)	—	—	0.54 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.2 (U)	—	1.4 (UJ)	NA	—	—
0236-96-0005	36-03178	3.17–3.67	SOIL	—	11 (UJ)	—	—	0.54 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.2 (U)	—	1.4 (UJ)	NA	—	—
0236-96-0007	36-03179	3.33–4.17	SOIL	—	11 (UJ)	—	—	0.56 (U)	—	—	—	—	—	—	0.11 (U)	17	—	—	2.2 (U)	—	1.5 (UJ)	NA	—	—
SWMU 36-006																								
0236-95-0083	36-03145	0.0–0.33	SOIL	—	11 (UJ)	—	—	1.5	15000	410	—	52 (J-)	200	—	0.11 (U)	200	—	—	2.1 (U)	—	1.3 (U)	NA	—	—
0236-95-0087	36-03145	1.33–2.0	SOIL	—	11 (UJ)	380	—	0.54 (U)	13000	—	—	55 (J-)	54	—	0.11 (U)	—	—	—	2.2 (U)	—	1.3 (U)	NA	—	150
0236-95-0084	36-03146	0.0–0.33	SOIL	—	11 (UJ)	—	—	0.56 (U)	—	—	—	—	—	—	0.11	—	—	—	2.2 (U)	—	1.4 (U)	NA	—	—
0236-95-0123	36-03146	1.33–2.0	SOIL	—	11 (UJ)	—	—	0.54 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.2 (U)	—	1.4 (U)	NA	—	—
0236-95-0086	36-03147	0.0–0.33	SOIL	—	11 (UJ)	—	—	0.57 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.3 (U)	—	1.4 (U)	NA	—	—
0236-95-0088	36-03149	0.0–0.33	SOIL	—	10 (UJ)	—	—	0.52 (U)	—	—	—	—	—	—	—	—	—	—	2.1 (U)	—	1.3 (U)	NA	—	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] — = Result was not detected or was below the BV.

[c] NA = Not analyzed.

Table 4.2-3
Organic Chemicals Detected at TA-36

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Butylbenzene[tert-]	Di-n-butylphthalate	Dibromo-3-Chloropropane[1,2-]	Hexanone[2-]	HMX	Isopropyltoluene[4-]	Methylene Chloride	Naphthalene	Tetrachloroethene	Toluene
SWMU 36-001																
0236-96-0009	36-03127	10.83–13.33	SOIL	—[a]	—	—	—	—	—	—	—	—	0.006 (J)	—	—	—
0236-96-0010	36-03127	14.25–16.67	SOIL	—	—	—	—	—	—	—	—	—	0.004 (J)	—	—	—
0236-96-0023	36-03131	9.17–11.67	SOIL	0.041	—	—	—	—	—	—	—	—	—	—	—	—
SWMU 36-004(d)																
0236-95-0001	36-03175	0.5–1.08	SOIL	—	—	0.098 (J)	—	—	0.002 (J)	—	—	0.031	—	0.002 (J)	0.002 (J)	0.0012 (J)
0236-95-0002	36-03175	2.33–2.75	SOIL	—	—	—	0.001 (J)	—	—	—	—	0.011	—	—	—	—
0236-95-0004	36-03176	2.0–2.58	SOIL	—	—	0.074 (J)	—	—	—	—	—	—	—	—	—	—
0236-96-0003	36-03177	5.58–6.33	QBT2	0.026	—	—	—	—	—	0.034	—	—	—	—	—	—
0236-96-0004	36-03178	0.33–1.08	SOIL	NA[b]	—	—	NA	—	NA	NA	—	NA	0.0085 (J+)	—	NA	NA
0236-96-0007	36-03179	3.33–4.17	SOIL	0.039	—	—	—	—	—	—	—	—	—	—	—	—
SWMU 36-005																
0236-97-0027	36-03039	3.25–3.33	SOIL	0.003 (J)	NA	NA	—	NA	—	—	NA	—	—	NA	—	—
SWMU 36-006																
0236-95-0087	36-03145	1.33–2.0	SOIL	—	—	—	—	—	—	—	—	—	0.0086 (J+)	—	—	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] — = Result was not detected.

[b] NA = Not analyzed.

Table 4.2-4
Radionuclides Detected or Detected above BVs/FVs at TA-36

Sample ID	Location ID	Depth (ft bgs)	Media	Cesium-137	Europium-152	Uranium-235	Uranium-238
Soil BV/FV[a]				**1.65**	**na[b]**	**0.20**	**2.29**
SWMU 36-001							
0236-96-0022	36-03131	5.5–7.58	SOIL	NA[c]	NA	—[d]	3.862
SWMU 36-004(d)							
0236-95-0001	36-03175	0.5–1.08	SOIL	0.24	—	—	—
0236-95-0002	36-03175	2.33–2.75	SOIL	0.066	—	—	—
0236-96-0001	36-03177	2.0–2.58	SOIL	0.221	—	—	2.69

Note: Units are pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] NA = Sample was not analyzed for this radionuclide.

[d] — = Result was not detected or was below the BV/FV.

Table 4.2-5
Screening-Level Inorganic Chemicals Detected above BVs at SWMU 36-005

Sample ID	Location ID	Depth (ft bgs)	Media	Antimony	Cadmium	Silver	Thallium	Uranium
Soil BV[a]				**0.83**	**0.4**	**1**	**0.73**	**1.82**
AAB1834	36-03018	0.0–0.5	SOIL	7.86 (U)	0.42 (U)	—[b]	1.34 (U)	2.61 (J)
AAB1836	36-03019	0.0–0.5	SOIL	7.49 (U)	—	—	1.3 (U)	2.64 (J)
AAB1837	36-03020	0.0–0.5	SOIL	7.65 (U)	0.41 (U)	—	1.25 (U)	2.77 (J)
AAB1838	36-03021	0.0–0.5	SOIL	8.1 (U)	0.44 (U)	—	1.34 (U)	3.5 (J)
AAB1839	36-03022	0.0–0.5	SOIL	8.21 (U)	0.44 (U)	—	1.32 (U)	3.17 (J)
AAB1840	36-03023	0.0–0.5	SOIL	7.88 (U)	0.42 (U)	—	1.34 (U)	2.49 (J)
AAB1841	36-03024	0.0–0.5	SOIL	7.59 (U)	0.41 (U)	—	1.31 (U)	3.42 (J)
AAB1842	36-03025	0.0–0.5	SOIL	7.24 (U)	—	—	1.3 (U)	—
AAB1843	36-03026	0.0–0.5	SOIL	7.01 (U)	—	—	1.24 (U)	8.15
AAB1852	36-03034	0.0–0.5	SOIL	5.3 (U)	0.53 (U)	—	—	3.31
AAB1854	36-03035	0.0–0.5	SOIL	5.3 (U)	0.53 (U)	—	—	2.43
AAB1855	36-03036	0.0–0.5	SOIL	5.2 (U)	0.52 (U)	—	—	2.18
AAB1856	36-03037	0.0–0.5	SOIL	5.2 (U)	0.52 (U)	—	—	2.88
AAB1857	36-03038	0.0–0.5	SOIL	5.4 (U)	0.54 (U)	—	—	2.3
AAB1858	36-03039	0.0–0.5	SOIL	5 (U)	0.5 (U)	—	—	2.8
AAB1859	36-03040	0.0–0.5	SOIL	5.2 (U)	0.55	—	—	2.01
AAB1860	36-03041	0.0–0.5	SOIL	5.2 (U)	0.52 (U)	—	—	2.21
AAB1861	36-03042	0.0–0.5	SOIL	6.77 (U)	—	1.3 (U)	1.24 (U)	1.93
AAB1863	36-03043	0.0–0.5	SOIL	7.22 (U)	—	1.2 (U)	1.25 (U)	2.34
AAB1864	36-03044	0.0–0.5	SOIL	7.61 (U)	0.41 (U)	1.3 (U)	1.31 (U)	2.7
AAB1865	36-03045	0.0–0.5	SOIL	7.75 (U)	0.42 (U)	1.2 (U)	1.33 (U)	2.54
AAB1866	36-03046	0.0–0.5	SOIL	7.11 (U)	—	—	1.23 (U)	2.33
AAB1867	36-03047	0.0–0.5	SOIL	7.78 (U)	0.42 (U)	1.3 (U)	1.39 (U)	5.11
AAB1868	36-03048	0.0–0.5	SOIL	7.7 (U)	0.48 (U)	1.4 (U)	1.31 (U)	2.48
AAB1869	36-03049	0.0–0.5	SOIL	7.36 (U)	—	—	1.23 (U)	—
AAB1870	36-03050	0.0–0.5	SOIL	7.06 (U)	—	—	1.27 (U)	3.46
AAB1872	36-03051	0.0–0.5	SOIL	7.31 (U)	—	1.3 (U)	1.24	2.45

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] — = Result was not detected or was below the BV.

Table 4.2-6
Screening-Level Organic Chemicals Detected at SWMU 36-005

Sample ID	Location ID	Depth (ft bgs)	Media	Acetone	Methyl-2-pentanone[4-]	Methylene Chloride	RDX	Toluene	Trichloroethene	Trimethylbenzene[1,2,4-]	Xylene (Total)
AAB1834	36-03018	0.0-0.5	SOIL	—*	—	0.011	—	—	—	—	—
AAB1839	36-03022	0.0-0.5	SOIL	—	—	0.012	1.72	—	—	—	—
AAB1840	36-03023	0.0-0.5	SOIL	—	—	0.007	—	—	—	—	—
AAB1841	36-03024	0.0-0.5	SOIL	—	—	0.008	—	—	—	—	—
AAB1843	36-03026	0.0-0.5	SOIL	0.52	—	0.13 (J)	—	—	—	—	—
AAB1854	36-03035	0.0-0.5	SOIL	—	—	0.01	—	—	—	—	—
AAB1857	36-03038	0.0-0.5	SOIL	—	—	0.016	—	0.009	0.035	0.07	0.061
AAB1858	36-03039	0.0-0.5	SOIL	—	0.02	—	—	0.028	0.11	0.12	0.143
AAB1859	36-03040	0.0-0.5	SOIL	—	—	0.01	—	—	—	—	—
AAB1860	36-03041	0.0-0.5	SOIL	—	—	0.01	—	0.008	0.031	0.055	0.055

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.
*— = Result was not detected.

Table 4.2-7
Screening-Level Radionuclides Detected or Detected above BVs/FVs at SWMU 36-005

Sample ID	Location ID	Depth (ft bgs)	Media	Europium-152	Uranium-235
Soil BV/FV[a]				**na**[b]	**0.2**
AAB1834	36-03018	0.0–0.5	SOIL	NA[c]	0.224
AAB1839	36-03022	0.0–0.5	SOIL	NA	0.2063
AAB1843	36-03026	0.0–0.5	SOIL	0.257	NA
AAB1857	36-03038	0.0–0.5	SOIL	NA	0.2087

Note: Units are pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] NA = Sample was not analyzed for this radionuclide.

Table 5.0-1
Summary of Investigation Methods

Method	Summary
Locating Utilities	Excavation/Soil Disturbance Permits will be obtained from the Industrial Hygiene and Safety–Operational Support Division. Underground utilities will be located, and the excavation permits secured before the readiness and planning review and before any field activities are undertaken.
Spade-and-Scoop Collection of Soil Samples	This method will be used to collect surface (i.e., 0–6 in.) soil or fill samples. A hole will be dug to the desired depth, as prescribed in the work plan, and a discrete grab sample collected. The sample will be homogenized in a decontaminated stainless-steel bowl before it is transferred to the appropriate sample containers.
Hand Auger Collection of Soil Samples	This method will typically be used for sampling soil or sediment at depths of less than 10–15 ft but may in some cases be used for collecting samples of weathered or nonwelded tuff. The method involves hand-turning a stainless-steel bucket auger (typically 3–4 in. inside 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 various required sample containers are filled.
Split-Spoon Core-Barrel Sampling	The split-spoon core barrel is a cylindrical barrel split lengthwise so the two halves can be separated to expose the core sample. The stainless-steel core barrel (3-in.-inner-diameter and 5 ft long) is pushed directly into the subsurface media with a hollow-stem auger drilling rig. A continuous length of core is extracted with the core barrel. Once it is extracted, the section of core will be screened for radioactivity and organic vapors, photographed, and described in a lithologic log. If it is located within a targeted sample interval, a portion of the core will be collected for fixed laboratory analysis.
Field Logging, Handling, and Documentation of Borehole Materials	Upon reaching the surface, core barrels will be immediately opened for field-screening, logging, and sampling. Logging of borehole materials includes run number, core recovery in feet, depth interval (in 5-ft increments), field-screening results, lithological and structural description, and a photograph. Once the core material is logged, selected samples will be taken from discrete intervals of the core. All borehole material not sampled will be managed as IDW.
Borehole Abandonment	Shallow boreholes, with a total depth of 20 ft or less, will be abandoned by filling the borehole with bentonite chips and then hydrating the chips in 1- to 2-ft lifts. The borehole will be visually inspected while the bentonite chips are being added to ensure bridging does not occur. Boreholes greater than 20 ft in depth will be pressure-grouted from the bottom of the borehole to the surface using the tremie pipe method. Acceptable grout materials include cement or bentonite grout, neat cement, or concrete. The use of backfill materials such as bentonite and grout will be documented in a field logbook regarding volume (calculated and actual), intervals of placement, and additives used to enhance backfilling. All borehole abandonment information will be presented in the investigation report.
Geophysical Surveys	Geophysical surveys will be performed at selected sites to identify anomalies that would indicate the location of former waste disposal sites. Geophysical methods employed will include terrain conductivity (EM-31 or equivalent), high-sensitivity metal detection (EM-61 or equivalent), and GPR. The area to be surveyed will be gridded as specified in the work plan and data digitally recorded. Geodetic coordinates will be recorded at 1-s intervals using an integrated GPS.
Headspace Vapor Screening	All soil and tuff samples will be field screened for VOCs by placing a portion of the sample in a glass jar. The jar will be sealed with foil and gently shaken and allowed to equilibrate for approximately 5 min. The sample will then be screened by inserting a PID probe equipped with an 11.7-eV lamp into the container. The results will be recorded in units of ppm.

Table 5.0-1 (continued)

Method	Summary
XRF Screening	Soil samples will be screened in the field using XRF to delineate areas of inorganic chemical contamination. The XRF used will have a diction limit equal to approximately 10% to 20% of the SSL. Samples will be collected and analyzed in accordance with the XRF manufacturer's instructions, including analysis of standards and other QA/QC samples.
Handling, Packaging, and Shipping of Samples	Samples will be sealed and labeled before they are packed in ice. Sample and transport containers will be examined to ensure they are free of external contamination. Samples will be packaged to minimize the possibility of breakage during transport. After environmental samples are collected, packaged, and preserved, they will be transported to the Sample Management Office (SMO). A split of each sample will be sent to an SMO-approved radiation-screening laboratory under chain of custody (COC). Once radiation-screening results are received, the SMO will send the corresponding analytical samples to fixed laboratories for full analysis.
Containers and Preservation of Samples	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on EPA guidance for environmental sampling, preservation, and QA. Specific requirements for each sample will be printed in the sample collection logs (SCLs) provided by the SMO (size and type of container, preservatives, etc.). All samples will be preserved by placing them in insulated containers with ice to maintain a temperature of 4°C.
Sample Control and Field Documentation	The collection, screening, and transport of samples will be documented on standard forms generated by the SMO. These forms include SCLs, COC forms, and sample container labels. Collection logs will be completed at the time the samples are collected and signed by the sampler and a reviewer who verifies that the logs are complete and accurate. Corresponding labels will be initialed and applied to each sample container, and custody seals will be placed around container lids or openings. The COC forms will be completed and assigned to verify that the samples are not left unattended.
Coordinating and Evaluating Geodetic Surveys	Geodetic surveys will focus on obtaining survey data of acceptable quality to use during project investigations. Geodetic surveys will be conducted with a Trimble 5700 DGPS. 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 State Plane Coordinate System, North American Datum 83, New Mexico Central Zone, U.S. survey ft. All elevation data will be reported relative to the National Geodetic Vertical Datum of 1983.
Management, Characterization, and Storage of IDW	The 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 signs and labels. Each waste generated container will be individually labeled with waste classification, item ID, and radioactivity (if applicable) immediately following containerization. All waste will be segregated by classification and compatibility to prevent cross-contamination.
Field Quality Control Samples	Field QC samples will be collected as follows. Field duplicate samples will be collected at a frequency of 10%. Field duplicates will be collected at the same time as a regular sample and submitted for the same analyses. Trip blanks will be collected whenever samples were collected for VOC analysis. Trip blanks will be collected at a frequency of one sample per day when VOC samples are collected. Trip-blank containers will consist of certified clean sand that are opened and kept with the other sample containers during the sampling process.
Field Decontamination of Equipment	Dry decontamination will be the preferred method at the investigation site to minimize generating liquid waste. Dry decontamination will include using a wire brush or other tool to remove soil or other material adhering to the sampling equipment, followed by applying a commercial cleaning agent (i.e., Fantastik) and paper wipes.

Appendix A

Acronyms and Abbreviations,
Metric Conversion Table, and Data Qualifier Definitions

A-1.0 ACRONYMS AND ABBREVIATIONS

AK	acceptable knowledge
AOC	area of concern
bgs	below ground surface
BV	background value
COC	chain of custody
COPC	chemical of potential concern
cpm	counts per minute
DARHT	Dual Axis Radiographic Hydrodynamic Test (facility)
DOE	Department of Energy (U.S.)
DRO	diesel range organics
DU	depleted uranium
EM	electromagnetic
EP	Environmental Programs Directorate
EPA	Environmental Protection Agency (U.S.)
ER Project	Environmental Restoration Project
FV	fallout value
GPR	ground-penetrating radar
GPS	global-positioning system
FFCA/AO	Federal Facility Compliance Agreement/Administrative Order
FIDLER	Field Instrument for Detecting Low Energy Radiation
HE	high explosives
HIR	historical investigation report
IDW	investigation-derived waste
IR	investigation report
HWFP	Hazardous Waste Facility Permit
IFGMP	Interim Facility-Wide Groundwater Monitoring Plan
LANL	Los Alamos National Laboratory
LASL	Los Alamos Scientific Laboratory (Laboratory's name before January 1, 1981)
LLW	low-level waste
MDA	material disposal area
MSGP	Multi-Sector General Permit
NFA	no further action
NMED	New Mexico Environment Department

NOI	notice of intent
NPDES	National Pollutant Discharge Elimination System
OD	open detonation
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyls
PHERMEX	Pulsed High-Energy Radiographic Machine Emitting X-rays (facility)
PID	photoionization detector
PPE	personal protective equipment
PRG	preliminary remediation goal
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
RLWTF	Radioactive Liquid Waste Treatment Facility
RPF	Records Processing Facility
SAL	screening action level
SAP	sampling and analysis plan
SCL	sample collection log
SDPPP	Site Drainage Pollution Prevention Plan
SMA	site-monitoring 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 [EPA]
TCLP	toxicity characteristic leaching procedure
TNT	2,4,6-trinitrotoluene
TPH	total petroleum hydrocarbons
VCA	voluntary corrective action
VOC	volatile organic compound

WAC	waste acceptance criteria
WCSF	waste characterization strategy form
XRF	x-ray fluorescence

A-2.0 METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain U.S. Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (μm)	0.0000394	inches (in.)
square kilometers (km2)	0.3861	square miles (mi2)
hectares (ha)	2.5	acres
square meters (m2)	10.764	square feet (ft2)
cubic meters (m3)	35.31	cubic feet (ft3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm3)	62.422	pounds per cubic foot (lb/ft3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (μg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

A-3.0 DATA QUALIFIER DEFINITIONS

Data Qualifier	Definition
U	The analyte was analyzed for but not detected.
J	The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.
J+	The analyte was positively identified, and the result is likely to be biased high.
J-	The analyte was positively identified, and the result is likely to be biased low.
UJ	The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific detection or quantitation limit.
R	The data are rejected as a result of major problems with quality assurance/quality control (QA/QC) parameters.

Appendix B

Management Plan for Investigation-Derived Waste

B-1.0 INTRODUCTION

This appendix describes how investigation-derived waste (IDW) generated during the Potrillo and Fence Canyons Aggregate Area investigation will be managed by Los Alamos National Laboratory (the Laboratory). IDW may include, but is not limited to, drill cuttings, excavated media, excavated man-made debris, contact waste, decontamination fluids, and all other waste that potentially has come into contact with contaminants.

B-2.0 IDW

All IDW generated during investigation activities will be managed in accordance with the current version of the standard operating procedure (SOP) EP-ERSS-SOP-5022, Characterization and Management of Environmental Restoration (ER) Project Waste (http://www.lanl.gov/environment/all/qa/adep.shtml). This SOP incorporates the requirements of all applicable U.S. Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) regulations, U.S. Department of Energy orders, and Laboratory requirements.

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.

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., surface soil, subsurface soil, etc.). 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. Data currently available for the aggregate area do not identify polychlorinated biphenyl (PCB) concentrations greater than 1 mg/kg. However, if this investigation identifies PCB concentrations of greater than 1 mg/kg, the Laboratory may submit a request to EPA (with a copy to NMED) to manage the waste as PCB remediation waste.

Considerable amounts of material will be excavated during the remediation of Solid Waste Management Units (SWMUs) 15-007(a), 15-008(a), 15-010(a), 36-001, and 36-006. To facilitate the staging and segregation of the remediation waste, the Laboratory will submit area of contamination designation requests for these SWMUs to the NMED for approval. The request will specify the boundaries of the proposed areas of contamination and will describe the activities to be conducted within the boundaries.

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. Table B-2.0-1 summarizes how waste will be managed.

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

B-2.1 Drill Cuttings

This waste stream consists of soil and rock chips generated by the drilling of boreholes for the intent of sampling. Drill cuttings include excess core sample not submitted for analysis and any returned samples sent for analysis. Drill cuttings will be containerized in 20 yd^3 rolloff containers, 55-gal. drums, B-12 containers, or other appropriate containers at the point of generation. If drilling is conducted within the boundary of an area of contamination, the drill cuttings will be managed within those boundaries. If drilling occurs outside the area of contamination boundaries, the initial management of the cuttings will rely on the data from previous investigations and/or process knowledge. Drill cuttings will be managed in secure, designated areas appropriate to the type of the waste. If new analytical data changes the expected waste category, the waste will be managed in accumulation areas appropriate to the final waste determination. 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. This waste stream will be characterized based either on direct sampling of the waste or on the results from core samples collected during drilling. If directly sampled, the following analyses will be performed: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), explosive compounds (if screening indicates the presence of high explosives [HE]), radionuclides, total metals, and if needed, toxicity characteristic 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 or disposed of as a low-level waste at Technical Area 54 (TA-54), Area G.

B-2.2 Excavated Environmental Media

Layback and overburden spoils (including environmental media mixed with buried debris) will consist of soil and rock removed from within or adjacent to (e.g., from benching to stabilize a trench) the SWMUs to be excavated. This material is expected to be contaminated due to the proximity of active and inactive firing sites to the sites to be remediated. This material will be field screened for radioactivity and VOCs during the excavation process. If contamination is not detected during screening, the spoils will be stored either in rolloff bins, other suitable containers, or on the ground surface with appropriate best management practices. If field screening indicates the potential for contamination, the layback and overburden spoils will be placed in rolloff bins or other suitable containers. The spoils will remain within the area of contamination boundary of the SWMU from which they were excavated, awaiting analytical results. Samples of the spoils will be collected as the spoils are excavated and composited, if appropriate (one composite sample for every 20 to 50 yd^3, depending on the homogeneity of spoils). The samples will be analyzed for VOCs; target analyte list (TAL) metals; explosive compounds, if screening indicates the presence of HE; radionuclides; and toxicity characteristic metals, as needed. Other constituents may be analyzed as necessary to meet the WAC for a receiving facility. If process knowledge, odors, or staining indicate the soils may be contaminated with petroleum products, the materials will also be analyzed for TPH and PCBs. If the spoils are determined to be suitable for reuse (i.e., is not hazardous waste and meets residential soil screening levels [SSLs]), the Laboratory will segregate any man-made debris from the soil and will use this soil to backfill the excavated SWMUs. If the spoils do not meet residential SSLs or are determined to be hazardous waste, they will be treated/disposed of at an authorized facility appropriate for the waste regulatory classification. Based on existing data, the Laboratory expects spoils that cannot be reused to be designated as industrial waste or low-level waste (LLW).

B-2.3 Excavated Man-Made Debris

Excavated man-made debris will be generated from the removal of four former disposal areas and three inactive septic systems. Debris will be segregated as it is excavated based on factors such as the type of debris, the type of alternative treatment technology that would be used to treat the debris, field screening, process knowledge, and/or staining or odors. Where practicable, this waste stream will be characterized by direct sampling of the waste (e.g., concrete). Direct samples will be analyzed for VOCs, SVOCs, explosive compounds, radionuclides, total metals, and, if needed, toxicity characteristic metals. Other constituents may be analyzed as necessary to meet the WAC for a receiving facility or if process knowledge or visual observations indicate other contaminants may be present (e.g., PCBs or asbestos). For debris that is difficult to characterize; acceptable knowledge (AK) will be used whenever possible, supplemented by sampling as needed. Sampling methods will often have to be identified on a case-by-case basis by qualified sampling personnel and all decisions documented in the field activity notebook.

Waste minimization will be implemented, where practicable, through segregation of waste materials. Nonhazardous materials that can be shown to have no detectable activity for radionuclides or that can be decontaminated to meet this criterion, will be recycled, if practicable.

The types of debris expected to be excavated from each SWMU are identified in the following subsections B-2.3.1 through B-2.3.5. The SWMUs are grouped by location. It is likely that five separate areas of contamination will be requested, one for each of the groupings described below.

B-2.3.1 Excavated Waste from SWMUs 15-007(a) and 15-010(a)

This waste stream will consist of components from two former buildings and one decommissioned septic system that served the former buildings (e.g., piping, metal, concrete reinforced with steel rebar and wood) and possibly contaminated soil that will be managed within the areas of contamination boundaries for these sites. The contents of the septic tank [SWMU 15-010(a)] were removed and the tank filled with sand in 1965.

The excavated materials will be placed initially in containers (e.g., rolloff bins) within the boundaries of an area of contamination. The Laboratory expects most of this waste to be designated as industrial waste that will be disposed of at an authorized off-site treatment/disposal facility or as LLW that will be disposed of at TA-54, Area G.

B-2.3.2 Excavated Waste from SWMU 15-008(a)

This waste stream will consist of debris from two small surface disposal areas at the southern edge of E-F Firing Site [SWMU 15-008(a)] and possibly, contaminated soil that will be managed within the area of contamination boundaries for this site. The two surface disposal areas were used to dispose of debris from tests conducted at E-F Firing Site including soil, rock, pebbles, metal fragments, plastic, electrical cable, electrical accessories, etc. The site is associated with E-F Firing Site.

The excavated materials will be placed initially in containers (e.g., rolloff bins) and managed within the boundary of an area of contamination. The Laboratory expects most of this waste to be designated as industrial waste that will be disposed of at an authorized off-site treatment/disposal facility or as LLW that will be disposed of at TA-54, Area G.

B-2.3.3 Excavated Waste from SWMU 36-001

This waste stream will consist of debris including wood and sand contaminated with barium, uranium, other inorganic chemicals, plastics, and HE from the Lower Slobbovia Firing Site. The excavated materials will be placed initially in containers (e.g., rolloff bins) and managed within the boundaries of an area of contamination. The Laboratory expects most of this waste to be designated as industrial waste that will be disposed of at an authorized off-site treatment/disposal facility or as LLW that will be disposed of at TA-54, Area G.

B-2.3.4 Excavated Waste from SWMU 36-006

This waste stream will consist of debris including cables, metal, concrete and other similar debris from the TA-36 firing sites. The excavated materials will be placed initially in containers (e.g., rolloff bins) and managed within the boundaries of an area of contamination. The Laboratory expects most of this waste to be designated as industrial waste that will be disposed of at an authorized off-site treatment/disposal facility or as LLW that will be disposed of at TA-54, Area G.

B-2.3 Contact Waste

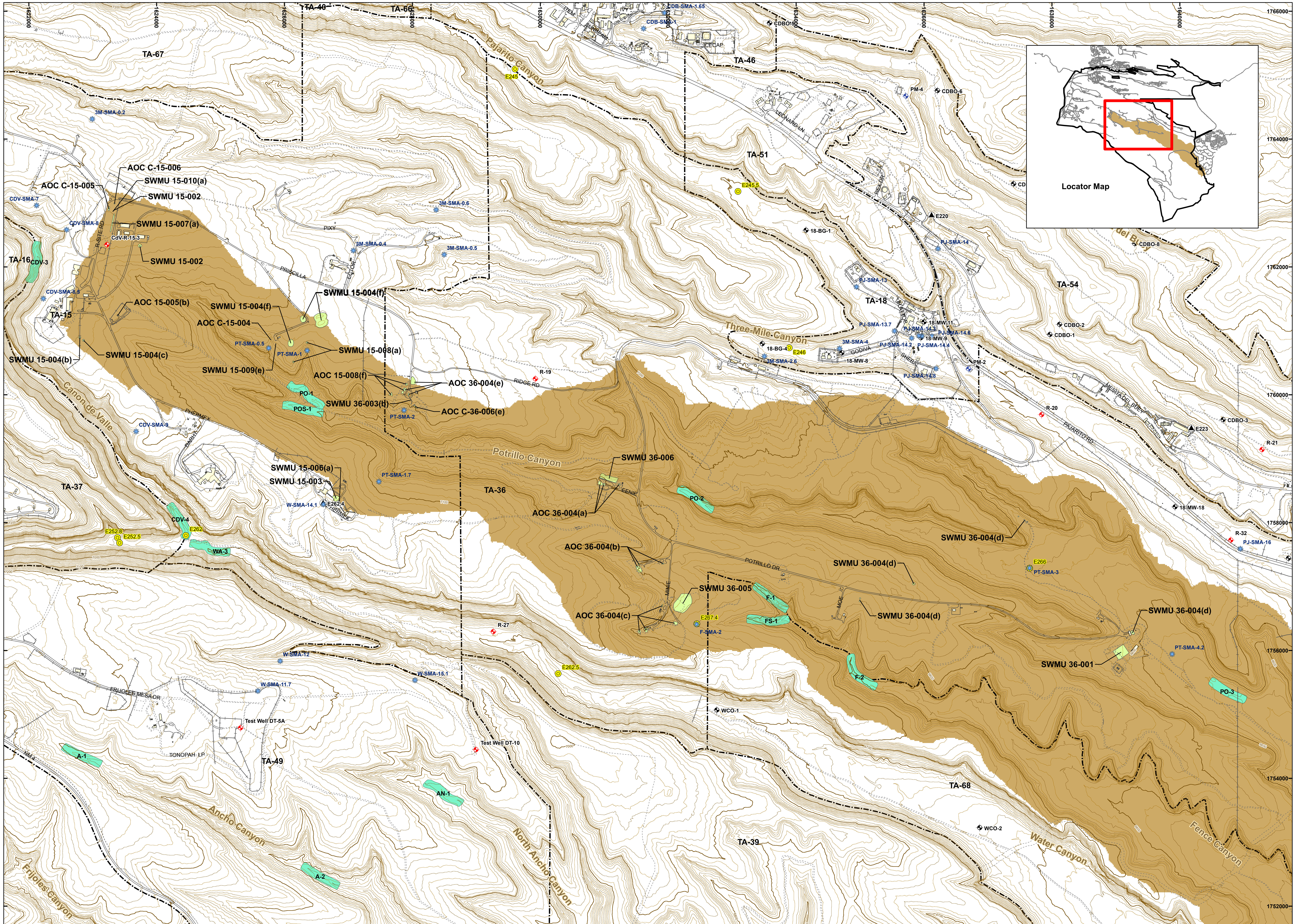
The contact waste stream consists of potentially contaminated materials that “contacted” waste during sampling and excavation. This waste stream consists primarily of, but is not limited, to personal protective equipment (PPE) such as gloves, decontamination wastes such as paper wipes, and disposable sampling supplies. Characterization of this waste stream will use AK of the waste materials, the methods of generation, and analysis of the material contacted (e.g., drill cuttings, soil, etc.). Initially, contact waste generated within an area of contamination will be placed in containers and managed within the area. If contact waste is generated at a location that is not within the area of contamination, the initial management of waste will rely on the data from previous investigations and/or process knowledge. Contact waste will be managed in secure, designated areas appropriate to the type of the waste. If new analytical data changes the expected waste category, the waste will be managed in accumulation areas appropriate to the final waste determination. The Laboratory expects most of the contact waste to be designated as nonhazardous, nonradioactive waste that will be disposed of at an authorized facility or as LLW that will be disposed of at TA-54, Area G.

B-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: VOCs, SVOCs, radionuclides, explosive compounds, total metals, and, if needed, toxicity characteristic metals. The Laboratory expects most of these wastes to be nonhazardous liquid waste or radioactive liquid waste that will be sent to one of the Laboratory’s wastewater treatment facilities whose WAC allow the waste to be received.

Table B-2.0-1
Summary of Estimated IDW Generation and Management

Waste Stream	Expected Waste Type	Expected Disposition
Drill cuttings	Nonhazardous or LLW	Land application or disposal at TA-54, Area G
Excavated environmental media	Nonhazardous or LLW	Reused as fill at the excavation location or disposed of at an approved off-site disposal facility or on-site at TA-54, Area G
Excavated man-made debris	Nonhazardous, industrial, or LLW	Disposal at an approved off-site disposal facility or on-site at TA-54, Area G or recycled
Contact waste	Nonhazardous or LLW	Disposal at an approved off-site solid waste disposal facility or on-site at TA-54, Area G
Decontamination fluids	Nonhazardous or LLW	Treatment at an on-site wastewater treatment facility



- IP SMA sampler
- Surface water gage station
- MSGP gage station
- Regional groundwater monitoring well
- Alluvial groundwater monitoring well
- Water Supply Well
- Reaches_March09
- SWMU or AOC
- Water course
- Paved road
- Dirt Road
- Fence
- Technical Area (TA) boundary
- Structure

Elevation Contour

- 100- and 20-ft interval
- 10-ft interval

PLATE 1

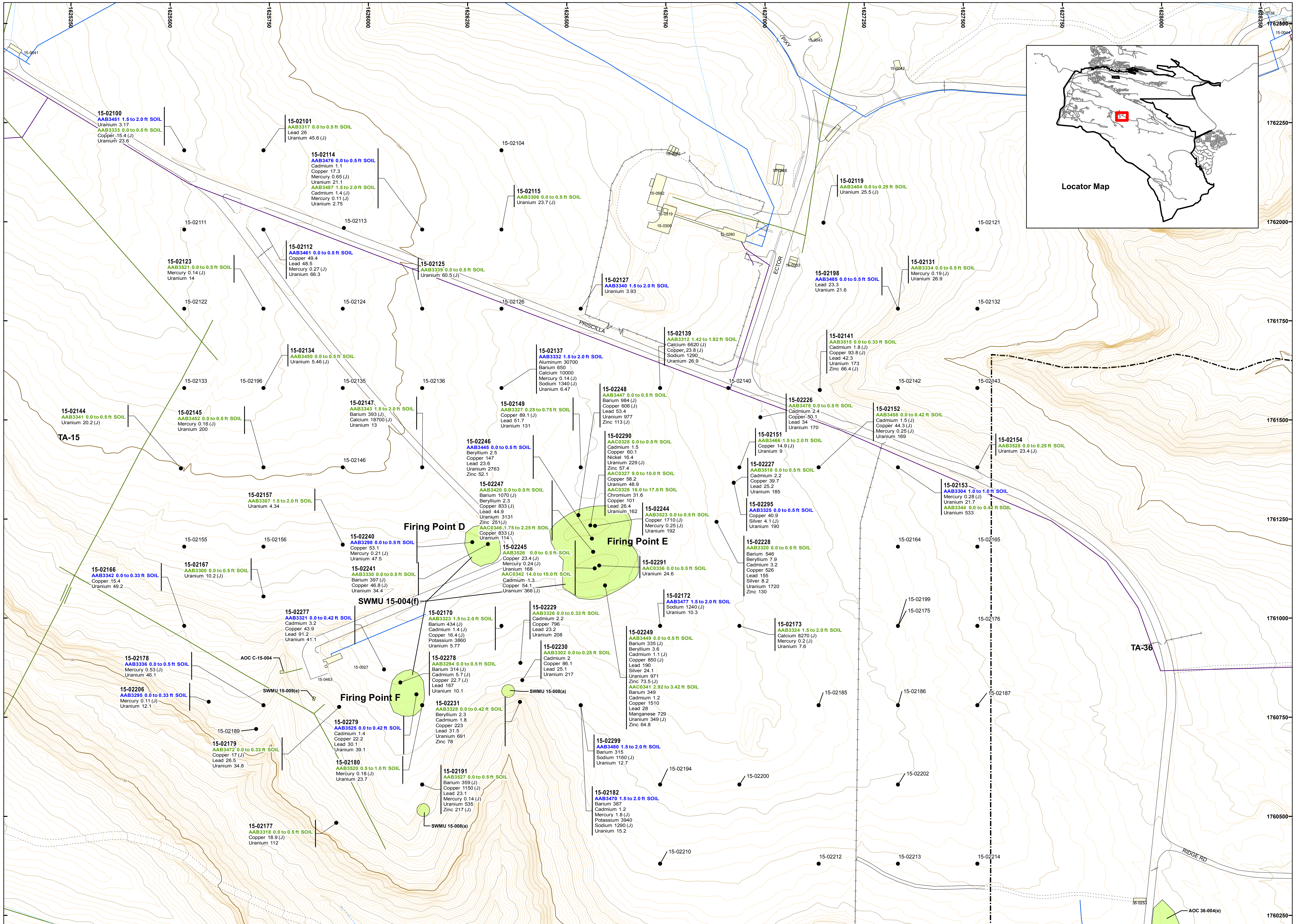
POTRILLO AND FENCE CANYONS AGGREGATE AREA

State Plane Coordinate System
New Mexico, Central Zone, US Survey Feet
North American Datum 1983
National Geodetic Vertical Datum 1929

WES-EDA GIS Team
09-0039-91
April 21, 2009

0 500 1,000 1,500 2,000
Feet

Disclaimer: This map was created for work processes associated with the LANL Environmental Programs Directorate, Corrective Actions Projects (EP-CAP). All other uses for this map should be confirmed with EP-CAP personnel.



- Historic sampling location
- SWMU or AOC
- Water
- Sewer
- Gas
- Communication
- Electrical
- Water course
- Storm drain
- Paved road
- Dirt Road
- Fence
- Technical Area (TA) boundary
- Structure

Elevation Contour

- 100- and 20-ft interval
- 10-ft interval
- 2-ft interval

Note: Concentration values are in mg/kg
Sampling locations in green are screening values
Sampling locations in blue are decision values

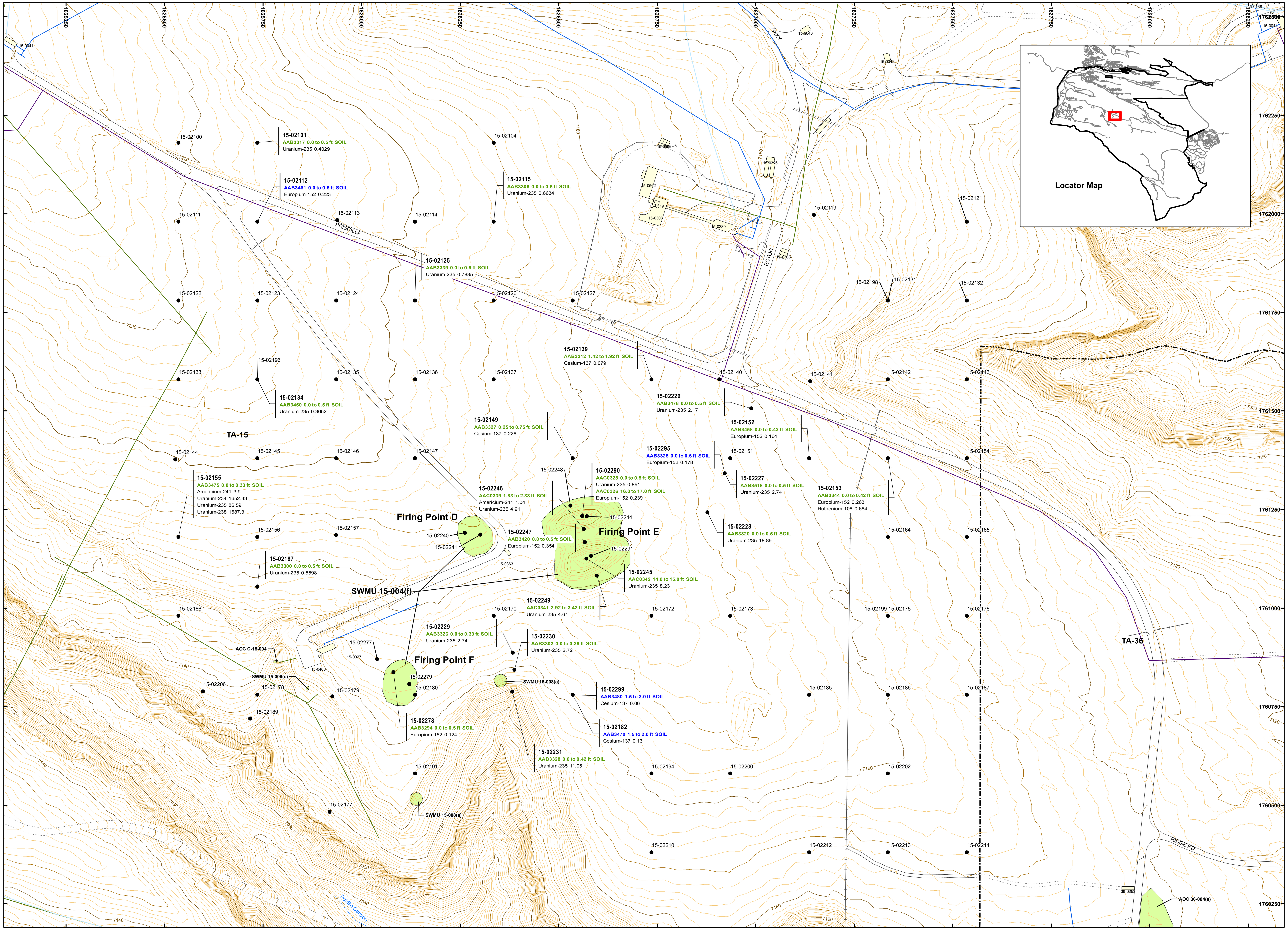
PLATE 2

SCREENING- AND DECISION-LEVEL INORGANIC CHEMICALS DETECTED ABOVE BVs AT SWMU 15-004(f)

N

State Plane Coordinate System
New Mexico, Central Zone, US Survey Feet
North American Datum 1983
National Geodetic Vertical Datum 1929

WES-EDA GIS Team
09-0039-83
April 20, 2009



- Historic sampling location
- SWMU or AOC
- Water
- Sewer
- Gas
- Communication
- Electrical
- Water course
- Storm drain
- Paved road
- Dirt Road
- Fence
- Technical Area (TA) boundary
- Structure

Elevation Contour

- 100- and 20-ft interval
- 10-ft interval
- 2-ft interval

Note: Concentration values are in mg/kg
Sampling locations in green are screening values
Sampling locations in blue are decision values

PLATE 3

SCREENING- AND DECISION-LEVEL RADIONUCLIDES DETECTED OR DETECTED ABOVE BVs/FVs AT SWMU 15-004(f)

State Plane Coordinate System
New Mexico, Central Zone, US Survey Feet
North American Datum 1983
National Geodetic Vertical Datum 1929

WES-EDA GIS Team
09-0039-90
April 22, 2009

0 50 100 200 300 400
Feet

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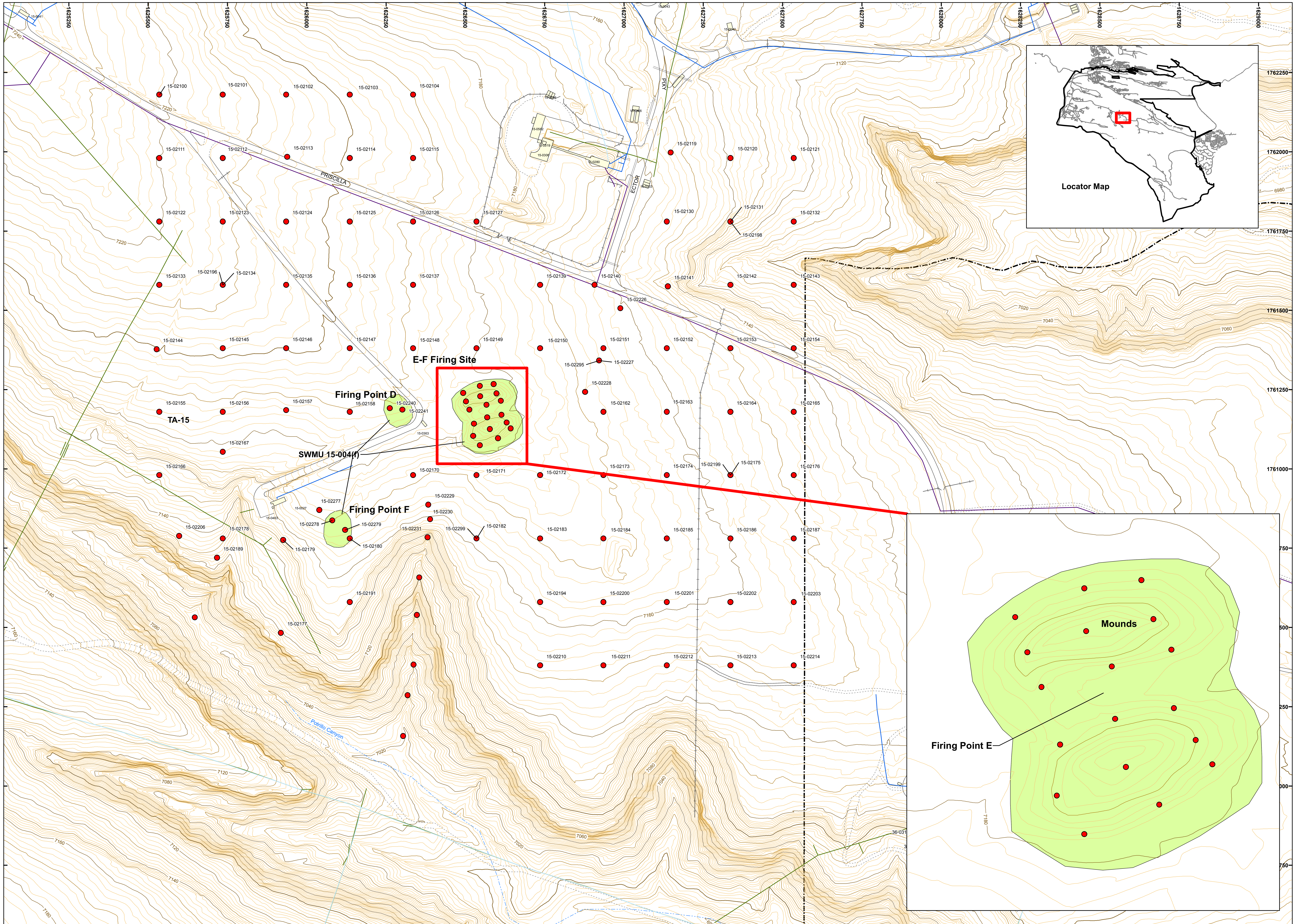

Proposed sampling location
SWMU or AOC
Water
Sewer
Gas
Communication
Electrical
Water course
Storm drain
Paved road
Dirt Road
Fence
Technical Area (TA) boundary
Structure

Elevation Contour

100- and 20-ft interval
10-ft interval
2-ft interval

PLATE 4

PROPOSED SAMPLING LOCATIONS AT SWMU 15-004(f)

N

State Plane Coordinate System
New Mexico, Central Zone, US Survey Feet
North American Datum 1983
National Geodetic Vertical Datum 1929

WES-EDA GIS Team
09-0039-30
April 22, 2009

0 50 100 200 300 400
Feet

Disclaimer: This map was created for work processes associated with the LANL Environmental Programs Directorate, Corrective Actions Projects (EP-CAP). All other uses for this map should be confirmed with EP-CAP personnel.

Table 4.0-1
Summary of Proposed Samples and Analyses

Site	Sampling Justification	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Cyanide (EPA SW-846:9012A)	Nitrate (EPA 300)	Perchlorate (EPA SW-846:6850)	VOCs (EPA SW-846:8260B)	SVOCs (EPA SW-846:8270C)	Explosive Compounds (EPA SW-846:8321A_MOD)	Dioxins/Furans (EPA SW-846:8280)	PCBs (EPA SW-846:8082)	Total Petroleum Hydrocarbons (EPA SW-846 8440)	Isotopic Uranium, (HASL-300)	Isotopic Thorium (HASL-300)	Isotopic Plutonium (HASL 300)	Gamma Spectroscopy (EPA 901.1M)	Americium-241 (HASL-300)
TA-15																		
SWMU 15-002	Collect 15 samples from 3 depths at 5 locations at each burn pit, 1 in the center of each pit and 4 step-out locations around each pit to define nature and extent at both burn pits.	0–1, 3–4, 6–7	Soil, tuff	X[a]	X	X	X	X	X	X	X	—X[b]	X	X	X	—[c]	—	—
SWMU 15-007(a)	Collect 8 confirmation samples from 2 depths at 4 locations beneath bottom of landfill excavation to confirm cleanup and define extent of any residual contamination.	0–1, 4–5 (below bottom of landfill excavation)	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	X	—	—	—
	Collect 12 samples from 2 depths at 2 step-out locations on each side of the landfill and 4 samples from 2 depths at 1 step-out location at each end of the landfill to define lateral extent.	4–5, 14–15	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	X	—	—	—
SWMUs 15-003 and 15-006(a) (Deferred)	Collect 10 samples from 2 depths at 5 locations in the drainage downgradient of both sites to determine if contaminants are migrating from the sites. NOTE: Runoff from both sites flows to the same drainage.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	—	X	X	—
SWMUs 15-004(b) and 15-004(c)	Collect 2 samples from 2 depths at one location within Firing Site A and one location within Firing Site B.	0-1, 3-4	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	—	—	X	X
	Collect 24 samples from 2 depths at 12 locations across the site and at additional locations with elevated screening results.	0–1, 3–4	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	—	—	X	X
SWMU 15-004(f)	Collect 42 samples from one depth at the 42 RFI grid locations across the site to supplement RFI data and to identify the areas and depths of soil requiring corrective action. The objective of this investigation is not to determine nature and extent of contamination, but to identify the areas and depths of soil requiring corrective action.	3–4	Soil, tuff	X	—	—	—	—	—	X	X[b]—	X[b]—	—	X	—	—	—	—
	Collect 102 samples from two depths at 51 previous RFI grid locations with no RFI data and at new locations identified by elevated field screening results. The objective of this investigation is not to determine nature and extent of contamination, but to identify the areas and depths of soil requiring corrective action.	0-1, 3–4	Soil, tuff	X	—	—	—	—	—	X	X[b]—	X[b]—	—	X	—	—	—	—
	Collect 54 samples from 3 depths at 3 locations on each side of both mounds and from 3 locations across the top of each mound to identify the areas and depths of soil requiring corrective action.	0–1, 6–7, 9–10	Soil, tuff	X	—	—	—	—	—	X	X[b]—	X[b]—	—	X	—	—	—	—
	Collect 10 samples from 2 depths at 5 locations in the drainage downgradient of the site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	—	—	X	X[b]—	X[b]—	—	X	—	—	—	—
	Collect 2 samples from 2 depths at 1 location at the head of Potrillo Canyon to determine if there is contaminant migration.	0-1, 2-3	Sediment	X	X	X	X	—	—	X	X[b]—	X[b]—	—	X	—	—	—	—
SWMU 15-008(a)	Collect 8 samples from 2 depths at 2 locations beneath **each** debris pile to confirm cleanup and define extent.	0–1, 3–4	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X	—	X	—	—	—	—
	Collect 16 samples from 2 depths at 4 step-out locations around both debris piles to determine extent.	0–1, 3–4	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X	—	X	—	—	—	—

Table 4.0-1 (continued)

Site	Sampling Justification	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Cyanide (EPA SW-846:9012A)	Nitrate (EPA 300)	Perchlorate (EPA SW-846:6850)	VOCs (EPA SW-846:8260B)	SVOCs (EPA SW-846:8270C)	Explosive Compounds (EPA SW-846:8321A_MOD)	Dioxins/Furans (EPA SW-846:8280)	PCBs (EPA SW-846:8082)	Total Petroleum Hydrocarbons (EPA SW-846 8440)	Isotopic Uranium, (HASL-300)	Isotopic Thorium (HASL-300)	Isotopic Plutonium (HASL 300)	Gamma Spectroscopy (EPA 901.1M)	Americium-241 (HASL-300)
AOC 15-005(b)	Collect 8 samples from 2 depths at 4 locations around Building 15-0242 to define extent. Avoid asphalt driveway.	0–1, 4–5	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	—	—	—	—	—
AOC 15-006(e)	No sampling; duplicate of AOC C-36-006(e).	n/a[e]a[d]	n/a	—	—	—	—	—	—	—	X[b]—	X[b]—	—	—	—	—	—	—
AOC 15-008(f) (Deferred)	Collect 20 samples from 2 depths at 5 locations in the drainage south of the west Sand Mounds and at 5 locations in the drainage south of the east Sand Mounds to determine if contaminants are migrating from the site.	0–1, 2–3	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	—	X	X	—
SWMU 15-009(e)	Collect 6 samples from 2 depths at 3 locations: adjacent to the tank inlet, adjacent to the tank outlet, and on one side of the tank to define extent.	0–1, 3–4 (below bottom of tank and tank inlet and outlet)	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	—	—	—	—
	Collect 4 samples from 2 depths at 2 locations along the inlet drain line to define extent.	0–1, 3–4 (below drain line)	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	—	—	—	—
	Collect 6 samples from 2 depths at 3 locations within outfall area to define extent.	0–1, 3–4 (within outfall area and drainage)	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	—	—	—	—
SWMU 15-010(a)	Collect 6 samples from 2 depths at 3 locations: below tank inlet, below tank outlet, and within the tank excavation to define extent.	0–1, 3–4 (below bottom of tank and tank inlet and outlet)	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	—	—	—	—
	Collect 6 samples from 2 depths at 3 locations along the two inlet drain lines to define extent.	0–1, 3–4 (below drain line)	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	—	—	—	—
	Collect 8 samples from 2 depths at 4 locations within outfall area to define extent.	0–1, 3–4 (within outfall area)	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	—	—	—	—
AOC C-15-004	Collect 4 samples from 2 depths at 2 locations to define extent.	0–1, 2–3	Soil ,tuff	—X	—	—	—	—	—	—	X[b]—	X	—	—X	—	—	—	—
AOC C-15-005	Collect 12 samples from 2 depths at 6 locations within and adjacent to building footprint.	0–1, 2–3	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	X	—	—	—
AOC C-15-006	Collect 12 samples from 2 depths at 6 locations within and adjacent to building footprint.	0–1, 2–3	Soil, tuff	X	X	X	X	X	X	X	X[b]—	X[b]—	—	X	X		—	
TA-36																		
SWMU 36-001	Collect 18 confirmation samples from 2 depths at 9 locations beneath bottom of landfill excavation to confirm cleanup and define extent of any residual contamination.	0–1, 4–5 (below bottom of landfill excavation)	Soil, tuff	X	X	X	X	X	X	X	X	X[b]—	—	X	X	—	—	—
	Collect 16 samples from 2 depths at 2 step-out locations on each side of the landfill excavation (8 total step-out locations).	4–5, 15–16	Soil, tuff	X	X	X	X	X	X	X	X	X[b]—	—	X	X	—	—	—

Table 4.0-1 (continued)

Site	Sampling Justification	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Cyanide (EPA SW-846:9012A)	Nitrate (EPA 300)	Perchlorate (EPA SW-846:6850)	VOCs (EPA SW-846:8260B)	SVOCs (EPA SW-846:8270C)	Explosive Compounds (EPA SW-846:8321A_MOD)	Dioxins/Furans (EPA SW-846:8280)	PCBs (EPA SW-846:8082)	Total Petroleum Hydrocarbons (EPA SW-846 8440)	Isotopic Uranium, (HASL-300)	Isotopic Thorium (HASL-300)	Isotopic Plutonium (HASL 300)	Gamma Spectroscopy (EPA 901.1M)	Americium-241 (HASL-300)
SWMU 36-003(b)	Collect 6 samples from 2 depths at 3 locations: adjacent to the tank inlet, adjacent to the tank outlet, and on one side of the tank to define extent.	0–1, 3–4 (below bottom of tank and tank inlet and outlet)	Soil, tuff	X	X	X	X	X	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	—	—
	Collect 4 samples from 2 depths at 2 locations along drain line to define extent.	0–1, 3–4 (below bottom drain line)	Soil, tuff	X	X	X	X	X	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	—	—
	Collect 6 samples from 2 depths at 3 locations at the outfall to define extent.	0–1, 3-4	Soil, tuff	X	X	X	X	X	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	—	—
AOC 36-004(a) (Deferred)	Collect 2 samples from 1 location in the drainage northwest and downgradient of the site. NOTE: Most drainage sampling locations will be addressed by the investigation and remediation of the SWMU 36-006 surface disposal site located directly downgradient of this site.	0–1, 2–3	Sediment	X	X	X	X	—	—	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	X	—
SWMU 36-006	Collect 12 samples from 2 depths at 6 locations beneath debris pile to confirm cleanup and define extent.	0–1, 2–3	Soil, tuff, sediment	X	X	X	X	X	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	—	—
	Collect 10 samples from 2 depths at 5 step-out locations around debris pile to define extent.	0–1, 2–3	Soil, tuff, sediment	X	X	X	X	X	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	—	—
AOC 36-004(b) (Deferred)	Collect 10 samples from 2 depths at 5 locations in the drainages downgradient of the Burn Pits to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	X	—
	Collect 6 samples from 2 depths at 3 locations in the drainage downgradient of the Skunk Works Firing Site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	X	—
AOC 36-004(c)	Collect 14 samples from 2 depths at 7 locations in the drainage downgradient of the site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	X	—
SWMU 36-004(d) (Deferred)	Collect 12 samples from 2 depths at 6 locations in the drainages downgradient of the site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—		X	
	Collect 6 samples from 2 depths at 3 locations in the drainage downgradient of the Skunk Works Firing Site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	X	X	X	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	X	—
AOC 36-004(e) (Deferred)	No sampling proposed. Drainage sampling will be covered by drainage sample locations for AOCs 15-008(f) and C-36-006(e).	n/a	n/a	—	—	—	—	—	—	—	~~X~~[b]—	~~X~~[b]—	—	—	—	—	—	—
SWMU 36-005	Collect 30 samples from 3 depths at 10 previous RFI location based on screening data to define vertical extent.	0–1, 2–3, 4–5	Soil, tuff	X	X	X	X	~~X~~[d]X[e]	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	—	—
	Collect 18 samples from 3 depths at 6 additional locations on the mesa top to define lateral extent.	0–1, 2–3, 4–5	Soil, tuff	X	X	X	X	~~X~~[d]X[e]	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	—	—
	Collect 6 samples from 2 depths at 3 locations in the drainage downgradient of the site to define extent.	0–1, 2–3	Sediment	X	X	X	X	~~X~~[d]X[e]	X	X	~~X~~[b]—	~~X~~[b]—	—	X	—	—	—	—
AOC C-36-001	No sampling. Site will be sampled as part of I-J Firing Site [SWMU 36-004(e)].	n/a	n/a	—	—	—	—	—	—	—	~~X~~[b]—	~~X~~[b]—	—	—	—	—	—	—

Table 4.0-1 (continued)

Site	Sampling Justification	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Cyanide (EPA SW-846:9012A)	Nitrate (EPA 300)	Perchlorate (EPA SW-846:6850)	VOCs (EPA SW-846:8260B)	SVOCs (EPA SW-846:8270C)	Explosive Compounds (EPA SW-846:8321A_MOD)	Dioxins/Furans (EPA SW-846:8280)	PCBs (EPA SW-846:8082)	Total Petroleum Hydrocarbons (EPA SW-846 8440)	Isotopic Uranium, (HASL-300)	Isotopic Thorium (HASL-300)	Isotopic Plutonium (HASL 300)	Gamma Spectroscopy (EPA 901.1M)	Americium-241 (HASL-300)
AOC C-36-006(e)	Collect 10 samples from 2 depths at 5 locations in the drainage downgradient of the site to determine if there is contaminant migration.	0–1, 2–3	Sediment	X	X	—	X	X	X	X	X[b]—	X[b]—	—	X	—	—	X	—

[a] X = Analysis proposed.

[b] One sample (i.e., the most contaminated sample) from each site where PCB and dioxin/furan analyses are not proposed based on the operational history of the site will be analyzed for PCBs and dioxins/furans. Sample selection will be based on field screening and sample location relative to potential contaminant sources.

[c] — = Analysis will not be performed.

[d c] n/a = Not applicable.

[e d] VOCs in subsurface samples only.

Table 4.1-2
Inorganic Chemicals Detected above BVs at TA-15

Sample ID	Location ID	Depth (ft bgs)	Media	Aluminum	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc
Soil/Fill BV[a]				29200	0.83	295	1.83	0.4	6120	19.3	8.64	14.7	22.3	671	0.1	15.4	3460	1.52	1	915	0.73	1.82	39.6	48.8
Qbt 2 BV				7340	0.5	46	1.21	1.63	2200	7.14	3.14	4.66	11.2	482	0.1	6.58	3500	0.3	1	2770	1.1	2.4	17	63.5
SWMU 15-004(b)																								
0215-96-0106	15-02428	0.67–1.17	SOIL	—[b]	11 (UJ)	—	—	0.53 (U)	—	—	—	—	50	—	NA[c]	—	—	—	2.1 (U)	—	1.3 (U)	NA	—	—
0215-96-0105	15-02434	0.67–1.17	SOIL	—	11 (U)	310	—	1.3	—	—	—	20	88	—	0.11 (U)	—	—	—	2.1 (U)	—	1.3 (U)	NA	—	—
0215-96-0104	15-02444	0.83–1.17	SOIL	—	11 (UJ)	510	—	0.66	—	—	—	700	100	—	0.11 (U)	—	—	—	2.2 (U)	—	1.3 (U)	NA	—	49 (J-)
0215-96-0116	15-02444	1.0–1.08	SOIL	—	12 (U)	920	—	3.7	—	—	8.7	180	370	—	0.12 (U)	—	—	—	2.4 (U)	—	1.2 (U)	NA	—	—
0215-96-0117	15-02464	2.75–2.92	SOIL	—	11 (U)	—	—	0.53 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.1 (U)	—	1.1 (U)	NA	—	49
SWMU 15-004(f)																								
AAB3451	15-02100	1.5–2.0	SOIL	—	3.9 (U)	—	—	1 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	—	—	—	3.17	—	—
AAB3461	15-02112	0.0–0.5	SOIL	—	3.8 (U)	—	—	0.96 (U)	—	—	—	49.4	48.5	—	0.27 (J)	—	—	—	—	—	—	66.3	—	—
AAB3476	15-02114	0.0–0.5	SOIL	—	3.7 (U)	—	—	1.1	—	—	—	17.3	—	—	0.65 (J)	—	—	—	—	—	—	21.1	—	—
AAB3340	15-02127	1.5–2.0	SOIL	—	4 (U)	—	—	1 (U)	—	—	—	—	—	—	—	—	—	—	—	—	—	3.93	—	—
AAB3332	15-02137	1.5–2.0	SOIL	30700	4 (U)	650	—	1 (U)	10000	—	11.1 (U)	—	—	—	0.14 (J)	—	—	—	—	1340 (J)	—	6.47	—	—
AAB3304	15-02153	1.0–1.0	SOIL	—	3.9 (U)	—	—	0.79 (U)	—	—	—	—	—	—	0.28 (J)	—	—	—	—	—	—	21.7	—	—
AAB3342	15-02166	0.0–0.33	SOIL	—	3.7 (U)	—	—	0.68 (U)	—	—	—	15.4	—	—	—	—	—	—	—	—	—	49.2	—	—
AAB3477	15-02172	1.5–2.0	SOIL	—	4.3 (U)	—	—	1 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	—	1240 (J)	0.75 (U)	10.3	—	—
AAB3336	15-02178	0.0–0.5	SOIL	—	3.7 (U)	—	—	0.6 (U)	—	—	—	—	—	—	0.53 (J)	—	—	—	—	—	—	46.1	—	—
AAB3470	15-02182	1.5–2.0	SOIL	—	4 (U)	387	—	1.2	—	—	—	—	—	—	1.8 (J)	—	3940	—	—	1290 (J)	—	15.2	—	—
AAB3485	15-02198	0.0–0.5	SOIL	—	3.7 (U)	—	—	0.87 (U)	—	—	—	—	23.3	—	—	—	—	—	—	—	—	21.6	—	—
AAB3295	15-02206	0.0–0.33	SOIL	—	3.7 (U)	—	—	0.78 (U)	—	—	—	—	—	—	0.11 (J)	—	—	—	—	—	—	12.1	—	—
AAB3298	15-02240	0.0–0.5	SOIL	—	3.9 (U)	—	—	0.76 (U)	—	—	—	53.1	—	—	0.21 (J)	—	—	—	—	—	—	47.5	—	—
AAB3473	15-02242	0.0–1.0	SOIL	—	3.8 (U)	834	—	0.59 (U)	—	—	—	7720	58.2	—	1.4 (J)	57.3	—	—	—	—	—	2820	—	309
AAB3445	15-02246	0.0–0.5	SOIL	—	3.9 (U)	—	2.5	0.43 (U)	—	—	—	147	23.6	—	0.11 (U)	—	—	—	—	—	—	2763	—	52.1
AAB3321	15-02277	0.0–0.42	SOIL	—	3.8 (U)	—	—	3.2	—	—	—	43.9	91.2	—	0.11 (U)	—	—	—	—	—	—	41.1	—	—
AAB3525	15-02279	0.0–0.42	SOIL	—	3.7 (U)	—	—	1.4	—	—	—	22.2	30.1	—	—	—	—	—	—	—	—	39.1	—	—
AAB3325	15-02295	0.0–0.5	SOIL	—	3.7 (U)	—	—	1 (U)	—	—	—	40.9	—	—	—	—	—	—	4.1 (J)	—	—	190	—	—
AAB3480	15-02299	1.5–2.0	SOIL	—	4 (U)	315	—	0.98 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	—	1160 (J)	—	12.7	—	—
15-008(a)																								
AAB3473	15-02242	0.0–1.0	SOIL	—	3.8 (U)	834	—	0.59 (U)	—	—	—	7720	58.2	—	1.4 (J)	57.3	—	—	—	—	—	2820	—	309
SWMU 15-009(e)																								
0215-97-0021	15-02510	0.0–0.5	SOIL	—	8.6 (J-)	—	—	0.63 (U)	—	—	—	—	—	—	—	—	—	—	4.1	—	—	33.5 (U)	—	—
0215-97-0023	15-02510	0.83–1.17	SOIL	—	7.1 (UJ)	—	—	0.62 (U)	—	—	—	—	—	—	—	—	—	—	1.8 (U)	—	—	26.8 (U)	—	—
0215-97-0024	15-02511	0.0–0.5	SOIL	—	7.2 (UJ)	—	—	0.62 (U)	—	—	—	—	—	—	—	—	—	—	2.4	—	—	67.8 (U)	—	—
0215-97-0025	15-02511	0.83–1.0	SOIL	—	7.4 (UJ)	—	—	0.64 (U)	—	—	—	—	—	—	—	—	—	—	1.8 (U)	—	—	34.9 (U)	—	—

Table 4.1-2 (continued)

Sample ID	Location ID	Depth (ft bgs)	Media	Aluminum	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc
Soil/Fill BV[a]				29200	0.83	295	1.83	0.4	6120	19.3	8.64	14.7	22.3	671	0.1	15.4	3460	1.52	1	915	0.73	1.82	39.6	48.8
Qbt 2 BV				7340	0.5	46	1.21	1.63	2200	7.14	3.14	4.66	11.2	482	0.1	6.58	3500	0.3	1	2770	1.1	2.4	17	63.5
0215-97-0026	15-02512	0.0–0.5	SOIL	—	7.2 (J-)	—	—	0.83 (J)	—	—	—	15.6	—	—	—	—	—	—	1.7 (U)	—	—	61.3 (U)	—	—
0215-97-0027	15-02512	0.83–1.0	SOIL	—	7.6 (UJ)	—	—	0.66 (U)	—	—	—	—	—	—	—	—	—	—	1.9 (U)	—	—	29.4 (U)	—	—
0215-97-0030	15-02513	6.0–7.0	SOIL	—	—	—	—	—	6200	—	—	—	—	—	—	—	—	—	—	—	—	2.15	—	—
0215-97-0034	15-02515	3.0–3.5	SOIL	—	—	—	—	—	—	—	—	—	135	—	—	—	—	—	—	—	—	2.67	—	—
0215-97-0035	15-02516	2.17–2.67	SOIL	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	18.9	—	—
SWMU 15-010(a)																								
0215-97-0063	15-02520	9.0–9.5	QBT2	—	6.6 (UJ)	147	—	—	—	10	5.3 (J)	11.2	18.6	—	3.7	—	—	0.55 (U)	1.9 (U)	—	—	2.62	—	—
0215-97-0064	15-02521	8.0–8.5	QBT2	—	6.7 (UJ)	139	—	—	2460	9.3	5.5 (J)	9.5	26	—	5.5	—	—	0.55 (U)	3.3	—	—	2.55	17.4	—
0215-97-0065	15-02522	8.5–9.0	QBT2	—	6.7 (UJ)	120	—	—	2850	8	5.4 (J)	8.2	26.5	—	3.5	—	—	0.49 (U)	2 (U)	—	—	2.79	—	—
0215-97-0066	15-02523	8.5–9.0	QBT2	—	6.5 (UJ)	153	—	—	4070	18	4.4 (J)	13.1	22.8	—	10.5	—	—	0.35 (U)	4.9	—	—	2.54	—	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] — = Result was not detected or was below the BV.

[c] NA = Not analyzed.

Table 4.1-3
Organic Chemicals Detected at TA-15

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Butylbenzene[tert-]	Di-n-butylphthalate	Dibromo-3-Chloropropane[1,2-]	Hexanone[2-]	HMX	Isopropyltoluene[4-]	Methylene Chloride	Naphthalene	Tetrachloroethene	Toluene
SWMU 15-009(e)																
0215-97-0030	15-02513	6.0–7.0	SOIL	0.0079 (J)	—[a]	—	—	—	—	—	—	—	—	—	—	—
0215-97-0031	15-02513	9.67–10.17	SOIL	0.0093 (J)	—	—	—	—	—	—	—	—	—	—	—	—
0215-97-0034	15-02515	3.0–3.5	SOIL	—	0.058 (J)	—	—	—	—	—	—	—	—	—	—	—
0215-97-0035	15-02516	2.17–2.67	SOIL	—	0.048 (J)	—	—	—	—	—	—	—	—	—	—	—
SWMU 15-010(a)																
0215-97-0063	15-02520	9.0–9.5	QBT2	NA[b]	—	0.099 (J)	NA	0.19 (J)	NA	NA	—	NA	NA	—	NA	NA
0215-97-0064	15-02521	8.0–8.5	QBT2	NA	—	0.044 (J)	NA	0.047 (J)	NA	NA	—	NA	NA	—	NA	NA
0215-97-0065	15-02522	8.5–9.0	QBT2	NA	—	0.044 (J)	NA	0.1 (J)	NA	NA	—	NA	NA	—	NA	NA
0215-97-0066	15-02523	8.5–9.0	QBT2	NA	—	0.049 (J)	NA	0.11 (J)	NA	NA	—	NA	NA	—	NA	NA

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] — = Result was not detected.

[b] NA = Not analyzed.

Table 4.1-4
Radionuclides Detected or Detected above BVs/FVs at TA-15

Sample ID	Location ID	Depth (ft bgs)	Media	Cesium-137	Europium-152
Soil BV/FV[a]				**1.65**	**na[b]**
SWMU 15-004(f)					
AAB3461	15-02112	0.0–0.5	SOIL	—[c]	0.223
AAB3470	15-02182	1.5–2.0	SOIL	0.13	—
AAB3325	15-02295	0.0–0.5	SOIL	—	0.178
AAB3480	15-02299	1.5–2.0	SOIL	0.06	—

Note: Units are pCi/g.
[a] BVs/FVs from LANL (1998, 059730).
[b] na = Not available.
[c] — = Result was not detected or was below the BV/FV.

Table 4.1-5
Screening-Level Inorganic Chemicals Detected above BVs at SWMU 15-004(f)

Sample ID	Location ID	Depth (ft bgs)	Media	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Potassium	Silver	Sodium	Thallium	Uranium	Zinc
SOIL BV[a]				0.83	295	1.83	0.4	6120	19.3	8.64	14.7	21500	22.3	671	0.1	15.4	3460	1	915	0.73	1.82	48.8
AAB3333	15-02100	0.0–0.5	SOIL	—[b]	—	—	—	—	—	—	15.4 (J)	—	—	—	—	—	—	—	—	—	23.6	—
AAB3317	15-02101	0.0–0.5	SOIL	NA[c]	NA	—	NA	NA	NA	NA	NA	NA	26	NA	—	NA	NA	NA	NA	NA	45.6 (J)	NA
AAB3487	15-02114	1.5–2.0	SOIL	—	—	—	1.4 (J)	—	—	—	—	—	—	—	0.11 (J)	—	—	—	—	1 (U)	2.75	—
AAB3306	15-02115	0.0–0.5	SOIL	NA	NA	—	NA	NA	NA	NA	NA	NA	—	NA	—	NA	NA	NA	NA	NA	23.7 (J)	NA
AAB3484	15-02119	0.0–0.25	SOIL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25.5 (J)	NA
AAB3521	15-02123	0.0–0.5	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.14 (J)	—	—	—	—	1 (U)	14	—
AAB3339	15-02125	0.0–0.5	SOIL	NA	NA	—	NA	NA	NA	NA	NA	NA	—	NA	—	NA	NA	NA	NA	NA	60.5 (J)	NA
AAB3334	15-02131	0.0–0.5	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.19 (J)	—	—	—	—	—	26.9	—
AAB3450	15-02134	0.0–0.5	SOIL	NA	NA	—	NA	NA	NA	NA	NA	NA	—	NA	—	NA	NA	NA	NA	NA	5.46 (J)	NA
AAB3312	15-02139	1.42–1.92	SOIL	—	—	—	—	6620 (J)	—	—	23.8 (J)	—	—	—	—	—	—	—	1290	0.94 (U)	26.9	—
AAB3515	15-02141	0.0–0.33	SOIL	—	—	—	1.8 (J)	—	—	—	93.8 (J)	—	42.3	—	—	—	—	—	—	1.4 (U)	173	66.4 (J)
AAB3341	15-02144	0.0–0.5	SOIL	NA	NA	—	NA	NA	NA	NA	NA	NA	—	NA	—	NA	NA	NA	NA	NA	20.2 (J)	NA
AAB3452	15-02145	0.0–0.5	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.16 (J)	—	—	—	—	1.1 (U)	200	—
AAB3343	15-02147	1.5–2.0	SOIL	—	393 (J)	—	—	18700 (J)	—	—	—	—	—	—	—	—	—	—	—	0.99 (U)	13	—
AAB3327	15-02149	0.25–0.75	SOIL	—	—	—	—	—	—	—	89.1 (J)	—	51.7	—	0.11 (U)	—	—	—	—	—	131	—
AAB3466	15-02151	1.5–2.0	SOIL	—	—	—	—	—	—	—	14.9 (J)	—	—	—	—	—	—	—	—	1.1 (U)	9	—
AAB3458	15-02152	0.0–0.42	SOIL	—	—	—	1.5 (J)	—	—	—	44.3 (J)	—	—	—	0.25 (J)	—	—	—	—	0.84 (U)	169	—
AAB3344	15-02153	0.0–0.42	SOIL	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.74 (U)	533	—
AAB3528	15-02154	0.0–0.25	SOIL	NA	NA	—	NA	NA	NA	NA	NA	NA	—	NA	—	NA	NA	NA	NA	NA	23.4 (J)	NA
AAB3307	15-02157	1.5–2.0	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.11 (U)	—	—	—	—	0.97 (U)	4.34	—
AAB3300	15-02167	0.0–0.5	SOIL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.2 (J)	NA
AAB3323	15-02170	1.5–2.0	SOIL	—	434 (J)	—	1.4 (J)	—	—	—	16.4 (J)	—	—	—	—	—	3860	—	—	1 (U)	5.77	—
AAB3324	15-02173	1.5–2.0	SOIL	—	—	—	—	8270 (J)	—	—	—	—	—	—	0.2 (J)	—	—	—	—	2 (U)	7.6	—
AAB3318	15-02177	0.0–0.5	SOIL	—	—	—	—	—	—	—	18.9 (J)	—	—	—	—	—	—	—	—	—	112	—
AAB3472	15-02179	0.0–0.33	SOIL	—	—	—	—	—	—	—	17 (J)	—	26.5	—	0.11 (U)	—	—	—	—	0.89 (U)	34.8	—
AAB3520	15-02180	0.5–1.0	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.18 (J)	—	—	—	—	1.1 (U)	23.7	—
AAB3527	15-02191	0.0–0.50	SOIL	—	359 (J)	—	—	—	—	—	1150 (J)	—	23.1	—	0.14 (J)	—	—	—	—	—	535	217 (J)
AAB3478	15-02226	0.0–0.5	SOIL	3.9 (U)	—	—	2.4	—	—	—	50.1	—	34	—	—	—	—	—	—	—	170	—
AAB3518	15-02227	0.0–0.5	SOIL	3.8 (U)	—	—	2.2	—	—	—	39.7	—	25.2	—	—	—	—	—	—	—	185	—
AAB3320	15-02228	0.0–0.5	SOIL	3.8 (U)	546	7.9	3.2	—	—	—	526	—	155	—	—	—	—	8.2	—	—	1720	130
AAB3326	15-02229	0.0–0.33	SOIL	3.9 (U)	—	—	2.2	—	—	—	796	—	23.2	—	0.11 (U)	—	—	—	—	—	208	—
AAB3302	15-02230	0.0–0.25	SOIL	4.1 (U)	—	—	2	—	—	—	86.1	—	25.1	—	0.11 (U)	—	—	—	—	—	217	—
AAB3328	15-02231	0.0–0.42	SOIL	3.9 (U)	—	2.3	1.8	—	—	—	223	—	31.5	—	—	—	—	—	—	—	691	78
AAB3516	15-02239	0.0–1.0	SOIL	—	915 (J)	2.3	12.8 (J)	—	—	9.2 (U)	4140 (J)	30100	57.5	—	0.11 (U)	16.9	—	—	—	0.97 (U)	1918	224 (J)

Table 4.1-5 (continued)

Sample ID	Location ID	Depth (ft bgs)	Media	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Potassium	Silver	Sodium	Thallium	Uranium	Zinc
AAB3330	15-02241	0.0–0.5	SOIL	—	397 (J)	—	—	—	—	—	46.8 (J)	—	—	—	—	—	—	—	—	0.9 (U)	34.4	—
AAB3331	15-02243	0.0–1.0	SOIL	—	—	—	1.6 (J)	—	—	—	66.5 (J)	—	—	—	—	—	—	—	—	0.87 (U)	244	—
AAB3523	15-02244	0.0–0.5	SOIL	—	—	—	—	—	—	—	1710 (J)	—	—	—	0.25 (J)	—	—	—	—	—	192	—
AAB3526	15-02245	0.0–0.5	SOIL	—	—	—	—	—	—	—	23.4 (J)	—	—	—	0.24 (J)	—	—	—	—	2.2 (U)	168	—
AAC0342	15-02245	14.0–15.0	SOIL	—	—	—	1.3	—	—	—	54.1	—	—	—	—	—	—	—	—	—	366 (J)	—
AAC0339	15-02246	1.83–2.33	SOIL	—	—	—	0.84 (U)	—	—	—	94.7	—	—	—	—	—	—	—	—	0.75 (U)	37.7 (J)	—
AAB3420	15-02247	0.0–0.5	SOIL	—	1070 (J)	2.3	—	—	—	—	833 (J)	—	44.9	—	—	—	—	—	—	—	3131	251 (J)
AAC0346	15-02247	1.75–2.25	SOIL	—	—	—	—	—	—	—	18.4	—	—	—	—	—	—	—	—	0.91 (U)	114	—
AAB3447	15-02248	0.0–0.5	SOIL	—	984 (J)	—	—	—	—	—	606 (J)	—	53.4	—	—	—	—	—	—	—	977	113 (J)
AAB3449	15-02249	0.0–0.5	SOIL	—	335 (J)	3.6	1.1 (J)	—	—	—	850 (J)	—	190	—	—	—	—	24.1	—	—	971	73.5 (J)
AAC0341	15-02249	2.92–3.42	SOIL	—	349	—	1.2	—	—	10.1 (U)	1510	—	28	729	—	—	—	—	—	0.76 (U)	349 (J)	64.8
AAB3294	15-02278	0.0–0.5	SOIL	—	314 (J)	—	5.7 (J)	—	—	—	22.7 (J)	—	167	—	—	—	—	—	—	—	10.1	—
AAC0328	15-02290	0.0–0.5	SOIL	—	—	—	1.5	—	—	8.7 (U)	60.1	—	—	—	—	16.4	—	—	—	0.77 (U)	229 (J)	57.4
AAC0327	15-02290	9.0–10.0	SOIL	—	—	—	—	—	—	—	58.2	—	—	—	—	—	—	—	—	0.9 (U)	48.9	—
AAC0326	15-02290	16.0–17.0	SOIL	—	—	—	—	—	31.6	—	101	—	26.4	—	—	—	—	—	—	0.9 (U)	162	—
AAC0336	15-02291	0.0–0.5	SOIL	—	—	—	—	—	—	—	—	—	—	—	0.11 (U)	—	—	—	—	0.95 (U)	24.6	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] — = Result was not detected or was below the BV.

[c] NA = Not analyzed.

Table 4.1-6
Screening-Level Organic Chemicals Detected at SWMU 15-004(f)

Sample ID	Location ID	Depth (ft bgs)	Media	Tetryl
AAB3516	15-02239	0.0–1.0	SOIL	0.092
AAB3331	15-02243	0.0–1.0	SOIL	0.093

Note: Units are mg/kg.

Table 4.2-2
Inorganic Chemicals Detected above BVs at TA-36

Sample ID	Location ID	Depth (ft bgs)	Media	Aluminum	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt 2 BV[a]				7340	0.5	46	1.21	1.63	2200	7.14	3.14	4.66	11.2	482	0.1	6.58	3500	0.3	1	2770	1.1	2.4	17	63.5
Soil BV				29200	0.83	295	1.83	0.4	6120	19.3	8.64	14.7	22.3	671	0.1	15.4	3460	1.52	1	915	0.73	1.82	39.6	48.8
SWMU 36-001																								
0236-96-0009	36-03127	10.83–13.33	SOIL	—[b]	5.6 (U)	—	—	0.56 (U)	—	—	—	—	—	—	—	—	—	—	—	—	—	NA[c]	—	—
0236-96-0010	36-03127	14.25–16.67	SOIL	—	5.7 (U)	—	—	0.57 (UJ)	—	—	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
0236-96-0022	36-03131	5.5–7.58	SOIL	—	0.87 (UJ)	—	—	—	—	—	—	43.1	—	—	—	—	—	—	—	—	0.89 (J)	NA	—	77.6
0236-96-0023	36-03131	9.17–11.67	SOIL	—	0.85 (UJ)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	NA	—	—
SWMU 36-004(d)																								
0236-96-0001	36-03177	2.0–2.58	SOIL	—	11 (UJ)	—	—	0.56 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.2 (U)	—	1.5 (UJ)	NA	—	—
0236-96-0002	36-03177	4.42–5.08	SOIL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11 (U)	NA	NA	—	NA	NA	1.4 (UJ)	NA	NA	NA
0236-96-0003	36-03177	5.58–6.33	QBT2	8400	11 (UJ)	100	—	—	2400	—	3.2	—	—	—	0.11 (U)	12	—	1.1 (UJ)	2.2 (U)	—	1.4 (UJ)	NA	—	—
0236-96-0004	36-03178	0.33–1.08	SOIL	—	11 (UJ)	—	—	0.54 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.2 (U)	—	1.4 (UJ)	NA	—	—
0236-96-0005	36-03178	3.17–3.67	SOIL	—	11 (UJ)	—	—	0.54 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.2 (U)	—	1.4 (UJ)	NA	—	—
0236-96-0007	36-03179	3.33–4.17	SOIL	—	11 (UJ)	—	—	0.56 (U)	—	—	—	—	—	—	0.11 (U)	17	—	—	2.2 (U)	—	1.5 (UJ)	NA	—	—
SWMU 36-006																								
0236-95-0083	36-03145	0.0–0.33	SOIL	—	11 (UJ)	—	—	1.5	15000	410	—	52 (J-)	200	—	0.11 (U)	200	—	—	2.1 (U)	—	1.3 (U)	NA	—	—
0236-95-0087	36-03145	1.33–2.0	SOIL	—	11 (UJ)	380	—	0.54 (U)	13000	—	—	55 (J-)	54	—	0.11 (U)	—	—	—	2.2 (U)	—	1.3 (U)	NA	—	150
0236-95-0084	36-03146	0.0–0.33	SOIL	—	11 (UJ)	—	—	0.56 (U)	—	—	—	—	—	—	0.11	—	—	—	2.2 (U)	—	1.4 (U)	NA	—	—
0236-95-0123	36-03146	1.33–2.0	SOIL	—	11 (UJ)	—	—	0.54 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.2 (U)	—	1.4 (U)	NA	—	—
0236-95-0086	36-03147	0.0–0.33	SOIL	—	11 (UJ)	—	—	0.57 (U)	—	—	—	—	—	—	0.11 (U)	—	—	—	2.3 (U)	—	1.4 (U)	NA	—	—
0236-95-0088	36-03149	0.0–0.33	SOIL	—	10 (UJ)	—	—	0.52 (U)	—	—	—	—	—	—	—	—	—	—	2.1 (U)	—	1.3 (U)	NA	—	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] — = Result was not detected or was below the BV.

[c] NA = Not analyzed.

Table 4.2-3
Organic Chemicals Detected at TA-36

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Butylbenzene[tert-]	Di-n-butylphthalate	Dibromo-3-Chloropropane[1,2-]	Hexanone[2-]	HMX	Isopropyltoluene[4-]	Methylene Chloride	Naphthalene	Tetrachloroethene	Toluene
SWMU 36-001																
0236-96-0009	36-03127	10.83–13.33	SOIL	—[a]	—	—	—	—	—	—	—	—	0.006 (J)	—	—	—
0236-96-0010	36-03127	14.25–16.67	SOIL	—	—	—	—	—	—	—	—	—	0.004 (J)	—	—	—
0236-96-0023	36-03131	9.17–11.67	SOIL	0.041	—	—	—	—	—	—	—	—	—	—	—	—
SWMU 36-004(d)																
0236-95-0001	36-03175	0.5–1.08	SOIL	—	—	0.098 (J)	—	—	0.002 (J)	—	—	0.031	—	0.002 (J)	0.002 (J)	0.0012 (J)
0236-95-0002	36-03175	2.33–2.75	SOIL	—	—	—	0.001 (J)	—	—	—	—	0.011	—	—	—	—
0236-95-0004	36-03176	2.0–2.58	SOIL	—	—	0.074 (J)	—	—	—	—	—	—	—	—	—	—
0236-96-0003	36-03177	5.58–6.33	QBT2	0.026	—	—	—	—	—	0.034	—	—	—	—	—	—
0236-96-0004	36-03178	0.33–1.08	SOIL	NA[b]	—	—	NA	—	NA	NA	—	NA	0.0085 (J+)	—	NA	NA
0236-96-0007	36-03179	3.33–4.17	SOIL	0.039	—	—	—	—	—	—	—	—	—	—	—	—
SWMU 36-005																
0236-97-0027	36-03039	3.25–3.33	SOIL	0.003 (J)	NA	NA	—	NA	—	—	NA	—	—	NA	—	—
SWMU 36-006																
0236-95-0087	36-03145	1.33–2.0	SOIL	—	—	—	—	—	—	—	—	—	0.0086 (J+)	—	—	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] — = Result was not detected.

[b] NA = Not analyzed.

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Investigation Work Plan for Potrillo and Fence Canyons Aggregate Area, Revision 1

Los Alamos NATIONAL LABORATORY EST. 1943

Prepared by the Environmental Programs Directorate

LA-UR-09-~~XXXX~~4327~~2342~~
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Investigation Work Plan for Potrillo and Fence Canyons Aggregate Area, Revision 1

July~~April~~ 2009

Responsible project leader:

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EXECUTIVE SUMMARY

The Potrillo and Fence Canyons Aggregate Area includes a total of 42 solid waste management units (SWMUs) and areas of concern (AOCs) located in Technical Area 15 (TA-15) and TA-36 at Los Alamos National Laboratory. Of these 42 sites, 15 have been previously investigated and/or remediated and have been approved for no further action. For the remaining 27 sites under investigation, 16 are located in TA-15, and 11 are located in TA-36. This investigation work plan identifies and describes the activities needed to complete the investigation of the remaining 27 SWMUs and AOCs. Details of previous investigations and analytical results for the 27 sites included in this work plan are provided in the historical investigation report for the Potrillo and Fence Canyons Aggregate Area.

The sampling strategy proposed in this work plan will be integrated with the data results of the South Canyons investigation to assess potential contaminant migration from sites within the Potrillo and Fence Canyons Aggregate Area. Additional data collected in Potrillo and Fence Canyons under the Laboratory's National Pollution Discharge Elimination System Individual Permit ~~will be used to assess potential contaminant migration from the Potrillo and Fence Canyons Aggregate Area sites. All results~~ relevant to Potrillo and Fence Canyons Aggregate Area sites will be included in the report to be submitted following execution of this work plan.

The objective of this work plan is to evaluate the historical data and, based on that evaluation, to propose additional sampling as necessary to define the nature and extent of contamination associated with the SWMUs and AOCs within the Potrillo and Fence Canyons Aggregate Area.

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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 fingerlike mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 and 7800 ft above mean sea level. The location of the Potrillo and Fence Canyons Aggregate Area with respect to the Laboratory technical areas (TAs) is shown in Figure 1.0-1.

The Laboratory's Environmental Programs (EP) Directorate, which includes the former Environmental Restoration (ER) Project, is participating in a national effort by DOE to clean up sites and facilities. The goal of EP is to ensure that past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve this goal, EP 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).

The SWMUs and AOCs addressed in this 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 work activities that will be executed and completed in accordance with the Consent Order.

1.1 Work Plan Overview

The Potrillo and Fence Canyons Aggregate Area includes a total of 42 SWMUs and AOCs located in TA-15 and TA-36 at the Laboratory (Plate 1). Historical details of previous investigations and data for these sites are provided in the historical investigation report (HIR) for the Potrillo and Fence Canyons Aggregate Area (LANL 2009, 105251). Of these 42 sites, 15 have been previously investigated and/or remediated and have been approved for no further action (NFA) status (NFA-approval documents are referenced in Table 1.1-1). Of the remaining 27 sites under investigation, 16 are located in TA-15, and 11 are located in TA-36. This work plan addresses the remaining 27 sites using the information from previous field investigations or removal actions to evaluate current conditions at each site.

Section 2 of the work plan presents the general site information, operational history, and the preliminary conceptual site model of the Potrillo and Fence Canyons Aggregate Area sites. General site conditions are discussed in section 3. Section 4 provides summaries of previous investigations and data collected and presents the scope of proposed activities for each site. The sites within the Potrillo and Fence Canyons Aggregate Area are widespread; therefore, they are organized by TA. Each TA subsection includes background information on operational history; summary of releases; current site use; and status of the sites in the TAs. Section 5 provides investigation methods for proposed field activities. Ongoing monitoring and sampling programs in the Potrillo and Fence Canyons Aggregate Area are presented in section 6. Section 7 is an overview of the anticipated schedule of the investigation and reporting activities.

The references cited in this work plan and the map data sources are provided in section 8. Appendix A of this work plan includes a list of acronyms and abbreviations, a glossary, metric conversion table, and a data qualifier definitions table. Appendix B describes the management of investigation-derived waste (IDW).

1.2 Work Plan Objectives

The objective of this work plan is to determine the nature and extent of releases from the 27 sites.

To accomplish this objective, this work plan

- presents historical and background information on the sites;
- describes the rationale for proposed data collection activities;
- identifies and proposes appropriate methods and protocols for collecting, analyzing, and evaluating data to characterize these sites; and
- identifies and proposes appropriate methods and protocols for remediating select sites.

2.0 BACKGROUND

2.1 General Site Information

TA-15, also known as R-Site, occupies portions of Threemile Mesa on the Pajarito Plateau near the southwestern boundary of the Laboratory (Plate 1). TA-15 occupies approximately 1200 acres and is used for high explosives (HE) research, development, and testing, primarily through hydrodynamic testing and dynamic experimentation. TA-15 contains the Pulsed High-Energy Radiographic Machine Emitting X-rays (PHERMEX) facility, the Dual Axis Radiographic Hydrodynamic Test (DARHT) facility, and building 15-0206, all of which are or were formerly used for testing weapons under development. Other activities at TA-15 include the investigation of weapons functioning and systems behavior in nonnuclear testing.

TA-36, also known as Kappa Site, is located in the Potrillo and Fence Canyons in a remote area near the eastern boundary of the Laboratory (Plate 1). TA-36 has been used from the 1950s to the present. TA-36 consists of a series of firing sites that support explosives experiments. The firing sites and facilities at TA-36 accommodate shipping, receiving, transporting, and testing HE. A total of over 30,000 test shots have been fired at Kappa Site, using an estimated 2200 to 4400 lb of depleted uranium (DU). Initially, the Kappa Site consisted of group offices; four firing sites named Eenie, Meenie, Minie, and Lower Slobbovia; and a storage magazine at Moe. In 1983, the boundary of TA-36 was expanded to incorporate the I-J Firing Site, formerly located in TA-15 (LANL 1993, 015313, p. 2-2).

2.2 Operational History

TA-15 has been used from the mid-1940s to the present for explosives experiments. In that capacity, test explosions ranging from a few kilograms of HE to as much as 650 kg were conducted. These experiments used natural uranium metal, DU metal, lesser quantities of beryllium, and other metals. In most cases, the tests were carried out aboveground, which resulted in the test materials being scattered over areas. Based on Laboratory records, it is estimated that some 75 metric tons of natural uranium and DU have been expended at the TA-15 firing sites since the mid-1940s (LANL 1993, 020946, pp. E2, E9).

2.3 Conceptual Site Model

The sampling proposed in this work plan uses a conceptual site model to predict areas of potential contamination and allow for adequate characterization of these areas. A conceptual site model describes potential contaminant sources, transport mechanisms, and receptors.

2.3.1 Potential Contaminant Sources

Releases at sites within Potrillo and Fence Canyons Aggregate Area may have occurred as a result of air emissions or effluent discharges. Previous sampling results indicate contamination from inorganic chemicals, organic chemicals, and radionuclides (LANL 2009, 105251). Additional sampling is needed to determine the nature and extent of contamination.

2.3.2 Potential Contaminant Transport Mechanisms

Current potential transport mechanisms that may lead to exposure include

- dissolution and/or particulate transport of surface contaminants during precipitation and runoff events,
- airborne transport of contaminated surface soil,
- continued dissolution and advective/dispersive transport of chemical contaminants contained in subsurface soil and tuff as a result of past operations,
- disturbance of contaminants in shallow soil and subsurface tuff by Laboratory operations, and
- disturbance and uptake of contaminants in shallow soil by plants and animals.

2.3.3 Potential Receptors and Pathways

Potential receptors and pathways may include

- Laboratory workers and
- plants and animals both on-site and in areas immediately surrounding the sites.

2.3.4 Cleanup Standards

As specified in Section VIII.B.1 of the Consent Order, screening levels will be used as soil cleanup levels unless they are determined to be impracticable or unless values do not exist for the current and reasonably foreseeable future land use. Soil screening levels (SSLs) for an industrial scenario are presented in Table 2.3-1 for previously detected inorganic and organic chemicals. The screening action levels (SALs) for the industrial scenario are also provided in Table 2.3-1 for previously detected radionuclides.

2.4 Data Overview

Data evaluated in this work plan include historical data collected from 1995 through 2006, as part of Resource Conservation and Recovery Act (RCRA) facility investigations (RFIs) and other corrective actions. In the Sample Management Database, all data records include a vintage code field denoting how and where samples were submitted for analyses.

Samples described in this work plan have undergone analyses at both on-site and off-site laboratories. Because analytical practices and documentation of analyses vary in quality and completeness, analytical data presented are of either screening-level or decision-level data. Screening-level data are appropriate for applications that only require determination of gross contamination areas and/or for general site characterization. Screening-level data are also often used to specify areas where additional data should be collected. Decision-level data are used to quantify the nature and extent of releases and to perform risk assessments. The decision-level data provide supporting information for the investigation activities proposed in the work plan.

Inorganic chemical and radionuclide data from previous investigations were compared with background values (BVs) and fallout values (FVs) (LANL 1998, 059730, p. 6-2). Fallout radionuclides in soil greater than a depth of 6 in. or in rock and organic chemicals are evaluated based on detection status.

This work plan summarizes the available decision-level data (and where appropriate, screening-level data) to determine whether the nature and extent of contamination are defined for each site. In addition, this work plan proposes sampling activities and analytical suites for those sites at which the nature and extent of contamination have not been defined.

3.0 SITE CONDITIONS

3.1 Surface Conditions

3.1.1 Soil

Soil on the Pajarito Plateau was initially mapped and described by Nyhan et al. (1978, 005702). The soil on the slopes between the mesa tops and canyon floors was mapped as mostly steep rock outcrops consisting of approximately 90% bedrock outcrop and patches of shallow, weakly developed colluvial soil. South-facing canyon walls generally are steep and usually have shallow soil in limited, isolated patches between rock outcrops. In contrast, the north-facing canyon walls generally have more extensive areas of shallow, dark-colored soil under thicker forest vegetation. The canyon floors generally contain poorly developed, deep, well-drained soil on floodplain terraces or small alluvial fans (Nyhan et al. 1978, 005702).

The soil in the bottom of Potrillo and Fence Canyons consists of well-drained soil of the Totavi series. The Totavi series consists of deep, well-drained soil that formed in alluvium in canyon bottoms. The surface soil is a brown gravelly loamy sand, or sandy loam, with 15 to 20% gravel. The permeability of this soil is high, runoff is very slow, and erosion hazard rating is low (Nyhan et al. 1978, 005702, p. 31).

The eastern half of the top of Mesita del Potrillo is classified as rock outcrop, mesic land type, which is found on moderately sloping to steep mesa tops and edges and consists of about 65% tuff rock outcrop with small areas of very shallow undeveloped soil. The western half of the top of Mesita del Potrillo consists of very shallow to shallow, well-drained soil of the Hackroy series; a Hackroy rock outcrop complex; moderately deep, well-drained soil of the Nyjack series; and deep well-drained soil of the fine-loamy Typic Eutroboralfs (LANL 1994, 034756, p. 3-23). The surface layer of the Hackroy soils is a brown sandy loam or loam that has medium runoff and moderate erosion hazard. The Hackroy rock outcrop complex has moderate to severe erosion hazard and medium to high runoff (Nyhan et al. 1978, 005702, p. 25). The surface layer of the Nyjack soil is a brown loam, very fine sandy loam, or sandy loam. This soil has moderate permeability, slow runoff, and slight erosion hazard (Nyhan et al. 1978, 005702, p. 25). The surface layer of the fine-loamy Typic Eutroboralfs soils is a very dark grayish brown loam, sandy loam, or very fine sandy loam. This soil exhibits slow runoff and moderate erosion hazard (Nyhan et al. 1978, 005702, p. 32).

3.1.2 Surface Water

Most surface water in the Los Alamos area occurs as ephemeral, intermittent, or interrupted streams in canyons cut into the Pajarito Plateau. Springs on the flanks of the Jemez Mountains, west of the Laboratory's western boundary, supply flow to the upper reaches of Cañon de Valle and to Guaje, Los Alamos, Pajarito, and Water Canyons (Purtymun 1975, 011787; Stoker 1993, 056021). These springs discharge water perched in the Bandelier Tuff and Tschicoma Formation at rates from 2 to 135 gal./min (Abeele et al. 1981, 006273). The volume of flow from the springs maintains natural perennial reaches of varying lengths in each of the canyons.

Mesas of the Pajarito Plateau are generally dry, both on the surface and within the bedrock forming the mesas. The surface water and alluvial groundwater hydrology of the south canyons watersheds is related to several primary factors, including the location and discharge volume of natural and anthropogenic water sources, seasonal events (e.g., snowmelt runoff and stormwater runoff), and general regional climatic conditions. Surface water flow in the south canyons system is generally ephemeral and occurs primarily as short-duration stormwater runoff. Locally persistent surface water has been observed in bedrock pools or where alluvial groundwater discharges from springs or seeps. Intermittent flow also occurs during snowmelt runoff or is associated with the discharge of alluvial groundwater from stream beds. Surface water supports small wetlands in three locations in the south canyons watersheds: in Fishladder Canyon, in S-Site Canyon, and in an additional mesa-top location in TA-16 (USACE 2005, 092220).

Most stream channels that drain the south canyons watersheds are dry for most of the year and are characterized by ephemeral or intermittent flow with only localized areas of perennial flow. In the south canyons watersheds, only Cañon de Valle and Water Canyon support perennial flow. Perennial flow is derived from springs in the eastern Jemez Mountains or the western Pajarito Plateau, but the volume is insufficient to maintain surface flows across the Laboratory before the water is depleted by evaporation, transpiration, and infiltration (LANL 2005, 091523, p. 24). In Water Canyon, snowmelt runoff can extend from the Jemez Mountains to the Rio Grande following heavy winter snowfalls. Stormwater runoff also occasionally extends across the Laboratory to the Rio Grande in the south canyons but is transient and associated with heavy rainfall events.

The mesa-top portion of the Potrillo and Fence Canyons Aggregate Area is currently an industrially developed area. No natural surface water is present in this area. During summer thunderstorms and spring snowmelt, runoff flows from the mesa top down the hillsides and into the ephemeral streams in Potrillo and Fence Canyons. Surface runoff from the mesa top enters both canyons by way of several drainages (LANL 1992, 007672).

Potrillo Canyon has a relatively small drainage area (3.4 mi^2) that originates at TA-15 at an elevation of approximately 7280 ft. The canyon extends southeast from TA-15 to the Rio Grande for a distance of approximately 6.5 mi. Stream flow in Potrillo Canyon is ephemeral and results primarily from natural runoff. The Potrillo Canyon watershed has no perennial springs or tributaries on Laboratory property (LANL 1997, 055622, p. 3-27). Fence Canyon also has a small drainage (1.1 mi^2) that originates near the boundary between TA-36 and TA-68 at an elevation of approximately 7094 ft. The canyon extends southeast before joining Potrillo Canyon in TA-71. Stream flow in Fence Canyon is ephemeral and results primarily from natural runoff. The Fence Canyon watershed has no perennial springs or tributaries on Laboratory property (LANL 1997, 055622, p. 3-27).

3.1.3 Land Use

Currently, land use of the Potrillo and Fence Canyons Aggregate Area is industrial. TA-15 has been used since the 1940s and TA-36 has been used from the 1950s to the present time for explosive experiments. The TAs are remote with small office and Laboratory buildings, utilities, paved and unpaved roads, and firing site structures scattered throughout the area. Most of the sites in this aggregate area are located on the mesa top of Mesita del Potrillo on the northern and southern edges of Potrillo Canyon. The Lower Slobbovia Firing Site, also known as the Skunk Works Firing Site, and three burn pits in central TA-36 are located in Potrillo Canyon. Fence Canyon borders the southern half of TA-36 (Plate 1).

3.2 Subsurface Conditions

3.2.1 Anticipated Stratigraphic Units

The generalized stratigraphy underlying the south canyons watersheds is shown in Figure 3.2-1. The headwaters of Cañon de Valle and Water Canyon occur within dacitic lavas of the Tschicoma Formation (Tt) in the eastern Jemez Mountains (Griggs and Hem 1964, 092516; Smith et al. 1970, 009752), and this unit also occurs at depths beneath the western part of the Laboratory. The mesa-top settings generally consist of Bandelier Tuff (Qbt) overlain by a relatively thin layer of soil. The Bandelier Tuff unit is subdivided into two members: the Otowi and the Tshirege (in ascending order). The Tshirege Member underlies the mesas of the Pajarito Plateau and is a compound cooling unit divided into four distinct cooling units: Qbt 4, 3, 2, and 1v/1g (Broxton et al. 1995, 050121; Broxton and Reneau 1995, 049726; Gardner et al. 2001, 070106). Cooling unit 4 (Qbt 4) is generally the uppermost unit in the western part of the Laboratory. Cooling unit 3 (Qbt 3) is generally the uppermost unit in the central part of the Laboratory, and cooling unit 2 (Qbt 2) is generally the uppermost unit in the eastern part of the Laboratory. Under the mesa tops and locally exposed along canyon walls, the Otowi and Tshirege Members are typically separated by the Cerro Toledo interval (Qct), a sequence of volcaniclastic sediments and primary fallout deposits. The basal Guaje Pumice Bed of the Otowi Member typically separates the Bandelier Tuff from the underlying clastic fanglomerate sediments of the Puye Formation (Tp) or basalts of the Cerros del Rio volcanic field (Tb), which are exposed in canyons in the eastern part of the Laboratory (Griggs and Hem 1964, 092516; Smith et al. 1970, 009752; Dethier 1997, 049843) and have been penetrated in drill holes beneath the Laboratory. Sedimentary rocks of the Santa Fe Group (Tsf) occur beneath the Puye Formation and the Cerros del Rio basalts and are also locally exposed in the easternmost part of the Laboratory near the Rio Grande.

The stratigraphic units underlying the Potrillo and Fence Canyons Aggregate Area from the surface to the regional aquifer are described briefly in the following sections. The descriptions begin with the oldest (deepest) and proceed to the youngest (topmost).

3.2.1.1 Santa Fe Group

The Santa Fe Group is penetrated by water supply wells PM-2 and PM-4, both of which are located north of TAs-15 and -36 in Pajarito Canyon. Based on borehole lithological and geophysical logs, Purtymun (1995, 045344, p. 4) informally divided the Santa Fe Group into three formations, which include (in ascending order) the Tesuque Formation, the Chamita Formation, and a coarse-grained upper facies.

The Tesuque and Chamita Formations are terrestrial sedimentary deposits that filled the Española Basin of the Rio Grande during subsidence in late Tertiary time. The coarse-grained upper facies of the Santa Fe Group was deposited in a late Miocene trough 3 to 4 mi (4.8 to 6.4 km) wide and 7 to 8 mi (11 to 13 km) long that extended northeastward beneath the Pajarito Plateau (see Figure 2-4 in the hydrogeologic workplan [LANL 1998, 059599]). This trough is filled with up to 1500 ft (approximately 450 m) of gravel, cobble, and boulders derived from the Jemez volcanic field and with volcanic, metamorphic, and sedimentary rocks derived from highlands to the north and east. The trough is partly coincident with low gravity anomalies that Ferguson et al. (1995, 056018) interpreted as a sediment-filled graben on the western side of the Española Basin of the Rio Grande rift. The eastern side of this trough crosses Cañada del Buey near state road NM 4. The western margin of the trough is not well constrained but may be located in the western portion of the Laboratory.

3.2.1.1.1 Tesuque Formation

In PM-3, located in Sandia Canyon, the Tesuque Formation primarily consists of poorly consolidated, light pinkish brown, silty sandstone, siltstone, and claystone (Cooper et al. 1965, 008582, p. 52). The sandstones are predominately fine-to-medium-grained, and the sand grains are subrounded to well-rounded.

3.2.1.1.2 Chamita Formation

The Chamita Formation is similar in appearance to the Tesuque Formation but reportedly contains a larger proportion of volcanic and granitic clasts in its gravel layers (Galusha and Blick 1971, 021526, p. 71) and Paleozoic limestone cobbles in its conglomerate layers (Dethier and Manley 1985, 021506). The Chamita Formation contains lithologically distinct quartzitic gravels (Galusha and Blick 1971, 021526, p. 71). Upper layers of the Chamita Formation may contain cobbles of Jemez volcanic rocks, primarily andesites and dacites. However, because of similarities of appearance, obvious time overlaps, and interfingering relations, differentiation of the Chamita Formation from the coarse-grained upper facies of the Santa Fe Group is often difficult, particularly in boreholes. The Chamita Formation was reported to be absent in PM-3 (Purtymun 1995, 045344, pp. 275-277). The coarse-grained upper facies of the Santa Fe Group may be a facies variation of the Chamita Formation.

3.2.1.1.3 Coarse-Grained Upper Facies of the Santa Fe Group

The coarse-grained upper facies of the Santa Fe Group is composed of a mixture of volcanic debris from the Sierra de los Valles and arkosic and granitic debris from the highlands to the north and east of the Pajarito Plateau. Purtymun (1995, 045344, p. 6) called this distinctive group of coarse-grained sediment at the top of the Santa Fe Group the "Chaquehui Formation." The name "Chaquehui Formation" as related to Santa Fe Group sediment is a potentially confusing designation because the type section of the "Chaquehui Formation" in Chaquehui Canyon is much younger than the coarse-grained upper facies of the Santa Fe Group identified in boreholes on the Pajarito Plateau. The Chaquehui Formation constitutes quartzite clast-bearing maar deposits of the Cerros del Rio volcanic field. In PM-3, the upper coarse-grained facies consists of medium- to coarse-grained sandstone, conglomerate, and siltstone (Purtymun 1967, 011829, p. 9). Because of the high permeability characteristics of this facies, it is an important aquifer for the development of high-yield, low-drawdown municipal and industrial water supply wells on the Pajarito Plateau.

3.2.1.2 Puye Formation, Tschicoma Formation, and Cerros del Rio Basalts

The Puye Formation is mostly a fanglomerate deposit generally consisting of poorly sorted boulders, cobbles, and coarse sands. At PM-3, the clasts are composed of dacite, rhyolite, and fragments of basalt and pumice (Purtymun 1967, 011829, p. 8). At TW-8 (located in Mortandad Canyon), the fanglomerate consists predominately of fine- to coarse-grained sands and interbedded clay, silt, and gravel (Baltz et al.

1963, 008402, Figure 4). The lower fanglomerate includes more than 95 ft (29 m) of light tan to light gray tuff and tuffaceous sand.

The lower Puye Formation includes coarse sand and boulder deposits interpreted to represent an axial facies deposit of the ancestral Rio Grande as described by Manley (1976, 057673) and Dethier (1997, 049843). The axial facies deposit was previously (informally) called the "Totavi Lentil" (Griggs and Hem 1964, 092516). At PM-3, this deposit is composed of gravel and boulders of dacite, rhyolite, and quartzite (Purtymun 1967, 011829, p. 9). The thickness of the axial facies deposit varies from 40 ft (12 m) at PM-4 (located in Cañada del Buey) to 70 ft (21 m) at PM-2 (located in Pajarito Canyon) and PM-5 (located on Mesita del Buey) (Purtymun 1995, 045344, pp. 275–277). The axial facies deposit interfingers with the fanglomerates of the Puye Formation and basaltic rocks of the Cerros del Rio volcanic field in White Rock Canyon.

At PM-2, PM-3, PM-4, and PM-5, a sequence of brown and gray basaltic lava flows split the Puye Formation into the main lower part and a thin upper part (Purtymun 1995, 045344, pp. 275–277). Similar basalts were penetrated in the Puye Formation by other deep boreholes in the area. These basalts are present beneath the Guaje Pumice Bed at PM-2 and PM-4, although variable thickness of fanglomerate facies may be present above the basalts. The basalts are stratigraphically equivalent to the basaltic rocks of the Cerros del Rio volcanic field and probably represent an extension of that volcanic field beneath the Pajarito Plateau.

Dacitic volcanic rocks, presumably representing the distal edge of a Tschicoma Formation lava flow, were encountered beneath the Bandelier Tuff in borehole SHB-1 (located west of TA-55). The dacite flow appears to occupy a similar stratigraphic position within the Puye Formation, as do the basalts. Similar dacite flows may underlie the upper and middle sections of Potrillo and Fence Canyons. However, several deep boreholes drilled to 750 ft (225 m) at TA-46 did not encounter either the dacite or the basalt flows in the upper Puye Formation (Purtymun 1995, 045344, p. 209). This may indicate that the volcanic flows in the Puye Formation do not extend laterally beneath the entire Pajarito Plateau.

The top of the regional zone of saturation beneath the Pajarito Plateau is usually encountered within the fanglomerate facies of the Puye Formation and the associated interbedded basalts. The regional zone of saturation initially was encountered beneath Sandia Canyon at a depth of 722 ft (220 m) in PM-1, 740 ft (225 m) in PM-3, and recently at a depth of 805 ft (245 m) in regional well R-12 (located in lower Sandia Canyon). A possible intermediate perched zone was encountered at a depth of 450 ft (140 m) in basalts within the Puye Formation during the drilling of PM-1. A perched intermediate zone of saturation was encountered from a depth of 443 ft to 519 ft in the lower part of the basaltic rocks of the Cerros del Rio volcanic field and in the underlying old alluvium in well R-12 (Purtymun 1995, 045344; Broxton et al. 1998, 059665).

3.2.1.3 Otowi Member of the Bandelier Tuff

The Otowi Member is a nonwelded, poorly consolidated ignimbrite sheet composed of stacked ash-flow units. These units are composed of pumice lapilli supported by a matrix of ash and crystal fragments. The Otowi Member varies in reported thickness from 184 ft (56 m) in borehole SHB-1 to 465 ft (142 m) in EGH-LA-1 (located in Mortandad Canyon). The deposits of the Otowi Member beneath upper Sandia and middle Mortandad Canyon (near TW-8 and EGH-LA-1) are among the thickest on the Pajarito Plateau from deposition in a pre-Bandelier Tuff paleovalley (see Figure 5 in Broxton and Reneau 1996, 055429, p. 330). The paleovalley containing the thick Otowi Member sediments continues southward across middle Cañada del Buey and Pajarito Canyon.

The Otowi Member outcrops in lower-offsite Sandia Canyon east of state road NM4 and is known to exist in the subsurface beneath the canyons from drill-hole data. The Otowi Member is 320 ft (98 m) thick at PM-4, 140 ft (43 m) thick at PM-3, and 120 ft (37 m) thick at PM-1. The Otowi Member thins eastward against a north-trending basaltic highland that crosses Sandia Canyon and Cañada del Buey near NM 4. The Otowi Member is absent in the lower off-site Sandia Canyon and Cañada del Buey where it either was not deposited or was removed by erosion before the Tshirege Member was deposited.

The basal part of the Otowi Member includes the Guaje Pumice Bed, which is a sequence of well stratified pumice-fall and ash-fall deposits. The Guaje Pumice Bed typically is 30 ft to 35 ft (9.1 m to 10.7 m) thick beneath the Pajarito Plateau (27 ft [8 m] at PM-2). Beneath lower Sandia Canyon, the Guaje Pumice Bed thickens from west to east and is 20 ft (6 m) thick in PM-3 and 45 ft (13.7 m) thick in PM-1 (Purtymun 1995, 045344, pp. 275–276).

3.2.1.4 Tephra and Volcaniclastic Sediment of the Cerro Toledo Interval

Tephra and volcaniclastic sediment of the Cerro Toledo interval are the informal names given to a complex sequence of epiclastic sediment and tephra of mixed provenance (Broxton and Reneau 1995, 049726, p. 11). This unit includes well-stratified tuffaceous sandstones and siltstones, primary ash-fall and pumice-fall deposits, and dacite-rich gravel and boulder deposits. The Cerro Toledo deposits, which vary in thickness from 0 to more than 100 ft (30 m), likely, were deposited episodically with unevenly distributed local deposits. Some sediments are deposited in drainage channels developed on top of the Otowi Member before deposition of the Tshirege Member. Other blanket-type fallout deposits were deposited across the plateau, including on paleotopographic drainage divides. Erosion and possible redeposition of the Cerro Toledo interval sediment and possibly the underlying Otowi Member occurred in places before deposition of the Tshirege Qbt 1 unit, which may have contributed to locally variable thickness. The Cerro Toledo interval is approximately 140 ft (43 m) thick in borehole SHB-1 (Gardner et al. 1993, 012582, p. 9) and approximately 80 ft (24 m) thick in borehole 35-2028 located in Ten Site Canyon (LANL 1996, 054422, p. 2-3).

3.2.1.5 Tshirege Member of the Bandelier Tuff

The Tshirege Member includes a number of subunits that can be recognized based on differences in physical and weathering properties. This work plan follows the nomenclature of (Broxton and Reneau 1995, 049726, p. 8), which was adopted for use as a standard by the former ER Project. Both Purtymun and Kennedy (1971, 004798) and Rogers (1995, 054419) applied different systems of stratigraphic nomenclature to subunits of the Tshirege Member.

Tsankawi Pumice Bed

The Tsankawi Pumice Bed (Qbtt) is the basal pumice outfall deposit of the Tshirege Member. It is composed of angular to subangular clast-supported pumice lapilli up to 2.4 in. in diameter.

Tshirege Member Unit 1g

Tshirege Member unit 1g (Qbt 1g) is the lowermost unit in the thick ignimbrite sheet that makes up most of the Tshirege Member. Qbt 1g is a porous, nonwelded, poorly sorted, vitric ignimbrite. It is poorly indurated but nonetheless forms steep cliffs because a resistant bench near the top of the unit forms a protective cap over the softer underlying tuff.

Tshirege Member Unit 1v

Tshirege Member unit 1v (Qbt 1v) is a series of cliff- and slope-forming outcrops composed of porous, nonwelded, devitrified ignimbriter. The base of the unit is a thin, horizontal zone of preferential weathering that marks the abrupt transition from vitric tuff below to devitrified tuff above. The lower part of Qbt 1v is a resistant orange brown colonnade tuff (Qbt 1v-c) that forms a distinctive low cliff characterized by columnar jointing. The colonnade tuff is overlain by a distinctive white band of slope-forming tuff.

Tshirege Member Unit 2

Unit 2 of the Tshirege Member of the Bandelier Tuff (Qbt 2) forms a distinctive, medium-brown, vertical cliff-forming unit that stands out in marked contrast to the slope-forming, lighter colored tuffs above and below. This unit is devitrified, relatively highly welded, and forms the steep, narrow canyon walls of middle and upper Potrillo and Fence Canyons.

Tshirege Member Unit 3

Unit 3 of the Tshirege Member of the Bandelier Tuff (Qbt 3) is a nonwelded to partially welded, devitrified ignimbrite. The basal part of Qbt 3 consists of a soft, nonwelded tuff that forms a broad, gently sloping bench on the top of Qbt 2 in canyon wall exposures and on broad canyon floors. The upper part of Qbt 3 is a partially welded tuff that forms the caprock on mesas adjacent to upper and middle portions of canyons. This unit is more densely welded to the west and locally contains apparent horizontal bedding and/or fracturing.

3.2.1.6 Alluvium

Alluvium of Pleistocene and Holocene age rests unconformably on the Bandelier Tuff in canyons at the Laboratory. The alluvium in the canyons is derived from weathering of the Bandelier Tuff, which forms the steep walls on the sides of the canyon. The alluvium also contains sediment derived from eolian sources and fallout pumice deposits. In the upper parts of the canyons, the alluvium is thin and consists of gravels, sand, silt, and clay (Devaurs and Purtymun 1985, 007415, p. 11). The sand consists mainly of fine- to coarse-grained crystals of quartz and sanidine. The gravel fraction of the alluvium is composed mostly of low-density tuff clasts that are soft and relatively easily pulverized, and dark, resistant, angular-to-subangular volcanic clasts that are present in the tuff as lithic fragments, and which remain in the alluvium after tuff weathering (Reneau and McDonald 1996, 055538, p. 46).

The alluvium is relatively thin in the upper and middle parts of the canyons but generally widens and thickens downstream. Large boulders of Tschicoma Formation dacite are present within the Cerro Toledo interval. The alluvium downstream from these outcrops may contain some reworked boulders and sediment from this unit.

3.2.2 Hydrogeology

The hydrogeology of the Pajarito Plateau is generally separable in terms of mesas and canyons forming the plateau. Mesas are generally devoid of water, both on the surface and within the rock forming the mesa. Canyons range from wet to relatively dry; the wettest canyons contain continuous streams and contain perennial groundwater in the canyon-bottom alluvium. Dry canyons have only occasional stream flow and may lack alluvial groundwater. Intermediate perched groundwater has been found at certain locations on the plateau at depths ranging between 100 and 400 ft. The regional aquifer is found at depths of about 600 to 1200 ft.

The hydrogeologic conceptual site model for the Laboratory (Collins et al. 2005, 092028) shows that, under natural conditions, relatively small volumes of water move beneath mesa tops because of low rainfall, high evaporation, and efficient water use by vegetation. Atmospheric evaporation may extend into mesas, further inhibiting downward flow.

The hydrogeology of the south canyons watersheds is explained in this subsection in terms of infiltration of surface water; and the type, location, and movement of groundwater. Hydrogeology is described in detail in the Laboratory's Interim Facility-Wide Groundwater Monitoring Plan (IFGMP) (LANL 2008, 101897).

Infiltration is expected to be highly variable spatially and temporally and governed primarily by the location, persistence, and volume of surface water, alluvial storage, and subsurface stratigraphy.

Surface water occurs as snowmelt and rainfall runoff and spring discharge. Rainfall runoff is typically very short-lived, generally lasting from a few hours to several days, and can extend through the full length of a watershed. Snowmelt runoff can be short-lived, associated with abrupt snowmelt events typical of late fall or late winter events, or can extend for several weeks or months associated with snowmelt of deeper snowpack in the upper portions of the watersheds. Springs in the south canyons are often seasonally persistent and create localized surface-water occurrences.

Surface water is hydrologically directly connected to the alluvial groundwater system. Studies elsewhere at the Laboratory indicate that surface water either recharges the alluvium in canyons or can be the expression of alluvial groundwater levels that locally intercept the stream channel elevation (LANL 2004, 087390). Alluvial groundwater is most extensive and persistent in canyons that contain perennial springs or that experience extended periods of snowmelt runoff or effluent discharges, such as Cañon de Valle. Alluvial groundwater loss is likely to be spatially variable and dependent largely on the hydrologic properties of suballuvium stratigraphy. Percolation through the underlying vadose zone likely occurs as matrix flow and possibly through fractures.

3.2.2.1 Groundwater

In the Los Alamos area, groundwater occurs as (1) water in shallow alluvium in some of the larger canyons, (2) intermediate perched groundwater (a perched groundwater body lies above a less permeable layer and is separated from the underlying aquifer by an unsaturated zone), and (3) the regional aquifer. Numerous wells have been installed at the Laboratory and in the surrounding area to investigate the presence of groundwater in these zones and to monitor groundwater quality. The locations of the existing wells within the vicinity of the Potrillo and Fence Canyons Aggregate Area are shown on Plate 1.

3.2.2.1.1 Alluvial Groundwater

Intermittent and ephemeral stream flow in the canyons of the Pajarito Plateau have deposited alluvium that can be as thick as 100 ft. The alluvium in canyons of the Jemez Mountains is generally composed of sand, gravel, pebbles, cobbles, and boulders derived from the Tschicoma Formation and Bandelier Tuff. The alluvium in canyons at the Laboratory is finer grained, consisting of clay, silt, sand, and gravel derived from the Bandelier Tuff.

In contrast to the underlying volcanic tuff and sediment, alluvium is relatively permeable. Ephemeral runoff in some canyons infiltrates the alluvium until downward movement is impeded by the less permeable tuff and sediment, which results in the buildup of a shallow alluvial groundwater body. Depletion by evapotranspiration and movement into the underlying rock limit the horizontal and vertical extent of the alluvial water (Purtymun et al. 1977, 011846). The limited saturated thickness and extent of the alluvial groundwater preclude its use as a viable source of water for municipal and industrial needs. Lateral flow of the alluvial perched groundwater is in an easterly, downcanyon direction (Purtymun et al. 1977, 011846).

There is only one known occurrence of alluvial groundwater in Potrillo Canyon. It was detected during the installation of moisture access hole POTM-2 in 1989 in the upper-middle part of the canyon (Becker 1991, 015317). Several other boreholes have been drilled near this area to define the extent of the groundwater found in POTM-2 but all are dry. Information about the occurrence of alluvial groundwater in Potrillo Canyon is limited to the part of the canyon from 0.2 mi upstream of the discharge sink to 1 mi downstream of the discharge sink (LANL 1998, 059599). No other investigations have been conducted to date. Potrillo Canyon has been the focus of some of the most detailed near-surface characterization activities at the Laboratory. A partial list of subsurface instrumentation already installed within or adjacent to the discharge sink includes three neutron moisture access tube clusters and two multi-level observation wells. These stations monitor the vertical moisture movement and the occurrence of saturation within the discharge sink (the observation wells have remained dry since their installation in 1991). Monitoring results from these holes and data from additional surface water and sediment monitoring activities will be evaluated to guide the design, placement, and number of additional wells needed to characterize this site (LANL 1998, 059599).

In 1989, three shallow moisture-access holes (POTM-1, POTM-2, and POTM-3) were drilled in Potrillo Canyon near the Lower Slobbovia firing site to investigate the infiltration of surface water into the alluvium in an area where the channel stops (a discharge sink) (Becker 1993, 015317). POTM-1 and POTM-3 were located upgradient and downgradient, respectively, of this area and typically encountered low moisture levels (Plate 1). POTM-2 was located within the area where surface water is lost to infiltration; moisture logs following runoff events showed nearly uniform moisture content with depth, indicating very rapid infiltration perhaps on the order of hours (Becker 1993, 015317, p. 51). Moisture did not appear to be retained in the profile down to 49 ft but appeared to be percolating to deeper depths. A 1989 seismic survey revealed a subsurface feature interpreted to be an underlying fault and a possible cause of the loss of water in this area (Becker 1993, 015317, p. 228), although no faults are visible in adjacent outcrops. Two deeper holes were cored in Potrillo Canyon in 1991 and completed as observation wells (Purtymun 1995, 045344, p. 331). One well had three zones at various depths (POTO-4A, POTO-4B, and POTO-4C) separated from each other by bentonite and cement. The second well was constructed with two zones (POTO-5A and POTO-5B). The zones were packed with sand. The moisture-access holes and wells were completed as part of a study to determine whether there was recharge to the alluvium and underlying tuff and transport of depleted uranium from the intermittent stream in Potrillo Canyon in TA-36 (Becker 1993, 015317). The wells were installed to study the chemistry and radiochemistry of infiltrating water at different depths (Purtymun 1995, 045344, p. 331). Borehole PCTH-1 was drilled in Potrillo Canyon near NM 4 in October 1989 as a Special Conditions requirement of the Laboratory's Hazardous Waste Facility Permit (HWFP) for the monitoring of perched groundwater zones. PCTH-1 was cored to a depth of 74 ft below ground surface (bgs) and penetrated a thin soil zone and a thick section of weathered to unweathered tuff. The entire section was dry and indicated no presence of past water. The hole was abandoned and plugged (Purtymun and Stoker 1990, 007508, pp. 1, 6).

A single alluvial well, FCO-1, was installed in the Fence Canyon watershed near NM 4 as a special conditions requirement of the Laboratory's HWFP for monitoring perched groundwater zones (Plate 1). It was drilled in August 1989 to a depth of 29 ft and completed to a depth of 15 ft (Purtymun and Stoker 1990, 007508, pp. 1, 7; Purtymun 1995, 045344, p. 150). To date, water has not been encountered in well FCO-1 (LANL 2006, 093713, pp. 74–76).

3.2.2.1.2 Perched Intermediate Waters

Observations of perched intermediate water are rare on the Pajarito Plateau. Perched intermediate waters are thought to form mainly at horizons where medium properties change dramatically, such as at paleosol horizons containing clay or caliche. It is not known whether perched intermediate water bodies are isolated or connected and to what degree they may influence travel times and pathways for contaminants in the vadose zone.

No perched intermediate groundwater has been encountered to date in Potrillo and Fence Canyons (LANL 2006, 093713, pp. 70–76).

3.2.2.1.3 Regional Groundwater

The regional aquifer is the only aquifer capable of large-scale municipal water supply in the Los Alamos area (Purtymun 1984, 006513). The surface of the regional aquifer rises westward from the Rio Grande within the Santa Fe Group into the lower part of the Puye Formation beneath the central and western part of the Pajarito Plateau. The depths to groundwater below the mesa tops range between about 1200 ft along the western margin of the plateau and about 600 ft at the eastern margin. The location of wells and generalized water-level contours on top of the regional aquifer are described in the 2007 General Facility Information report (LANL 2007, 095364). The regional aquifer is typically separated from the alluvial groundwater and intermediate perched zone groundwater by 350 to 620 ft of tuff, basalt, and sediment.

The regional aquifer is a complex, heterogeneous system that includes confined and unconfined zones. The degree of hydraulic communication between these zones is thought to be spatially variable. The shallow portion of the regional aquifer (near the water table) is predominantly under phreatic (unconfined) conditions and has limited thickness (approximately 30 to 50 m [98 to 164 ft]). Groundwater flow and contaminant transport directions in this zone generally follow the gradient of the regional water table; the flow is generally east/southeastward. The direction and gradient of flow at the regional water table are predominantly controlled by areas of recharge (e.g., the Sierra de los Valles and variably within some Pajarito Plateau canyons) and discharge (White Rock Canyon springs and the Rio Grande). The deep portion of the regional aquifer is predominantly under confined conditions, and it is stressed by Pajarito Plateau water-supply pumping. The pumping likely has a small impact on the flow directions in the phreatic zone because of poor hydraulic communication (LANL 2007, 098938, p. 7).

Actively monitored regional aquifer wells in the south canyons system include wells CdV-15-3, CdV-37-2, R-19, R-18, R-25, R-26, and R-27 in the Water Canyon and Cañon de Valle watersheds, and test wells DT-5A, DT-9, and DT-10 in the Ancho Canyon watershed. Locations of the regional aquifer wells are shown on Plate 1.

Regional characterization well R-19 is located on Potrillo Mesa between Threemile and Potrillo Canyons, east of the I-J Firing Site at TA-36 and is designed to provide water-quality and water-level data for potential intermediate-depth perched zones and for the regional aquifer downgradient of HE release sites at TA-16 (Plate 1). The regional water table was found at a depth of 1178 ft, 60 ft deeper than expected (Broxton et al. 2001, 071254, pp. xi, 37). Notable differences between the predicted and as-drilled stratigraphy are the greater thickness of the Cerro Toledo interval (266 ft), the lesser thickness of the Otowi Member of the Bandelier Tuff (194 ft), the thinner sequence of Cerros del Rio basalts (135 ft), the absence of axial facies river gravels (Totavi) at the base of the Puye Formation, and the occurrence of unassigned pumiceous sedimentary deposits in lieu of Santa Fe Group sedimentary deposits (Broxton et al. 2001, 071254, pp. 7–8). The most significant observation from well R-19 for the conceptual hydrologic model is that the thick perched zone of saturation encountered at well R-25 was not present at either well R-19 or well CdV-R-15-3. In fact, the occurrence of any perched water at these wells is uncertain. If such saturation is present, it is markedly thinner than at well R-25, which indicates limited potential for transport through perched water from the well R-25 area across the area of well R-19. Head data collected within the regional zone of saturation at well R-19 indicate a downward vertical gradient, confirming the existing conceptual model that well R-19 is located in a recharge area. Hydrologic testing of pre-Puye Formation deposits (not previously available) yielded hydraulic conductivity values that are consistent with those for medium sand or silty sand (Broxton et al. 2001, 071254, p. 56).

Well CdV-R-15-3 is located at TA-15 near the head of Potrillo Canyon, approximately 800 ft east of the northeast rim of Cañon de Valle (Plate 1). Well CdV-R-15-3 was drilled in the spring of 2000 as part of the corrective measures study for Consolidated Unit 16-021(c)-99 to determine if the HE contamination that has been detected in the perched and regional aquifers of well R-25 (located in TA-16) extends to the east (Kopp et al. 2002, 073179). The top of the regional zone of saturation was found to lie at a depth of 1245 ft bgs in the Puye Formation fanglomerate (Kopp et al. 2002, 073179, p. xii). Unanticipated stratigraphic features at well CdV-R-15-3 included a thick (220 ft) Cerro Toledo interval and the absence of axial river gravels of the Puye Formation and Santa Fe Group sediments, similar in trend to the stratigraphic observations at well R-19. In addition, well CdV-R-15-3 provided the westernmost known occurrence of the Cerros del Rio basalts beneath the Pajarito Plateau. The unexpected occurrence of a basaltic debris flow beneath the Cerros del Rio lava indicates very active erosional processes along the western margin of the Cerros del Rio volcanic field. The Puye Formation is much thicker and more varied beneath this portion of the Pajarito Plateau than had been previously suspected (Kopp et al. 2002, 073179, p. xi).

4.0 SITE DESCRIPTIONS AND PROPOSED INVESTIGATION ACTIVITIES

The following sections present site descriptions, summaries of previous investigation activities, proposed sampling activities, and proposed remedial activities. Table 4.0-1 summarizes the investigation strategy for each SWMU or AOC, including the analytical methods for site-characterization activities proposed in this work plan.

The Potrillo and Fence Canyons Aggregate Area has been disturbed as a result of many years of new construction and demolition of former structures and historical and on-going firing-site activities. Before sampling is conducted, geodetic and geophysical methods in conjunction with radiological surveys may be used to verify specific SWMU and AOC boundaries. The sampling locations proposed in this work plan may be relocated as a result of these surveys; however, the overall sampling strategy will remain the same.

Eleven sites [SWMUs 15-002, 15-004(b), 15-004(c), 15-004(f), 15-009(e), 36-003(b), and 36-005 and AOCs 15-005(b), C-15-004, C-15-005, and C-15-006] are proposed for characterization. Five sites [SWMUs 15-007(a), 15-008(a), 15-010(a), 36-001, and 36-006] are proposed for cleanup under this investigation work plan. Cleanup levels proposed for the sites to be remediated are presented in Table 2.3-1.

A limited sampling campaign is proposed for SWMUs 15-003, 15-006(a), and 36-004(d) and AOCs 15-008(f), 36-004(a), 36-004(b), and 36-004(e). These SWMUs and AOCs are deferred sites listed on Table IV-2 of the Consent Order. Continued explosives testing at AOCs 36-004(c), C-36-001, and C-36-006(e) makes any determination of nature and extent obsolete as soon as the next firing activity occurs. AOC 36-004(c) is also an active open detonation (OD) site. Therefore, it is proposed that full characterization of these three sites be delayed until firing operations cease. At that time, the collection of definitive data is possible and will allow for the selection of the most appropriate corrective action for these sites. This work plan proposes an interim sampling strategy to determine if contaminants are migrating from any of the deferred or delayed sites.

One sample will be collected at each SWMU and AOC where PCB and/or dioxin/furan analysis is not already proposed and will be submitted for analysis of PCBs and dioxins/furans (Table 4.0-1). The sample selection will be based on field screening and location relative to potential contaminant sources. Section 5.3 describes the criteria for collecting the additional samples.

The approved South Canyons investigation work plan addresses sources of contamination and the nature and extent of contamination in sediment, surface water of active stream channels, and groundwater beneath canyon floors (LANL 2006, 093713; NMED 2007, 095490). The South Canyons investigation includes sampling and analysis of media from the watersheds associated with Potrillo and Fence Canyons and representative sections of their reaches. Four reaches have been identified in Fence Canyon (F-1, F-2, F-3, and FS-1) and five reaches have been identified in Potrillo Canyon (PO-1, PO-2, PO-3, PO-4, and POS-1) (Plate 1). (Reaches F-3 in Fence Canyon and PO-4 in Potrillo Canyon are located directly north of NM 4 in the drainage channel for each canyon; because these locations are approximately 1 mi east of the Potrillo and Fence Canyons Aggregate Area, they are not shown on Plate 1.) For the Potrillo and Fence Canyons Aggregate Area, the South Canyons investigation work plan proposes collecting 10 sediment samples in each reach. If necessary, subsequent sampling is generally limited to chemicals of potential concern (COPCs) identified during the initial sampling and analysis. Subsequent investigations may include additional sampling in previously investigated reaches or full investigations of new reaches, contingent on the results of the initial sampling and analysis. Analytical suites for these reaches include perchlorate, target analyte list (TAL) metals, cyanide, pesticides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbon (PAHs), semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), radionuclides, and explosive compounds (LANL 2006, 093713, p. 14). Sediment sampling for the South Canyons approved work plan will begin in 2010 and ~~the~~ data from Potrillo and Fence Canyons will be reported in the ~~South~~ Potrillo and Fence Canyons investigation report, due to NMED in August 2011. Canyons investigation sediment data from reaches downstream of sites where investigation has been deferred per Table IV-2 of the Consent Order available at the time the Potrillo and Fence Canyons Aggregate Area investigation report is being prepared will be provided and evaluated to determine the extent of contaminants migrating from these sites. In addition, available stormwater data collected in Potrillo and Fence Canyons under the Laboratory's National Pollution Discharge Elimination System Individual Permit relevant to Potrillo and Fence Canyons Aggregate Area sites will be included in the investigation report.

4.1 TA-15

TA-15, also known as R-Site, occupies portions of Threemile Mesa on the Pajarito Plateau near the southwestern boundary of the Laboratory in a roughly rectangular area approximately 1.3 mi wide by 1.5 mi long. TA-15 is bounded by TA-66 and TA-67 to the north, TA-14, TA-16, TA-37, and TA-49 to the west and south, and TA-36 to the east. The eastern portion of TA-15 is located within the Potrillo and Fence Canyons Aggregate Area; Potrillo Canyon intersects the eastern half of TA-15 (Plate 1). Sites to be investigated at TA-15 include drainages downgradient of active firing sites, one inactive landfill, two surface disposal sites, four former firing sites, two former septic systems, one former storage area, one former transformer platform, and two former building locations.

Samples collected for TA-15 and analyses requested for decision-level data are presented in Table 4.1-1. Decision-level data are presented in Tables 4.1-2, 4.1-3, and 4.1-4. All laboratory analytical data (both decision-level and screening-level) are also provided in Appendix B of the HIR (LANL 2009, 105251).

Figures 4.1-1 to 4.1-31 include base maps, maps showing inorganic chemicals and radionuclides detected or detected above BVs/FVs and detected organic chemicals, and maps showing the proposed sampling locations for the TA-15 sites.

4.1.1 SWMU 15-002, Burn Pit

Site Description

SWMU 15-002 is described in the 1990 SWMU report as an inactive burn pit west of E-F Firing Site (LANL 1990, 007512, p. 88). The burn pit was surrounded on three sides by a 3-ft-high, 10-ft-diameter earthen berm (LANL 1993, 020946, p. 8-28). A recent review of engineering drawings and aerial photographs demonstrates that SWMU 15-002 actually consists of two former burn pits. The burn pit originally identified in the 1990 SWMU report is located south of building 15-0534 (Figure 4.1-1). The second burn pit is located east of former buildings 15-0001 and 15-0023. Together with SWMU 15-007(a), this SWMU comprises Consolidated Unit 15-002-00 (Table 1.1-1).

The originally identified pit is shown on a 1948 engineering drawing (ENG C-15208) and aerial photographs taken between 1946 and 1974 (LASL 1946, 015400; LASL 1948, 105275; LASL 1958, 015825; LASL 1974, 017204). The 1948 aerial photograph shows a bermed area surrounding the pit on three sides (north, west, and south). A small dirt road led to this bermed area. Aerial photographs taken in 1958 still show the bermed area; however, in the photograph the road appears not to have been used for some time and is overgrown with vegetation, indicating the burn site was no longer used (LASL 1958, 015825). Although former employees were not able to provide the exact location for this pit, they described this burn pit as sites used to burn oil/uranium mixtures and HE (DOE 1986, 036409, p. TA15-7).

Engineering drawings ENG-C 1481 and SK-1301 show a second burn pit east of former buildings 15-0001 and 15-0023 (LASL 1951, 105277; LASL 1951, 105278).

Previous Investigations

An aerial radiological survey conducted in 1982 by EG&G Energy Measurements detected no radionuclides at levels above background at the location of the originally identified burn pit south of building 15-0534 (LANL 1993, 020946, p. 8-28).

A Phase I RFI was conducted at the location of the burn pit south of building 15-0534 in 1995 and 1996. Phase I activities consisted of performing a radiological survey of the site and collecting a surface (0 to 0.5 ft bgs) and subsurface (1.5 to 2.0 ft bgs) sample at each of two locations from within the pit (LANL 1996, 054977, pp. 5-6–5-8). All four samples were analyzed for uranium, metals, and SVOCs, and the two subsurface samples were also analyzed for VOCs. All data collected during the Phase I RFI are screening-level data and are not presented in this work plan; however, the data showed isotopic thorium detected above BVs, inorganic chemicals above BVs, and detected VOCs. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251).

Proposed Activities

The extent of contamination has not been defined at this site. Fifteen samples will be collected from five locations at each former burn pit, one in the center of each pit and four step-out locations around each pit, to define nature and extent of contamination (Figure 4.1-2). The samples will be collected from three depths at each location (0 to 1.0 ft, 3.0 to 4.0 ft, and 6.0 to 7.0 ft bgs). Samples collected from SWMU 15-002 will be field screened for radioactivity, VOCs, and explosive compounds. If field-screening results indicate elevated levels in the deepest sample, sampling will continue until field-screening results show no elevated levels. Samples will be analyzed for VOCs, SVOCs, dioxins/furans, metals, cyanide, nitrate, perchlorate, explosives compounds, isotopic uranium, isotopic thorium, and total petroleum hydrocarbons (TPH). Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.2 SWMU 15-007(a), MDA N

Site Description

SWMU 15-007(a) is an inactive landfill known as Material Disposal Area (MDA) N. MDA N is located west of buildings 15-0563 and 15-0565 and east of R-Site Road (Figure 4.1-3). Together with SWMU 15-002, this SWMU comprises Consolidated Unit 15-002-00 (Table 1.1-1). MDA N is approximately 300 ft long × 30 ft wide (LASL 1974, 038450). MDA N was used for the disposal of debris from the demolition of buildings 15-0001 and 15-0007 between 1962 and 1965 (LANL 1993, 020946, p. 9-2). Building 15-0001 housed a laboratory and shop, and building 15-0007 housed a control room and darkroom. Hazardous materials known to be present in these buildings included thorium in building 15-0001 and mercury and photographic chemicals in building 15-0007. Based on a 1965 aerial photograph, MDA N was closed by 1965 (LASL 1965, 016374).

Previous Investigations

An aerial radiological survey of SWMU 15-007(a) was conducted in 1982. The survey identified no radiation above background at this site (LANL 1993, 020946, p. 9-2).

A Phase I RFI was conducted at SWMU 15-007(a) in 1995 and 1996. Sampling was preceded by a surface radiological survey and geophysical surveys (magnetometry, electromagnetic [EM], and resistivity) intended to define the boundaries of the landfill. One surface and two subsurface samples were collected from each of seven locations identified based on the results of the geophysical surveys (LANL 1996, 054977, pp. 5-11, 5-16). Twenty-two samples were collected from seven locations from depth intervals ranging from 0 to 0.5 to 50.0 to 56.0 ft bgs. Thirteen samples were analyzed for isotopic thorium, uranium, metals, VOCs, and SVOCs. Phase I RFI data were determined to be screening-level data and are not presented in this work plan. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251).

Based on a review of the 1951 TA-15 Structure Location Plan and engineering drawing ENG-R4470, MDA N was determined to be located east-southeast of former building 15-0023, not to the north as concluded from the previous geophysical survey (LASL 1951, 105389; LASL 1974, 038450). Therefore, the 1995 and 1996 RFI sampling for MDA N was conducted at the incorrect location, and the samples are not representative of this site.

Proposed Activities

SWMU 15-007(a) is proposed for remediation. Preliminary site activities will include a surface radiological survey and geophysical surveys (magnetometry, EM, and resistivity), followed by the excavation of test pits and trenches to locate and define the landfill boundaries. Remediation activities will involve waste characterization, waste and soil/fill excavation, segregation, containerization, transportation, off-site disposal, confirmation sampling, and backfilling and site restoration. The methodology to meet waste disposition requirements is described in Appendix B and will be further detailed in the investigation report. Proposed cleanup activities are summarized in section 5.8 of this work plan. Historical information and dimensions of similar landfills indicate the waste from the demolition of former buildings 15-0001 and 15-0007 is buried in a trench that is likely between 10 ft and 12 ft deep. Once located and characterized, all visible waste and stained soil and/or tuff will be removed from the landfill and the bottom and sides of the excavation and surveyed for radiation, explosive compounds, metals, and VOCs. Additional media will be excavated until field-screening results indicate no elevated levels.

Confirmation samples will be collected within and next to the excavation boundaries to confirm cleanup and to define the nature and extent of any residual contamination. Proposed sampling locations are shown in Figure 4.1-4. Eight samples will be collected from two depths (0 to 1.0 ft and 4.0 to 5.0 ft) at four locations beneath the bottom of the excavation. Twelve characterization samples will be collected from depths of 4.0 to 5.0 ft and 14.0 to 15.0 ft bgs (assuming a total landfill excavation depth of 12 ft bgs) at two step-out sampling locations on each side of the landfill excavation and one step-out sampling location at each end of the landfill excavation. Step-out sampling locations will be 6 ft from the edge of the landfill excavation. Samples will be analyzed for isotopic uranium, isotopic thorium, cyanide, nitrate, perchlorate, VOCs, SVOCs, explosive compounds, and metals; the final analytical suite will be confirmed and supplemented, if necessary, with waste characterization data. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.3 SWMU 15-003, PHERMEX Steel Firing Pad

Site Description

SWMU 15-003, a steel firing pad located within the PHERMEX firing site [SWMU 15-006(a)] (Figure 4.1-5), is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). Together with SWMU 15-006(a) (also deferred), this SWMU comprises Consolidated Unit 15-003-00. SWMU 15-003 consists of a 6-in.-thick steel pad approximately 12 ft wide × 24 ft long (LANL 1990, 007512, p. 68).

Although the SWMU 15-003 steel firing pad was originally intended for the treatment of hazardous explosive waste by OD and had been granted a RCRA interim status designation under hazardous waste regulations, the steel pad was never actually used to treat hazardous explosives waste. Additionally, the operating division determined that this unit was not needed for future waste-treatment activities. Therefore, in 1998, the Laboratory requested that this unit be withdrawn from the Laboratory's Part B application as an OD site, and NMED concurred (LANL 1998, 087452; DOE 1999, 063048; NMED 1999, 065076).

The steel pad was used for nontreatment-related experimental test shots (LANL 1998, 087452). The exact dates of use of the steel pad are not known; however, operations at the PHERMEX facility began in approximately 1961 (LANL 1993, 020946, p. 6-3).

Previous Investigations

Past environmental surveys at the PHERMEX firing site include an aerial radiological survey conducted in 1982 that identified elevated levels of uranium-238. A 1991 surface radiation survey identified elevated contact exposure rates believed to be associated with chunks of DU at the PHERMEX firing site (LANL 1993, 020946, p. 6-5). No RFI sampling has been conducted at SWMU 15-003.

Proposed Activities

Although SWMU 15-003 is deferred for investigation per Table IV-2 of the Consent Order, 10 samples will be collected from sediment catchments at five locations in the drainage downgradient of the site to determine if contaminants are migrating from the site (Figure 4.1-6). The samples will be collected from two depths (0 to 1.0 ft and 2.0 to 3.0 ft bgs) and analyzed for cyanide, nitrate, perchlorate, metals, explosive compounds, VOCs, SVOCs, isotopic uranium, isotopic plutonium, and gamma spectroscopy. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.4 SWMU 15-006(a), PHERMEX Firing Site

Site Description

SWMU 15-006(a), the PHERMEX firing site (Figure 4.1-5), is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). Together with SWMU 15-003 (also deferred), this SWMU comprises Consolidated Unit 15-003-00. The PHERMEX firing site consists of a firing chamber (structure 15-0184) and related equipment. The PHERMEX firing site and associated facilities were built in the early 1960s (LANL 1993, 020946, p. 2-3).

Previous Investigations

Past environmental surveys at the PHERMEX firing site include an aerial radiological survey conducted in 1982 that identified elevated levels of uranium-238. A 1991 surface radiation survey identified elevated contact exposure rates believed to be associated with chunks of DU at the PHERMEX firing site (LANL 1993, 020946, p. 6-5). No RFI sampling has been conducted at SWMU 15-006(a).

Proposed Activities

Stormwater runoff from SWMUs 15-003 and 15-006(a) flows to the same drainage; therefore, data from the 10 sediment samples to be collected for SWMU 15-003 will be used to determine if contaminants are migrating from SWMU 15-006(a) (see section 4.1.3).

4.1.5 SWMUs 15-004(b) and 15-004(c), Firing Sites A and B

Site Description

SWMU 15-004(b) is inactive Firing Site A located approximately 400 ft southeast of building 15-0183, and SWMU 15-004(c) is inactive Firing Site B located approximately 600 ft southeast of building 15-0183 (Figure 4.1-7). Both SWMUs comprise Consolidated Unit 15-004(b)-99 (Table 1.1-1). Firing Sites A and B are located approximately 100 ft apart. Firing site A was among the first firing sites to be used at the Laboratory and operated from 1945 to 1953. Aerial photographs taken in 1958 show that the areas of land cleared of vegetation and affected by explosives at these two firing sites were relatively small and located approximately 400 ft south of the bunker (former structure 15-0014) and control building (former building 15-0074) associated with Firing Sites A and B (LASL 1958, 015826). Both firing sites and associated structures were decommissioned and the ground surface was regraded in 1967. Before they were decommissioned, the bunker (former structure 15-0014) and the control building (former building 15-0074) were surveyed and were found to contain no detectable levels of HE or radionuclides (Buckland 1965, 005305; Courtright 1965, 005282).

Information is limited concerning the materials used in tests at Firing Sites A. Most of the experiments conducted at SWMU 15-004(b) involved small amounts of HE (i.e., up to 50 lb). Tests involving larger quantities of HE were conducted at Firing Site B, SWMU 15-004(c) (LANL 1995, 050294, p. 4-3). Other materials used as Firing Sites A and B include natural uranium, beryllium, lead, mercury, and HE. The amount of uranium used in any one test was a few kilograms (LANL 1993, 020946, p. 8-5).

Previous Investigations

Past environmental surveys at this site include an aerial radiological survey conducted in 1982 that identified background levels of radiation (LANL 1993, 020946, p. 8-5).

Because of their close proximity, SWMUs 15-004(b) and 15-004(c) were investigated as a combined area during the 1994/1995 Phase I RFI (LANL 1995, 050294, pp. 4-3–4-12). Four samples were collected from two depths (0 to 0.5 ft and 1.5 to 2.0 ft bgs) from two locations at SWMU 15-004(b), and four samples were collected from two depths (0 to 0.5 ft and 1.5 to 2.0 ft bgs) from two locations at SWMU 15-004(c); the samples were analyzed for uranium and metals. Based on the analytical results, the RFI report recommended that an expedited cleanup be implemented at SWMU 15-004(b) to remove lead contamination (LANL 1996, 054977, p. 4-12). The data collected during the 1994/1995 investigation activities are screening-level data and are not presented in this work plan; however, RFI activities and results were presented in the RFI report (LANL 1995, 050294, pp. 4-3–4-12). Screening-level data showed inorganic chemicals detected above BVs and cesium-137 and europium-152 detected or detected above the FVs.

A voluntary corrective action (VCA) was conducted at SWMU 15-004(b) in 1996 to determine the extent of lead contamination at the site and to remove soil with lead above the Laboratory-adopted lead preliminary remediation goal (PRG) of 1000 mg/kg (LANL 1996, 055046). A photograph discovered after the Operable Unit (OU) 1086 RFI work plan was submitted indicated the firing site was located farther west than the location described in the work plan (LANL 1993, 020946, p. 8-6). The VCA sampling locations were adjusted to reflect the revised location of the site. The VCA consisted of x-ray fluorescence (XRF) sampling to determine the extent of lead contamination and HE spot testing. Based upon these results and the Phase I RFI results, soil was removed until the lead concentrations met the 1000 mg/kg PRG. Five confirmation soil samples were collected and submitted for laboratory analysis of metals, HE and isotopic uranium; one sample also was analyzed for toxicity characteristic leaching procedure (TCLP) metals for waste characterization purposes (LANL 1996, 055046, p. 8). Confirmation samples collected following the 1996 VCA and the analyses requested are presented in Table 4.1-1.

Decision-level data from the VCA are presented in Table 4.1-2, which shows inorganic chemicals detected above BVs or having detection limits above BVs. Sampling locations and results for inorganic chemicals detected above BVs are shown in Figure 4.1-8.

Inorganic chemicals detected above BVs included barium, cadmium, cobalt, copper, lead, and zinc. Barium was detected above the maximum soil background concentration (410 mg/kg; LANL 1998, 059730) in two samples and above the soil BV but below the maximum soil background concentration in one sample. Cadmium was detected above the soil BV but below the maximum soil background concentration (2.6 mg/kg; LANL 1998, 059730) in two samples and above the maximum soil background concentration in one sample. Cobalt was detected above the soil BV but below the maximum soil background concentration (9.5 mg/kg; LANL 1998, 059730) in one sample. Copper was detected above the maximum soil background concentration (16 mg/kg; LANL 1998, 059730) in three samples, and lead was detected above the maximum soil background concentration (28 mg/kg; LANL 1998, 059730) in four samples. Zinc was detected above the soil BV but below the maximum soil background concentration

(75.5 mg/kg; LANL 1998, 059730) in two samples. Antimony, mercury, silver, and thallium were not detected above the soil BVs but had detection limits above BVs.

Review of historical aerial photographs during the preparation of the HIR and this work plan revealed that the locations of Firing Sites A and B [SWMUs 15-004(b) and 15-004(c)] are south of the areas investigated during the 1995 and 1996 RFIs and the 1996 VCA (LANL 2009, 105251). The RFI and VCA were conducted near the former control building (former building 15-0074) and former bunker (former structure 15-0014), approximately 400 ft north of the actual locations of the two former firing sites. Therefore, the results from samples collected during the 1995 and 1996 RFIs and 1996 VCA are not representative of the former firing site locations.

Proposed Activities

The nature and extent of contamination have not been defined at the two former firing sites or around the former control room and bunker. The sites of former Firing Sites A and B will be located in the field based on historical aerial photographs. A grid (100 ft × 100 ft grid points) will be established over the entire area around the former control building and bunker locations (north to the road, east across the road, and west past the fence) and south to include the two firing points and the area around the firing points to the mesa edge approximately 200 ft south of the firing points (Figure 4.1-9). Radiological, XRF, and D TECH HE surveys will be conducted at grid locations across the site. Samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at a minimum of 12 random locations across the site, at locations with elevated screening results, and from one location at each of the former firing sites. The samples will be analyzed for cyanide, nitrate, perchlorate, metals, explosive compounds, VOCs, SVOCs, isotopic uranium, gamma spectroscopy, and americium-241. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.6 SWMU 15-004(f), E-F Firing Site

Site Description

SWMU 15-004(f) is an inactive firing site, E-F Firing Site, that consists of three inactive firing points (D, E, and F) covering a total area of approximately 60 acres (Figure 4.1-10). Together with SWMU 15-008(a), SWMU 15-004(f) comprises Consolidated Unit 15-004(f)-99 (Table 1.1-1). E-F Firing Site began operating in 1946 and was last used in 1981. It was operated extensively from 1947 to 1973 and was the largest firing site at the Laboratory (LANL 1993, 020946, p. 7-3).

Originally, E-F Firing Site consisted of a single firing point (D) that was built in 1946 and that ceased to operate in 1949 (LANL 1990, 007512, p. 69). In 1947, the firing area was expanded to include Firing Point E, which was used for large-scale shots containing up to 2500 lb of HE, and Firing Point F, which was used for smaller-scale shots. Firing Points E and F were approximately 800 ft apart and were wired to an underground control bunker (structure 15-0027). Tests at the two firing points were conducted on the ground and created depressions in the ground. After test shots, the firing points were either regraded or backfilled with gravel to fill in any depressions. Eventually, soil mounds were constructed on two sides of Firing Point E to protect TA-15 structures from shrapnel (LANL 1993, 020946, pp. 7-3–7-5).

Tests at E-F Firing Site involved HE, uranium, beryllium, lead, and mercury (LANL 1993, 020946, p. 7-8).

Previous Investigations

The site was surveyed in 1982 by EG&G Energy Measurements with radiological detectors mounted in a helicopter as part of a survey of the entire Laboratory. Results of this effort identified elevated levels of radiation at the site (LANL 1993, 020946, p. 7-3).

A Phase I RFI was conducted at SWMU 15-004(f) in 1994 (LANL 1995, 050294, pp. 4-23–4-57). Surface samples (0 to 0.5 ft bgs) were collected from 85 locations from selected grid points and subsurface samples (1.5 to 2.0 ft bgs) were collected from a subset of 35 of the sampling locations. Samples were field screened for radioactivity, metals, and HE. Based on the field-screening results, 43 surface samples and 17 subsurface samples collected from 53 locations were submitted for analysis of radionuclides and metals (LANL 1995, 050294, pp. 4-23–4-57). Samples collected during the 1994 RFI with decision-level data and the analyses requested are presented in Table 4.1-1. Figure 4.1-10 shows all previous RFI sampling locations.

In 1999, the former ER Project submitted to NMED a plan for a technology feasibility demonstration project at SWMU 15-004(f) (LANL 1999, 063100). An environmental pilot treatment study was conducted in 2001 at E-F Firing Site. The process was designed to selectively remove uranium by precipitation. The soil was sluiced to separate large uranium aggregates, heaped into containers, and leached with a sodium bicarbonate solution. The soil was then placed on a drying tray, and the leachate was pumped into a settling tank, where its pH was adjusted to 6.5 using phosphoric acid, followed by passage through a container of apatite mineral (DOE 2001, 070068, p. 6). Although the pilot treatment study was implemented, a report was never produced.

Decision-level data from the RFI are presented in Tables 4.1-2 and 4.1-4, which show inorganic chemicals detected above BVs or having detection limits above BVs and radionuclides detected or detected above BVs/FVs, respectively. Sampling locations and the results for inorganic chemicals detected above BVs and radionuclides detected or detected above BVs/FVs are shown in blue on Plates 2 and 3, respectively. Sampling locations with screening-level data are also provided on both plates in green font to help determine proposed sampling locations.

Inorganic chemicals detected above soil BVs included aluminum, barium, beryllium, cadmium, calcium, copper, lead, mercury, nickel, potassium, silver, sodium, uranium, and zinc. Aluminum was detected above the BV but below the maximum soil background concentration (61,500 mg/kg; LANL 1998, 059730) in one sample. Barium was detected above the maximum soil background concentration (410 mg/kg) in two samples and above the soil BV but below the maximum background concentration in two samples. Beryllium was detected above the soil BV but below the maximum background concentration (3.95 mg/kg; LANL 1998, 059730) in one sample. Cadmium was detected above the soil BV but below the maximum background concentration (2.6 mg/kg) in three samples and above the maximum soil background concentration in one sample. Calcium was detected above the soil BV, but below the maximum background concentration (14,000 mg/kg; LANL 1998, 059730) in one sample. Copper was detected above the maximum soil background concentration (16 mg/kg) in eight samples and above the soil BV but below the maximum background concentration in one sample. Lead was detected above the maximum soil background concentration (28 mg/kg) in four samples and above the soil BV but below the maximum background concentration in two samples. Mercury was detected above the soil BV in nine samples. Nickel was detected above the maximum soil background concentration (29 mg/kg; LANL 1998, 059730) in one sample. Potassium was detected above the soil BV but below the maximum background concentration (6850 mg/kg; LANL 1998, 059730) in one sample. Sodium was detected above the soil BV but below the maximum background concentration (1800 mg/kg; LANL 1998, 059730) in four samples. Silver was detected above the soil BV in one sample. Uranium was detected above the maximum soil background concentration (3.6 mg/kg; LANL 1998, 059730) in 18 samples and above the soil BV but below the maximum background concentration in one sample. Zinc was detected above the soil BV but below the maximum background concentration (75.5 mg/kg) in one sample and above the maximum soil background concentration in one sample. Antimony, cobalt, and thallium were not detected above BVs but had detection limits above soil BVs. Cesium-137 was detected in two samples collected at a depth of 1.5 to 2.0 ft bgs. Europium-152 was detected in two surface samples; there is no BV/FV for this radionuclide.

Proposed Activities

SWMU 15-004(f) will be characterized to support corrective actions design to recover DU and determine if residual contamination poses an unacceptable risk based on industrial land use. Decision-level data from the 1994 RFI are presented in Tables 4.1-2 and 4.1-4, and screening-level data from the 1994 RFI are presented in Tables 4.1-5, 4.1-6, and 4.1-7. Sampling locations and the results for the combined RFI data set are shown on Plate 2 (inorganic chemicals detected above BVs) and Plate 3 (radionuclides detected or detected above BVs/FVs), respectively. Tetryl was the only organic chemical detected at two sampling locations (15-02239 and 15-02243) (Table 4.1-6); therefore, a figure showing these VOC screening-level data was not prepared. In addition, sampling locations 15-02239 and 15-02243 are associated with the northern the SWMU 15-008(a) debris mound, which will be remediated (see section 4.1.7).

The 1994 RFI grid sampling locations will be reestablished across the site (Plate 4). Forty-two samples will be collected from one depth (3 to 4 ft bgs) at 42 RFI sampling locations with screening-level and decision-level data showing inorganic chemicals detected above soil BVs and/or radionuclides detected or detected above BVs/FVs (Plates 2 and 3). Characterization samples will be analyzed for metals, explosive compounds, and isotopic uranium. These 42 RFI sampling locations are listed in Table 4.1-8.

XRF surveys (for barium, copper, lead and uranium), D TECH HE screening, and radiological surveys (using a Field Instrument for Detecting Low Energy Radiation [FIDLER], or equivalent, instrument) will be conducted at the 51 RFI grid sampling locations where no inorganic chemicals were detected above BVs and/or no radionuclides were detected or detected above BVs/FVs (Plates 2 and 3) and at locations outside the RFI grid sampling locations to ensure all areas with elevated DU and metals are identified (LANL 1998, 058844.107, pp. 4-33-4-43). Samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at any of these 51 RFI grid sampling locations without data and locations outside the RFI sampling grid with elevated XRF screening, HE screening, and/or radiological survey results. The objective of the investigation at SWMU 15-004(f) is not to determine the nature and extent of contamination but rather to identify the areas and depths of soil requiring corrective action. Characterization samples will be analyzed for metals, explosive compounds, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

The two earthen mounds will be characterized to determine disposition requirements and if any portion of the soil could be spread over the site as a part of site restoration following future corrective actions. Fifty-four samples will be collected from three depths (0 to 1 ft, 6 to 7 ft, and 9 to 10 ft bgs) at a minimum of three locations on each side (two sides per mound) of the two mounds and at three locations on top of each mound (inset on Plate 4). The core will be field screened for metals and radioactivity to guide sample collection and borehole depth. RFI decision-level and screening-level data from sampling locations associated with the two earthen mounds (15-02290, 15-02244, 15-02248, 15-02246, 15-02247, 15-02291, 15-02249, and 15-02245) will be used to guide new sampling locations and support characterization of the soil. Characterization samples collected from the earthen mounds will be analyzed for metals, explosive compounds, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

Samples will be collected from the head of Portillo Canyon and from the drainage directly downgradient and south of SWMU 15-004(f) to determine if contaminants are migrating from the site. Ten samples will be collected from in sediment catchments at five locations in the drainage directly downgradient of the SWMU 15-004(f), and two samples will be collected from one sampling location at the head of Potrillo Canyon southwest of the site. Samples will be collected from two depths (0 to 1.0 ft and 2.0 to 3.0 ft bgs) (Plate 4). Data from samples to be collected in the drainage downgradient of SWMU 15-009(e) will address potential contaminant migration in the drainage west of SWMU 15-004(f) (Figure 4.1-21). Data from samples to be collected in the drainage downgradient of AOC 15-008(f) will address potential contaminant migration in the drainage east of SWMU 15-004(f) (Figure 4.1-17). South Canyons Reach (PO-1) is located directly downgradient of SWMU 15-004(f); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490) along with data collected from stormwater monitoring stations PT-SMA-0.5 and PT-SMA-1 (Plate 1). Drainage samples will be analyzed for cyanide, nitrate, perchlorate, metals, explosive compounds, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.7 SWMU 15-008(a), Two Surface Disposal Areas at E-F Firing Site

Site Description

SWMU 15-008(a) consists of two small surface disposal areas located on the edge of Potrillo Canyon directly south of E-F Firing Site [SWMU 15-004(f)] (Figure 4.1-11). Together with SWMU 15-004(f), SWMU 15-008(a) comprises Consolidated Unit 15-004(f)-99 (Table 1.1-1). The disposal areas are located within 200 ft of each other, with each disposal area having dimensions of approximately 8 ft in diameter × 2 ft high. Both areas were used to dispose of debris from tests conducted at the E-F Firing Site, including soil, rock, pebbles, metal fragments, plastic, electrical cable, electrical accessories. The exact period of operation of the surface disposal sites is not known but probably falls within the period of operation for E-F Firing Site (1946 to 1981) (LANL 1993, 020946, p. 7-20).

Previous Investigations

An aerial radiological survey conducted in 1982 identified no areas of elevated levels of radioactivity at SWMU 15-008(a) (LANL 1993, 020946, p. 7-3).

A Phase I RFI was conducted at SWMU 15-008(a) in 1994 (LANL 1995, 050294, pp. 4-23–4-57). Three surface samples (0 to 0.5 ft bgs) were collected from each of the two debris piles and four surface samples (0 to 0.5 ft bgs) were collected from nearby drainages. The samples were field screened for radioactivity, metals, and HE and submitted for laboratory analysis of radionuclides, metals, and uranium (LANL 1995, 050294, pp. 4-23–4-57). The samples collected in 1994 and the analyses requested are presented in Table 4.1-1.

Decision-level data from the RFI are presented in Table 4.1-2, which shows inorganic chemicals detected above BVs or having detection limits above BVs. Sampling locations and results for inorganic chemicals detected above BVs are shown in Figure 4.1-12.

Inorganic chemicals detected above soil BVs included barium, copper, lead, mercury, nickel, uranium, and zinc. Barium, copper, lead, mercury, nickel, uranium, and zinc were each detected above the maximum soil background concentration in one sample (410 mg/kg, 16 mg/kg, 28 mg/kg, 0.1 mg/kg, 29 mg/kg, 3.6 mg/kg and 75.5 mg/kg, respectively). Antimony and cadmium were not detected above BVs but had detection limits above soil BVs.

Proposed Activities

SWMU 15-008(a) is proposed for remediation. The debris piles will be characterized, containerized, and disposed of in accordance with applicable Laboratory waste management requirements. The methodology to meet waste disposition requirements is described in Appendix B and will be further detailed in the investigation report. Proposed cleanup activities are summarized in section 5.8 of this work plan. Following removal of the debris piles, the area beneath and directly adjacent to the debris piles will be surveyed for radiation, explosive compounds, metals, and VOCs. Additional media will be excavated until field-screening results indicate no elevated levels. A total of eight confirmation samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at two locations beneath each debris pile. In addition, a total of 16 samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at four step-out locations around each debris pile based on field-screening results (Figure 4.1-13). Samples will be analyzed for metals, cyanide, nitrate, perchlorate, VOCs, SVOCs, explosive compounds, PCBs, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites. Stormwater runoff from SWMUs 15-008(a) and 15-004(f) flow to the same drainage; therefore, sediment samples collected from the drainage downgradient of SWMU 15-004(f) will determine if any contaminants have migrated from SWMU 15-008(a) (see section 4.1.7 and Plate 4). South Canyons Reach (PO-1) is located directly downgradient of the site; therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713) along with data collected from stormwater monitoring station PT-SMA-1 (NMED 2007, 095490).

4.1.8 AOC 15-005(b), Storage Area

Site Description

AOC 15-005(b) is a former storage area located inside an HE make-up building (15-0242) (Figure 4.1-14). This area was used to store containers of waste HE. Experiments were assembled, approved adhesives were used during the assembly process, and solvents may have been used to clean some of the parts. The period of operation of this site and the quantities of wastes stored are not known (LANL 1993, 020946, p. 9-12).

Previous Investigations

During the Phase I RFI conducted at AOC 15-005(b) from June 1995 to March 1996, three surface samples (0 to 0.5 ft bgs) and two subsurface (1.5 to 2.0 ft bgs) samples were collected from two locations immediately outside building 15-0242 (LANL 1996, 054977, pp. 5-72–5-75). Samples were field screened for radioactivity, metals, and HE and submitted for analysis of uranium and metals (LANL 1996, 054977, pp. 5-72–5-75). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals detected above BVs.

Proposed Activities

The nature and extent of contamination have not been defined at this site. Eight samples will be collected from two depths (0 to 1.0 ft and 4.0 to 5.0 ft bgs) at four locations around building 15-0242 (Figure 4.1-15). Sampling locations will be outside of the soil that covers three sides and the roof of building 15-0242 and not on the asphalt driveway at the entrance to the building. Samples will be analyzed for metals, cyanide, nitrate, explosive compounds, perchlorate, VOCs, and SVOCs. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.9 AOC 15-006(e), Projectile Test Area, Duplicate of AOC C-36-006(e)

Site Description

AOC 15-006(e) is a duplicate of AOC C-36-006(e) (see section 4.2.11). AOC 15-006(e) will be proposed for no further action in the investigation report.

4.1.10 AOC 15-008(f), Sand Mounds at I-J Firing Site (TA-36)

Site Description

AOC 15-008(f) consists of several sand mounds located adjacent to the I-J Firing Site [SWMU 36-004(e)] (Figure 4.1-16). AOC 15-008(f) is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). The I-J Firing Site is located on a mesa overlooking Potrillo Canyon and was originally located in TA-15 when it was constructed in 1948, although it is now part of TA-36 (LANL 1993, 015313, pp. 5-39–5-40, 5-43).

Previous Investigations

Previous environmental investigations at AOC 15-008(f) include a surface radiological survey in 1991 that identified localized areas of elevated radiation levels (LANL 1993, 015313, pp. 5-43).

Elevated radiological readings were observed in surface soil samples collected along the surface water runoff pathways from I-J Firing Site and from the AOC 15-008(f) sand mounds during remediation of a septic tank [SWMU 36-003(b)] at the I-J Firing Site (LANL 1997, 062453, p. 1). No RFI sampling has been conducted at this site.

Proposed Activities

Although AOC 15-008(f) is deferred for investigation per Table IV-2 of the Consent Order, 10 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) from five locations within sediment catchments in the drainage downgradient of the western sand mounds, and 10 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) from five locations within sediment catchments in the drainage downgradient eastern sand mounds to determine if contaminants are migrating from the site (Figure 4.1-17). Note that the proposed sampling locations shown in this figure will also address potential migration from AOCs 36-004(e) and C-36-006(e). Samples will be analyzed for cyanide, nitrate, perchlorate, metals, explosive compounds, VOCs, SVOC, isotopic uranium, isotopic plutonium, and gamma spectroscopy. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.11 SWMU 15-009(e), Septic Tank

Site Description

SWMU 15-009(e) is a decommissioned 1500-gal. septic tank (structure 15-0072) at E-F Firing Site [SWMU 15-004(f)] (Figure 4.1-18). The septic tank was constructed in 1947 and received sanitary waste from the E-F Firing Site control building (15-0027), located approximately 175 ft northeast of the tank; the drainline goes around structure 15-0463, which is a transportable used for storage. The septic tank is constructed of 4- to 6-in. reinforced concrete and is 5 ft long × 9 ft deep × 7 ft wide (LANL 1993, 020946, pp. 7-21, 10-20). The septic tank was used until 1981 when E-F Firing Site last operated. Discharges from the septic tank flowed through a vitrified clay pipe to an outfall located approximately 30 ft from the tank at the edge of Potrillo Canyon (LANL 1997, 074091, p. 1).

Previous Investigations

A Phase I RFI was conducted at SWMU 15-009(e) in 1994 to characterize the contents of the septic tank (structure 15-0072) (LANL 1995, 050294, pp. 4-23–4-57). Two samples of liquid were collected from the tank and submitted for analysis of radionuclides, metals, VOCs, and SVOCs. Based on the results of the Phase I RFI, which showed inorganic chemicals detected above BVs, a VCA was recommended for SWMU 15-009(e) (LANL 1995, 050294, pp. 4-23–4-57).

A VCA was conducted at SWMU 15-009(e) in 1997 to remove the contents of the tank and to determine the nature and extent of contamination. The interior of the septic tank was pressure-washed, concrete-chip samples were collected from the interior of the tank to demonstrate the adequacy of the corrective action, and a rinsate sample was collected for waste characterization purposes (LANL 1997, 074091, p. 15). Twelve soil samples were collected from beneath the inlet and outlet drainlines, next to and below the septic tank, and from the drainage channel and outfall area (LANL 1997, 074091, pp. 1–3). The samples were submitted for analysis of HE and metals, and a subset of the samples was analyzed for VOCs and SVOCs. The tank and drainlines were filled and plugged with expandable concrete and left in place. The samples collected for the 1997 VCA and the analyses requested are presented in Table 4.1-1.

Decision-level data from the VCA are presented in Tables 4.1-2 and 4.1-3, which show inorganic chemicals detected above BVs or with detection limits above BVs and detected organic chemicals. Sampling locations and results for inorganic chemicals detected above BVs and detected organic chemicals are shown in Figures 4.1-19 and 4.1-20, respectively.

Inorganic chemicals detected above soil BVs included antimony, cadmium, calcium, copper, lead, silver, and uranium. Antimony was detected above the maximum soil background concentration (1 mg/kg; LANL 1998, 059730) in two samples. Cadmium was detected above the soil BV but below the maximum soil background concentration (2.6 mg/kg) in one sample. Calcium was detected above the soil BV but below the maximum soil background concentration (14,000 mg/kg) in one sample. Copper was detected above the soil BV but just below the maximum soil background concentration (16 mg/kg) in one sample. Lead was detected above the maximum soil background concentration (28 mg/kg) in one sample. Silver was detected above the soil BV in two samples. Uranium was detected above the maximum soil background concentration (3.6 mg/kg) in one sample and above the soil BV but below the maximum background concentration in two samples. Acetone and benzo(b)fluoranthene were detected in two samples.

Proposed Activities

The vertical and lateral extent of contamination have not been determined for SWMU 15-009(e). Since the septic tank contents were removed and the tank pressure-washed and filled with expandable concrete, it will be left in place. Six samples will be collected from two depths (0 to 1 ft and 3 to 4 ft below structures) from three locations: next to the tank inlet, next to the tank outlet, and on the east side of the tank. Four samples will be collected from two depths (0 to 1 ft and 3 to 4 ft beneath the drainline) at two locations along the inlet drainline. Six samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) in sediment catchments at three locations at the outfall and in the drainage below the outfall (Figure 4.1-21). Samples will be analyzed for metals, VOCs, SVOCs, isotopic uranium, explosive compounds, perchlorate, cyanide, and nitrate. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.12 SWMU 15-010(a), Septic Tank

Site Description

SWMU 15-010(a) is a decommissioned septic tank (structure 15-0080) located east of former buildings 15-0001 and 15-0023 at R-Site (Figure 4.1-22). The septic tank is constructed of reinforced concrete and measures approximately 8 ft long × 5 ft wide × 3 ft wide with a 900-gal. capacity (LANL 1996, 054977, p. 5-79). The septic tank was constructed in 1944 and was connected to a laboratory and shop (former building 15-0001) that were removed in 1962. The septic tank was later connected to relocated laboratory storage building 15-0023 (LANL 1996, 054977, p. 5-79). A 1965 memorandum (Michel 1965, 005292) states the septic tank was reactivated after 1961 to provide sanitary facilities to former building 15-0007, which housed a photography laboratory (AOC C-15-006). Engineering records show that building 15-0007 was destroyed in 1962, and no engineering drawings document the connection of the septic tank to building 15-0007 (LANL 1983, 094948). The septic tank was surveyed in 1965 and found to be free of HE and radioactivity (LANL 1996, 054977, p. 5-84). The septic tank was filled with sand and left in place (LANL 1996, 054977, p. 5-84).

Previous Investigations

A Phase I RFI was conducted at SWMU 15-010(a) from June 1995 to March 1996 (LANL 1996, 054977, pp. 5-82–5-84). Originally, the RFI was to have included soil sampling at the location of the SWMU 15-010(a) septic tank. However, because the septic tank was found to be in place, the RFI was modified to characterize the contents of the septic tank. The top of the tank was damaged, and the tank had been backfilled with sand. Two sand samples were collected from two depths at one location within the septic tank. The samples were field screened for radioactivity, inorganic chemicals, and HE and submitted for analysis of radionuclides, inorganic chemicals, organic chemicals, and HE (LANL 1996, 054977, pp. 5-79–5-80). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals detected above BVs.

Due to mercury concentrations detected in the sand samples, the Phase I RFI report recommended Phase II sampling to better characterize SWMU 15-010(a), and Phase II sampling was conducted in 1997. Four tuff samples were collected from four subsurface locations: three samples at depth intervals of 8.0 to 8.5 ft, 8.5 to 9.0 ft, and 9.0 to 9.5 ft bgs and one sample at a depth interval of 9.0 to 9.5 ft bgs (LANL 1997, 058499, pp. 17–20). Samples were submitted for analysis of HE, metals and SVOCs. Samples collected during the 1997 Phase II RFI and the analyses requested are presented in Table 4.1-1.

Decision-level data from the Phase II RFI are presented in Tables 4.1-2 and 4.1-3, which show inorganic chemicals detected above BVs or having detection limits above BVs and detected organic chemicals. Sampling locations and results for inorganic chemicals detected above BVs and detected organic chemicals are shown in Figures 4.1-23 and 4.1-24, respectively.

Inorganic chemicals detected above Qbt 2 BVs included barium, calcium, chromium, cobalt, copper, lead, mercury, silver, uranium, and vanadium. Barium, copper, and lead were detected above the maximum Qbt 2 background concentrations (51.6 mg/kg, 6.2 mg/kg, and 15.5 mg/kg, respectively; LANL 1998, 059730) in four samples. Calcium was detected above the maximum Qbt 2 background concentration (2230 mg/kg; LANL 1998, 059730) in three samples. Chromium was detected above the maximum Qbt 2 background concentration (13 mg/kg; LANL 1998, 059730) in one sample and above the Qbt 2 BV but below the maximum background concentration in three samples. Cobalt was detected above the Qbt 2

BV in four samples. Mercury was detected above the Qbt 2 BV in four samples. Silver was detected above the Qbt 2 BV in two samples. Uranium was detected above the Qbt 2 BV but below the maximum background concentration (5 mg/kg; LANL 1998, 059730) in four samples. Vanadium was detected above the Qbt 2 BV but below the maximum background concentration (21 mg/kg; LANL 1998, 059730) in one sample. Antimony and selenium were not detected above Qbt 2 BVs but had detection limits above BVs. Bis(2-ethylhexyl)phthalate and di-n-butylphthalate were each detected in four tuff samples. HE was not detected.

Proposed Activities

SWMU 15-010(a) is proposed for remediation. Although the septic tank contents have been removed, the tank was not pressure-washed and was filled only with sand. Therefore, the septic tank (including the sand in the tank) will be excavated, characterized, removed, and disposed of in accordance with applicable Laboratory waste management requirements. The inlet and outlet drainlines will be plugged. The methodology to meet waste disposition requirements is described in Appendix B and will be further detailed in the investigation report. Proposed cleanup activities are summarized in section 5.8 of this work plan. Following removal of the septic tank, the excavation will be surveyed for radiation, explosive compounds, metals, and VOCs. Additional media will be excavated until field-screening results indicate no elevated levels. Six confirmation samples will be collected from two depths (0 to 1 ft and 3 to 4 ft below the structures) from three locations: beneath the tank inlet, within the tank excavation, and beneath the tank outlet. Four samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) beneath the drainline at two locations along the inlet drainline from former building 15-0001, and two samples will be collected from two depths (0 to 1 ft and 3 to 4 ft) beneath the drainline at one location along the inlet drainline from former building 15-0023. Eight samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at four locations in the outfall area (Figure 4.1-25). Samples will be analyzed for metals, VOCs, SVOCs, isotopic uranium, explosive compounds, perchlorate, cyanide, and nitrate. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.13 AOC C-15-004, Former Transformer Station

Site Description

AOC C-15-004, a former transformer station (former structure 15-0056), was located approximately 30 ft southwest of the former E-F Firing Site control room (building 15-0027) (Figure 4.1-26). Two transformers (18-gal. and 30-gal. capacity) were located on a 5-ft-long wooden platform 10 ft above the ground (LANL 1993, 020946, p. 7-21). Each transformer contained mineral oil with polychlorinated biphenyls (PCBs) of unknown concentration. The date of installation is also not known, but the transformers were removed from the site in 1989 (Francis 1992, 057736, p. 2). No evidence was found of a release on the wooden platform or on the soil beneath the platform (LANL 1993, 020946, p. 7-21).

Previous Investigations

A Phase I RFI was conducted in 1994 at AOC C-15-004 (LANL 1995, 050294, p. 4-25). A surface sample (0 to 0.5 ft bgs) was collected from two locations beneath the former transformer platform. The samples were field screened for radioactivity and submitted for analysis of PCBs (LANL 1995, 050294, p. 4-25). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1994, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed that PCBs were not detected in the RFI samples.

Proposed Activities

Four samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at two locations beneath the former location of the transformer platform to confirm that there is no residual PCB contamination at the site (Figure 4.1-27). All four samples will be analyzed for PCBs ~~only~~. These samples will also be analyzed for metals and isotopic uranium to determine if the site was impacted by the E-F Firing Site. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.14 AOC C-15-005, Potential Soil Contamination from Former Building

Site Description

AOC C-15-005 is an area of potential soil contamination associated with the footprint of a former laboratory and shop (former building 15-0001) (Figure 4.1-28). Former building 15-0001 was constructed in 1944 to support experiments performed at Firing Sites C and D (LANL 1993, 020946, p. 9-2). Engineering records document that building 15-0001 was destroyed by burning in 1962 (LANL 2009, 105251). The remaining debris from the demolition of building 15-0001 was disposed of at MDA N in 1962 [SWMU 15-007(a)] (LANL 1993, 020946, p. 9-2). Information about the use of materials in this building is limited, but thorium contamination was discovered in the building and cleaned up (LANL 1993, 020946, p. 9-2).

Previous Investigations

During the Phase I RFI conducted at AOC C-15-005 from June 1995 to March 1996, four soil samples were collected from two depths (0 to 0.5 ft and 1.5 to 2.0 ft bgs) at two locations within the building footprint. The samples were field screened for radioactivity, VOCs, and HE. One surface sample and both subsurface samples were submitted for analysis of inorganic chemicals, VOCs, SVOCs, isotopic thorium, and uranium (LANL 1996, 054977, pp. 5-16–5-18). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals detected above BVs, detected VOCs, and isotopic thorium detected or detected above BVs.

Proposed Activities

The extent of contamination has not been defined for AOC C-15-005. Twelve samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at six locations within and next to the footprint of former building 15-0001 and analyzed for cyanide, nitrate, perchlorate, VOCs, SVOCs, metals, explosive compounds, isotopic uranium, and isotopic thorium (Figure 4.1-29). Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.1.15 AOC C-15-006, Potential Soil Contamination from Former Building

Site Description

AOC C-15-006 is an area of potential soil contamination associated with the footprint of a former control building and darkroom (former building 15-0007) (Figure 4.1-30). Former building 15-0007 was constructed in 1944 to support activities performed at Firing Sites C and D (LANL 1993, 020946, p. 9-2). Engineering records document that building 15-0007 was destroyed by burning in 1962 (LANL 1993, 020946, p. 9-2). Debris from the demolition of building 15-0007 was disposed of at MDA N in 1962

[SWMU 15-007(a)] (LANL 1993, 020946, p. 9-2). Information about the use of materials in this building is limited, but mercury and darkroom chemicals were used (LANL 1993, 020946, p. 9-2).

Previous Investigations

A Phase I RFI was conducted at AOC C-15-006 from June 1995 to March 1996 (LANL 1996, 054977, pp. 5-20–5-22). Two soil samples were collected from two depths (0 to 0.5 ft and 1.5 to 2.0 ft bgs) at one location within the footprint of building 15-0007. The samples were field screened for radioactivity, inorganic chemicals, and HE. Only the surface sample was submitted for analysis for inorganic chemicals, SVOCs, isotopic thorium, and uranium (LANL 1996, 054977, pp. 5-20–5-22). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1995 and 1996, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed no inorganic chemicals detected above BVs, no detected VOCs, and no radionuclides detected above BVs.

Proposed Activities

The extent of contamination has not been defined for AOC C-15-006. Twelve samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at six locations within and adjacent to the footprint of former building 15-0007 and analyzed for cyanide, nitrate, perchlorate, VOCs, SVOCs, metals, HE, isotopic uranium, and isotopic thorium (Figure 4.1-31). Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.2 TA-36

TA-36, originally designated as Kappa Site, occupies approximately 3.7 mi^2 in the central-south-central portion of the Laboratory (Plate 1). TA-36 is bounded to the west and northwest by TA-15, to the east by TA-71 and White Rock, and to the south by TA-39 and TA-68. TA-68 and TA-71 are considered buffer areas and have not been used for Laboratory operations. Potrillo Canyon intersects TA-36, and Fence Canyon parallels the southern boundary of TA-36 (Plate 1). Sites to be investigated at TA-36 include a landfill, one septic system, one surface disposal site, a storage area, a former shot-containment-vessel location, a project test area, former burn pits, and an inactive firing site.

Samples collected at TA-36 during previous investigations and corrective actions and analyses requested are presented in Table 4.2-1. Decision-level data are presented in Tables 4.2-2, 4.2-3, and 4.2-4, for inorganic chemicals, organic chemicals, and radionuclides, respectively. All laboratory analytical data are also provided in Appendix B of the HIR (LANL 2009, 105251). Figures 4.2-1 to 4.2-28 include base maps; maps showing inorganic chemicals and radionuclides detected or detected above BVs/FVs and detected organic chemicals; and maps showing the proposed sampling locations for TA-36 sites.

4.2.1 SWMU 36-001, MDA AA

Site Description

SWMU 36-001, an inactive landfill known as MDA AA, is located approximately 300 ft southwest of control bunker (building 36-0120) and 150 ft southwest of the x-ray device (structure 36-0086) (Figure 4.2-1). MDA AA reportedly consists of two disposal trenches containing burned debris from test shots conducted at the Lower Slobbovia Firing Site (LANL 1993, 015313, p. 5-1). The debris consisted of wood and sand contaminated with barium, uranium, other inorganic chemicals, plastics, and HE (LANL 1989, 105232). The dimensions of the north trench are 80 ft × 40 ft × 8 ft to 13 ft deep, and the dimensions of the south trench are 120 ft × 20 ft to 30 ft × 3 ft to 12 ft deep (LANL 1996, 054733, p. 5-3). The debris was transported by truck from the Lower Slobbovia Firing Site, placed in the trenches, and burned. Once a trench was filled, it was covered with approximately 4 ft of soil. The trenches were excavated in the mid-1960s, and the site was closed in 1989 (LANL 1993, 015313, pp. 5-1–5-9).

Previous Investigations

A Phase I RFI was conducted at SWMU 36-001 from 1993 to 1996 (LANL 1996, 054733, pp. 5-1–5-9). Initial RFI activities consisted of geophysical surveys using EM, magnetometer/gradiometer, and ground-penetrating radar (GPR) techniques to define the trenches. Geophysical survey results showed the presence of buried debris but did not delineate the boundaries of discrete disposal trenches. As a result, an exploratory drilling program was conducted to define the extent of buried materials. Approximately 88 boreholes were drilled and ash and/or debris were found at 21 borehole locations, which helped delineate the two disposal trenches. Once the trenches had been delineated, samples were collected from borehole locations with elevated field-screening results. Five boreholes were advanced into the north trench, and four boreholes were advanced into the south trench. Samples were collected at three depth intervals in each borehole. Two of the depth intervals were in the ash/debris zone, and one was approximately 2 ft below the bottom of each trench. In addition, samples of fill/cover material were collected at three of the borehole locations, field screened for VOCs, radioactivity, and HE, and submitted for analysis of inorganic chemicals, isotopic uranium, VOCs, SVOCs, and HE (LANL 1996, 054733, pp. 5-1–5-9). The data collected from seven of the nine sampling locations during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected during the Phase I RFI, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). In addition to the Phase I activities, interim action activities were conducted in 1996 to implement erosion-control measures around SWMU 36-001 (LANL 1996, 054449, pp. 1–7). During the interim action, erosion gullies were stabilized near SWMU 36-001 to prevent encroachment onto the site and erosion of the soil cover over the trenches. The samples collected during the Phase I RFI having decision-level data and the analyses requested are presented in Table 4.2-1.

Decision-level data from the two RFI sampling locations (36-03127 and 36-03131) are presented in Tables 4.2-2, 4.2-3, and 4.2-4, which show inorganic chemicals detected above BVs or having detection limits above BV, detected organic chemicals, and radionuclides detected or detected above BVs/FVs, respectively. Sampling locations and results for inorganic chemicals detected above BVs, detected organic chemicals, and radionuclides detected or detected above BVs/FVs are shown in Figures 4.2-2, 4.2-3, and 4.2-4, respectively.

Inorganic chemicals detected above soil BVs are copper, thallium and zinc. Copper and zinc were each detected above the maximum soil background concentration (16 mg/kg and 75.5 mg/kg, respectively) in one sample. Thallium was detected above the soil BV but below the maximum soil background concentration (1.0 mg/kg) in one sample. Antimony and cadmium were not detected above soil BVs but had detection limits above BVs. Acetone was detected in one soil sample and methylene chloride was detected in two samples. Uranium-238 was detected above the soil BV in one sample.

Proposed Activities

SWMU 36-001 is proposed for remediation. Preliminary site activities will include a surface radiological survey and geophysical surveys (magnetometry, EM, and resistivity), followed by the excavation of test pits and trenches to locate and define the landfill boundaries. Remediation activities will involve waste characterization, waste and soil/fill excavation and removal, segregation, containerization, transportation, off-site disposal, confirmation sampling, and backfilling and site restoration. The methodology to meet waste disposition requirements is described in Appendix B and will be detailed further in the investigation report. Proposed cleanup activities are summarized in section 5.8 of this work plan. Historical information and photographs indicate that the north trench is approximately 13 ft deep and the south trench is approximately 12 ft deep, and both contain primarily potentially contaminated wood and sand from firing-site operations. Once located and characterized, all visible waste and stained soil and/or tuff will be removed from the landfill and the bottom and sides of the excavation surveyed for radiation, explosive compounds, metals, and VOCs. Additional media will be excavated until field-screening results indicate no elevated levels.

Confirmation samples will be collected within and next to the excavation to confirm cleanup and the nature and extent of any residual contamination. Proposed sampling locations are shown in Figure 4.2-5. Eighteen samples will be collected from two depths (0 to 1.0 ft and 4.0 to 5.0 ft) at 9 locations beneath the bottom of the excavation. A total of 16 characterization samples will be collected from two depths (4.0 to 5.0 ft and 15.0 to 16.0 ft bgs), assuming a total landfill excavation depth of 13 ft bgs, at two step-out sampling locations on each side of the landfill excavation. Step-out sampling locations will be 6 ft from the edge of the landfill excavation. Samples will be analyzed for isotopic uranium, isotopic thorium, cyanide, nitrate, perchlorate, VOCs, SVOCs, explosive compounds, metals, and dioxins/furans. The final analytical suite will be confirmed and supplemented, if necessary, with waste characterization data. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites. South Canyons Reach PO-3 is located directly downgradient of the site (Plate 1); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.2 SWMU 36-003(b), Septic System, I-J Firing Site

Site Description

SWMU 36-003(b) is a decommissioned septic system located at the west end of TA-36 (Figure 4.2-6). The septic system consists of a septic tank (structure 36-0061) and its associated drainlines and outfall. The septic tank sits near the edge of Mesita del Potrillo, approximately 100 ft southwest of building 36-0055, the control bunker for the I-J Firing Site (LANL 1993, 015313, p. 5-24). The control bunker housed the electronics and instrumentation used in the operation of the I-J Firing Site [SWMU 36-004(e)] and also contained a toilet, sink, and water fountain, all of which were connected to the septic tank via a 4-in.-diameter clay-tile pipe (LASL 1949, 105276). The septic tank is constructed of reinforced concrete and measures 7 ft long × 3.5 ft wide × 5.73 ft deep with a capacity of 420 gal. The tank has a buried overflow pipe that formerly discharged near the north rim of Potrillo Canyon. The overflow pipe was capped in 1989 to stop its discharge into the canyon. After the overflow pipe was capped, the septic tank continued to be used (LANL 1993, 015313, p. 5-24). Until the early 1990s when the tank was taken out of service, the tank contents were periodically removed and taken to a sanitary wastewater treatment plant for treatment and disposal after the overflow pipe had been capped (LANL 1993, 015313, p. 5-24).

Previous Investigations

The contents of the tank were sampled in 1981 and the analytical data confirmed HE was not present (LANL 1993, 015313, p. 5-27).

A Phase I RFI was conducted at SWMU 36-003(b) in 1994 (LANL 1995, 053985, pp. 5-4–5-12). Two samples of the liquid were collected from one location within the tank, and four sludge samples were collected from three locations within the tank. In addition, five surface soil samples were collected from four locations in the drainage channel downstream of the outfall. The samples were field screened for VOCs, radioactivity, and HE and submitted for analysis for inorganic chemicals, uranium, HE, VOCs, and

SVOCs (LANL 1995, 053985, p. 1-15). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1994, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed detected inorganic chemicals above BVs and detected HE.

The 1996 VCA implemented at SWMU 36-003(b) included removing the septic tank contents, pressure washing the tank, and filling the tank with expanding cement. The tank contents were disposed of as low-level radioactive waste (LLW) at Area G at TA-54 and at the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF). No confirmation samples were collected (LANL 1996, 055072, pp. 1–4).

Proposed Activities

The extent of contamination has not been determined for SWMU 36-003(b). Since the septic tank contents were removed and the tank pressure-washed and filled with expandable concrete, it will be left in place. Six samples will be collected from two depths (0 to 1 ft and 3 to 4 ft below the structures) from three locations: next to the tank inlet, next to the tank outlet, and on the south side of the septic tank. Four samples will be collected from two depths (0 to 1 ft and 3 to 4 ft beneath the drainline) at two locations along the inlet drainline; one of these sampling locations will be adjacent to the drainline connection to building 36-0055. Six samples will be collected from two depths (0 to 1 ft and 3 to 4 ft bgs) at three locations at the outfall and below the outfall. Proposed sampling locations are shown in Figure 4.2-7. Samples will be analyzed for metals, VOCs, SVOCs, isotopic uranium, explosive compounds, perchlorate, cyanide, and nitrate. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.2.3 AOC 36-004(a), Eenie Firing Site

Site Description

AOC 36-004(a) is the Eenie Firing Site located on Mesita del Potrillo on the rim of Potrillo Canyon (Figure 4.2-8). AOC 36-004(a) is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). Together with SWMU 36-006, AOC 36-004(a) comprises Consolidated Unit 36-006-99 (Table 1.1-1). AOC 36-004(a) consists of the impact area, a control bunker (building 36-0003), and a make-up building (36-0004) that contains a storage area. Construction of the Eenie Firing Site began in 1949 and was completed in 1951 (LANL 1992, 014987, p. 5-7). Materials used in experimental shots include lead oxide, mercury, copper, nickel, brass, DU, and nitroglycerine. Other activities conducted at the site include shoulder-mounted projectiles fired into targets in the southern portion of the firing site (Kelkar 1992, 012470).

Previous Investigations

No previous investigations have been conducted at AOC 36-004(a).

Proposed Activities

Although AOC 36-004(a) is deferred for investigation per Table IV-2 of the Consent Order, samples will be collected from drainages downgradient of the site to determine if contaminants are migrating from the site. Most of the downgradient drainage sampling locations will be addressed by the investigation and remediation of the SWMU 36-006 surface disposal site, located directly downgradient of AOC 36-004(a) (section 4.2.4). Two additional samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at one location in the drainage northwest and downgradient of the site (Figure 4.2-9). The samples will be analyzed for cyanide, nitrate, perchlorate, metals, explosive compounds, isotopic uranium, and gamma spectroscopy. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.2.4 SWMU 36-006, Surface Disposal Site

Site Description

SWMU 36-006 consists of an inactive surface disposal area located on the southern slope of Potrillo Canyon, approximately 100 ft north of the Eenie Firing Site [AOC 36-004(a)] (Figure 4.2-10). Together with AOC 36-004(a), SWMU 36-006 comprises Consolidated Unit 36-006-99 (Table 1.1-1).
SWMU 36-006 was used to dispose of cables, metal, concrete, and other similar debris from the TA-36 firing sites (LANL 1993, 015313, p. 5-63). The majority of the debris covers an approximately 75-ft-wide area that extends approximately 100 ft down the south canyon slope. The remainder of the debris is scattered laterally 300 ft along the south canyon slope. This debris was dumped into the canyon from trucks. SWMU 36-006 was used from 1955 to 1970. Although the TA-36 firing sites are still active, SWMU 36-006 is no longer used as a surface disposal area (LANL 1996, 054733, p. 5-36).

Previous Investigations

A Phase I RFI was conducted at SWMU 36-006 during 1995 (LANL 1996, 054733, pp. 5-39–5-43). Surface (0 to 0.5 ft bgs) and subsurface samples (1.5 ft to 2.0 ft bgs) were collected from 19 locations around the disposal area and field screened for inorganic chemicals, radioactivity, VOCs, and HE to bias sampling locations. Most of the field screening showed background levels, although some elevated lead and uranium concentrations were noted. Based on these results, four locations were selected for sampling. Surface samples (0 to 0.33 ft bgs) were collected from a location upgradient of the debris area and in the first sediment catchments downgradient of the debris area. In addition, one surface sample (0 to 0.33 ft bgs) and one subsurface sample (1.33 to 1.5 ft bgs) were collected from each of two locations at the base of the debris area. All six samples were submitted for analysis for metals, HE, VOCs, and SVOCs (LANL 1996, 054733, pp. 5-39–5-43). Samples collected during the 1995 Phase I RFI and the analyses requested are presented in Table 4.2-1.

Decision-level data from the RFI are presented in Tables 4.2-2 and 4.2-3, which show inorganic chemicals detected above BVs or having detection limits above BVs and detected organic chemicals, respectively. Sampling locations and results for inorganic chemicals detected above BVs and detected organic chemicals are shown in Figures 4.2-11 and 4.2-12, respectively.

Inorganic chemicals detected above soil BVs are barium, cadmium, calcium, chromium, copper, lead, mercury, nickel, and zinc. Barium and cadmium were each detected above the soil BV but below the maximum soil background concentration (410 mg/kg, 2.6 mg/kg, respectively) in one sample. Chromium, mercury, nickel, and zinc were each detected above the maximum soil background concentration (36.5 mg/kg, 0.1 mg/kg, 29 mg/kg, and 75.5 mg/kg, respectively) in one sample. Copper and lead were each detected above the maximum soil background concentration (16 mg/kg and 28 mg/kg, respectively) in two samples. Calcium was detected above the BV in two samples and above the maximum background concentration (14,000 mg/kg) in the sample. Antimony, silver, and thallium were not detected above soil BVs but had detection limits above BVs. Methylene chloride was detected in one sample.

Proposed Activities

SWMU 36-006 is proposed for remediation. Remediation activities will involve waste characterization, removal, segregation, containerization, transportation, off-site disposal, confirmation sampling, and site restoration. The methodology to meet waste disposition requirements is described in Appendix B and will be further detailed in the investigation report. Proposed cleanup activities are summarized in section 5.8 of this work plan. The extent of the debris area will be confirmed, surveyed, and mapped. Waste, including cables, metal, concrete, and other similar debris, will be removed from the sides and bottom of Potrillo Canyon using hand tools and placed into bags and gunnysacks for removal from locations near the mesa top. Field technicians will use rappelling equipment to safely collect debris from the steeper portions of the debris field. Equipment similar to a skyline yarder may be brought to the site to haul the debris to the mesa top where it will be loaded into rolloff bins. The skyline yarder is a piece of equipment primarily used for logging operations that allows materials to be brought up steep slopes with the use of a motorized carriage attached to a skyline. A skyline yarder could be run from the top of a 40-ft mast near the firing site to an anchor at the bottom of the canyon where debris-filled bags can be placed in a cargo net attached to the carriage of the skyline yarder with a retractable cable, called a hayline. The carriage will bring the cargo net to the surface where the material will be dumped into rolloff bins. Once all visible waste along with any stained soil and/or tuff has been removed, the area will be surveyed for radiation, explosive compounds, metals, and VOCs. Additional media will be excavated until field-screening results indicate no elevated levels.

Twenty-two confirmation samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at six locations beneath the former debris pile and at five step-out locations around the debris pile (Figure 4.2-13). The samples will be analyzed samples for metals, cyanide, nitrate, perchlorate, VOCs, SVOCs, explosive compounds, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.2.5 AOC 36-004(b), Meenie Firing Site

Site Description

AOC 36-004(b) is the Meenie Firing Site located in a flat area at the head of Fence Canyon (Figure 4.2-14). AOC 36-004(b) is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). This firing site consists of the firing point, a control bunker (building 36-0006), and a magazine and make-up building (36-0005). Construction of the Meenie Firing Site began in 1949 and was completed in 1950 (LANL 1993, 020946, p. 5-37). The site has been extensively used for gun firing, with shots fired into a cliff north of the firing area and into an embankment south of the firing area. Shots fired at this site have involved up to 300 lb of HE, and at least one shot involved detonating 60 gal. of nitromethane in a sealed aluminum container. Lead bricks were often used as part of shots until 1971 and were sometimes pulverized during detonation (Stauffer 1992, 105416).

Previous Investigations

An RFI was conducted at AOC 36-004(b) in 1994 (ICF Kaiser Engineers 1996, 054713, pp. 107–119). Field activities included investigating off-site migration of potential contaminants via major drainage channels. Sediment catchment areas with substantial accumulations of fine particles were identified and eight samples were collected (ICF Kaiser Engineers 1996, 054713, pp. 107–119). Samples were analyzed for metals, radionuclides, VOCs, and SVOCs. Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1994, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals above BVs and sodium-22, cesium-137, europium-152, americium-241, cobalt-60, plutonium 238/239, and ruthenium-106 detected or detected above FVs.

Proposed Activities

Although AOC 36-004(b) is deferred for investigation per Table IV-2 of the Consent Order, 10 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at five locations in sediment catchments in the drainage downgradient of the site toward Fence Canyon to determine if contaminants are migrating from the site (Figure 4.2-15). The samples will be analyzed for cyanide, nitrate, perchlorate, VOCs, SVOCs, metals, explosive compounds, isotopic uranium, and gamma spectroscopy. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites. South Canyons Reach F-1 is located downgradient of AOC 36-004(b) (Plate 1); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.6 AOC 36-004(c), Minie Firing Site

Site Description

AOC 36-004(c) is the Minie Firing Site located near the head of Fence Canyon, approximately 800 ft southeast of the Meenie Firing Site [AOC 36-004(b)] (Figure 4.2-16). AOC 36-004(c) is an active RCRA-regulated OD site and is also used to conduct experiments involving explosives. This firing site consists of the firing point, a control bunker (building 36-0008), a make-up building (36-0007), a firing platform (no structure number), and an x-ray house (no structure number). Construction of the Minie Firing Site began in 1949 and was completed in 1950 (LANL 1993, 020946, p. 5-37). The site has been extensively used to conduct armor-piercing experiments. In these experiments, penetrator jets are directed at targets on the canyon wall to the west of the site. Metal plates are placed behind the targets to stop the penetrators (Kelkar 1992, 012469). AOC 36-004(c) has also been used for OD of scrap HE. Emergency detonation of leaking gas cylinders has also been performed, but very infrequently (LANL 1990, 007513, p. 109).

Previous Investigations

A Phase I RFI was conducted at AOC 36-004(c) in 1994 (ICF Kaiser Engineers 1996, 054713, pp. 107–119). Field activities included investigating off-site migration of potential contaminants via major drainage channels. Sediment catchment areas with substantial accumulations of fine particles were identified, and eight samples were collected (ICF Kaiser Engineers 1996, 054713, pp. 107–119) and analyzed for metals, radionuclides, VOCs and SVOCs. Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1994, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals above BVs and sodium-22, cesium-137, europium-152, americium-241, cobalt-60, plutonium 238/239 and ruthenium-106 detected or detected above FVs.

Proposed Activities

AOC 36-004(c) is an active RCRA-regulated OD site and firing site; therefore, sampling to determine nature and extent is not feasible presently because continued explosives testing makes any determining nature and extent obsolete as soon as the next firing activity occurs. Therefore, it is proposed that full characterization of AOC 36-004(c) be delayed until firing operations cease. This work plan proposes an interim sampling strategy to determine if contaminants are migrating from the site. Fourteen samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at seven locations in sediment catchments in the drainage downgradient of the site (Figure 4.2-17). Samples will be analyzed for cyanide, nitrate, perchlorate, VOCs, SVOCs, metals, explosive compounds, isotopic uranium, and gamma spectroscopy. Table 4.0-1 summarizes proposed sampling locations, depths, and analytical suites. South Canyons Reach FS-1 is located downgradient of AOC 36-004(c) (Plate 1); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.7 SWMU 36-004(d), Skunk Works Firing Site, Lower Slobbovia Firing Site, and Burn Pits

Site Description

SWMU 36-004(d) consists of the Lower Slobbovia Firing Site and the Skunk Works Firing Site, located in Potrillo Canyon, and three burn pits located on the mesa top next to Potrillo Canyon (Figure 4.2-18). AOC 36-004(d) is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1).

The Lower Slobbovia Firing Site consists of two firing points and a control building (36-0012). One of the firing points (structure 36-0013) was constructed in 1950 and is located on top of an approximately 200-ft-diameter sand and dirt pad. The control building (36-0012) was constructed into the side of the pad (LANL 1993, 020946, p. 5-38). The second firing point consisted of a wooden tower (structure 36-0120), constructed in 1986 at the northwest end of a 1000-ft long sled track for conducting drop tests (Kelkar 1992, 012471). Shots fired at the Lower Slobbovia Firing Site primarily involve HE (LANL 1990, 007513, p. 109). Less than 2% of the shots have involved significant amounts of metal (e.g., DU, lead, copper, aluminum, and steel) (Kelkar 1992, 012471). The largest shot fired at Lower Slobbovia used 5000 to 6000 lb of HE (Kelkar 1992, 012469). In addition, underground tests, buried to approximately 100 ft, were conducted at this site (Kelkar 1992, 012469).

The Skunk Works Firing Site, located approximately 0.5 mi northwest of the Lower Slobbovia Firing Site, was used to conduct small-explosives experiments during the 1950s (Kelkar 1992, 012471). These experiments involved gas (acetylene and oxygen), liquid (tetranitromethane), and solid explosives. Beryllium and radioactive materials were not used at the site (LANL 1996, 054733, pp. 5-21–5-28). Structures at the Skunk Works Firing Site included a 5-ft × 5.5-ft × 5-ft belowgrade structure that formerly served as a battery storage room and two buildings (36-0044 and 36-0045) that were moved to the site from TA-15. All the structures have been removed. The Skunk Works firing pad was located next to building 36-0045. A shallow depression, located approximately 100 ft farther up the canyon, was also used as a firing pad (LANL 1996, 054733, pp. 5-21–5-28).

The burn pits were used for burning and disposal of test debris before MDA AA was established in the mid-1960s (LANL 1993, 020946, p. 5-39). These pits are located on Mesita del Potrillo approximately 4000 ft west of the Lower Slobbovia control building (36-0012). The largest pit is a bermed enclosure located north of Potrillo Road and is approximately 40 ft in diameter. Two smaller areas are located south of Potrillo Road (LANL 1996, 054733, p. 5-29–5-31). Debris was transported by truck from TA-36 firing sites to the pits, placed in the pits, and burned. The debris consisted of wood, nails, other metal fragments, plastics, and sand contaminated with barium, uranium, and HE (LANL 1996, 054733, pp. 5-29–5-36).

Previous Investigations

Previous environmental investigations at SWMU 36-004(d) include sampling performed during the 1988 DOE environmental survey. This effort involved collecting five composite surface samples from the Lower Slobbovia Firing Site and analyzing these samples for inorganic chemicals and radionuclides. The results indicated elevated levels of copper, lead, uranium, and zinc (DOE 1992, 030081, pp. 55–56).

A Phase I RFI investigation was conducted from 1994 to 1996 at the Skunk Works Firing Site and the burn pits (LANL 1996, 054733, pp. 5-27–5-28, 5-35–5-36). Phase I RFI activities at the Skunk Works Firing Site included a radiological survey of the site and field screening for inorganic chemicals, VOCs, and HE. Based on field-screening results, a surface (0 to 0.5 ft bgs) and a subsurface soil sample (1.5 to 2.0 ft bgs) were collected at three locations, including the former firing pad next to building 36-0045, the depression to the northwest of building 36-0045, and the former battery storage room. A surface sample (0 to 0.5 ft bgs) was also collected from the drainage channel receiving surface runoff from the site. The samples were field screened for radioactivity, VOCs, and HE and submitted for analysis of metals, isotopic uranium, HE, VOCs, and SVOCs (LANL 1996, 054733, pp. 5-21–5-28). Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected during the RFI, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed detected inorganic chemicals above BVs, detected VOCs and SVOCs, and radionuclides, including sodium-22, cesium-137, europium-152, americium-241, cobalt-60, plutonium-238/239, ruthenium-106, and isotopes of uranium detected above BVs.

Phase I RFI activities at the burn pits included radiological and geophysical surveys to determine the pit locations; however, the survey results were inconclusive, and additional historical research was conducted to determine the locations of the burn pits. The pits were discovered along Potrillo Road. Ash was found within the bermed area of the north pit (LANL 1996, 054733, pp. 5-30–5-33). Subsurface soil samples were collected at three locations within the north pit. Samples were collected from one depth (3.33 ft to 4.17 ft bgs) at one location), two depths (0.33 ft to 1.08 ft bgs and 3.17 ft to 3.67 ft bgs) from one location, and three depths (2 ft to 2.58 ft, 4.42 ft to 5.08 ft, and 5.58 ft to 6.33 ft bgs) at one location at the north pit. Subsurface samples were also collected from two depths at each of two locations at the two south pit areas from depth ranging from (0.5 to 1.08 ft and 2 to 2.75 ft bgs). The samples were field screened for radioactivity, VOCs, and HE and submitted for analysis of metals, isotopic uranium, HE, VOCs, SVOCs, and gamma-emitting radionuclides (LANL 1996, 054733, pp. 5-21–5-28). Samples collected during the Phase I RFI of the burn pits and the analyses requested are presented in Table 4.2-1.

Decision-level data from the Phase I RFI at the burn pits are presented in Tables 4.2-2, 4.2-3, and 4.2-4, which show inorganic chemicals detected above BVs or having detection limits above BVs, detected organic chemicals, and radionuclides detected or detected above BVs/FVs, respectively. Sampling locations and results for inorganic chemicals detected above BVs, detected organic chemicals, and radionuclides detected or detected above BVs/FVs are shown in Figures 4.2-19, 4.2-20, and 4.2.21, respectively.

Inorganic chemicals detected above soil or Qbt 2 BVs are aluminum, barium, calcium, cobalt, and nickel. Aluminum, barium, calcium, and nickel were each detected above the maximum Qbt 2 background concentrations (8370 mg/kg, 51.6 mg/kg, 2230 mg/kg, and 7 mg/kg, respectively) in one sample. Cobalt was detected above the Qbt 2 BV in one sample. Nickel was detected above the soil BV but below the maximum background concentration (29 mg/kg) in one sample. Antimony, cadmium, mercury, selenium, silver, and thallium were not detected above soil and/or Qbt 2 BVs but had detection limits above BVs. Methylene chloride, tert-butylbenzene, 1,2-dibromo-3-dichloropropane, 2-hexanone, naphthalene, tetrachloroethene, and toluene were each detected in one sample. Acetone, bis(2-ethylhexyl)phthalate, and 4-isopropyltoluene were each detected in two samples. Cesium-137 was detected in three subsurface samples, and uranium-238 was detected above the soil BV in one sample.

Proposed Activities

Although SWMU 36-004(d) is deferred for investigation per Table IV-2 of the Consent Order, 12 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at six locations in sediment catchments in the drainages downgradient of the two burn pits and six samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at three locations in sediment catchments in the drainage downgradient of the Skunk

Works Firing Site to determine if contaminants are migrating from the site (Figure 4.2-22). The Lower Slobbovia Firing Site is located in the bottom of Potrillo Canyon in an open area. The samples will be analyzed for cyanide, nitrate, perchlorate, VOCs, SVOCs, metals, explosive compounds, isotopic uranium, and gamma spectroscopy. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites. The area downgradient of the Lower Slobbovia Firing Site is virtually flat with no visible signs of runoff or erosion. South Canyons Reach PO-3 is located directly east and downgradient of the Lower Slobbovia Firing Site (Plate 1); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490). In addition, stormwater sampling station PT-SMA-4 is located downgradient of the site. Available stormwater monitoring data from this site will be included in the investigation report.

4.2.8 AOC 36-004(e), I-J Firing Site

Site Description

AOC 36-004(e) is the I-J Firing Site located at the west end of TA-36 on Mesita del Potrillo along the north rim of Potrillo Canyon (Figure 4.2-6 and Plate 1). AOC 36-004(e) is deferred for investigation per Table IV-2 of the Consent Order (Table 1.1-1). The I-J Firing Site consists of two firing points (I and J) and the control building (36-0055). The site was constructed in 1948 and was located in TA-15 until 1981 when the boundary of TA-36 was expanded to encompass the portion of TA-15 that contained the I-J Firing Site. Shots at I-J Firing Site used up to 500 lb of HE and involved a variety of solid and liquid explosives and inorganic chemicals (LANL 1993, 020946, p. 5-40). According to former employees, significant amounts of DU were used at I-J Firing Site in addition to small quantities of mercury and cadmium (Kelkar 1992, 009043). Some shots were fired into iron, copper, or lead targets. Other metals used in shots included aluminum, antimony, various steels, lithium-magnesium alloys, and lithium hydride (Kelkar 1992, 012468). In addition, hydrocarbons, argon, benzene, small amounts of mercury, cadmium, and beryllium were used in shots (Kelkar 1992, 009043; Kelkar 1992, 012468).

All shots involving radioactive materials at the I-J Firing Site were conducted in fully enclosed containment vessels. These vessels were removed from the I-J Firing Site for use at TA-15, although one was later returned to the I-J Firing Site (LANL 1993, 020946, p. 5-40). The returned vessel was identified in the 1990 SWMU report as AOC C-36-001 (LANL 1990, 007513) and was subsequently removed from the site in 1994 and disposed of at MDA G, TA-54 (LANL 1996, 053779, p. 3). Other firing-site activities conducted at I-J Firing Site included tests in which DU projectiles were fired into an embankment. This projectile test area was designated as AOC C-36-006(e) (LANL 1993, 020946, pp. 5-39–5-40).

Previous Investigations

Previous investigations conducted at I-J Firing Site consist of a surface radiological survey conducted in 1991 that identified areas of elevated radioactivity at the time of the survey. Numerous pieces of DU and oxidized DU were present around the site. Based on the presence of visible pieces of DU, an interim action plan was prepared in 1997 that called for removing visible pieces of DU from the firing site and surrounding area and emplacing stormwater controls (LANL 1997, 062453, p. 3-5). However, the plan was not implemented, and AOC 36-004(e) has not been sampled.

Proposed Activities

The I-J Firing Site is deferred for investigation per Table IV-2 of the Consent Order; therefore, no characterization samples are proposed for the site at this time. To determine if contaminants are migrating from the firing site, samples will be collected from sediment catchments in the drainages downgradient of the I-J Firing Site. Drainage sampling will be covered by sampling locations proposed for AOCs 15-008(f) and C-36-006(e) (sections 4.1.10 and 4.2.11, respectively, and Figure 4.1-17). These data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.9 SWMU 36-005, Storage Area

Site Description

SWMU 36-005 is an inactive storage area (known as the "Boneyard") located near the head of Fence Canyon between the Meenie and Minie Firing Sites [AOCs 36-004(b) and 36-004(c), respectively] (Figure 4.2-23 and Plate 1). This storage area is an undeveloped area, approximately 500 ft × 300 ft, largely covered with grass and ponderosa pine. From the 1950s until the late 1970s, the Boneyard was used as a parking lot for trailers and a storage area for large nonwaste items. From the late 1970s until the late 1980s, the site was used to store large waste items exposed to explosives tests (Kelkar 1992, 012470), including metal drums, cans, cylinders, and scrap metals such as lead sheets, copper, uranium-contaminated steel, and iron (LANL 1993, 020946, p. 5-53).

In the late 1980s, a major cleanup was conducted at the site. Cans labeled isopentane, uranium-contaminated iron and steel, drums, and cylinders were removed during this cleanup effort (LANL 1993, 020946, p. 5-53).

Previous Investigations

Previous environmental investigations at SWMU 36-005 include a radiological survey and sampling performed by the DOE environmental survey in 1988. This effort involved the collection of six grab samples from four locations showing elevated radiation levels and six grab samples from locations showing visible staining or debris (LANL 1993, 015313, pp. 5-55–5-56).

A Phase I RFI conducted at SWMU 36-005 in 1994 included land, geomorphic, and radiological surveys (LANL 1995, 053985, pp. 4-12–4-13). The radiological survey identified no areas of elevated radiation. Thirty-one surface soil samples (0 to 0.5 ft bgs) were collected from 27 locations. Nine of these locations were in the current active storage area; nine were in the drainage channel from the site; and nine were from random locations, including three locations outside the Boneyard. The samples were field screened for VOCs, radioactivity, and HE and submitted for analysis of metals, isotopic uranium, and VOCs. Data collected during the Phase I RFI are screening-level data and are not presented in this work plan. Samples collected in 1994, the analyses requested, and the data are presented in the HIR (LANL 2009, 105251). Screening-level data showed inorganic chemicals detected above BVs, detected organic chemicals, and uranium-235 detected above the BV.

On the basis of the Phase I results, the RFI report recommended additional sampling to determine the vertical extent of organic chemical contamination. A sampling and analysis plan (SAP) was prepared that called for collecting subsurface samples at locations where the maximum concentrations of organic chemicals were detected. Phase II RFI activities were conducted in 1997, and four subsurface soil samples were collected from three locations from depths ranging from 1.0 to 1.2 ft, 1.3 to 1.5 ft, 1.7 to 1.8 ft, and 3.2 to 3.3 ft bgs. The samples were submitted for analysis of VOCs. The samples collected during the 1997 Phase I RFI and the analyses requested are presented in Table 4.2-1.

Decision-level data from the Phase II RFI samples are presented in Table 4.2-3, which shows detected organic chemicals. Sampling locations and detected organic chemicals are shown in Figure 4.2-25. Acetone was detected in one soil sample.

Proposed Activities

The extent of contamination has not been determined for SWMU 36-005. Any remaining debris at the site will be screened for HE and radiation and removed from the site. Thirty samples will be collected from 10 previous RFI sampling locations (36-03026, 36-03034, 36-03035, 36-03036, 36-03038, 36-03039, 36-03041, 36-03043, 36-03046, and 36-03051) based on screening-level data provided in Tables 4.2-5, 4.2-6, and 4.2-7 and Figures 4.2-24 and 4.2-25 and decision-level data provided in Table 4.2-3 (Figure 4.2-25). In addition, 18 samples will be collected from 6 new sampling locations around the former RFI sampling locations on the mesa top to define lateral extent. Mesa-top samples will be collected from three depths (0 to 1 ft, 2 to 3 ft and 4 to 5 ft bgs). In addition, 12 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) from three previous drainage sampling locations (36-03018, 36-03022, and 36-03020) in the drainage downgradient of the site (Figure 4.2-27). [Drainage sampling locations for AOC 36-004(c) extend down the drainage into Fence Canyon, which is also downgradient of SWMU 36-005.] Samples will be field screened for VOCs, explosive compounds, and radiation and analyzed for metals, cyanide, explosive compounds, perchlorate, nitrate, VOCs (subsurface samples only), SVOCs, and isotopic uranium. Table 4.0-1 summarizes the proposed sampling locations, depths, and analytical suites. South Canyons Reaches F-1, FS-1, and F-2 are located downgradient of the SWMU 36-005 (Plate 1); therefore, these data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.10 AOC C-36-001, Former Containment Vessel

Site Description

AOC C-36-001 is a former containment vessel that provided secondary containment for explosives tests at TA-36 (Figure 4.2-28). The containment vessel was manufactured in 1970 and located at the PHERMEX test facility at TA-15. The containment vessel was later relocated to the I-J Firing Site and placed south of building 36-0055 where it remained until 1983 when it was removed. The containment vessel consisted of a 19.5-ton steel sphere that was 12 ft in diameter. An explosive device was placed and detonated in a primary containment vessel which, in turn, was placed inside the AOC C-36-001 containment vessel. The explosion gases were vented through a filtration system that captured particulates and did not allow release of the test material (LANL 1993, 020946, p. 5-40). No specific location(s) exists for this site; the location is identified only as the general area south of building 36-0055 (LANL 1996, 053779).

Previous Investigations

In 1994, a VCA was implemented at AOC C-36-001 that involved decontamination and disposal of the vessel. The vessel was taken from TA-36 to building 15-0233 for initial decontamination and was subsequently taken to the decontamination facility at TA-50 for further decontamination. It was then returned to TA-15 pending acceptance for disposal at TA-54, Area G. In October 1994, the containment vessel was disposed of at MDA G, TA-54 (LANL 1996, 053779, p. 3). No confirmation samples were collected during the VCA.

Proposed Activities

The previous location(s) of the former containment vessel used at PHERMEX and at the I-J Firing Site are not known. Therefore, characterization of any releases from AOC C-36-001 will be accomplished by the PHERMEX and I-J Firing Site investigations. Both of these firing sites are deferred for investigation per Table IV-2 of the Consent Order. To determine if contaminants are migrating from either firing site, samples will be collected from sediment catchments in the drainages downgradient of PHERMEX and the I-J Firing Site (sections 4.1.3, 4.1.4, and 4.2.8, respectively, and Figure 4.1-17). These data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

4.2.11 AOC C-36-006(e), Projectile Test Area

Site Description

AOC C-36-006(e) is a former projectile test area located within the southern portion of the I-J Firing Site [AOC 36-004(e)] along the north rim of Potrillo Canyon (Figure 4.1-16). AOC C-36-006(e) was formerly used for testing DU projectiles as part of I-J Firing Site activities (LANL 1993, 020946, pp. 5-39 and 5-40). Projectiles were fired from a 120-mm gun into a nearby embankment. Although some projectiles were recovered after an experiment was completed, much of the projectile material remains on site (LANL 1990, 007512, p. 72).

Originally, the I-J Firing Site was located within the boundary of TA-15. In 1981, the boundary of TA-36 was expanded to include portions of TA-15. As part of this expansion, the area in which the I-J Firing Site was located was transferred to TA-36. However, the 1990 SWMU report (LANL 1990, 007514, p. 262) is inconsistent in addressing the SWMUs and AOCs affected by the transfer. Although the SWMU report addresses the I-J Firing Site as SWMU 36-004(e), it addresses the nearby projectile test area (which was also part of the 1981 transfer to TA-36) as AOC 15-006(e). AOC 15-006(e) was renamed AOC C-36-006(e) in the OU 1086 work plan because the projectile test area was within the boundaries of TA-36 when the work plan was written (LANL 1993, 020946, pp. 5-39–5-40).

Previous Investigations

Previous investigations conducted at I-J Firing Site, which encompasses AOC C-36-006(e), consisted of a surface radiological survey conducted in 1991 that identified areas of elevated radioactivity at the time of the survey. Numerous pieces of DU and oxidized DU were present around the site. Based on the presence of visible pieces of DU, an interim action plan was prepared in 1997 that called for removing visible pieces of DU from the firing site and surrounding area, and installing stormwater controls (LANL 1997, 062453, p. 3). However, the plan was not implemented, and AOC C-36-006(e) has not been sampled.

Proposed Activities

AOC C-36-006(e) is encompassed by the I-J Firing Site, which is deferred for investigation per Table IV-2 of the Consent Order. Potential contaminants, including DU, metals, and HE, are indistinguishable between the two sites; therefore, no characterization sampling is proposed for AOC C-36-006(e) at this time. AOC C-36-006(e) will be investigated when I-J Firing Site is investigated. To determine if contaminants are migrating from the site, 10 samples will be collected from two depths (0 to 1 ft and 2 to 3 ft bgs) at five locations in sediment catchments in the drainage downgradient of the site (Figure 4.1-17). Samples will be analyzed for metals, cyanide, perchlorate, VOCs, SVOCs, explosive compounds, uranium, and gamma spectroscopy. These data will be supplemented by the South Canyons investigation sediment sampling program (LANL 2006, 093713; NMED 2007, 095490).

5.0 INVESTIGATION METHODS

A summary of investigation methods to be implemented is presented in Table 5.0-1. The standard operating procedures (SOPs) used to implement these methods are available at http://www.lanl.gov/environment/all/qa.shtml.

Summaries of the field-investigation methods are provided below. Additional procedures may be added as necessary to describe and document quality-affecting activities.

Chemical and radionuclide analyses will be performed in accordance with the analytical statement of work (LANL 2000, 071233). Accredited contract analytical laboratories will use the most recent EPA- and industry-accepted extraction and analytical methods for analyses of the samples.

5.1 Field Surveys

The following sections describe the field surveys that will be conducted at the Potrillo and Fence Canyons Aggregate Area sites.

5.1.1 Geodetic Surveys

Geodetic surveys will be conducted by a land surveyor in accordance with the latest version of SOP-03.11, Coordinating and Evaluating Geodetic Surveys, to locate historical structures and to document field activities such as sampling and excavation locations. The surveyors will use a Trimble GeoXT hand-held global-positioning system (GPS) or equivalent for the surveys. The coordinate values will be expressed in the New Mexico State Plane Coordinate System (transverse mercator), Central Zone, North American Datum 1983. Elevations will be reported per the National Geodetic Vertical Datum of 1929. All GPS equipment used will meet the accuracy requirements specified in the SOP.

5.1.2 Geophysical Surveys

Geophysical surveys will be performed at selected sites to identify anomalies that would indicate the location of former waste disposal sites including former landfills at TA-15 and TA-36. Geophysical methods employed will include terrain conductivity (EM-31 or equivalent), high-sensitivity metal detection (EM-61 or equivalent), and GPR.

Terrain conductivity and high-sensitivity metal detection data will be recorded at approximately 2-ft intervals along lines spaced approximately 20 ft apart. Higher resolution coverage will be completed, as needed, in selected targeted areas using 5-ft line spacing. Line and station separation may vary depending upon surface obstructions. Geodetic coordinates will be recorded at 1-s intervals using an integrated GPS. A base station free from cultural interference will be occupied at the beginning and end of each survey day to calibrate the instrument and perform system functional tests. During these tests, battery, phasing, and sensitivity checks will be performed.

The GPR survey will be performed using a digital subsurface interface radar system. After initial field tests are conducted to determine maximum penetration and sufficient resolution, an appropriate transducer will be selected to perform the survey. Different transducers may be used in an attempt to provide greater penetration depths. Data will be digitally recorded, displayed, and analyzed during acquisition to allow real-time interpretation. Line locations will be selected based on electromagnetic anomaly and surface obstructions.

5.2 Field Screening

Because sampling is primarily being conducted to finalize nature and extent based on previous investigations, field screening will be conducted mainly for health and safety purposes. However, if elevated field-screening levels are observed for the deepest sample collected from a specific sampling location, sample collection will continue until field-screening results show no elevated readings. The Laboratory's proposed field-screening approach will be to (1) visually examine all samples for evidence of contamination, (2) screen for organic vapors, (3) screen for radioactivity, (4) screen for metals, and (5) screen for HE. The field-screening methods are discussed below.

5.2.1 Volatile Organic Compounds

Based on the previous RFI results, significant VOC contamination is not expected to be encountered, and VOC screening will be conducted primarily for health and safety purposes.

Screening will be conducted using a photoionization detector (PID) capable of measuring quantities as low as 1 ppm. Vapor screening of soils, sediments, and subsurface core for VOCs will be conducted using a PID equipped with an 11.7 eV lamp. All samples will be screened for VOCs in headspace gas in accordance with SOP-06.33, Headspace Vapor Screening with a Photo Ionization Detector.

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."

5.2.2 Radioactivity

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 and will be performed using appropriate field instruments. Instruments will be calibrated in accordance with the Laboratory's Health Physics Operations Group procedures. All instrument calibration activities 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."

A FIDLER or similar instrument will be used at grid locations across SWMU 15-004(f) to provide definitive identification of locations with elevated DU potentially requiring removal.

5.2.3 Metals Field Screening (XRF)

A Spectrace 9000 (or similar make and model) field-portable XRF instrument will used to field screen for a few specific metals (barium, copper, and lead) previously detected at many of the sites and typically associated with firing-site activities in the Potrillo and Fence Canyons Aggregate Area in accordance with the manufacturer's instructions. An elevated detection for XRF analysis is defined as an instrument reading that exceeds 2 times the BV of the sample matrix. The XRF field-screening results will be recorded on the field boring or test pit logs. The instrument will be operated in accordance with the manufacturer's instructions, including collecting and preparing samples and analyzing standard samples. XRF-screening surveys will be performed as described in the proposed activities in section 4.0 of this work plan for SWMUs 15-007(a), 15-004(b), 15-004(c), 15-004(f), 15-008(a), 36-001, 36-005, and 36-006. Sampling locations may be moved, as necessary, if surface obstructions are encountered.

5.2.4 HE Screening

The Strategic Diagnostics, Inc., D TECH RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) immunoassay test kits will be used to field screen quantitatively for RDX and TNT (2,4,6-trinitrotoluene). All assays will be conducted following the manufacturer's instructions, including equipment calibration, equipment use, sample dilution, and reagent storage. An elevated immunoassay result is defined as 2 times the estimated quantitation limit (approximately 2 mg/kg). Immunoassay field-screening results will be recorded on the field boring or test pit logs.

5.3 Sample Collection

The methods for collecting surface, subsurface, and sediment samples are described below, along with the methods for collecting samples from test pits and excavations. One sample from each site (i.e., the most contaminated sample) will be selected for analysis of PCBs and dioxins/furans if samples are not otherwise being analyzed for these constituents based on the operational history of the site. At SWMUs and AOCs where one sample will be collected for analysis of PCB and dioxin/furan, the sample will be selected based on the results of field screening described in section 5.2 above and on the location relative to potential contaminant sources. The sample will be collected from the most contaminated location at each site (based on field screening) or, if field screening is inconclusive, from a location at the site in closest proximity to the potential source of contamination.

5.3.1 Surface Samples

Samples will be placed in appropriate containers in accordance with EP-ERSS-SOP-5056, Sample Container and Preservation. Quality assurance/quality control (QA/QC) samples will include field duplicate samples, equipment blanks, and trip blanks. These samples will be collected following the current version of EP-ERSS-SOP 5059, Field Quality Control Samples, and will comply with a frequency of 10% of total samples collected for field duplicates and rinsate blanks. Trip blanks will be supplied and remain with analytical samples when samples are collected for VOC analysis. QA/QC samples are used to monitor the validity of the sample collection procedures.

Surface and shallow subsurface soil and sediment samples will be collected in accordance with SOP-06.09, Spade and Scoop Method for the Collection of Soil Samples. Stainless-steel shovels, spades, scoops, and bowls will be used for ease of decontamination. Decontamination will be completed using a dry decontamination method with disposable paper towels and an over-the-counter cleaner, such as Fantastik or an equivalent. If the surface location is at bedrock, an axe or hammer and chisel will be used to collect samples.

5.3.2 Subsurface Samples

Subsurface samples will be collected using hand- or hollow-stem auger or direct-push methods, depending on the depth of the samples and the material being sampled. A brief description of these methods is provided below.

5.3.2.1 Hand Auger

Hand augers may be used to bore shallow holes (e.g., 0 to 10 ft). The hand auger is advanced by turning or pounding the auger into the soil until the barrel is filled. The auger is removed and the sample is dumped out into a clean bowl. Hand-auger samples will be collected in accordance with SOP-06.10, Hand Auger and Thin-Wall Tube Sampler.

5.3.2.2 Direct Push

Direct push is a subsurface sampling method that pushes a tool string into the ground using the weight of a truck in combination with a hydraulic ram or hammer. Various tool strings can be used for obtaining discrete samples, continuous samples, both discrete and continuous samples, and groundwater samples. The direct-push core samples collected in this investigation will be continuous. The inside of the continuous sampler is exposed to the subsurface environment while it is advanced to the sampling interval. This is a dual-tube sampler, so named because it uses two sets of rods to collect soil cores. The outer rods receive the driving force from the hydraulic pushing method and provide a sealed hole from which soil samples may be recovered without the threat of cross-contamination or cave-in. The inner set of rods is placed within the outer rods and holds a sampler in place as the outer rods are driven to the sample interval. The inner rods are then retracted to retrieve the soil core. The direct-push methods will follow the American Society of Testing and Materials D18 Subcommittee on Direct Push Sampling (D18.21.01) (ASTM 1997, 057511).

5.3.2.3 Hollow-Stem Auger

Hollow-stem augers will be used to collect subsurface samples where hand-augering is impractical because of the depth of the depth or the material being sampled. The hollow-stem auger consists of a hollow-steel shaft with a continuous spiraled steel flight welded onto the exterior of the stem. The stem is connected to an auger bit; when the auger is rotated, it transports cuttings to the surface. The hollow stem of the auger allows insertion of drill rods, split-spoon core barrels, Shelby tubes, and other samplers through the center of the auger so samples may be retrieved during drilling operations.

During sampling, the auger will be advanced to just above the desired sampling interval. The sample will then be collected by driving a split-spoon sampler into undisturbed soil/tuff to the desired depth in accordance with SOP-06.26, Core Barrel Sampling for Subsurface Earth Materials. Immediately after sampling, boreholes will be abandoned using bentonite chips or a bentonite/concrete mixture. All borehole cuttings will be managed as IDW, as described in Appendix B of this work plan. All borehole abandonment information will be provided in the Potrillo and Fence Canyons Aggregate Area investigation report.

Field documentation will include detailed borehole logs for each borehole drilled. The borehole logs will document the matrix material in detail and will include the results of all field screening; fractures and matrix samples will be assigned unique identifiers. All field documentation will be completed in accordance with the current version of SOP-12.01, Field Logging, Handling, and Documentation of Borehole Materials.

Borehole Abandonment

All hollow-stem auger boreholes will be properly abandoned according to the most recent version of EP-~~-~~ERSS-SOP-5~~.~~034, Monitor~~ing~~ Well and RFI Borehole Abandonment, which meets the requirements of Section X.D of the Consent Order. ~~,~~ Borehole abandonment will use ~~by~~ one of the following methods.

- Shallow boreholes, with a total depth of 20 ft or less, will be abandoned by filling the borehole with bentonite chips and then hydrating the chips in 1- to 2-ft lifts. The borehole will be visually inspected while the bentonite chips are being added to ensure bridging does not occur.
- Boreholes greater than 20 ft in depth will be pressure-grouted from the bottom of the borehole to the surface using the tremie pipe method. Acceptable grout materials include cement or bentonite grout, neat cement, or concrete.

The use of backfill materials such as bentonite and grout will be documented in a field logbook with regard to volume (calculated and actual), intervals of placement, and additives used to enhance backfilling. All borehole abandonment information will be presented in the investigation report.

5.3.3 Sediment Samples

Sediment samples will be collected from areas of sediment accumulation that include sediment judged to be representative of the historical period of Laboratory operations. The locations will be selected based on geomorphic relationships in areas likely to have been affected by discharges from Laboratory operations. Preliminary sediment sampling locations have been selected and are shown in section 4 figures. Because sediment systems are dynamic and subject to redistribution by runoff events, however, some locations may need to be adjusted at the time this work plan is implemented. In the course of collecting sediment samples, it may be determined that the selected location is not appropriate because of conditions observed during excavation of the sediment (e.g., the sediment is much shallower than anticipated, the sediment is predominantly coarse-grained, or the sediment shows evidence of being older than the target age). Sediment sampling locations may be adjusted as appropriate. Any changes to sediment sampling locations will be documented as deviations from this work plan in the investigation report.

5.3.4 Test Pit and/or Trench Samples

Excavations or test pits will be completed using a track excavator or backhoe to locate inactive landfills and septic tanks. Excavated soil will be staged a minimum of 3 ft from the edge of the excavation, and excavations deeper than 4 ft bgs will be appropriately benched to allow access and egress, if necessary. After field screening, confirmation sampling, and any necessary over excavation work are completed, the test pits and/or trenches will be backfilled. The soil removed from the excavation will be returned to the excavation provided the sample ~~sampling~~ analysis shows it is not hazardous waste and residential SSLs are not exceeded ~~that industrial SSLs are not exceeded~~. Otherwise, the excavations will be backfilled with clean fill material.

5.4 Laboratory Methods

The analytical suites vary by site as specified in section 4 and are summarized in Table 4.0-1. All analytical suites are presented in the statement of work for analytical laboratories (LANL 2000, 071233). The specific analytical methods to be used are specified in Table 4.0-1. Sample collection and analysis will be coordinated with the Sample Management Office.

5.5 Health and Safety

The field investigations described in this investigation work plan will comply with all applicable requirements pertaining to worker health and safety. An integrated work document and a site-specific health and safety plan will be in place before fieldwork is performed.

5.6 Equipment Decontamination

Equipment for drilling and sampling will be decontaminated before and after drilling and sampling activities (as well as between drilling boreholes) to minimize the potential for cross-contamination. Dry decontamination methods are preferred and will be given priority because they do not generate liquid wastes. Residual material adhering to the equipment will be removed using dry decontamination methods, including wire-brushing and scraping, as described in EP-ERSS-SOP-5061, “Field Decontamination of Equipment.” Dry decontamination of sampling equipment may include use of a nonphosphate detergent such as Fantastik on a paper towel, and the equipment is wiped so that no liquid waste is generated.

If dry decontamination methods are not effective, equipment may be decontaminated by steam-cleaning or hot water pressure-washing, as described in EP-ERSS-SOP-5061. Wet decontamination methods will be conducted on a high-density polyethylene liner on a temporary decontamination pad. 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.

5.7 Investigation-Derived Waste

IDW generated during field-investigation activities may include, but is not limited to, drill cuttings; contaminated soil; excavated debris; contaminated personal protective equipment (PPE), sampling supplies, and plastic; fluids from the decontamination of PPE and sampling equipment; and all other waste that has potentially come into contact with contaminants.

All IDW generated during field-investigation activities will be managed in accordance with applicable SOPs that incorporate the requirements of all applicable EPA and NMED regulations, DOE orders, and Laboratory implementation requirements. Appendix B presents the IDW management plan.

5.8 Cleanup Activities

SWMUs 15-007(a), 15-008(a), 15-010(a), 36-001, and 36-006 are proposed for remediation under this investigation work plan. Excavation of waste, contaminated media, waste disposition, and confirmation sampling will be completed at these sites. This section summarizes proposed remediation activities. The general sequence of activities for waste excavation, transportation, disposal, and confirmation sampling is summarized below. Specific details are provided for each site in section 4.

5.8.1 Removal of Surficial and Buried Waste, Inactive Units, Contaminated Soil and Sediment

The general sequence of waste-removal activities is as follows:

- Mobilization
    - Assemble construction documents
    - Conduct construction readiness assessment
    - Conduct preconstruction meeting
    - Construct access roads
    - Construct staging area
    - Install temporary field trailers
    - Determine boundaries of waste. First, the original waste limit coordinates will be surveyed and staked, as determined in the RFI report and reported in the HIR. Next, excavation and potholing, with visual examination using methods described in section 5.1, will be used to establish or to confirm waste boundaries only where the original boundaries are inadequately defined to implement cleanup.
    - Mobilize heavy equipment to site
    - Identify underground utilities
- Site preparation
    - Install fencing
    - Install stormwater controls
    - ~~Abandon monitoring wells~~
    - Abandon/relocate utilities
    - Conduct preexcavation survey
- Removal of waste
    - Excavate waste
    - Stockpile and load roll-off container
    - Characterize for dispositioning
    - Transport to off-site disposal facility
    - Survey boundaries of excavation
    - Confirmation sampling
    - Establish subgrade and conduct survey
- Backfill
    - Backfill and compact
    - Vegetate surface
    - Survey finished surface

- Demobilize

5.8.2 Waste Management and Disposal

Management of all investigation waste, including waste generated during cleanup, is described in Appendix B.

5.8.3 Transportation

All waste will be hauled in rolloff containers directly to the selected disposal facility.

5.8.4 Confirmation Sampling

Confirmation sampling will be performed at all remediated sites (section 4).

6.0 MONITORING PROGRAMS

Groundwater, sediment, and surface water monitoring is occurring within the Potrillo and Fence Canyons Aggregate Area as part of other environmental activities. This monitoring is described briefly below.

6.1 Groundwater

Section IV.B.5.b.iii of the Consent Order requires monitoring and sampling of all monitoring wells in Potrillo and Fence Canyons. Alluvial monitoring and observation wells in Potrillo and Fence Canyons include POTO-4A, POTO-4B, POTO-4C, POTO-5A, POTO-5B, and FCO-1 (Plate 1). These wells are monitored as part of the IFGMP (LANL 2008, 101897). To date, no regional wells have been located within the Potrillo and Fence Canyons Aggregate Area.

6.2 Stormwater

Monitoring of stormwater in Potrillo and Fence Canyons is being performed under is being performed under the NPDES Multi-Sector General Permit (MSGP) and Federal Facility Compliance Agreement/Administrative Order (FFCA/AO). The MSGP and FFCA/AO are being replaced by a new NPDES Individual Permit (IP). Monitoring under the MSGP, FFC/AO, and IP is performed using site monitoring areas (SMAs), which monitor stormwater runoff from individual SWMUs and AOCs or groups of SWMUs and AOCs. SWMUs and AOCs in the Potrillo and Fence Canyons Aggregate Area that are subject to SMA monitoring under the IP are SWMUs 15-004(f), 15-006(a), 15-008(a), 15-009(e), 36-003(b), 36-004(d), and 36-006 and AOCs 15-008(f), C-15-004, 36-004(a), 36-004(c), 36-004(e), and C-36-006(e). The monitoring requirements for each SMA are contained in a Site Drainage Pollution Prevention Plan (SDPPP) for SWMUs and AOCs and the Storm Water Monitoring Plan, which is updated annually and submitted to EPA. The SDPPP also contains the SMA results.

The six SMAs located within Potrillo Canyon include PT-SMA-0.5, PT-SMA-1, PT-SMA-1.7, PT-SMA-2, PT-SMA-3, and PT-SMA-4.2; no decision-level data are yet reported for these locations. SMAs located in Fence Canyon includes F-SMA-2, which monitors active firing site Minie [AOC 36-004(c)]. The SMA monitoring program was initiated in 2005. One round of sampling has been conducted at F-SMA-2, and five rounds have been conducted at PT-SMA-1. Two stormwater gauging stations (E266 and E267) are located in Potrillo Canyon and one stormwater gauging station (E267.5) is located in Fence Canyon (Plate 1). Data from these stations, if available, will be included in the investigation report.

7.0 SCHEDULE

The scheduled notice date for NMED to approve this investigation work plan is August 13, 2009. Field work will not proceed until the work plan is approved. The expected duration of field activities is 18 mo. The investigation report for Potrillo and Fence Canyons Aggregate Area will be submitted within 3 mo after completion of field activities. Therefore, a submittal date of no later than May 15, 2011, is proposed for the investigation report.

8.0 REFERENCES AND MAP DATA SOURCES

8.1 References

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

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Appendix B

Management Plan for Investigation-Derived Waste

B-1.0 INTRODUCTION

This appendix describes how investigation-derived waste (IDW) generated during the Potrillo and Fence Canyons Aggregate Area investigation will be managed by Los Alamos National Laboratory (the Laboratory). IDW may include, but is not limited to, drill cuttings, excavated media, excavated man-made debris, contact waste, decontamination fluids, and all other waste that potentially has come into contact with contaminants.

B-2.0 IDW

All IDW generated during investigation activities will be managed in accordance with the current version of the standard operating procedure (SOP) EP-ERSS-SOP-5022, Characterization and Management of Environmental Restoration (ER) Project Waste (http://www.lanl.gov/environment/all/qa/adep.shtml). This SOP incorporates the requirements of all applicable U.S. Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) regulations, U.S. Department of Energy orders, and Laboratory requirements.

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.

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., surface soil, subsurface soil, etc.). 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. Data currently available for the aggregate area do not identify polychlorinated biphenyl (PCB) concentrations greater than 1 mg/kg. However, if this investigation identifies PCB concentrations of greater than 1 mg/kg, the Laboratory may submit a request to EPA (with a copy to NMED) to manage the waste as PCB remediation waste.

Considerable amounts of material will be excavated during the remediation of Solid Waste Management Units (SWMUs) 15-007(a), 15-008(a), 15-010(a), 36-001, and 36-006. To facilitate the staging and segregation of the remediation waste, the Laboratory will submit area of contamination designation requests for these SWMUs to the NMED for approval. The request will specify the boundaries of the proposed areas of contamination and will describe the activities to be conducted within the boundaries.

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. Table B-2.0-1 summarizes how waste will be managed.

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

B-2.1 Drill Cuttings

This waste stream consists of soil and rock chips generated by the drilling of boreholes for the intent of sampling. ~~Cuttings may or may not contain residues of drilling additives (e.g., foam) used to promote borehole integrity.~~ Drill cuttings include excess core sample not submitted for analysis and any returned samples sent for analysis. Drill cuttings will be containerized in 20 yd^3 rolloff containers, 55-gal. drums, B-12 containers, or other appropriate containers at the point of generation. If drilling is conducted within the boundary of an area of contamination, the drill cuttings will be managed within those boundaries. If drilling occurs outside the area of contamination boundaries, the initial management of the cuttings will rely on the data from previous investigations and/or process knowledge. Drill cuttings will be managed in secure, designated areas appropriate to the type of the waste. If new analytical data changes the expected waste category, the waste will be managed in accumulation areas appropriate to the final waste determination. 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. This waste stream will be characterized based either on direct sampling of the waste or on the results from core samples collected during drilling. If directly sampled, the following analyses will be performed: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), explosive compounds (if screening indicates the presence of high explosives [HE]), radionuclides, total metals, and if needed, toxicity characteristic 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 or disposed of as a low-level waste at Technical Area 54 (TA-54), Area G.

B-2.2 Excavated Environmental Media

Layback and overburden spoils (including environmental media mixed with buried debris) will consist of soil and rock removed from within or adjacent to (e.g., from benching to stabilize a trench) the SWMUs to be excavated. This material is expected to be contaminated due to the proximity of active and inactive firing sites to the sites to be remediated. This material will be field screened for radioactivity and VOCs during the excavation process. If contamination is not detected during screening, the spoils will be stored either in rolloff bins, other suitable containers, or on the ground surface with appropriate best management practices. If field screening indicates the potential for contamination, the layback and overburden spoils will be placed in rolloff bins or other suitable containers. The spoils will remain within the area of contamination boundary of the SWMU from which they were excavated, awaiting analytical results. Samples of the spoils will be collected as the spoils are excavated and composited, if appropriate (one composite sample for every 20 to 50 yd^3, depending on the homogeneity of spoils). The samples will be analyzed for VOCs; target analyte list (TAL) metals; explosive compounds, if screening indicates the presence of HE; radionuclides; and toxicity characteristic metals, as needed. Other constituents may be analyzed as necessary to meet the WAC for a receiving facility. If process knowledge, odors, or staining indicate the soils may be contaminated with petroleum products, the materials will also be analyzed for TPH and PCBs. If the spoils are determined to be suitable for reuse (i.e., is not hazardous waste and meets residential soil screening levels [SSLs] ~~meets industrial cleanup standards as determined using NMED's and DOE's soil screening guidance~~), the Laboratory will segregate any man-made debris from the soil and will use this soil to backfill the excavated SWMUs. If the spoils do not meet residential SSLs or are determined to be hazardous waste ~~industrial cleanup standards~~, they will be treated/disposed of at an authorized facility appropriate for the waste regulatory classification. Based on existing data, the Laboratory expects spoils that cannot be reused to be designated as industrial waste or low-level waste (LLW).

B-2.3 Excavated Man-Made Debris

Excavated man-made debris will be generated from the removal of four former disposal areas and three inactive septic systems. Debris will be segregated as it is excavated based on factors such as the type of debris, the type of alternative treatment technology that would be used to treat the debris, field screening, process knowledge, and/or staining or odors. Where practicable, this waste stream will be characterized by direct sampling of the waste (e.g., concrete). Direct samples will be analyzed for VOCs, SVOCs, explosive compounds, radionuclides, total metals, and, if needed, toxicity characteristic metals. Other constituents may be analyzed as necessary to meet the WAC for a receiving facility or if process knowledge or visual observations indicate other contaminants may be present (e.g., PCBs or asbestos). For debris that is difficult to characterize; acceptable knowledge (AK) will be used whenever possible, supplemented by sampling as needed. Sampling methods will often have to be identified on a case-by-case basis by qualified sampling personnel and all decisions documented in the field activity notebook.

Waste minimization will be implemented, where practicable, through segregation of waste materials. Nonhazardous materials that can be shown to have no detectable activity for radionuclides or that can be decontaminated to meet this criterion, will be recycled, if practicable.

The types of debris expected to be excavated from each SWMU are identified in the following subsections B-2.3.1 through B-2.3.5. The SWMUs are grouped by location. It is likely that five separate areas of contamination will be requested, one for each of the groupings described below.

B-2.3.1 Excavated Waste from SWMUs 15-007(a) and 15-010(a)

This waste stream will consist of components from two former buildings and one decommissioned septic system that served the former buildings (e.g., piping, metal, concrete reinforced with steel rebar and wood) and possibly contaminated soil that will be managed within the areas of contamination boundaries for these sites. The contents of the septic tank [SWMU 15-010(a)] were removed and the tank filled with sand in 1965.

The excavated materials will be placed initially in containers (e.g., rolloff bins) within the boundaries of an area of contamination. The Laboratory expects most of this waste to be designated as industrial waste that will be disposed of at an authorized off-site treatment/disposal facility or as LLW that will be disposed of at TA-54, Area G.

B-2.3.2 Excavated Waste from SWMU 15-008(a)

This waste stream will consist of debris from two small surface disposal areas at the southern edge of E-F Firing Site [SWMU 15-008(a)] and possibly, contaminated soil that will be managed within the area of contamination boundaries for this site. The two surface disposal areas were used to dispose of debris from tests conducted at E-F Firing Site including soil, rock, pebbles, metal fragments, plastic, electrical cable, electrical accessories, etc. The site is associated with E-F Firing Site.

The excavated materials will be placed initially in containers (e.g., rolloff bins) and managed within the boundary of an area of contamination. The Laboratory expects most of this waste to be designated as industrial waste that will be disposed of at an authorized off-site treatment/disposal facility or as LLW that will be disposed of at TA-54, Area G.

B-2.3.3 Excavated Waste from SWMU 36-001

This waste stream will consist of debris including wood and sand contaminated with barium, uranium, other inorganic chemicals, plastics, and HE from the Lower Slobbovia Firing Site. The excavated materials will be placed initially in containers (e.g., rolloff bins) and managed within the boundaries of an area of contamination. The Laboratory expects most of this waste to be designated as industrial waste that will be disposed of at an authorized off-site treatment/disposal facility or as LLW that will be disposed of at TA-54, Area G.

B-2.3.4 Excavated Waste from SWMU 36-006

This waste stream will consist of debris including cables, metal, concrete and other similar debris from the TA-36 firing sites. The excavated materials will be placed initially in containers (e.g., rolloff bins) and managed within the boundaries of an area of contamination. The Laboratory expects most of this waste to be designated as industrial waste that will be disposed of at an authorized off-site treatment/disposal facility or as LLW that will be disposed of at TA-54, Area G.

B-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 AK of the waste materials, the methods of generation, and analysis of the material contacted (e.g., drill cuttings, soil, etc.). Initially, contact waste generated within an area of contamination will be placed in containers and managed within the area. If contact waste is generated at a location that is not within the area of contamination, the initial management of waste will rely on the data from previous investigations and/or process knowledge. Contact waste will be managed in secure, designated areas appropriate to the type of the waste. If new analytical data changes the expected waste category, the waste will be managed in accumulation areas appropriate to the final waste determination. The Laboratory expects most of the contact waste to be designated as nonhazardous, nonradioactive waste that will be disposed of at an authorized facility or as LLW that will be disposed of at TA-54, Area G.

B-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: VOCs, SVOCs, radionuclides, explosive compounds, total metals, and, if needed, toxicity characteristic metals. The Laboratory expects most of these wastes to be nonhazardous liquid waste or radioactive liquid waste that will be sent to one of the Laboratory’s wastewater treatment facilities whose WAC allow the waste to be received.

Table B-2.0-1
Summary of Estimated IDW Generation and Management

Waste Stream	Expected Waste Type	Expected Disposition
Drill cuttings	Nonhazardous or LLW	Land application or disposal at TA-54, Area G
Excavated environmental media	Nonhazardous or LLW	Reused as fill at the excavation location or disposed of at an approved off-site disposal facility or on-site at TA-54, Area G
Excavated man-made debris	Nonhazardous, industrial, or LLW	Disposal at an approved off-site disposal facility or on-site at TA-54, Area G or recycled
Contact waste	Nonhazardous or LLW	Disposal at an approved off-site solid waste disposal facility or on-site at TA-54, Area G
Decontamination fluids	Nonhazardous or LLW	Treatment at an on-site wastewater treatment facility

Table 1.1-1
Status of SWMUs and AOCs in Potrillo and Fence Canyons Aggregate Area

Consolidated Unit	Site ID	Brief Description	Site Status	Reference
TA-15				
15-002-00	SWMU 15-002	Burn Pit	Under Investigation	Work plan section 4.1.1
	SWMU 15-007(a)	MDA N	Under Investigation	Work plan section 4.1.2
15-003-00	SWMU 15-003	PHERMEX Steel Firing Pad	Deferred per Table IV-2 of the Consent Order	Work plan section 4.1.3
	SWMU 15-006(a)	PHERMEX Firing Site	Deferred per Table IV-2 of the Consent Order	Work plan section 4.1.4
	AOC C-15-004	Former Transformer Station	Under Investigation	Work plan section 4.1.13
15-004(b)-99	SWMU 15-004(b)	Firing Site A	Under Investigation	Work plan section 4.1.5
	SWMU 15-004(c)	Firing Site B	Under Investigation	Work plan section 4.1.5
15-004(f)-99	SWMU 15-004(f)	E-F Firing Site	Under Investigation	Work plan section 4.1.6
	SWMU 15-008(a)	Two Surface Disposal Sites at E-F Firing Site	Under Investigation	Work plan section 4.1.7
	AOC C-15-005	Potential Soil Contamination from Former Building	Under Investigation	Work plan section 4.1.14
	AOC 15-005(b)	Storage Area	Under Investigation	Work plan section 4.1.8
	AOC C-15-006	Potential Soil Contamination from Former Building	Under Investigation	Work plan section 4.1.15
	AOC 15-006(e)	Projectile Test Area, Duplicate of AOC C-36-006(e)	Under Investigation	Work plan section 4.1.9
	AOC 15-008(f)	Sand Mounds at I-J Firing Site (TA-36)	Deferred per Table IV-2 of the Consent Order	Work plan section 4.1.10
	SWMU 15-009(e)	Septic Tank	Under Investigation	Work plan section 4.1.11
	SWMU 15-009(j)	Septic System	Removed from the Module VIII of the Laboratory's Hazardous Waste Facility Permit (HWPF), 11/09/01	NMED 2001, 072819
	SWMU 15-010(a)	Septic Tank	Under Investigation	Work plan section 4.1.12
	AOC C-15-012	Underground Storage Tank	No Further Action Approved, 01/21/05	EPA 2005, 088464
	SWMU 15-012(b)	Former Wash Area	Removed from the Module VIII of the Laboratory's Hazardous Waste Facility Permit (HWPF), 11/09/01	NMED 2001, 072819
	AOC C-15-013	Underground Storage Tank	No Further Action Approved, 01/21/05	EPA 2005, 088464

Table 1.1-1 (continued)

Consolidated Unit	Site ID	Brief Description	Site Status	Reference
	AOC 15-013(b)	Underground Storage Tank	No Further Action Approved, 01/21/05	EPA 2005, 088464
	AOC 15-014(c)	Sink Drain	No Further Action Approved, 01/21/05	EPA 2005, 088464
TA-36				
	SWMU 36-001	MDA AA	Under Investigation	Work plan section 4.2.1
	AOC C-36-001	Former Containment Vessel	Under Investigation	Work plan section 4.2.10
	AOC C-36-002	Borrow Pit	No Further Action Approved, 01/21/05	EPA 2005, 088464
	SWMU 36-003(b)	Septic System, I-J Firing Site	Under Investigation	Work plan section 4.2.2
	SWMU 36-003(c)	Septic System	Removed from the Module VIII of the Laboratory's Hazardous Waste Facility Permit (HWPF), 12/23/98	NMED 1998, 063042
36-006-99	AOC 36-004(a)	Eenie Firing Site	Deferred per Table IV-2 of the Consent Order	Work plan section 4.2.3
	SWMU 36-006	Surface Disposal Site	Under Investigation	Work plan section 4.2.4
	AOC 36-004(b)	Meenie Firing Site	Deferred per Table IV-2 of the Consent Order	Work plan section 4.2.5
	AOC 36-004(c)	Minie Firing Site	Active RCRA-Regulated OD Site (Interim Status)	Work plan section 4.2.6
	SWMU 36-004(d)	Skunk Works Firing Site, Lower Slobbovia Firing Site, and Burn Pits	Deferred per Table IV-2 of the Consent Order	Work plan section 4.2.7
	AOC 36-004(e)	I-J Firing Site	Deferred per Table IV-2 of the Consent Order	Work plan section 4.2.8
	AOC 36-004(f)	Firing Site	No Further Action Approved, 01/21/05	EPA 2005, 088464
	SWMU 36-005	Storage Area	Under Investigation	Work plan section 4.2.9
	AOC C-36-006(e)	Projectile Test Area	Under Investigation	Work Plan section 4.2.11
	AOC 36-007(a)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464
	AOC 36-007(b)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464
	AOC 36-007(c)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464
	AOC 36-007(d)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464
	AOC 36-007(e)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464

Table 1.1-1 (continued)

Consolidated Unit	Site ID	Brief Description	Site Status	Reference
	AOC 36-007(f)	Storage Area	No Further Action Approved, 01/21/05	EPA 2005, 088464

Note: Shading denotes NFA approved or complete with controls.

Table 2.3-1
Industrial SSLs and SALs

Chemical	Industrial SSL[a] (inorganic and organic chemicals) or Industrial SAL[b] (radionuclides)
Inorganic Chemicals (mg/kg)	
Aluminum	100,000
Antimony	454
Barium	100,000
Beryllium	2250
Cadmium	564
Chromium	14,000[c]
Cobalt	20,500
Copper	45400
Lead	800
Manganese	48,400
Mercury	310[c]
Nickel	22700
Silver	5680
Thallium	74.9
Uranium	3100[c]
Zinc	100000
Organic Chemicals (mg/kg)	
Acetone	100,000
Benzo(b)fluorathene	23.4
Bis(2-ethylhexyl)phthalate	1370
Tert-Butylbenzene	106
Di-n-butylphthalate	68400
1,2-Dibromo-3-chloropropane	9.68
2-Hexanone	n/a[d]
HMX	34,200
4-Isopropyltoluene	n/a
Methylene Chloride	490
Naphthalene	300
Tetrachloroethene	31.6
Toluene	252

Table 2.3-1 (continued)

Chemical	Industrial SSL[a] (inorganic and organic chemicals) or Industrial SAL[b] (radionuclides)
Radionuclides (pCi/g)	
Cesium-137	23
Europium-152	11
Uranium-235	87
Uranium-238	430

[a] SSLs from NMED (2006, 092513), unless otherwise noted.

[b] SALs from LANL (2005, 088493).

[c] SSL is from the EPA Regional Screening Table (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/composite_sl_table_run_12SEP2008.pdf)

[d] n/a = Not available.

Table 4.0-1
Summary of Proposed Samples and Analyses

11x17

Table 4.1-1
Summary of Historical Samples Collected and Analyses Requested at TA-15

Sample ID	Location ID	Depth (ft)	Media	Gamma Spectroscopy	High Explosives	Isotopic Uranium	Metals	SVOCs	Uranium	VOCs
SWMU 15-004(b)										
0215-96-0106	15-02428	0.67–1.17	SOIL	—[a]	2535[b]	2530	2529	—	—	—
0215-96-0105	15-02434	0.67–1.17	SOIL	—	2535	2530	2529	—	—	—
0215-96-0104	15-02444	0.83–1.17	SOIL	—	2535	2530	2529	—	—	—
0215-96-0116	15-02444	1.0–1.08	SOIL	—	2558	2562	2560	—	—	—
0215-96-0117	15-02464	2.75–2.92	SOIL	—	2558	2562	2560	—	—	—
SWMU 15-004(f)										
AAB3451	15-02100	1.5–2.0	SOIL	19509	—	—	18681	—	19509	—
AAB3461	15-02112	0.0–0.5	SOIL	19509	—	—	18681	—	19509	—
AAB3476	15-02114	0.0–0.5	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3340	15-02127	1.5–2.0	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3332	15-02137	1.5–2.0	SOIL	19509	—	—	18681	—	19509	—
AAB3304	15-02153	1.0–1.0	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3342	15-02166	0.0–0.33	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3477	15-02172	1.5–2.0	SOIL	19509	—	—	18681	—	19509	—
AAB3336	15-02178	0.0–0.5	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3470	15-02182	1.5–2.0	SOIL	19509	—	—	18681	—	19509	—
AAB3485	15-02198	0.0–0.5	SOIL	19509	—	—	18681, 20984	—	19509	—
AAB3295	15-02206	0.0–0.33	SOIL	19509	—	—	18681, 20993	—	19509	—
AAB3298	15-02240	0.0–0.5	SOIL	19509	—	—	18681	—	19509	—
AAB3473	15-02242	0.0–1.0	SOIL	19509	—	—	18681	—	19509	—
AAB3445	15-02246	0.0–0.5	SOIL	19509	—	—	18681, 20982	—	19509	—
AAB3321	15-02277	0.0–0.42	SOIL	19509	—	—	18681	—	19509	—
AAB3525	15-02279	0.0–0.42	SOIL	19509	—	—	18681	—	19509	—
AAB3325	15-02295	0.0–0.5	SOIL	19509	—	—	18681	—	19509	—
AAB3480	15-02299	1.5–2.0	SOIL	19509	—	—	18681	—	19509	—
SWMU 15-008(a)										
AAB3473	15-02242	0.0–1.0	SOIL	19509	—	—	18681	—	19509	—

Table 4.1-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Gamma Spectroscopy	High Explosives	Isotopic Uranium	Metals	SVOCs	Uranium	VOCs
SWMU 15-009(e)										
0215-97-0021	15-02510	0.0–0.5	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0023	15-02510	0.83–1.17	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0024	15-02511	0.0–0.5	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0025	15-02511	0.83–1.0	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0026	15-02512	0.0–0.5	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0027	15-02512	0.83–1.0	SOIL	—	3358R	—	3359R	—	—	—
0215-97-0030	15-02513	6.0–7.0	SOIL	—	3606R	—	3607R	3605R	—	3605R
0215-97-0031	15-02513	9.67–10.17	SOIL	—	3606R	—	3607R	3605R	—	3605R
0215-97-0032	15-02514	6.0–6.67	SOIL	—	3606R	—	3607R	3605R	—	3605R
0215-97-0033	15-02514	9.67–10.08	SOIL	—	3606R	—	3607R	3605R	—	3605R
0215-97-0034	15-02515	3.0–3.50	SOIL	—	3606R	—	3607R	3605R	—	3605R
0215-97-0035	15-02516	2.17–2.67	SOIL	—	3606R	—	3607R	3605R	—	3605R
SWMU 15-010(a)										
0215-97-0063	15-02520	9.0–9.5	QBT2	—	3492R	—	3493R, 3494R	3491R	—	—
0215-97-0064	15-02521	8.0–8.5	QBT2	—	3492R	—	3493R, 3494R	3491R	—	—
0215-97-0065	15-02522	8.5–9.0	QBT2	—	3492R	—	3493R, 3494R	3491R	—	—
0215-97-0066	15-02523	8.5–9.0	QBT2	—	3492R	—	3493R, 3494R	3491R	—	—

[a] — = Analysis not requested.

[b] Request number.

Table 4.1-2
Inorganic Chemicals Detected above BVs at TA-15

11x17

Table 4.1-3
Organic Chemicals Detected at TA-15

11x17

Table 4.1-4
Radionuclides Detected or Detected above BVs/FVs at TA-15

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Table 4.1-5
Screening-Level Inorganic Chemicals Detected above BVs at SWMU 15-004(f)

11x17

Table 4.1-6
Screening-Level Organic Chemicals Detected at SWMU 15-004(f)

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Table 4.1-7
Screening-Level Radionuclides Detected or Detected above BVs/FVs at SWMU 15-004(f)

Sample ID	Location ID	Depth (ft bgs)	Media	Americium-241	Cesium-137	Europium-152	Ruthenium-106	Uranium-234	Uranium-235	Uranium-238
Soil BV/FV[a]				**0.013**	**1.65**	**na[b]**	**na**	**2.59**	**0.2**	**2.29**
AAB3317	15-02101	0.0–0.5	SOIL	NA[c]	—[d]	NA	NA	NA	0.4029	NA
AAB3306	15-02115	0.0–0.5	SOIL	NA	—	NA	NA	NA	0.6634	NA
AAB3484	15-02119	0.0–0.25	SOIL	NA	NA	NA	NA	NA	NA	NA
AAB3339	15-02125	0.0–0.5	SOIL	NA	—	NA	NA	NA	0.7885	NA
AAB3450	15-02134	0.0–0.5	SOIL	NA	NA	NA	NA	NA	0.3652	NA
AAB3312	15-02139	1.42–1.92	SOIL	—	0.079	—	—	NA	NA	NA
AAB3327	15-02149	0.25–0.75	SOIL	—	0.226	—	—	NA	NA	NA
AAB3458	15-02152	0.0–0.42	SOIL	—	—	0.164	—	NA	NA	NA
AAB3344	15-02153	0.0–0.42	SOIL	—	—	0.263	0.664	NA	NA	NA
AAB3528	15-02154	0.0–0.25	SOIL	NA	—	NA	NA	NA	NA	NA
AAB3475	15-02155	0.0–0.33	SOIL	3.9	—	NA	NA	1652.33	86.59	1687.3
AAB3300	15-02167	0.0–0.5	SOIL	NA	NA	NA	NA	NA	0.5598	NA
AAB3478	15-02226	0.0–0.5	SOIL	NA	NA	NA	NA	NA	2.17	NA
AAB3518	15-02227	0.0–0.5	SOIL	NA	—	NA	NA	NA	2.74	NA
AAB3320	15-02228	0.0–0.5	SOIL	—	NA	NA	NA	NA	18.89	NA
AAB3326	15-02229	0.0–0.33	SOIL	NA	NA	NA	NA	NA	2.74	NA
AAB3302	15-02230	0.0–0.25	SOIL	NA	—	NA	NA	NA	2.72	NA
AAB3328	15-02231	0.0–0.42	SOIL	NA	—	NA	NA	NA	11.05	NA
AAB3516	15-02239	0.0–1.0	SOIL	—	0.352	—	—	NA	NA	NA
AAB3331	15-02243	0.0–1.0	SOIL	—	0.294	—	—	NA	NA	NA
AAC0342	15-02245	14.0–15.0	SOIL	—	—	NA	—	NA	8.23	NA

Table 4.1-7 (continued)

Sample ID	Location ID	Depth (ft bgs)	Media	Americium-241	Cesium-137	Europium-152	Ruthenium-106	Uranium-234	Uranium-235	Uranium-238
Soil BV/FV[a]				**0.013**	**1.65**	**na**[b]	**na**	**2.59**	**0.2**	**2.29**
AAC0339	15-02246	1.83–2.33	SOIL	1.04	—	NA	—	NA	4.91	NA
AAB3420	15-02247	0.0–0.5	SOIL	—	—	0.354	—	NA	NA	NA
AAC0341	15-02249	2.92–3.42	SOIL	—	—	NA	—	NA	4.61	NA
AAB3294	15-02278	0.0–0.5	SOIL	—	—	0.124	—	NA	NA	NA
AAC0328	15-02290	0.0–0.5	SOIL	—	—	NA	—	NA	0.891	NA
AAC0326	15-02290	16.0–17.0	SOIL	—	—	0.239	—	NA	NA	NA

Note: Units are pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] NA = Sample was not analyzed for this radionuclide.

[d] — = Result was not detected or was below the BV/FV.

Table 4.1-8
Proposed Sampling Locations at SWMU 15-004(f) with
Inorganic Chemicals and/or Radionuclides Detected above BVs/FVs

15-02100	15-02141	15-02226	15-02172	15-02179	15-02157
15-02101	15-02139	15-02151	15-02149	15-02277	15-02144
15-02114	15-02137	15-02152	15-02182/-02299	15-02178	15-02147
15-02115	15-02125	15-02153	15-02231	15-02206	15-02240
15-02127	15-02112	15-02227	15-02180	15-02166	15-02241
15-02119	15-02123	15-02228	15-02191	15-02167	15-02170
15-02131/-02198*	15-02134	15-02173	15-02177	15-02278	15-02155

*Sample location IDs share a single location.

Table 4.2-1
Summary of Historical Samples Collected and Analyses Requested at TA-36

Sample ID	Location ID	Depth (ft)	Media	Gamma Spectroscopy	High Explosives	Isotopic Uranium	Metals	SVOCs	Uranium	VOCs
SWMU 36-001										
0236-96-0009	36-03127	10.83–13.33	SOIL	—[a]	1808[b]	1810	1809	1808	—	1808
0236-96-0010	36-03127	14.25–16.67	SOIL	—	1808	1810	1809	1808	—	1808
0236-96-0022	36-03131	5.5–7.58	SOIL	—	1791	1793	1792	1791	—	1791
0236-96-0023	36-03131	9.17–11.67	SOIL	—	1791	1793	1792	1791	—	1791
SWMU 36-004(d)										
0236-95-0001	36-03175	0.5–1.08	SOIL	1700	1698	1700	1699	1698	—	1698
0236-95-0002	36-03175	2.33–2.75	SOIL	1700	1698	1700	1699	1698	—	1698
0236-95-0003	36-03176	0.5–1.0	SOIL	1700	1698	1700	1699	1698	—	1698
0236-95-0004	36-03176	2.0–2.58	SOIL	1700	1698	1700	1699	1698	—	1698
0236-96-0001	36-03177	2.0–2.58	SOIL	1728	1727	1728	1726	1725	—	-
0236-96-0002	36-03177	4.42–5.08	SOIL	1728	1727	1728	1726	1725	—	1725
0236-96-0003	36-03177	5.58–6.33	QBT2	1728	1727	1728	1726	1725	—	1725
0236-96-0004	36-03178	0.33–1.08	SOIL	1728	1727	1728	1726	1725	—	1725
0236-96-0005	36-03178	3.17–3.67	SOIL	1728	1727	1728	1726	1725	—	1725
0236-96-0007	36-03179	3.33–4.17	SOIL	1728	1727	1728	1726	1725	—	1725
SWMU 36-005										
0236-97-0023	36-03026	1.67–1.83	SOIL	—	—	—	—	—	—	3076R
0236-97-0024	36-03038	1.0–1.17	SOIL	—	—	—	—	—	—	3076R
0236-97-0026	36-03039	1.33–1.5	SOIL	—	—	—	—	—	—	3076R
0236-97-0027	36-03039	3.25–3.33	SOIL	—	—	—	—	—	—	3076R
SWMU 36-006										
0236-95-0083	36-03145	0.0–0.33	SOIL	—	1711	—	1713	1712	—	1712
0236-95-0087	36-03145	1.33–2.0	SOIL	—	1711	—	1713	1712	—	1712
0236-95-0084	36-03146	0.0–0.33	SOIL	—	1711	—	1713	1712	—	1712
0236-95-0123	36-03146	1.33–2.0	SOIL	—	1711	—	1713	1712	—	1712
0236-95-0086	36-03147	0.0–0.33	SOIL	—	1711	—	1713	1712	—	1712
0236-95-0088	36-03149	0.0–0.33	SOIL	—	1711	—	1713	1712	—	1712

[a] — = Analysis not requested.

[b] Request number.

Table 4.2-2
Inorganic Chemicals Detected above BVs at TA-36

11x17

Table 4.2-3
Organic Chemicals Detected at TA-36

11x17

Table 4.2-4
Radionuclides Detected or Detected above BVs/FVs at TA-36

Sample ID	Location ID	Depth (ft bgs)	Media	Cesium-137	Europium-152	Uranium-235	Uranium-238
Soil BV/FV[a]				**1.65**	**na[b]**	**0.20**	**2.29**
SWMU 36-001							
0236-96-0022	36-03131	5.5–7.58	SOIL	NA[c]	NA	—[d]	3.862
SWMU 36-004(d)							
0236-95-0001	36-03175	0.5–1.08	SOIL	0.24	—	—	—
0236-95-0002	36-03175	2.33–2.75	SOIL	0.066	—	—	—
0236-96-0001	36-03177	2.0–2.58	SOIL	0.221	—	—	2.69

Note: Units are pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] NA = Sample was not analyzed for this radionuclide.

[d] — = Result was not detected or was below the BV/FV.

Table 4.2-5
Screening-Level Inorganic Chemicals Detected above BVs at SWMU 36-005

Sample ID	Location ID	Depth (ft bgs)	Media	Antimony	Cadmium	Silver	Thallium	Uranium
Soil BV[a]				**0.83**	**0.4**	**1**	**0.73**	**1.82**
AAB1834	36-03018	0.0–0.5	SOIL	7.86 (U)	0.42 (U)	—[b]	1.34 (U)	2.61 (J)
AAB1836	36-03019	0.0–0.5	SOIL	7.49 (U)	—	—	1.3 (U)	2.64 (J)
AAB1837	36-03020	0.0–0.5	SOIL	7.65 (U)	0.41 (U)	—	1.25 (U)	2.77 (J)
AAB1838	36-03021	0.0–0.5	SOIL	8.1 (U)	0.44 (U)	—	1.34 (U)	3.5 (J)
AAB1839	36-03022	0.0–0.5	SOIL	8.21 (U)	0.44 (U)	—	1.32 (U)	3.17 (J)
AAB1840	36-03023	0.0–0.5	SOIL	7.88 (U)	0.42 (U)	—	1.34 (U)	2.49 (J)
AAB1841	36-03024	0.0–0.5	SOIL	7.59 (U)	0.41 (U)	—	1.31 (U)	3.42 (J)
AAB1842	36-03025	0.0–0.5	SOIL	7.24 (U)	—	—	1.3 (U)	—
AAB1843	36-03026	0.0–0.5	SOIL	7.01 (U)	—	—	1.24 (U)	8.15
AAB1852	36-03034	0.0–0.5	SOIL	5.3 (U)	0.53 (U)	—	—	3.31
AAB1854	36-03035	0.0–0.5	SOIL	5.3 (U)	0.53 (U)	—	—	2.43
AAB1855	36-03036	0.0–0.5	SOIL	5.2 (U)	0.52 (U)	—	—	2.18
AAB1856	36-03037	0.0–0.5	SOIL	5.2 (U)	0.52 (U)	—	—	2.88
AAB1857	36-03038	0.0–0.5	SOIL	5.4 (U)	0.54 (U)	—	—	2.3
AAB1858	36-03039	0.0–0.5	SOIL	5 (U)	0.5 (U)	—	—	2.8
AAB1859	36-03040	0.0–0.5	SOIL	5.2 (U)	0.55	—	—	2.01
AAB1860	36-03041	0.0–0.5	SOIL	5.2 (U)	0.52 (U)	—	—	2.21
AAB1861	36-03042	0.0–0.5	SOIL	6.77 (U)	—	1.3 (U)	1.24 (U)	1.93
AAB1863	36-03043	0.0–0.5	SOIL	7.22 (U)	—	1.2 (U)	1.25 (U)	2.34
AAB1864	36-03044	0.0–0.5	SOIL	7.61 (U)	0.41 (U)	1.3 (U)	1.31 (U)	2.7
AAB1865	36-03045	0.0–0.5	SOIL	7.75 (U)	0.42 (U)	1.2 (U)	1.33 (U)	2.54
AAB1866	36-03046	0.0–0.5	SOIL	7.11 (U)	—	—	1.23 (U)	2.33
AAB1867	36-03047	0.0–0.5	SOIL	7.78 (U)	0.42 (U)	1.3 (U)	1.39 (U)	5.11
AAB1868	36-03048	0.0–0.5	SOIL	7.7 (U)	0.48 (U)	1.4 (U)	1.31 (U)	2.48
AAB1869	36-03049	0.0–0.5	SOIL	7.36 (U)	—	—	1.23 (U)	—
AAB1870	36-03050	0.0–0.5	SOIL	7.06 (U)	—	—	1.27 (U)	3.46
AAB1872	36-03051	0.0–0.5	SOIL	7.31 (U)	—	1.3 (U)	1.24	2.45

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] — = Result was not detected or was below the BV.

Table 4.2-6
Screening-Level Organic Chemicals Detected at SWMU 36-005

Sample ID	Location ID	Depth (ft bgs)	Media	Acetone	Methyl-2-pentanone[4-]	Methylene Chloride	RDX	Toluene	Trichloroethene	Trimethylbenzene[1,2,4-]	Xylene (Total)
AAB1834	36-03018	0.0-0.5	SOIL	—*	—	0.011	—	—	—	—	—
AAB1839	36-03022	0.0-0.5	SOIL	—	—	0.012	1.72	—	—	—	—
AAB1840	36-03023	0.0-0.5	SOIL	—	—	0.007	—	—	—	—	—
AAB1841	36-03024	0.0-0.5	SOIL	—	—	0.008	—	—	—	—	—
AAB1843	36-03026	0.0-0.5	SOIL	0.52	—	0.13 (J)	—	—	—	—	—
AAB1854	36-03035	0.0-0.5	SOIL	—	—	0.01	—	—	—	—	—
AAB1857	36-03038	0.0-0.5	SOIL	—	—	0.016	—	0.009	0.035	0.07	0.061
AAB1858	36-03039	0.0-0.5	SOIL	—	0.02	—	—	0.028	0.11	0.12	0.143
AAB1859	36-03040	0.0-0.5	SOIL	—	—	0.01	—	—	—	—	—
AAB1860	36-03041	0.0-0.5	SOIL	—	—	0.01	—	0.008	0.031	0.055	0.055

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.
*— = Result was not detected.

Table 4.2-7
Screening-Level Radionuclides Detected or Detected above BVs/FVs at SWMU 36-005

Sample ID	Location ID	Depth (ft bgs)	Media	Europium-152	Uranium-235
Soil BV/FV[a]				**na**[b]	**0.2**
AAB1834	36-03018	0.0–0.5	SOIL	NA[c]	0.224
AAB1839	36-03022	0.0–0.5	SOIL	NA	0.2063
AAB1843	36-03026	0.0–0.5	SOIL	0.257	NA
AAB1857	36-03038	0.0–0.5	SOIL	NA	0.2087

Note: Units are pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] NA = Sample was not analyzed for this radionuclide.

Table 5.0-1
Summary of Investigation Methods

Method	Summary
Locating Utilities	Excavation/Soil Disturbance Permits will be obtained from the Industrial Hygiene and Safety–Operational Support Division. Underground utilities will be located, and the excavation permits secured before the readiness and planning review and before any field activities are undertaken.
Spade-and-Scoop Collection of Soil Samples	This method will be used to collect surface (i.e., 0–6 in.) soil or fill samples. A hole will be dug to the desired depth, as prescribed in the work plan, and a discrete grab sample collected. The sample will be homogenized in a decontaminated stainless-steel bowl before it is transferred to the appropriate sample containers.
Hand Auger Collection of Soil Samples	This method will typically be used for sampling soil or sediment at depths of less than 10–15 ft but may in some cases be used for collecting samples of weathered or nonwelded tuff. The method involves hand-turning a stainless-steel bucket auger (typically 3–4 in. inside 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 various required sample containers are filled.
Split-Spoon Core-Barrel Sampling	The split-spoon core barrel is a cylindrical barrel split lengthwise so the two halves can be separated to expose the core sample. The stainless-steel core barrel (3-in.-inner-diameter and 5 ft long) is pushed directly into the subsurface media with a hollow-stem auger drilling rig. A continuous length of core is extracted with the core barrel. Once it is extracted, the section of core will be screened for radioactivity and organic vapors, photographed, and described in a lithologic log. If it is located within a targeted sample interval, a portion of the core will be collected for fixed laboratory analysis.
Field Logging, Handling, and Documentation of Borehole Materials	Upon reaching the surface, core barrels will be immediately opened for field-screening, logging, and sampling. Logging of borehole materials includes run number, core recovery in feet, depth interval (in 5-ft increments), field-screening results, lithological and structural description, and a photograph. Once the core material is logged, selected samples will be taken from discrete intervals of the core. All borehole material not sampled will be managed as IDW.
Borehole Abandonment	Shallow boreholes, with a total depth of 20 ft or less, will be abandoned by filling the borehole with bentonite chips and then hydrating the chips in 1- to 2-ft lifts. The borehole will be visually inspected while the bentonite chips are being added to ensure bridging does not occur. Boreholes greater than 20 ft in depth will be pressure-grouted from the bottom of the borehole to the surface using the tremie pipe method. Acceptable grout materials include cement or bentonite grout, neat cement, or concrete. The use of backfill materials such as bentonite and grout will be documented in a field logbook regarding volume (calculated and actual), intervals of placement, and additives used to enhance backfilling. All borehole abandonment information will be presented in the investigation report.
Geophysical Surveys	Geophysical surveys will be performed at selected sites to identify anomalies that would indicate the location of former waste disposal sites. Geophysical methods employed will include terrain conductivity (EM-31 or equivalent), high-sensitivity metal detection (EM-61 or equivalent), and GPR. The area to be surveyed will be gridded as specified in the work plan and data digitally recorded. Geodetic coordinates will be recorded at 1-s intervals using an integrated GPS.
Headspace Vapor Screening	All soil and tuff samples will be field screened for VOCs by placing a portion of the sample in a glass jar. The jar will be sealed with foil and gently shaken and allowed to equilibrate for approximately 5 min. The sample will then be screened by inserting a PID probe equipped with an 11.7-eV lamp into the container. The results will be recorded in units of ppm.

Table 5.0-1 (continued)

Method	Summary
XRF Screening	Soil samples will be screened in the field using XRF to delineate areas of inorganic chemical contamination. The XRF used will have a diction limit equal to approximately 10% to 20% of the SSL. Samples will be collected and analyzed in accordance with the XRF manufacturer's instructions, including analysis of standards and other QA/QC samples.
Handling, Packaging, and Shipping of Samples	Samples will be sealed and labeled before they are packed in ice. Sample and transport containers will be examined to ensure they are free of external contamination. Samples will be packaged to minimize the possibility of breakage during transport. After environmental samples are collected, packaged, and preserved, they will be transported to the Sample Management Office (SMO). A split of each sample will be sent to an SMO-approved radiation-screening laboratory under chain of custody (COC). Once radiation-screening results are received, the SMO will send the corresponding analytical samples to fixed laboratories for full analysis.
Containers and Preservation of Samples	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on EPA guidance for environmental sampling, preservation, and QA. Specific requirements for each sample will be printed in the sample collection logs (SCLs) provided by the SMO (size and type of container, preservatives, etc.). All samples will be preserved by placing them in insulated containers with ice to maintain a temperature of 4°C.
Sample Control and Field Documentation	The collection, screening, and transport of samples will be documented on standard forms generated by the SMO. These forms include SCLs, COC forms, and sample container labels. Collection logs will be completed at the time the samples are collected and signed by the sampler and a reviewer who verifies that the logs are complete and accurate. Corresponding labels will be initialed and applied to each sample container, and custody seals will be placed around container lids or openings. The COC forms will be completed and assigned to verify that the samples are not left unattended.
Coordinating and Evaluating Geodetic Surveys	Geodetic surveys will focus on obtaining survey data of acceptable quality to use during project investigations. Geodetic surveys will be conducted with a Trimble 5700 DGPS. 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 State Plane Coordinate System, North American Datum 83, New Mexico Central Zone, U.S. survey ft. All elevation data will be reported relative to the National Geodetic Vertical Datum of 1983.
Management, Characterization, and Storage of IDW	The 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 signs and labels. Each waste generated container will be individually labeled with waste classification, item ID, and radioactivity (if applicable) immediately following containerization. All waste will be segregated by classification and compatibility to prevent cross-contamination.
Field Quality Control Samples	Field QC samples will be collected as follows. Field duplicate samples will be collected at a frequency of 10%. Field duplicates will be collected at the same time as a regular sample and submitted for the same analyses. Trip blanks will be collected whenever samples were collected for VOC analysis. Trip blanks will be collected at a frequency of one sample per day when VOC samples are collected. Trip-blank containers will consist of certified clean sand that are opened and kept with the other sample containers during the sampling process.
Field Decontamination of Equipment	Dry decontamination will be the preferred method at the investigation site to minimize generating liquid waste. Dry decontamination will include using a wire brush or other tool to remove soil or other material adhering to the sampling equipment, followed by applying a commercial cleaning agent (i.e., Fantastik) and paper wipes.