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Investigation Work Plan for Lower Pajarito Canyon Aggregate Area, Revision 1

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EXECUTIVE SUMMARY

The Lower Pajarito Canyon Aggregate Area includes Technical Area 18 (TA-18), former TA-27, and TA-54 of Los Alamos National Laboratory (the Laboratory) and consists of 72 solid waste management units (SWMUs) and areas of concern (AOCs). Of these sites, 11 sites have been previously investigated and/or remediated and have been approved for no further action. Thirty sites have been or will be investigated under TA-54 investigations and are not discussed in this work plan. For the remaining 31 sites, this work plan describes the operational history, evaluates existing analytical data, and proposes characterization activities. Details of previous investigations and analytical results for all 31 sites are provided in the historical investigation report for Lower Pajarito Canyon Aggregate Area.

Of the 31 sites in the Lower Pajarito Canyon Aggregate Area that require some additional characterization activities, 29 sites are located within TA-18, and 2 sites are located within former TA-27. These sites include the following:

- septic tanks and outfalls
- sanitary waste lines and sewage treatment facilities
- industrial waste lines, drains, and outfalls
- storm drains and outfalls
- areas of potential soil contamination from Laboratory operations

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 Lower Pajarito Canyon Aggregate Area. If the sampling approach proposed in this work plan is not sufficient to define nature and extent of contamination, the Laboratory will request approval from New Mexico Environment Department to add sampling locations and analysis, as needed. To the extent possible, multiple phases of investigation will be avoided.

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Appendixes

Appendix A Acronyms and Abbreviations, Metric Conversion Table, and Data Qualifier Definitions
Appendix B Management Plan for Investigation-Derived Waste

Plates

Plate 1 Lower Pajarito Canyon Aggregate Area

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, shown in Figure 1.0-1, 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 (the 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 ft to 7800 ft above mean sea level. The Lower Pajarito Canyon Aggregate Area is shown on Plate 1.

The Laboratory's Environmental Programs (EP) Directorate, formerly the Environmental Restoration Project, is participating in a national effort by DOE to clean up sites and facilities formerly involved in weapons research and development. The goal of the EP Directorate 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, the EP Directorate is currently investigating sites potentially contaminated by past Laboratory operations. The purpose of this investigation work plan is to provide supporting information for the activities necessary to complete site investigations. The sites under investigation are designated as solid waste management units (SWMUs) and areas of concern (AOCs).

The SWMUs and AOCs (sites) 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 a 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 Lower Pajarito Canyon Aggregate Area consists of 72 SWMUs and AOCs located in Technical Area 18 (TA-18), former TA-27, and TA-54.

Thirty of the Lower Pajarito Canyon Aggregate Area sites are located in TA-54. Of the 30 sites located in TA-54, 9 have been approved for no further action (NFA), 9 have been or will be closed under the Resource Conservation and Recovery Act (RCRA), and 9 are included in other Consent Order investigations. The remaining three TA-54 sites [AOC 54-012(a), SWMU 54-012(b), and AOC 54-015(b)] are proposed to be included in the final closure activities undertaken for TA-54 Areas G or L. Thus, none of the Lower Pajarito Aggregate Area sites located at TA-54 are proposed for investigation in this work plan.

For the remaining 42 sites in the Lower Pajarito Canyon Aggregate Area, 11 have been previously investigated and/or remediated and have been approved for NFA, and 31 are addressed in this work plan. For the 31 sites addressed in this work plan, investigation activities are proposed using information from previous field investigations to evaluate current conditions at each site. Of these 31 sites, 29 are located within TA-18, and 2 are within former TA-27. Historical details of previous investigations and data for the TA-18 and former TA-27 sites are provided in the historical investigation report (HIR) for Lower Pajarito Canyon Aggregate Area (LANL 2010, 109639).

Table 1.1-1 provides a summary of the 72 sites within the Lower Pajarito Canyon Aggregate Area. For the 41 sites not included in this work plan, brief descriptions and summaries of their status are presented in Table 1.1-1, but the sites are not discussed in detail. Plate 1 shows the locations of the sites under investigation in the Lower Pajarito Canyon Aggregate Area along with monitoring wells, surface water and stormwater runoff monitoring stations, and canyon reaches.

Section 2 of this work plan presents general site information, operational history, the preliminary conceptual site model, a data overview, and investigation objectives. General site conditions are presented in section 3. Specific site descriptions and proposed investigation activities are presented in sections 4 (TA-18), 5 (former TA-27), and 6 (TA-54). Investigation methods are described in section 7. Ongoing monitoring and sampling programs in the Lower Pajarito Canyon Aggregate Area and surrounding TAs are presented in section 8, and an overview of the anticipated schedule is presented in section 9. Section 10 lists the references cited in this work plan and the map data sources. Appendix A contains the list of acronyms and abbreviations used in this investigation work plan, a metric conversion table, and a data qualifier definition table. Appendix B describes the management of investigation-derived waste (IDW).

1.2 Work Plan Objectives

The first objective of this work plan is to propose sampling that will define the nature and extent of contamination associated with the sites. The second objective is to support decisions regarding the need to remediate or remove inactive structures related to the sites, where appropriate.

To accomplish this objective, this work plan

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

Where appropriate, the investigation will use data collected in canyon reaches, reported in the Pajarito Canyon Investigation Report (LANL 2008, 104909), to supplement the data from samples proposed in this work plan as necessary to define the nature and extent of contamination. Data in downstream reach PA-3E are expected to serve to define the lateral extent of contamination associated with one or more sites in the Lower Pajarito Canyon Aggregate Area investigation.

2.0 BACKGROUND

2.1 General Site Information

The Lower Pajarito Canyon Aggregate Area is located in the east-central portion of the Laboratory and includes the section of Pajarito Canyon from its junction with Threemile Canyon downstream to where it joins the Rio Grande. The aggregate area includes portions of TA-18 in Threemile and Pajarito Canyons, TA-36 in Pajarito Canyon and on Potrillo Mesa to the south of the canyon, TA-54 on Mesita del Buey to the north of Pajarito Canyon, and private land to the east of the Laboratory boundary at NM 4.

The Lower Pajarito Canyon Aggregate Area consists of 72 SWMUs and AOCs located in TA-18, former TA-27, and TA-54, presented in Table 1.1-1.

TA-18, now known as Pajarito Site, is located at a fork in Pajarito Canyon where Threemile Canyon enters from the southwest. TA-18 contains 38 SWMUs and AOCs. Of these, 9 have been approved for NFA and 29 will be investigated as part of this work plan. Former TA-27 contains four SWMUs and AOCs; two sites have been approved for NFA and two sites will be investigated as part of this work plan. TA-54 contains 30 SWMUs and AOCs, none of which will be investigated as part of this work plan (see section 1.1).

TA-18 was first developed in 1943 to study properties of radioactive materials and then used as a firing site. The central area at TA-18 originally consisted primarily of building 18-1, which contained an electronics laboratory, a shop, and a photochemical laboratory (LANL 1993, 015310, p. 2-4). Buildings TA-18-23, TA-18-32, and TA-18-116 are three remotely controlled kivas that surround the central area of TA-18 and building 18-1. During the 1970s and 1980s, buildings TA-18-186, TA-18-187, TA-18-188, TA-18-189, TA-18-227, TA-18-256, TA-18-257, and TA-18-258 were added to the site (LANL 1993, 015310, p. 2-10). Currently TA-18 is undergoing decontamination and decommissioning (Birdsell 2008, 102779). Demolition will be undertaken at some future date.

Former TA-27, located in Pajarito Canyon, lies within the current boundaries of TA-36 near the southern boundary of TA-54. Former TA-27 was used during the war years by a plutonium gun assembly program. The TA included firing sites at which large shots containing uranium or thorium and beryllium were tested. The army also used the area as a mortar impact area. In late 1945, former TA-27 was upgraded with several structures from TA-18 and became known as Gamma Site. Within the present boundaries of TA-18 were two firing sites. From 1945 to 1947, former TA-27 served as TA-18’s third firing site, called Far Point. From west to east, former TA-27’s structures consisted of two small concrete control bunkers covered by earthen berms, a boardwalk, a series of instrumented manholes, and five round firing pits. During the 1960s, all structures, concrete foundations, and debris were removed from former TA-27 and the ground surface was leveled. Firing Pit 4 and Firing Pit 5 were north of Pajarito Road; all other structures were south of Pajarito Road. Only Firing Pit 4 has a surface expression; the other firing pits are buried. The material in and around Firing Pit 5 may have been removed during excavations for road gravel (LANL 1993, 015310, p. 2-3).

TA-54 is located on east-west trending Mesita del Buey and is bounded by Cañada del Buey to the north and Pajarito Canyon to the south. All TA-54 sites within the Lower Pajarito Canyon Aggregate Area are being addressed under TA-54 corrective actions and will be included in the final closure activities undertaken for Area G or Area L.

2.2 Operational History

TA-18 was developed in August 1943 during the Manhattan Project to study rates of spontaneous fission from samples of radioactive materials (LANL 1993, 015310, p. 2-4). During this period, TA-18 was known as Pajarito Canyon Laboratory. In 1944, TA-18 was enlarged and used as a proving ground to study implosions. Explosives testing ended in late 1945. In April 1946, the site was transferred to the Laboratory’s Critical Assemblies Group. Since that time, TA-18 activities have revolved around critical assembly work (LANL 1993, 015310, p. 2-4).

From 1955 to 1972, fission reactor mockup studies for the Rover Program, a nuclear rocket propulsion program, were also conducted at TA-18 using remotely controlled structures, referred to as kivas. SWMUs 18-003(a), 18-003(b), 18-003(c), 18-003(d), 18-012(a), and AOCs 18-013 and 18-010(f) were potentially impacted by mockup studies conducted within the kivas. Reactor mockups consisted of various geometries and used materials such as deuterium oxide, enriched uranium, graphite, niobium, uranium oxide, and zirconium hydride. Beryllium oxide was also used in some mockups. The Rover Program was terminated in 1973 (LANL 1993, 015310, p. 2-10). All operations at TA-18 ceased in July 2004, (Birdsell 2008, 102779).

From 1945 to 1947, former TA-27 was used for full-scale tests of implosion weapon designs that required larger charges of high explosives (HE) that could be fired at the two TA-18 firing sites. Shots fired at former TA-27's Gamma Site contained up to two tons of HE and used materials such as beryllium, depleted uranium, and thorium. In early 1947, the entire site was abandoned and fenced off; since that time, no Laboratory operations have taken place at former TA-27. Around 1969, the sanitary sewage lagoons were built. This was the last major activity at TA-27 (LANL 1993, 015310, pp. 2-1−2-3).

TA-54 Area G is the main site for the storage and disposal of radioactive solid waste at the Laboratory. Area L was used as a disposal site for hazardous chemicals from the late 1950s until land disposal stopped in 1985. No disposal of hazardous or mixed waste currently occurs at either Area G or at Area L. Waste management operations at Area G and Area L are currently conducted under a RCRA operating permit for the storage of hazardous and nonhazardous mixed waste. Mixed waste is stored under interim status authority (LANL 1992, 007669, pp. 2-1−2-6).

2.3 Conceptual Site Model

The sampling proposed in this work plan is based on a conceptual site model that identifies likely areas of potential contamination. A conceptual site model describes potential contaminant sources, transport mechanisms, and receptors. The conceptual site model is applied to individual sites to select sampling locations that are most likely to define the nature and extent of contamination. Analytical results from the samples collected may lead to changes or refinement of the conceptual site model and a need for additional characterization sampling in a later phase of the investigation.

2.3.1 Potential Contaminant Sources

Releases at the sites may have occurred as a result of leaks from sanitary lagoons, septic systems, sumps, tanks, outfalls, drainlines, sewer lines, waste lines, settling pits, pipes, and drains; discharges from outfalls; or releases from buildings, firing sites, drop towers, bazooka impacts, and magazines.

2.3.2 Potential Contaminant Transport Mechanisms

Current potential transport mechanisms that may lead to exposure include the following:

- 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 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

Potential receptors at one or more of the sites include the following:

- Laboratory workers
- construction workers
- plants and animals

2.3.4 Cleanup Standards

As specified in section VII.B.1 of the Consent Order, soil screening levels will be used as soil cleanup levels unless they are determined to be impractical or unless values do not exist for the current and reasonably foreseeable future land use. Human health screening levels for chemicals and radionuclides are provided in Table 2.3-1.

2.4 Data Overview

Data evaluated in this investigation work plan include historical data collected from 1994 to 1998 as part of 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.

In the early years the samples were submitted to the Laboratory's Chemical Science and Technology (CST) Division and were either analyzed at a CST laboratory (on-site) or submitted to one of several off-site contract analytical laboratories. Samples analyzed at a CST laboratory are identified by the vintage code "CST Onsite." Two vintage codes identify samples CST Division submitted to off-site contract analytical laboratories: "CST Offsite" if validation was not performed and "CSTROUT03" if validation was performed.

From late 1995 until the present, samples have been submitted through the Sample Management Office (SMO) to off-site contract analytical laboratories. Two vintage codes identify samples the SMO submitted to off-site contract analytical laboratories—"AN95" if validation was not performed and "SMO" if validation was performed.

Decision-level data for inorganic chemicals and radionuclides from previous investigations are compared with background values (BVs) and fallout values (FVs) (LANL 1998, 059730) as applicable. The data tables for inorganic chemicals and radionuclides include only decision-level data where sample concentrations are greater than the BVs or FVs or detected if no BVs/FVs are available. Data tables for organic chemicals include all detected concentrations of organic chemicals.

Decision-level data will be used to determine the nature and extent of site contaminants, and to perform human health and ecological risk screening evaluations, as appropriate. Screening-level data are used to determine areas of contamination and to direct sample collection and analyses proposed in this investigation work plan but will not be used in defining the nature and extent of contamination or in risk screening evaluations.

2.5 Investigation Objectives

The goal of the investigation is to characterize sites with sufficient samples to (1) define the nature and extent of contamination, (2) determine whether chemical concentrations are statistically different than background, and (3) calculate meaningful 95% upper confidence limits for each contaminant at each site that can serve as an exposure point concentration for risk screening evaluations. In this investigation work plan, if the nature and extent of contamination are not defined for a site, samples are proposed to obtain the necessary data based on available decision-level and/or screening-level data, site history, and a conceptual site model. As discussed in the individual sections for each site, the nature and extent of contamination are not currently defined for any of the sites under investigation.

The proposed investigation is based on a biased sampling approach enabled by adequate knowledge of site operational history and current site configurations. The goal that site sample data be compared with background using statistical methods requires that a sufficient number of samples be collected at each site to enable statistically valid comparisons. Statistical comparisons may be used when a minimum of 10 samples are available for each combination of contaminant and sample media (e.g., chromium in soil, lead in sediment, etc.). Where practicable, this investigation work plan proposes a sufficient number of samples to perform statistical comparisons with background for each contaminant. In addition, the need to define the vertical extent of contamination requires that at each sampling location, a minimum of two depth intervals be sampled.

It is the intent of this work plan to define nature and extent of contamination identified above background levels. If during the sampling campaign it is discovered that the sampling approach proposed is not sufficient to define nature and extent of contamination for a given site, the Laboratory will request approval from NMED to add sampling locations and analysis, as needed. To the extent possible, multiple phases of investigation will be avoided.

3.0 SITE CONDITIONS

3.1 Surface Conditions

3.1.1 Topography

Lower Pajarito Canyon Aggregate Area is located in the canyon bottom of Pajarito Canyon and at the confluence of Threemile Canyon and Pajarito Canyon, shown on Plate 1. The area is a flat canyon bottom bounded by steep canyon walls on both sides. The area extends from an elevation of approximately 6630 ft to 6800 ft above sea level. The drainage area for the canyon systems extends from the topographic divide on the Sierra de Los Valles (to the west) eastward to the Rio Grande. During the summer, stormwater runoff occasionally reaches the Rio Grande via the canyon systems (LANL 1997, 055622, p. 3-1).

3.1.2 Vegetation

The vegetation communities are similar for all the areas composing the Lower Pajarito Canyon Aggregate Area. The primary community in the canyon bottom is piñon-juniper, and on the canyon walls it is ponderosa pine. The dominant overstory trees in the canyon bottom are one-seed juniper, piñon, and ponderosa pine. Shrubs consist primarily of Gambel oak, wavyleaf oak, and mountain mahogany, and to a lesser extent cliff rose, squawbush, and big sagebrush. The dominant grass is blue gramma along with bluestem and mountain muhly. Common forbs include wormwood and bittersweet. Open areas without vegetation are also present.

3.1.3 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. By 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 Lower Pajarito Canyon Aggregate Area belongs to the Rock Outcrop, Steep; Totavi; and the Typic Ustorthents−Rock Outcrop complex. Soil descriptions are summarized below (Nyhan et al. 1978, 005702).

- The Rock Outcrop, Steep soil mainly consists of tuff except at the lower end of some of the canyons where there is basalt. The soil is very shallow and undeveloped situated on tuff, mesic rock outcrop, and frigid rock outcrop.
- The Totavi series consists of deep, well-drained soil with an A horizon sequence that formed in alluvium in canyon bottoms. Soil textures are a gravelly loamy sand or sandy loam.
- The Typic Ustorthents−Rock Outcrop complex includes deep well-drained soil that weathered from dacites and latites of the Puye Conglomerate. The surface layers of this complex are generally a pale-brown stony or gravelly sandy loam about 5 cm thick with moderately rapid to very rapid permeability and a very low available water capacity.

3.1.4 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. Figure 3.1-1 shows surface-water drainage to the Rio Grande.

The surface-water infiltration pathways within the aggregate area include native or disturbed soil, unconsolidated alluvium, Bandelier Tuff, Puye Formation, basalt, faults and fracture systems, and cooling joints (LANL 1999, 064617, p. 3-25).

3.1.5 Land Use

Currently, land use of the Lower Pajarito Canyon Aggregate Area is industrial. The area is anticipated to remain industrial through continued use by the Laboratory and will not change in the foreseeable future. Public access is controlled through physical controls, including fencing and limited access via guard stations.

3.2 Subsurface Conditions

3.2.1 Stratigraphic Units

This section summarizes the stratigraphy of the Lower Pajarito Canyon Aggregate Area. Additional information on the geologic setting of the area and information on the Pajarito Plateau can be found in the Laboratory's Hydrogeologic Workplan (LANL 1998, 059599). Figure 3.2-1 shows a generalized stratigraphic sequence for the Pajarito Plateau.

The bedrock at or near the surface of the mesa top is the Bandelier Tuff. There are approximately 1250 ft of volcanic and sedimentary materials between any potential contaminant-bearing units at the mesa surface and the regional aquifer. The stratigraphic units that may be encountered during investigation of the Lower Pajarito Canyon Aggregate Area are described briefly in the following sections. The descriptions begin with the oldest (deepest) and proceed to the youngest (topmost). The stratigraphic units that may be encountered during investigation of the Lower Pajarito Canyon Aggregate Area are limited to Qal and the upper units (Qbt 1v, Qbt 1g, and Qbt 2) of the Tshirege Member of the Bandelier Tuff, described below.

The Bandelier Tuff consists of the Otowi and Tshirege Members, which are stratigraphically separated in many places by the tephras and volcaniclastic sediment of the Cerro Toledo interval. The Bandelier Tuff was emplaced during cataclysmic eruptions of the Valles Caldera between 1.61 and 1.22 million years ago. The tuff is composed of pumice, minor rock fragments, and crystals supported in an ashy matrix. It is a prominent cliff-forming unit because of its generally strong consolidation (Broxton and Reneau 1995, 049726).

The Guaje Pumice Bed. The Guaje Pumice Bed occurs at the base of the Otowi Member, making a significant and extensive marker horizon. The Guaje Pumice Bed (Bailey et al. 1969, 021498; Self et al. 1986, 021579) contains well-sorted pumice fragments whose mean size varies between 0.8 and 1.6 in. Its thickness averages approximately 28 ft below most of the Plateau, with local areas of thickening and thinning. Its distinctive white color and texture make it easily identifiable in cuttings and core, and it is an important marker bed for the base of the Bandelier Tuff.

Otowi Member. Griggs and Hem (1964, 092516), Smith and Bailey (1966, 021584), Bailey et al. (1969, 021498), and Smith et al. (1970, 009752) describe the Otowi Member. It consists of moderately consolidated (indurated), porous, and nonwelded vitric tuff (ignimbrite) that forms gentle colluvium-covered slopes along the base of canyon walls. The Otowi ignimbrites contain light gray to orange pumice supported in a white to tan ash matrix (Broxton et al. 1995, 050121; Broxton et al. 1995, 050119; Goff 1995, 049682). The ash matrix consists of glass shards, broken pumice, crystal fragments, and fragments of perlite.

Tephras and Volcaniclastic Sediment of the Cerro Toledo Interval. The Cerro Toledo interval is an informal name given to a sequence of volcaniclastic sediment and tephra of mixed provenance that separates the Otowi and Tshirege Members of the Bandelier Tuff (Broxton et al. 1995, 050121; Broxton and Reneau 1995, 049726; Goff 1995, 049682). Although it is located between the two members of the Bandelier Tuff, it is not considered part of that formation (Bailey et al. 1969, 021498). Outcrops of the Cerro Toledo interval generally occur wherever the top of the Otowi Member appears in Pajarito Canyon and in canyons to the north. The unit contains primary volcanic deposits described by Smith et al. (1970, 009752) as well as reworked volcaniclastic sediment. The occurrence of the Cerro Toledo interval is widespread; however, its thickness is variable, ranging between several feet and more than 100 ft.

The predominant rock types in the Cerro Toledo interval are rhyolitic tuffaceous sediment and tephra (Heiken et al. 1986, 048638; Stix et al. 1988, 049680; Broxton et al. 1995, 050121; Goff 1995, 049682). The tuffaceous sediment is the reworked equivalent of Cerro Toledo rhyolite tephra. Oxidation and clay-rich horizons indicate at least two periods of soil development occurred within the Cerro Toledo deposits. Because the soil is rich in clay, it may act as a barrier to the movement of vadose-zone moisture content. Some of the deposits contain both crystal-poor and crystal-rich varieties of pumice. The pumice deposits tend to form porous and permeable horizons within the Cerro Toledo interval and locally may provide important pathways for moisture content transport in the vadose zone. A subordinate lithology within the Cerro Toledo interval includes clast-supported gravel, cobble, and boulder deposits derived from the Tschicoma Formation (Broxton et al. 1995, 050121; Goff 1995, 049682; Broxton and Reneau 1996, 055429).

Tshirege Member. The Tshirege Member is the upper member of the Bandelier Tuff and is the most widely exposed bedrock unit of the Pajarito Plateau (Griggs and Hem 1964, 092516; Smith and Bailey 1966, 021584; Bailey et al. 1969, 021498; Smith et al. 1970, 009752). Emplacement of this unit occurred during eruptions of the Valles Caldera approximately 1.2 million years ago (Izett and Obradovich 1994, 048817; Spell et al. 1996, 055542). The Tshirege Member is a multiple-flow, ash and pumice sheet that forms the prominent cliffs in most of the canyons on the Pajarito Plateau. It is a cooling unit whose physical properties vary vertically and laterally. The consolidation in this member is largely from compaction and welding at high temperatures after the tuff was emplaced. Its light-brown, orange-brown, purplish, and white cliffs have numerous, mostly vertical fractures that may extend from several feet up to several tens of feet. The Tshirege Member includes thin but distinctive layers of bedded, sand-sized particles called surge deposits that demark separate flow units within the tuff. The Tshirege Member is generally over 200 ft thick.

The Tshirege Member differs from the Otowi Member most notably in its generally greater degree of welding and compaction. Time breaks between the successive emplacement of flow units caused the tuff to cool as several distinct cooling units. For this reason, the Tshirege Member consists of at least four cooling subunits that display variable physical properties vertically and horizontally (Smith and Bailey 1966, 021584; Crowe et al. 1978, 005720; Broxton et al. 1995, 050121). The welding and crystallization variability in the Tshirege Member produce recognizable vertical variations in its properties, such as density, porosity, hardness, composition, color, and surface-weathering patterns. The subunits are mappable based on a combination of hydrologic properties and lithologic characteristics.

Broxton et al. (1995, 050121) provide extensive descriptions of the Tshirege Member cooling units. The following paragraphs describe, in ascending order, subunits of the Tshirege Member.

The Tsankawi Pumice Bed forms the base of the Tshirege Member. Where exposed, it is commonly 20 to 30 in. thick. This pumice-fall deposit contains moderately well-sorted pumice lapilli (diameters reaching about 2.5 in.) in a crystal-rich matrix. Several thin ash beds are interbedded with the pumice-fall deposits.

Subunit Qbt 1g is the lowermost tuff subunit of the Tshirege Member. It consists of porous, nonwelded, and poorly sorted ash-flow tuff. This unit is poorly indurated but nonetheless forms steep cliffs because of a resistant bench near the top of the unit; the bench forms a harder, protective cap over the softer underlying tuff. A thin (4- to 10-in.), pumice-poor surge deposit commonly occurs at the base of this unit.

Subunit Qbt 1v forms alternating cliff-like and sloping outcrops composed of porous, nonwelded, crystallized tuff. The base of this unit is a thin, horizontal zone of preferential weathering that marks the abrupt transition from glassy tuff below (in unit Qbt 1g) to the crystallized tuff above. This feature forms a widespread marker horizon (locally termed the vapor-phase notch) throughout the Pajarito Plateau that is readily visible in canyon walls in parts of Pajarito Canyon. The lower part of Qbt 1v is orange-brown, resistant to weathering, and has distinctive columnar (vertical) joints; hence, the term “colonnade tuff” is appropriate for its description. A distinctive white band of alternating cliff- and slope-forming tuffs overlies the colonnade tuff. The tuff of Qbt 1v is commonly nonwelded (pumices and shards retain their initial equant shapes) and has an open, porous structure.

Subunit Qbt 2 forms a distinctive, medium-brown, vertical cliff that stands out in marked contrast to the slope-forming, lighter-colored tuff above and below. It displays the greatest degree of welding in the Tshirege Member. A series of surge beds commonly marks its base. It typically has low porosity and permeability relative to the other units of the Tshirege Member.

The Qal deposit consists of stratified, lenticular deposits of unconsolidated fluvial sands, gravels, and cobbles. Smaller canyons whose headwaters are located on the Plateau contain detritus exclusively of Bandelier Tuff. Larger canyon systems that head in the Sierra de los Valles contain Bandelier detritus mixed with dacite detritus derived from the Tschicoma Formation. Active and inactive channels and floodplains form complex, cross-cutting deposits. These fluvial sediments interfinger laterally with colluvium derived from canyon walls.

3.2.2 Hydrogeology

The hydrogeology of the Pajarito Plateau is 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 at depths ranging between 100 and 700 ft below ground surface (bgs). The regional aquifer is found at depths of about 600 to 1200 ft bgs.

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.

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 Lower Pajarito Canyon Aggregate Area are shown on Plate 1.

The Laboratory formulated a comprehensive groundwater protection plan (LANL 1996, 070215) for an enhanced set of characterization and monitoring activities. The approved hydrogeologic workplan (LANL 1998, 059599) details the implementation of extensive groundwater characterization across the Pajarito Plateau within an area potentially affected by past and present Laboratory operations.

Alluvial Groundwater

Intermittent and ephemeral stream flows in the canyons of the Pajarito Plateau have deposited alluvium that is as much as 100 ft thick. The alluvium in canyons that head on the Jemez Mountains is generally composed of sands, gravels, pebbles, cobbles, and boulders derived from the Tschicoma Formation and Bandelier Tuff on the flank of the mountains. The alluvium in canyons that head on the Plateau is comparatively more finely grained, consisting of clays, silts, sands, and gravels derived from the Bandelier Tuff (LANL 1998, 059599, p. 2-17).

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).

Intermediate Perched Water

Identification of perched groundwater systems beneath the Pajarito Plateau comes mostly from direct observation of saturation in boreholes, wells, or piezometers or from borehole geophysics. Perched groundwater is widely distributed across the northern and central part of the Pajarito Plateau with depth to water ranging from 118 to 894 ft bgs. Perched groundwater occurs principally in (1) the relatively wet Los Alamos and Pueblo Canyon watersheds, (2) the smaller watersheds of Sandia and Mortandad Canyons that receive significant volumes of treated effluent from Laboratory operations, and (3) the Cañon de Valle area in the southwestern part of the Laboratory. Perched water is most often found in Puye fanglomerates, Cerros del Rio basalt, and in units of Bandelier Tuff. There are few reported occurrences in the southern part of the Laboratory, but few deep boreholes are located in that area. Additional perched zones probably occur beneath the adjacent watersheds of Pajarito and Water Canyons (Collins et al. 2005, 092028, pp. 2-96−2-97).

Regional Aquifer

The regional aquifer is the only aquifer capable of serving as a 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 from about 1200 ft along the western margin of the Plateau to 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 2009 General Facility Information report (LANL 2009, 105632). 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 (LANL 1993, 023249).

Groundwater in the regional aquifer flows east-southeast toward the Rio Grande. The velocity of groundwater flow ranges from about 20 to 250 ft/yr (LANL 1998, 058841, p. 2-7). Details of depths to the regional aquifer, flow directions and rates, and well locations are presented in various Laboratory documents (Purtymun 1995, 045344; LANL 1997, 055622; LANL 2000, 066802). Figure 3.2-2 shows depths to the top of the regional aquifer across the Laboratory.

3.2.2.2 Vadose Zone

The unsaturated zone from the mesa surface to the top of the regional aquifer is referred to as the vadose zone. The source of moisture content for the vadose zone is precipitation, but much of it runs off, evaporates, or is absorbed by plants. The subsurface vertical movement of water is influenced by properties and conditions of the materials that make up the vadose zone.

Although water moves slowly through the unsaturated tuff matrix, it can move rapidly through fractures if saturated conditions exist (Hollis et al. 1997, 063131). Fractures may provide conduits for fluid flow but probably only in discrete, disconnected intervals of the subsurface. Because they are open to the passage of both air and water, fractures can have both wetting and drying effects, depending on the relative abundance of water in the fractures and the tuff matrix.

The Bandelier Tuff is very dry and does not readily transmit moisture content. Most of the pore spaces in the tuff are of capillary size and have a strong tendency to hold water against gravity by surface-tension forces. Vegetation is very effective at removing moisture content near the surface. During the summer rainy season, when rainfall is highest, near-surface moisture content is variable because of higher rates of evaporation and of transpiration by vegetation, which flourishes during this time.

The various units of the Bandelier Tuff tend to have relatively high porosities. Porosity ranges between 30% and 60% by volume, generally decreasing for more highly welded tuff. Permeability varies for each cooling unit of the Bandelier Tuff. The moisture content of native tuff is low, generally less than 5% by volume throughout the profile (Kearl et al. 1986, 015368; Purtymun and Stoker 1990, 007508).

4.0 PROPOSED INVESTIGATION ACTIVITIES AT TA-18

4.1 Consolidated Unit 18-001(a)-00

Consolidated Unit 18-001(a)-00 consists of SWMU 18-001(a), two sanitary lagoons and their associated outfall (Figure 4.1-1), and SWMU 18-001(b), a vitrified-clay sewer line that discharges into the SWMU 18-001(a) sanitary lagoons (Figure 4.1-2). The consolidated unit is located adjacent to Pajarito Road southeast of the central area of TA-18.

4.1.1 SWMU 18-001(a), Lagoons

SWMU 18-001(a) consists of two former sanitary lagoons, an effluent line, and an outfall (Figure 4.1-1). The lagoons were 60 ft wide by 120 ft long and approximately 12 ft deep and were located at TA-18 on the south side of Pajarito Road approximately 1 mi east of TA-18. The lagoon side walls and floor were gunite-lined from the floor to approximately one-third up the wall height; the other two-thirds were lined with an asphalt-aggregate mixture. The two lagoons were separated by a berm that contained two concrete distribution boxes directing the sewage flow into the lagoons.

The effluent line consisted of an 8-in. cast-iron pipe that exited between the lagoons and extended approximately 200 ft in a northeasterly direction. The effluent line discharged through an outfall on the north side of Pajarito Road into the Pajarito Canyon stream channel. Sewage effluent from TA-18 was transported to the lagoons via a now-inactive sanitary sewer line [SWMU 18-001(b)] that served the central area of TA-18. Liquid waste that discharged into the lagoons consisted of sanitary sewage, wash water from industrial drains and sinks in laboratories, and photochemicals. The sanitary lagoons, effluent line, and outfall were placed into service in 1969 and discontinued in December 1992, when sanitary sewage waste from TA-18 was redirected to the Sanitary Wastewater Systems Consolidation (SWSC) (LANL 1993, 015310, pp. 5-1–5-3).

4.1.1.1 Summary of Previous Investigations for SWMU 18-001(a)

An RFI was conducted at SWMU 18-001(a) in September 1993. Five sediment samples were collected from five locations in each lagoon for a total of 10 samples. Four sediment samples were collected at four locations from the outfall area within the stream channel in Pajarito Canyon that received effluent from the sewage lagoons. Sediment samples were collected to a depth of 1 ft bgs. The collected samples were submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), and radionuclides. Because the sampling locations were located within an area possibly affected by former explosive testing at former TA-27, analysis for HE was also performed (LANL 1995, 044014, p. 4-11).

An accelerated cleanup of the lagoons was carried out as a voluntary corrective action (VCA) in August and September 1995. The VCA consisted of removing the two concrete distribution boxes and the 8-in. cast-iron pipes associated with them. The concrete portion of the berm was left intact and the asphalt-lined portion of the berms was bulldozed into the lagoons as fill material (LANL 1996, 054324, p. 4).

4.1.1.2 Summary of Data for SWMU 18-001(a)

The data collected during the 1993 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.1.1.3 Scope of Activities for SWMU 18-001(a)

Sixty surface and subsurface samples will be collected from 12 locations (six locations in each lagoon) beneath the former lagoons (Figure 4.1-3). Fifteen surface and subsurface samples will be collected from three locations beneath the former berm that separated the two lagoons. Locations 1a-8 and 1a-9 will also serve as locations for characterization of the effluent pipe and former distribution box. Samples will be collected from five depths (0–1 ft, 4–5 ft, 11–12 ft, 14–15 ft, and 19–20 ft bgs) and analyzed for target analyte list (TAL) metals, nitrate, perchlorate, total cyanide, polychlorinated biphenyls (PCBs) (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and potential of hydrogen (pH).

Twenty-one surface and subsurface samples will be collected from seven locations around the perimeter of the lagoons (Figure 4.1-3). Locations 1a-22 and 1a-23 will also serve as locations for characterization of the effluent pipe. Samples will be collected from three depths (0–1 ft, 14–15 ft, and 29–30 ft bgs) and analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH.

Eight surface and subsurface samples will be collected from location 1a-20 (Figure 4.1-3). Samples will be collected from eight depths (0–1 ft, 14–15 ft, 29–30 ft, 50–51 ft bgs, and at 25-ft intervals thereafter to a depth of up to 180 ft bgs or the contact between the Cerro Toledo Interval and Otowi Member whichever is deeper). The deepest 20 to 50 ft (minimum) of open borehole will be video logged to determine if perched saturation is present and, if so, to estimate groundwater flow rates into the open hole. If sufficient water yield is present when perched water is encountered, NMED will be contacted for coordination of a properly designed monitoring well installation. Additional sampling intervals may be added to this location to ensure that a sample is collected from every geologic unit encountered. Samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH.

Two subsurface samples will be collected from one location adjacent to the effluent pipe that exited the lagoons (Figure 4.1-3). Samples will be collected from two depths (5–6 ft and 10–11 ft bgs) and analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH.

Ten surface and subsurface samples will be collected from five locations at the outfall and in the drainage below the outfall (Figure 4.1-3). Samples will be collected from two depths (0–1 ft and 2–3 ft bgs) and analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH.

4.1.2 SWMU 18-001(b), Drainline

SWMU 18-001(b) (Figure 4.1-2) consists of an inactive sewer line at TA-18 located on the south side of Pajarito Road. The inactive sewer line runs parallel to Pajarito Road and extends from the central area of TA-18 approximately 5000 ft east to the location of the former sanitary lagoons [SWMU 18-001(a)]. It is constructed of 4-in.-diameter vitrified-clay pipe, and is buried approximately 5–6 ft bgs. Eleven manholes (structures 18-160, 18-161, and 18-169 to 18-177) are associated with the inactive sewer line. The manholes consist of a 3-ft-diameter concrete culvert pipe positioned vertically so that the manhole opening is approximately 1 ft above ground while the base extends to approximately 5–6 ft bgs. The base of each manhole is lined with concrete. Inlet and outlet ports from the sanitary sewer line are located at the bottom of each manhole.

SWMU 18-001(b) emptied into the two former lagoons [SWMU 18-001(a)]. The sewer line and manholes were placed into service in 1969, and service was discontinued in 1992 when the sewage from TA-18 was redirected to the SWSC (LANL 1995, 044014, p. 4-7).

4.1.2.1 Summary of Previous Investigations for SWMU 18-001(b)

An RFI was conducted at SWMU 18-001(b) in September 1993. Sediment or water samples were collected from manholes 160, 169, 170, 173, 175, 176, and 177. None of the manholes had both water and sediment in sufficient quantities to allow sampling of both media. Five sediment samples were collected from manholes 160, 169, 170, and 176. In manholes 161, 171, 172, and 174, neither sediment nor water was present in sufficient quantities to allow sample collection. Collection of sediment samples generally required removal of nearly all the sediment in a manhole because of minimal quantity (LANL 1995, 044014, p. 4-11).

An expedited cleanup (EC) for SWMU 18-001(b) was conducted in September 1995. The EC consisted of pouring approximately 1 yd^3 of concrete into each manhole as a means of plugging the inlet and outlet ports of the sewer line at each manhole. The top portion of each manhole was lifted off, removed, and after being checked for radionuclides, was disposed of. The open excavations at each manhole were backfilled with soil and graded to blend the backfill with the surrounding natural terrain (LANL 1996, 054485, p. 1).

4.1.2.2 Summary of Data for SWMU 18-001(b)

The data collected during the 1993 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.1.2.3 Scope of Activities for SWMU 18-001(b)

Twenty-four subsurface samples will be collected from twelve locations beneath the inactive sewer line (Figure 4.1-4). Samples will be collected from two depths (directly below the sewer line at 5 ft bgs and 5 ft below the sewer line at 10 ft bgs) and analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.1-2 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.2 Consolidated Unit 18-001(c)-00

Consolidated Unit 18-001(c)-00 (Figure 4.2-1) consists of SWMU 18-001(c), a sump located in the basement of building 18-30, and SWMU 18-012(b), an outfall that receives discharge from several sources in buildings 18-30 and 18-31.

4.2.1 SWMU 18-001(c), Sump

SWMU 18-001(c) consists of a sump, equipped with two sump pumps and a drain, located at TA-18 in the basement of building 18-30. Building 18-30 is an administrative building that housed control systems for remote nuclear criticality research. The sump, which was placed into service in 1969, served primarily to collect groundwater from drains outside the basement walls; however, some sinks and floor drains from offices and machine shops within building 18-30 formerly drained to the sump. The drains were diverted to the TA-18 sanitary sewer line in the fall of 1992. By the summer of 1994, all of the drains associated with building 18-30 were diverted into the sanitary sewer line.

No specific data are available on discharges to the sump. Discharge from the sump was combined with other discharges from buildings 18-30 and 18-31 and was released through an outfall [SWMU 18-012(b)] south of building 18-30. The outfall is within approximately 20 ft of the main drainage channel in Pajarito Canyon (LANL 1993, 015310, p. 5-14).

4.2.1.1 Summary of Previous Investigations for SWMU 18-001(c)

An RFI was conducted at SWMU 18-001(c) in September 1993. Two water samples were collected from the bottom of the sump. No sediment was present in the bottom of the sump (LANL 1995, 044014, p. 4-25).

4.2.1.2 Summary of Data for SWMU 18-001(c)

No soil samples were collected for analysis at SWMU 18-001(c).

4.2.1.3 Scope of Activities for SWMU 18-001(c)

It is proposed that characterization of the sump associated with SWMU 18-001(c) be delayed until demolition of structures occurs at TA-18 because of the sump's physical location within building 18-30. Demolition is expected to occur within the next 5 yr.

4.2.2 SWMU 18-012(b), Outfall from Buildings 18-30 and 18-31

SWMU 18-012(b) (Figure 4.2-1) is an outfall that received discharge from several sources in buildings 18-30 and 18-31. The outfall, active since the buildings were constructed in 1950, is located south of building 18-31 approximately 20 ft north of the main drainage channel in Pajarito Canyon (LANL 1993, 015310, p. 5-45). The outfall received discharge from an associated sump [SWMU 18-001(c)], floor drains, sinks, stormwater from the east-wing roof of building 18-31, and a welding quench tank in building 18-30. The outfall also received discharge from machine shop floor drains and stormwater from the roof of building 18-31 (LANL 1993, 015310, p. 5-14).

Discharge from both buildings was transported to the outfall via a series of 4-in. polyethylene pipes connected to the sources within the buildings. Currently, this outfall receives only stormwater from the east-wing roof of building 18-30 (LANL 1993, 015310, p. 5-45). The drainline that exits the southeast corner of building 18-31 flows into the SWMU 18-003(e) septic system and is not associated with SWMU 18-012(b).

4.2.2.1 Summary of Previous Investigations for SWMU 18-012(b)

An RFI was conducted at SWMU 18-012(b) in September 1993 and May through October 1994 (LANL 1995, 052183, p. 1-6). Four surface sediment samples were collected from four locations for field screening at the outfall and analyzed for inorganic chemicals, SVOCs, and gross-alpha, -beta, and -gamma radioactivity. The two samples with the most elevated field-screening levels were submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, SVOCs, and radionuclides (LANL 1995, 052183, p. 4-71).

4.2.2.2 Summary of Data for SWMU 18-012(b)

The data collected during the 1993−1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.2.2.3 Scope of Activities for SWMU 18-012(b)

Six subsurface samples will be collected from two locations adjacent to where the drainlines exit from buildings 18-30 and 18-31 and a third location at the line junction (Figure 4.2-2). Samples will be collected from two depths (directly below the drainline and 5 ft below the drainline). Ten surface and subsurface samples will be collected from one location at the outfall, two locations in the drainage below the outfall, and two locations in the main Pajarito Canyon drainage channel (Figure 4.2-2). Samples will be collected from two depths (0–1 ft and 2–3 ft bgs). Samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs, SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.2-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites. Samples at locations along drainlines near buildings may need to be delayed because of access problems until decontamination and decommissioning (D&D) of the related structures are completed, depending on the implementation schedules of D&D and the Lower Pajarito Canyon Aggregate Area investigation.

4.3 SWMU 18-002(a), Firing Site

SWMU 18-002(a) (Figure 4.3-1) consists of an inactive HE firing site at TA-18 in Pajarito Canyon south of the present location of building 18-23 (Kiva 1). The firing site was used from 1944 to 1945 and consisted of two structures:

- former structure 18-3, a firing chamber 2 ft wide × 2 ft long × 2.2 ft deep constructed from 1-in.-thick steel
- former structure 18-2, an aboveground armored bunker, commonly called a “battleship,” used to protect shot instrumentation.

The firing chamber was open on the top and set flush with the ground west of the bunker, which was designated as storage for HE in the historical TA-18 structure log. Structure 18-3 was removed in 1945, while structure 18-2 is no longer used (LANL 1993, 015310, p. 5-52).

4.3.1 Summary of Previous Investigations for SWMU 18-002(a)

An RFI was conducted at SWMU 18-002(a) in September 1993 and May through October 1994. Soil was screened for radioactivity every 3 ft (up to 500 ft) on radials extending north, south, east, and west from the center of the firing point. No significant radioactivity measurements were found.

Eight grab samples of surface soil were taken from each of 11 locations for field screening and analyzed at a mobile laboratory for inorganic chemicals, HE, SVOCs, and gross-alpha, -beta, and -gamma radioactivity. Four of the grab samples from each location were chosen for analytical sampling based on elevated levels of total uranium, barium, lead, and gross alpha, beta, and gamma radiation. At 8 of the 11 sampling locations, a single composite sample was prepared using material from all 4 grab samples (8 total composite samples). At the three remaining sampling locations, two composite samples were prepared using material from all four grab samples (six total composite samples).

Fourteen total composite samples were prepared from the four grab samples at each location and submitted to an off-site contract laboratory for analyses of inorganic chemicals, HE, organic chemicals, and radionuclides (LANL 1995, 052183, pp. 4-93−4-104).

4.3.2 Summary of Data for SWMU 18-002(a)

The data collected during the 1993−1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.3.3 Scope of Activities for SWMU 18-002(a)

Sixteen surface and subsurface samples will be collected from eight locations around the former firing chamber (Figure 4.3-2). These locations will be positioned at radial distances approximately 10 ft and 25 ft from the center of the former firing chamber, and samples will be collected from two depths (0–1 ft and 2–3 ft bgs). Two additional samples will be collected from one location at the center of the firing chamber, and samples will be collected from two depths (4–5 ft and 9–10 ft bgs).

All samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, explosive compounds, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, and pH. Table 4.3-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.4 SWMU 18-002(b), Firing Site

SWMU 18-002(b) (Figure 4.4-1) is an inactive firing site at TA-18 in Threemile Canyon near the present location of building 18-32 (Kiva 2). The firing site was used from 1944 to 1945. The site consisted of a 2-ft-long × 2-ft-wide × 2-ft-deep firing chamber (former structure 18-4) constructed from 1-in.-thick steel and an aboveground armored bunker (structure 18-5), commonly called a “battleship,” used to protect shot instrumentation. The top of the firing chamber was open and set flush with the ground west of structure 18-5. A ground-level wooden structure (former structure 18-6), located east of structure 18-5, was the battery building for the firing site cable conduit system. It contained racks of lead-acid batteries. Structure 18-4 was removed in 1945, structure 18-6 was dismantled in 1951, and structure 18-5 remains (LANL 1995, 052183, pp. 4-105−4-114).

Three additional firing points further upcanyon are associated with SWMU 18-002(b). Firing Point C (now beneath building 18-32) was 51 ft west of structure 18-5 and on its midline. Firing Point G, located at the southeast corner of the current storage building 18-122, was 145 ft west of structure 18-5 on its midline. Firing Points C and G were used in firing operations involving smaller charges than the third firing point. The third firing point, Medium Firing Point, was built to handle HE charges of up to 2 tons. It was located 478 ft west of structure 18-5 and 15 ft south of its midline. A flat, graded area west of building 18-32 marks the former location of this firing point. The firing points were removed in the late 1940s, before the construction of building 18-32 (LANL 1993, 015310, p. 5-53).

4.4.1 Summary of Previous Investigations for SWMU 18-002(b)

An RFI was conducted at SWMU 18-002(b) in June 1994. Sampling was conducted on the canyon floor within two concentric sampling zones that extended a radius of 500 ft from the center of the westernmost site, Medium Firing Point, and 500 ft from the center of the easternmost site, Firing Point C. The sampling locations were also designed to address possible contamination from structure 18-4 and Firing Point G, which are located between the end firing points. The two end firing points were 427 ft apart so their sets of concentric zones overlapped. Soil was screened for radioactivity every 3 ft (up to 500 ft) on radials extended north, south, east, and west from the center of each firing point. No significant radioactivity measurements were found.

Eight grab samples of surface soil were taken from each of 11 locations for field screening and analyzed at a mobile laboratory for inorganic chemicals, HE, SVOCs, and gross-alpha, -beta, and -gamma radioactivity. Four of the grab samples from each location were chosen for analytical sampling based on elevated levels of total uranium, barium, lead, and tritium. At 8 of the 11 sampling locations, a single composite sample was prepared using material from all 4 grab samples (8 total composite samples). At the three remaining sampling locations, two composite samples were prepared using material from all four grab samples (six total composite samples). Fourteen total composite samples were prepared from the four grab samples at each location and submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, HE, organic chemicals, and radionuclides (LANL 1995, 052183, pp. 4-105−4-114).

Subsurface soil was collected from five boreholes at Medium Firing Point. All boreholes were 5 ft deep, with sampling performed at intervals of 0–12 in., 25–35 in., and 50–60 in. One borehole was centered on the surveyed position of the firing point, and the others were positioned 10 ft north, south, east, and west from the first hole. This arrangement was designed to sample the area immediately around the firing point for chemicals of potential concern (COPCs) driven into the ground by the explosions as well as for any subsurface migration of COPCs (LANL 1995, 052183, pp. 4-105−4-114).

4.4.2 Summary of Data for SWMU 18-002(b)

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.4.3 Scope of Activities for SWMU 18-002(b)

Twenty surface and subsurface samples will be collected from 10 locations around the perimeter of the firing chamber and in the area of building 18-32 (Figure 4.4-2). Samples will be collected from two depths (0–1 ft and 2–3 ft bgs). Two additional samples will be collected from one location at the center of the firing chamber (4–5 ft and 9–10 ft bgs). All samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, explosive compounds, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, and pH.

Sixteen surface and subsurface samples will be collected from eight locations around former Medium Firing Point (Figure 4.4-2). These locations will be positioned at radial distances of approximately 15 ft and 30 ft from the center of the former firing point and will be sampled at two depths (0–1 ft and 2–3 ft bgs). Two additional samples will be collected from one location at the center of the firing point (4–5 ft and 9–10 ft bgs).

All samples collected at Medium Firing Point will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, explosive compounds, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.4-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.5 AOC 18-002(c), Former Drop Tower

AOC 18-002(c) (Figure 4.5-1) consists of a former drop tower in Threemile Canyon used in tests involving inert mockups and ballistic objects. The drop tower was used from 1944 to 1945. The tower was located in TA-18 approximately 500 ft west of a structure called a “battleship” at one of the three firing pads identified at SWMU 18-002(b). The drop tower was removed in the late 1940s, before the construction of building 18-32 (LANL 1995, 052183, pp. 4-105−4-114).

4.5.1 Summary of Previous Investigations for AOC 18-002(c)

An RFI was conducted at AOC 18-002(c) in September 1993 and May through October 1994. Because the effects of AOC 18-002(c) are indistinguishable from those of the firing points in SWMU 18-002(b), sampling results from the investigation of SWMU 18-002(b) were used to characterize contamination at AOC 18-002(c) (LANL 1995, 052183, pp. 4-105−4-114).

4.5.2 Summary of Data for AOC 18-002(c)

No analytical soil samples were collected specific to AOC 18-002(c). Refer to section 4.4.2 for information on results from SWMU 18-002(b).

4.5.3 Scope of Activities for AOC 18-002(c)

Twenty-two surface and subsurface samples will be collected from one location upgradient from the former drop tower, one location at the former drop tower, and nine locations downgradient of the former drop tower (Figure 4.5-2). Samples will be collected from two depths (0–1 ft and 2–3 ft bgs) and analyzed for TAL metals, nitrate, perchlorate, total cyanide, explosive compounds, PCBs (in 20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, and pH. Table 4.5-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.6 Consolidated Unit 18-003(a)-00

Consolidated Unit 18-003(a)-00 (Figure 4.6-1) consists of SWMU 18-003(a), an inactive settling pit, and SWMU 18-003(b), an inactive septic system that received overflow from SWMU 18-003(a). The consolidated unit is located northwest of the central area of TA-18 near building 18-23.

4.6.1 SWMU 18-003(a), Settling Pit

SWMU 18-003(a) is an inactive settling pit that received industrial and radioactive wastewater from building 18-23. The pit is located approximately 50 ft southwest of building 18-23, where uranium mockup tests and critical assembly work was conducted when the pit was in service from 1947 to 1991. The pit measures approximately 5.5 ft long × 5.5 ft wide × 10 ft deep and has reinforced concrete walls and an open gravel floor. The pit contained a removable 120-gal.-capacity steel catch basin, mounted on steel rails, which measured 2 ft in diameter × 5 ft high. The basin was emptied annually while in operation and the waste was disposed of off-site (LANL 1993, 051310, p. 5-4).

4.6.1.1 Summary of Previous Investigations for SWMU 18-003(a)

An RFI was conducted at SWMU 18-003(a) in September 1993 and June through August 1994. Two samples each of sludge and liquid were collected from the catch basin of the settling pit using a special long-handled bailer. Liquid samples were analyzed for total uranium and other inorganic chemicals and for isotopic plutonium. The analyses of sludge samples were the same as for liquid samples with the addition of SVOCs and VOCs. Two soil samples were collected from the pit using a Teflon core-barrel sampler. The analyses of subsurface soil samples were the same as for sludge samples with the addition of chloride, nitrate, and gamma-emitting radionuclides (LANL 1995, 052183, pp. 4-4−4-22).

An interim action (IA) was conducted at SWMU 18-003(a) from March through September 1996. The IA consisted of removing the liquid and sludge contained in the catch basin, pressure-rinsing the interior of the basin, and disposing of the basin’s contents and associated decontamination water. To prevent potential release of contamination, the floor drains in building 18-23 were sealed by fastening a gasket and metal plate over the drain opening, water service to the building was shut off, and the overflow line was plugged with an expandable rubber stopper. Two soil samples were also collected from 0 to 6 in. in the gravel bottom of the pit and submitted to an off-site contract analytical laboratory for analyses of total uranium and other metals, SVOCs, VOCs, and isotopic plutonium (LANL 1996, 054470, Table A-2).

A voluntary corrective measure (VCM) was conducted in 1997 to eliminate a potential pathway to alluvial groundwater. The effort included removing and disposing of the steel catch basin, plugging the inlet and outlet lines as they entered the pit, and then grouting the interior of the pit with Flowcrete to prevent any potential releases to alluvial groundwater. Additional soil samples were collected near the inlet, outlining the approximate depth of the pit floor, to characterize the soil. During remedial activities, a section of the vitrified-clay pipe outlet was inadvertently removed by a backhoe. The pipe section and its contents were submitted for laboratory analysis (LANL 1999, 063647, p. 6).

4.6.1.2 Summary of Data for SWMU 18-003(a)

The data collected during the 1993−1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639). Decision-level analytical data, samples collected, and analytes requested from the 1996 IA and 1997 VCM are presented in Tables 4.6-1 to 4.6-4.

The results of the analyses of samples collected during the 1996 IA are as follows (LANL 1996, 055044, pp. A-1−A-11):

- Barium, cadmium, calcium, chromium, cobalt, copper, lead, mercury, nickel, total uranium, and zinc were detected above BVs (Figure 4.6-2).
- Polycyclic aromatic hydrocarbons (PAHs), SVOCs, and VOCs were detected (Figure 4.6-3).
- Plutonium-239/240 was detected above FV (Figure 4.6-4).

The results of the analyses of samples collected during the 1997 VCM are as follows (LANL 1999, 063647, pp. 8–9):

- Barium, cadmium, calcium, chromium, cobalt, copper, lead, mercury, nickel, total uranium, and zinc were detected above BVs (Figure 4.6-2).
- PAHs, SVOCs, and VOCs were detected (Figure 4.6-3).

The nature and extent of contamination have not been defined for this site.

4.6.1.3 Scope of Activities for SWMU 18-003(a)

Twenty-two subsurface samples will be collected from nine locations adjacent to the inlet line, pit inlet, settling pit, pit outlet, and outlet line (Figure 4.6-5). Samples adjacent to the lines will be collected at 20-ft intervals along the path of the line, beginning at the point of exit from the building or tank, to coincide with the expected locations of the pipe joints. Five locations will be sampled at two depths (immediately below the level of the line or pit and 5 ft below the level of the line or pit). Four locations will be sampled at three depths (immediately below the level of the line or pit, 5 ft below the level of the line or pit, and 10 ft below the level of the line or pit). A third sample depth is included at some locations to investigate the potential of contaminants migrating to greater depths.

All samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, zirconium, PCBs (20% of the samples), SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, tritium, moisture content, and pH. Table 4.6-5 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.6.2 SWMU 18-003(b), Septic System

SWMU 18-003(b) (Figure 4.6-1) is an inactive septic system that includes an inlet line, a septic tank, a discharge line, and a drain field. SWMU 18-003(b) is located at TA-18 approximately 100 ft south of building 18-23, 20 ft south of building 18-168, and 50 ft southwest of SWMU 18-003(a), a settling tank that discharged overflow through an outlet drainline connected to SWMU 18-003(b). The septic system received sanitary wastes and wash water from building 18-23 from 1947 to 1995. The reinforced concrete septic tank is 7 ft long x 4 ft wide x 5.5 ft deep with a capacity of approximately 524 gal. The inlet line leading to the tank is approximately 100 ft long and the outlet line is approximately 50 ft long. The drain field consists of four drainlines, each approximately 68 ft long and spaced 10 ft apart (LANL 1995, 052183, p. 4-4).

4.6.2.1 Summary of Previous Investigations for SWMU 18-003(b)

An RFI was conducted at SWMU 18-003(b) in September 1993 and from June to August 1994. Two samples each of sludge and liquid were collected from the septic tank with a special long-handled bailer. Liquid and sludge samples were analyzed for total uranium, other inorganic chemicals, and isotopic plutonium. Three surface soil samples adjacent to the tank and five surface samples above the drain field were collected with a Teflon core-barrel sampler. Surface soil analyses were the same as for the liquid and sludge with the addition of SVOCs and gamma-emitting radionuclides. Three subsurface soil samples next to the drainline connections and seven subsurface samples adjacent to the drain field were collected using a truck-mounted, hollow-stem auger and core rig. Subsurface soil analyses were the same as for the surface soil with the addition of chloride, nitrate, and VOCs.

An IA was conducted at SWMU 18-003(b) from March to September 1996. The IA consisted of removing the liquid and sludge contained in the septic tank, pressure-rinsing the interior of the tank, and disposing of the tank’s contents and associated decontamination water. To prevent potential release of contamination, floor drains in building 18-23 were sealed by fastening a gasket and metal plate over the drain opening, and water service to the building was shut off (LANL 1996, 055044, p. 3). One liquid sample and one sludge sample were collected for waste characterization purposes (LANL 1996, 055044, p. 3).

A VCM plan was conducted in 1997 to characterize the tank structure and adjacent soil. Concrete and wood samples were collected from the wooden baffles associated with the interior of the tank, and soil samples were obtained from beneath the inlet and outlet connections. Soil samples were collected adjacent to the tank at the approximate depth of the tank floor and 2 ft deeper (LANL 1999, 063647, pp. 10–11).

4.6.2.2 Summary of Data for SWMU 18-003(b)

The data collected during the 1993−1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639). Decision-level analytical data, samples collected, and analytes requested from the 1997 VCM are presented in Tables 4.6-6 to 4.6-9.

The results of the analyses of samples collected during the 1997 VCM are as follows (LANL 1999, 063647, pp. 10–11):

- Cadmium, copper, mercury, and thallium were detected above BV (Figure 4.6-2).
- SVOCs and VOCs were detected (Figure 4.6-3).
- Uranium-234, -235, and -238 were detected above BVs (Figure 4.6-4).

The nature and extent of contamination have not been defined for this site.

4.6.2.3 Scope of Activities for SWMU 18-003(b)

Sixty-two subsurface samples will be collected from 26 locations adjacent to the inlet line, tank inlet, septic tank, tank outlet, discharge line, and drain field (Figure 4.6-5). Samples adjacent to the lines will be collected at 20-ft intervals along the path of the line, beginning at the point of exit from the building or tank, to coincide with the expected locations of the pipe joints. Sixteen locations will be sampled at two depths (immediately below the level of the line or tank and 5 ft below the level of the line or tank). Ten locations will be sampled at three depths (immediately below the level of the line or tank, 5 ft below the level of the line or tank, and 10 ft below the level of the line or tank). A third sample depth is included at some locations to investigate the potential of contaminants migrating to greater depths. The depth of the third sampling interval may be adjusted if alluvium is encountered before the planned depth is reached (see section 7.4).

All samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, zirconium, PCBs (20% of the samples), SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.6-10 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.7 SWMU 18-003(c), Septic System

SWMU 18-003(c) (Figure 4.7-1) is an inactive septic system at TA-18 that received sanitary waste from building 18-32 from 1952 to 1995. The system includes an inlet line, a reinforced concrete septic tank (structure 18-42), a discharge line, a drain field, and an outfall. The septic tank is located approximately 15 ft east of building 18-128 and approximately 90 ft northeast of building 18-32. The tank measures 6 ft in diameter x 5 ft deep and has a capacity of 650 gal. The inlet line leading to the tank is approximately 130 ft in length, and the total length of the outlet line is approximately 115 ft.

The drain field begins approximately 60 ft east of the septic tank and extends east 55 ft. The drain field consists of four drainlines spaced approximately 10 ft apart. Each line is approximately 75 ft long. An outfall, located at the distal end of the drain field, discharged into the stream channel in Threemile Canyon (LANL 1993, 015310, p. 5-7).

4.7.1 Summary of Previous Investigations for SWMU 18-003(c)

An RFI was conducted at SWMU 18-003(c) in September 1993 and June to August 1994. Two samples each of sludge and liquid were collected from the septic tank. Sludge and liquid samples were analyzed for total uranium and other metals and for isotopic plutonium. Nine surface soil samples were collected adjacent to the tank and above the drain field. Two sediment samples were collected below the outfall.

The analyses of outfall sediment samples were the same as for sludge and liquid samples with the addition of SVOC analysis. The analyses of surface soil samples were the same as for outfall samples with the addition of gamma-emitting radionuclides. Eight subsurface soil samples and three groundwater samples were collected adjacent to the tank. Analyses of subsurface soil samples were the same as for surface soil samples with the addition of chloride, nitrate, and VOC analyses. Analyses of groundwater samples were the same as for surface soil samples with the addition of general minerals and VOCs. One permanent well (18-MW-8) was installed to allow future groundwater monitoring.

An IA was conducted at SWMU 18-003(c) from March to September 1996. The IA consisted of removing the liquid and sludge contained in the septic tank, pressure-rinsing the interior of the tank, and disposing of the tank's contents and associated decontamination water. The liquid fraction from the tank was disposed of at the TA-50 treatment facility, and the sludge fraction was solidified using an acrylic anionic polymer and disposed of off-site. To prevent potential release of contamination, the floor drains in building 18-32 were sealed by fastening a gasket and metal plate over the drain opening; water service to the building was shut off (LANL 1996, 055044, p. 3). One liquid sample and one sludge sample were collected for waste characterization purposes (LANL 1996, 054470, Table A-3).

A VCM was conducted for waste characterization and site assessment purposes. Concrete samples were collected from the tank's interior, and soil samples were obtained beneath the inlet and outlet lines. Soil samples also were collected adjacent to the tank at the approximate depth of the tank floor and 2 ft deeper. A total of six samples were analyzed for total uranium and other metals, HE, PCBs, SVOCs, VOCs, and isotopic plutonium (LANL 1999, 063647, pp.11–15).

4.7.2 Summary of Data for SWMU 18-003(c)

The data collected during the 1993−1994 RFI and the 1996 IA do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639). Decision-level analytical data, samples collected, and analytes requested from the 1997 VCM are presented in Tables 4.7-1 to 4.7-4.

The results of the analyses of samples collected during the 1997 VCM are as follows (LANL 1999, 063647, pp. 11−15):

- Cadmium, copper, lead, mercury, and zinc were detected above BVs (Figure 4.7-2).
- PAHs, PCBs, and SVOCs were detected (Figure 4.7-3). No VOCs or HE were detected.
- Plutonium-238 and -239/240, and uranium-234 and -235, were detected above BVs/FVs (Figure 4.7-4).

The nature and extent of contamination have not been defined for this site.

4.7.3 Scope of Activities for SWMU 18-003(c)

Eighty subsurface samples will be collected from 34 locations adjacent to the inlet line, tank inlet, septic tank, tank outlet, discharge line, and drain field (Figure 4.7-5). Samples adjacent to the lines will be collected at 20-ft intervals along the path of the line, beginning at the point of exit from the building or tank, to coincide with the expected locations of the pipe joints. Twenty-two locations will be sampled at two depths (immediately below the level of the line or tank and 5 ft below the level of the line or tank). Twelve locations will be sampled at three depths (immediately below the level of the line or tank, 5 ft below the level of the line or tank, and 10 ft below the level of the line or tank). A third sample depth is included at some locations to investigate the potential of contaminants migrating to greater depths. Samples at locations along drainlines near buildings may need to be delayed because of access problems until D&D of the related structures are completed, depending on the implementation schedules of D&D and the Lower Pajarito Canyon Aggregate Area investigation.

All samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, zirconium, PCBs, SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Analysis of PCBs will be requested for 100% of the samples because PCBs were detected in decision-level analytical results from samples collected during the 1997 VCM.

Four surface and subsurface samples will be collected from two locations at the outfall and approximately 5 ft downgradient of the outfall, directly in the drainage channel. Samples will be collected from two depths (0–1 ft and 2–3 ft bgs). Both depths must consist of soil or sediment material. If alluvium material is encountered before attaining second depth, sampling depths must be adjusted to obtain two depths of sediment material. Samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, zirconium, PCBs, SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, tritium, moisture content, and pH. Analysis of PCBs will be requested for 100% of the samples because PCBs were detected in decision-level analytical results from samples collected during the 1997 VCM. Table 4.7-5 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.8 SWMU 18-003(d), Septic System

SWMU 18-003(d) (Figure 4.8-1) is an inactive septic system at TA-18 that served the sanitary sewer system in building 18-116 (Kiva 3) from 1960 to 1995. The system includes an inlet line, a cylindrical septic tank (structure 18-120), an outlet line, a distribution box (structure 18-35), and a drain field. A manhole for the sewer system, located at the southwest corner of building 18-116, is largely obscured by pavement. The septic tank, located approximately 200 ft north of building 18-116, is constructed of reinforced concrete. The tank is 4 ft in diameter × 6 ft deep and has a capacity of approximately 500 gal. The inlet line from building 18-116 to the septic tank is approximately 275 ft long, and the outlet line from the tank to the distribution box is approximately 10 ft long. The drain field is constructed of perforated-clay tile pipe, buried approximately 5 ft bgs, and has four drainlines spaced 10 ft apart from each other. Each drainline is approximately 59 ft long (LANL 1993, 051310, p. 5-7).

4.8.1 Summary of Previous Investigations for SWMU 18-003(d)

An RFI was conducted at SWMU 18-003(d) in September 1993 and June to August 1994. Two samples each of sludge and liquid were collected from the septic tank pit. Sludge and liquid samples were analyzed for total uranium, other metals, VOCs, and isotopic plutonium. Nine subsurface soil samples and two groundwater samples were collected for laboratory analyses. Seven surface soil samples adjacent to the tank and above the drain field were collected.

Surface soil samples were submitted for laboratory analyses of total uranium and other metals, SVOCs, isotopic plutonium, and gamma-emitting radionuclides. Analyses of groundwater and subsurface soil samples were the same as for surface soil samples with the addition of general minerals and VOCs for groundwater, and chloride, nitrate, and VOCs for subsurface soil (LANL 1995, 052183, pp. 4-33–4-42). In the RFI report, LANL proposed an EC to pressure-rinse the tank and to remove and properly dispose of the contents of the tank and rinsate (LANL 1995, 052183, pp. 4-33–4-42).

An IA was conducted at SWMU 18-003(d) from March to September 1996. The IA consisted of removing the liquid and sludge contained in the septic tank, pressure-rinsing the interior of the tank, and disposing of the tank's contents and associated decontamination water. To prevent potential release of contamination, sanitary facilities were removed from building 18-116 and the water supply was disconnected. The liquid fraction was disposed of at TA-50, and the sludge and decontamination waste was disposed of off-site (LANL 1996, 055044, p. 4). One liquid sample and one sludge sample were collected for waste characterization purposes (LANL 1996, 054470, Table A-4).

A VCA was conducted at SWMU 18-003(d) from October 1996 to September 1998. The VCA consisted of constructing five permanent alluvial monitoring wells in the vicinity of the SWMU 18-003(d) drain field and sampling the groundwater of the wells quarterly for 2 yr. The wells were subsequently abandoned and are no longer in use. Seventeen soil samples were collected during well construction and submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, SVOCs, VOCs, and radionuclides (LANL 1997, 057015, pp. 4-1–5-8). Results for the eight quarters of groundwater monitoring did not identify any organic COPCs above their respective New Mexico Water Quality Control Commission standards (LANL 1999, 062884, pp. 3–10).

4.8.2 Summary of Data for SWMU 18-003(d)

The data collected during the 1993−1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639). Decision-level analytical data, samples collected, and analytes requested from the 1996 to 1998 corrective action are presented in Tables 4.8-1 to 4.8-3.

The results of the analyses of samples collected during the 1996 through 1998 VCA are as follows (LANL 1997, 057015, pp. 5-3−5-8):

- Manganese, thallium, and zinc were detected above BVs (Figure 4.8-2).
- VOCs were detected (Figure 4.8-3).
- No radionuclides were detected.

The nature and extent of contamination have not been defined for this site.

4.8.3 Scope of Activities for SWMU 18-003(d)

Seventy-nine subsurface samples will be collected from 34 locations adjacent to the inlet line, tank inlet, septic tank, tank outlet, discharge line, and drain field (Figure 4.8-4). Samples adjacent to the lines will be collected at 20-ft intervals along the path of the line, beginning at the point of exit from the building or tank, to coincide with the expected locations of the pipe joints. Twenty locations will be sampled at two depths (immediately below the level of the line or tank and 5 ft below the level of the line or tank). Eleven locations will be sampled at three depths (immediately below the level of the line or tank, 5 ft below the level of the line or tank, and 10 ft below the level of the line or tank). A third sample depth is included at some locations to investigate the potential of contaminants migrating to greater depths. Samples at locations along drainlines near buildings may need to be delayed because of access problems until D&D of the related structures are completed, depending on the implementation schedules of D&D and the Lower Pajarito Canyon Aggregate Area investigation.

All samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, zirconium, PCBs (20% of the samples), SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.8-4 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.9 SWMU 18-003(e), Septic System

SWMU 18-003(e) (Figure 4.9-1) is an inactive septic system at TA-18 that includes two inlet lines, a cylindrical septic tank (structure 18-40), an outlet line, a drain field, and a former outfall. The septic tank is located approximately 50 ft southwest of building 18-37 and approximately 50 ft east of building 18-29 (a log cabin). The tank is constructed of reinforced concrete and measures 6 ft in diameter × 6 ft deep. The septic system received sanitary waste from building 18-31 (a utility building), building 18-37 (Guard Station 205), building 18-129 (a reactor subassembly building), building 18-189, and building 18-190.

While in operation from 1951 to 1969, the septic system may have also received industrial waste from a sink in building 18-28 (a warehouse). Septic tanks associated with SWMUs 18-003(g, h) (structure 18-43 and structure 18-152, respectively) may have discharged to this septic system.

Effluent discharged into a drain field that has four drainlines, each of which is approximately 40 ft long. The drainlines, which are 10 ft apart from each other, merge at the distal end of the drain field and continue an estimated 100 ft to the former outfall. In 1969, sanitary waste from the buildings was connected to the site sewer system that routed effluent to the sanitary sewage lagoons. At that time, the septic tank was backfilled with sand (LANL 1993, 015310, pp. 5-7–5-13).

4.9.1 Summary of Previous Investigations for SWMU 18-003(e)

An RFI was conducted at SWMU 18-003(e) in July 1994. Two samples of the tank sand fill were collected from the septic tank. The fill samples were submitted to an off-site contract analytical laboratory for analyses of total uranium, metals, SVOCs, VOCs, and isotopic plutonium. In addition to the fill samples, 21 soil samples were collected from surface soil and boreholes adjacent to the tank, within the drain field, and near the former outfall. Soil samples were submitted to an off-site contract analytical laboratory for analyses of total uranium and other metals, SVOCs, VOCs, and isotopic plutonium. Two groundwater samples were collected, one from each borehole that encountered shallow groundwater (LANL 1995, 047257, p. 5).

An EC was conducted at SWMU 18-003(e) from August to September 1995. The EC consisted of removal and disposal of the sand fill contents of the septic tank, three pressure-steam washes of the tank's interior, and disposal of the wash water. The tank was backfilled with flowable fill concrete to ensure the inlet and outlet ports were properly plugged (LANL 1996, 054488, p. 3).

4.9.2 Summary of Data for SWMU 18-003(e)

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.9.3 Scope of Activities for SWMU 18-003(e)

Fifty-five subsurface samples will be collected from 23 locations adjacent to the inlet line, tank inlet, septic tank, tank outlet, discharge line, drain field, and former outfall (Figure 4.9-2). Samples adjacent to the lines will be collected at 20-ft intervals along the path of the line, beginning at the point of exit from the building or tank, to coincide with the expected locations of the pipe joints. Fourteen locations will be sampled at two depths (immediately below the level of the line or tank and 5 ft below the level of the line or tank). Nine locations will be sampled at three depths (immediately below the level of the line or pit, 5 ft below the level of the line or pit, and 10 ft below the level of the line or pit). A third sample depth is included at some locations to investigate the potential of contaminants migrating to greater depths. Data from canyon reach PA-3E (shaded in green) will be included in the investigation report to supplement the data collected from SWMU 18-003(e) as needed to define the lateral extent of contamination.

Thirty-eight subsurface samples will be collected from 19 locations adjacent to the drainlines from buildings 18-31, 18-37, 18-129, 18-189, and 18-190 to the septic tank (Figure 4.9-2). Samples adjacent to the lines will be collected at 20-ft intervals along the path of the line, beginning at the point of exit from the building. The samples will be collected from two depths (immediately below the level of the line and 5 ft below the level of the line). Samples at locations along drainlines near buildings may need to be delayed because of access problems until D&D of the related structures are completed, depending on the implementation schedules of D&D and the Lower Pajarito Canyon Aggregate Area investigation.

Eight subsurface samples will be collected from location 3e-23 (Figure 4.9-2). Samples will be collected from eight depths (immediately below the level of the line or tank, 5 ft below the level of the line or tank, 25–26 ft bgs, and at 25-ft intervals thereafter to a depth of up to 180 ft bgs or the contact between the Cerro Toledo Interval and Otowi Member whichever is deeper). The deepest 20 to 50 ft (minimum) of open borehole will be video logged to determine if perched saturation is present and, if so, to estimate groundwater flow rates into the open hole. If sufficient water yield is present when perched water is encountered, NMED will be contacted for coordination of a properly designed monitoring well installation. Additional sampling intervals may be added to this location to ensure that a sample is collected from every geologic unit encountered.

All samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.9-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.10 SWMU 18-003(f), Septic System

SWMU 18-003(f) (Figure 4.10-1) is an inactive septic system at TA-18 that includes an inlet line, a septic tank (structure 18-41), a discharge line, and a drain field. The septic system received sanitary waste and photochemical laboratory waste from building 18-30 from 1951 to 1969. In 1969, building 18-30 was connected to the sanitary sewage lagoons and the septic tank was filled with sand. The septic tank, located 25 ft west of building 18-30, is constructed of reinforced concrete and has a 1000-gal. capacity. The tank drained west to the distribution box and drain field. The drain field is located beneath asphalt pavement and the grassy area west of building 18-30. Historical documents indicate that a manhole, a settling pit with associated drainlines, and an outfall may have been associated with SWMU 18-003(f), but they were not located during the 1993 RFI investigation (LANL 1995, 052183, p. 4-44).

4.10.1 Summary of Previous Investigations for SWMU 18-003(f)

In August 1994, an RFI was conducted at SWMU 18-003(f). Two samples of sand fill were collected from the septic tank, 3 soil samples were collected adjacent to the inlet and outlet tank connections, and 15 soil samples were collected within the drain field. Tank fill was analyzed for total uranium, other inorganic chemicals, SVOCs, and VOCs. The analyses of subsurface soil samples were the same as for the tank fill with the addition of chloride and nitrate. The analyses of three groundwater samples, also collected from beneath the drain field, were the same as for the tank contents with the addition of general minerals (LANL 1995, 052183, pp. 4-44–4-51).

4.10.2 Summary of Data for SWMU 18-003(f)

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.10.3 Scope of Activities for SWMU 18-003(f)

Seventy-two subsurface samples will be collected from 30 locations adjacent to the inlet line, tank inlet, septic tank, tank outlet, discharge line, drain field, former outfall, in the drainage pathway below the outfall, and in the main Pajarito Canyon drainage channel (Figure 4.10-2). Samples adjacent to the lines will be collected at 20-ft intervals along the path of the line, beginning at the point of exit from the building or tank, to coincide with the expected locations of the pipe joints. Eighteen locations will be sampled at two depths (immediately below the level of the line or tank and 5 ft below the level of the line or tank). Twelve locations will be sampled at three depths (immediately below the level of the line or tank, 5 ft below the level of the line or tank, and 10 ft below the level of the line or tank). A third sample depth is included at some locations to investigate the potential of contaminants migrating to greater depths.

All samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.10-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.11 SWMU 18-003(g), Septic System

SWMU 18-003(g) (Figure 4.11-1) is an inactive septic system at TA-18 consisting of an inlet line, a septic tank (structure 18-43), a discharge line, and a drain field. The reinforced concrete septic tank is located approximately 25 ft southwest of building 18-1 and 10 ft northeast of building 18-147. Installed in 1944, the tank is 3 ft wide x 5 ft long x 5 ft deep and has an estimated capacity of 500 gal. Between 1944 and 1969, the septic system received sanitary and photochemical laboratory waste from building 18-1 and discharged to a drain field southeast of septic tank 18-43. In 1969, SWMU 18-003(g) was connected to the site sewer system that routed effluent to the sanitary sewage lagoons that were previously located east of TA-18. When the TA-46 SWSC plant came online in 1992, discharges to the lagoons ceased and the septic tank contents were routinely pumped and trucked to the SWSC plant. Most of building 18-1 was demolished in 1968, leaving only a high bay, which was used as an electronic assembly and storage area until decommissioning of the building in 2009.

4.11.1 Summary of Previous Investigations for SWMU 18-003(g)

An RFI was conducted at SWMU 18-003(g) in September 1993 and August 1994. Two samples of liquid and one of sludge were collected from the septic tank using a special long-handled bailer. The tank had only enough sludge for one SVOC and VOC analysis. Liquid samples were analyzed for total uranium and other inorganic chemicals, SVOCs, VOCs, and isotopic plutonium. No surface soil samples were collected because asphalt pavement covered the area.

Four subsurface soil samples and three groundwater samples were collected from a borehole 10 ft downgradient (southeast) of the tank using a Teflon core-barrel sampler. Analyses of subsurface soil samples were the same as for tank liquid samples with the addition of chloride, nitrate, and gamma-emitting radionuclides. Analyses of groundwater samples were the same as for tank liquid samples with the addition of general minerals and gamma-emitting radionuclides. One permanent well (well 18-MW-11) was installed for groundwater monitoring (LANL 1995, 052183, pp. 4-52–4-57).

An IA was conducted at SWMU 18-003(g) from March to September 1996. The IA consisted of removing the liquid and sludge contained in the septic tank, pressure-rinsing the interior of the tank, and disposing of the tank’s contents and associated decontamination water. Sludge and liquid waste from the tank were sanitized, using calcium hypochlorite because of the high fecal coliform concentration, and disposed of at

TA-54 (LANL 1996, 055044, p. 3). One liquid sample and one sludge sample were collected for waste characterization purposes (LANL 1996, 054470, Table A-3).

4.11.2 Summary of Data for SWMU 18-003(g)

The data collected during the 1993−1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.11.3 Scope of Activities for SWMU 18-003(g)

Forty-one subsurface samples will be collected from 17 locations adjacent to the inlet line, tank inlet, septic tank, tank outlet, and discharge line (Figure 4.11-2). Samples adjacent to the lines will be collected at 20-ft intervals along the path of the line, beginning at the point of exit from the building or tank, to coincide with the expected locations of the pipe joints. Ten locations will be sampled at two depths (immediately below the level of the line or tank and 5 ft below the level of the line or tank). Seven locations will be sampled at three depths (immediately below the level of the line or tank, 5 ft below the level of the line or tank, and 10 ft below the level of the line or tank). A third sample depth is included at some locations to investigate the potential of contaminants migrating to greater depths.

All samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.11-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.12 SWMU 18-003(h), Septic System

SWMU 18-003(h) (Figure 4.11-1) is an inactive septic system at TA-18 consisting of an inlet line, a septic tank (structure 18-152), and a discharge line. The septic tank is located approximately 5 ft southeast of building 18-147. Installed in 1997, the steel tank measures 4.3 ft in diameter × 5 ft deep and has a capacity of 500 gal. Between 1967 and 1992, the septic system received sanitary waste from building 18-147 and discharged to the sanitary sewer system that routed effluent to the sanitary sewage lagoons east of TA-18. When the TA-46 SWSC plant came online in 1992, discharges to the lagoons ceased and the septic tank contents were routinely pumped and trucked to the SWSC plant. Building 18-147 was decommissioned in 2009 (LASL 1967, 111196; LASL 1969, 111197).

4.12.1 Summary of Previous Investigations for SWMU 18-003(h)

An RFI was conducted at SWMU 18-003(h) in September 1993 and August 1994. Two samples of liquid were collected from the septic tank. The tank did not contain sludge. Tank fluid was analyzed for total uranium, SVOCs, VOCs, and isotopic plutonium. No surface soil samples were collected because asphalt pavement covered the area. Two subsurface soil samples were collected from a borehole 10 ft downgradient (southeast) of the tank using a truck-mounted, hollow-stem auger and a core rig. Analyses of subsurface soil samples were the same as for the tank liquid with the addition of chloride and nitrate analyses. Groundwater samples could not be collected because the auger accidentally penetrated the active sanitary sewer line from structure 18-152. A second borehole could not be drilled because the rig could not access the site (LANL 1995, 052183, pp. 4-58−4-61).

4.12.2 Summary of Data for SWMU 18-003(h)

The data collected during the 1993−1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.12.3 Scope of Activities for SWMU 18-003(h)

Fourteen subsurface samples will be collected from six locations adjacent to the inlet line, tank inlet, septic tank, tank outlet, and discharge line (Figure 4.11-2). Samples adjacent to the lines will be collected at 20-ft intervals along the path of the line, beginning at the point of exit from the building or tank, to coincide with the expected locations of the pipe joints. Four locations will be sampled at two depths (immediately below the level of the line or tank and 5 ft below the level of the line or tank). Two locations will be sampled at three depths (immediately below the level of the line or tank, 5 ft below the level of the line or tank, and 10 ft below the level of the line or tank). A third sample depth is included at some locations to investigate the potential of contaminants migrating to greater depths.

All samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs, SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.12-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.13 Consolidated Unit 18-004(a)-00

Consolidated Unit 18-004(a)-00 (Figure 4.13-1) consists of SWMU 18-004(a), a stainless-steel industrial waste line, and 18-004(b), a concrete pit containing two stainless-steel tanks that received discharge from SWMU 18-004(a). The consolidated unit is located in the central area of TA-18 west of building 18-30.

4.13.1 SWMU 18-004(a), Waste Line

SWMU 18-004(a) consists of a 3-in.-diameter × approximately 50-ft-long stainless-steel industrial waste line located at TA-18 belowground on the west side of building 18-30. The waste line was connected to sinks that served the west side of building 18-30 and discharged into two associated stainless-steel tanks [SWMU 18-004(b)]. The waste line was designed to receive radioactively contaminated liquid waste from building 18-30 (LANL 1993, 015310, p. 5-13). The 1990 SWMU report (LANL 1990, 007512) states that the waste line received radioactively contaminated liquid waste from building 18-30 (LANL 1993, 015310, p. 5-13).

During interviews conducted for the RFI work plan, former personnel from building 18-30 indicated that sealed radioactive sources, detectors, and reactor-fuel elements were the only radioactive materials present in building 18-30, and no radioactive liquids were ever present. The interviews also indicated that while no radioactive waste entered the waste line, some chemical wastes (primarily acids and cleaning solvents) did. The waste line and associated tanks were in service from the 1950s to 1977 when they were decommissioned. At that time the inlet end of the waste line was capped and remains inactive. Because no information regarding the removal of the waste line was found, it is assumed that the line remains buried in place (LANL 1993, 015310, p. 5-13).

4.13.1.1 Summary of Previous Investigations for SWMU 18-004(a)

An RFI was conducted at SWMU 18-004(a) in June 1994. The capped end of the stainless-steel waste line was found in the north wall of room 114 in building 18-30. The inside of the pipe was swiped at the capped end and analyzed for total uranium and for gross-alpha, -beta, and -gamma radioactivity. Radionuclides were not detected in the swipe samples collected from the inside of the pipe. Field instruments held at the opening of the pipe detected no radioactivity or organic vapors above background levels. No analytical data samples were collected at the site (LANL 1995, 052183, p. 4-62).

4.13.1.2 Summary of Data for SWMU 18-004(a)

No soil samples were collected for analyses at SWMU 18-004(a).

4.13.1.3 Scope of Activities for SWMU 18-004(a)

Four subsurface samples will be collected from two locations adjacent to the waste line (Figure 4.13-2). Samples will be collected from two depths (immediately below the level of the line and 5 ft below the level of the line) and analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs, SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, tritium, moisture content, and pH. Table 4.13-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.13.2 SWMU 18-004(b), Area of Potential Soil Contamination from Former Tanks and Pit

SWMU 18-004(b) consists of an area of potential soil contamination associated with a subsurface concrete containment pit (structure 18-38) that measures 4 ft wide × 9 ft long × 8 ft high and is located at TA-18 on the west side of building 18-30 (Figure 4.13-1). The pit contained two stainless-steel tanks designed to receive radioactively contaminated liquid waste from building 18-30 through an associated 3-in. stainless-steel industrial waste line [SWMU 18-004(a)]. The waste line was connected to sinks that served the west side of building 18-30. A 9-in.-diameter × 6-in.-high sump was built into the floor of the pit, possibly to catch any overflow from the tanks. Whenever the tanks became full, they were taken out for waste removal and cleaning and then returned to service. The 1990 SWMU Report (LANL 1990, 007512) states that the waste line received radioactively contaminated liquid waste from building 18-30.

During interviews conducted for the RFI work plan, former personnel from building 18-30 indicated that sealed radioactive sources, detectors, and reactor-fuel elements were the only radioactive materials present in building 18-30, and no radioactive liquids were ever present. The interviews also indicated that while no radioactive waste entered the tanks, some chemical wastes (primarily acids and cleaning solvents) did. The tanks and associated waste line were in service from the 1950s to 1977 when they were decommissioned. The tanks were removed in 1977, the concrete bottom of the pit was left in place, the walls of the pit were razed, and the pit was backfilled to grade (LANL 1993, 015310, p. 5-13).

4.13.2.1 Summary of Previous Investigations for SWMU 18-004(b)

An RFI was conducted at SWMU 18-004(b) in June 1994. Geophysical tests using engineering drawings were conducted to locate the concrete bottom of the pit that had supported the stainless-steel tanks, but the tests failed to find the concrete bottom of the pit. Additionally, underground electrical conduits critical to operations of building 18-23 were located only 1–2 ft away from the presumed position of the former pit. The risk to these conduits precluded any further excavation at the site. No further investigation was conducted at SWMU 18-004(b) (LANL 1995, 052183, p. 4-62).

4.13.2.2 Summary of Data for SWMU 18-004(b)

No soil samples were collected for analyses at SWMU 18-004(b).

4.13.2.3 Scope of Activities for SWMU 18-004(b)

Six subsurface samples will be collected from three locations below the location of the former pit and tanks and upgradient of the former pit and tanks (Figure 4.13-2). Samples will be collected from two depths (immediately below the pit at 8 ft bgs and 5 ft below the pit at 13 ft bgs) and analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs, SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, tritium, moisture content, and pH. Table 4.13-2 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.14 SWMU 18-005(a), Area of Potential Soil Contamination from Former Magazine 18-15

SWMU 18-005(a) (Figure 4.14-1) consists of an area of potentially contaminated soil associated with a former magazine (structure 18-15) at TA-18 that was used from 1945 until it was demolished in 1977. The magazine was a small, round, dirt-bermed wooden structure constructed at grade and located west of building 18-297. The magazine originally stored HE for firing-site activities conducted at SWMU 18-002(a). Uranium and beryllium oxide were also stored in the magazine for nuclear criticality studies conducted from approximately 1946 to 1955. The former location of structure 18-15 is not currently visible, and the berm surrounding the former location of the magazine is no longer present (LANL 1993, 015310, p. 5-63).

4.14.1 Summary of Previous Investigations for SWMU 18-005(a)

An RFI was conducted at SWMU 18-005(a) in September 1993 and May to October 1994 (LANL 1995, 052183, p. 1-6). Five soil samples were collected using a hand auger to collect core to a depth of 1 ft from five equally spaced sampling locations 2 ft outside the estimated perimeter of the dirt berm. This strategy assumed that sampling locations close to the structure would intersect the area of highest residual contamination if any release had occurred. No field-screening surveys were conducted other than a preliminary radiological screening. HE spot testing was performed to ensure sample-handling safety and proper transport. The spot tests did not detect HE. Samples were submitted to an off-site analytical laboratory for analyses of inorganic chemicals, HE, and radionuclides (LANL 1995, 052183, pp. 4-130−4-133).

4.14.2 Summary of Data for SWMU 18-005(a)

The data collected during the 1993−1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.14.3 Scope of Activities for SWMU 18-005(a)

Twelve surface and subsurface samples will be collected from six locations beneath former structure 18-15 and around the perimeter of former structure 18-15 (Figure 4.14-2). Samples will be collected from native soil and tuff at two depths (0–1 ft and 4–5 ft) as determined in the field and analyzed for TAL metals, nitrate, perchlorate, total cyanide, explosive compounds, SVOCs, VOCs (except in surface samples), gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, and pH. Samples will not be analyzed for PCBs because the former magazine was used only for storage of HE materials, with no record or indication of PCB use at the site. Table 4.14-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.15 AOC 18-006, Former Storage Pipe

AOC 18-006 (Figure 4.15-1) consists of a former 100-ft-long × 6-in.-diameter underground stainless-steel storage pipe at TA-18. AOC 18-006 is located adjacent to and west of structure 18-168 in a graded, fenced, and relatively flat canyon bottom approximately 60 ft north of the creek in Pajarito Canyon. The pipe was slightly tilted so that its depth ranged from 3 ft at its west end to 5 ft at its east end. Engineering drawings show that the storage pipe's east end terminated 2 ft from structure 18-168. The pipe had no connection to the structure, but it was in close proximity to a buried grounding cable that surrounds the structure's foundation. The west end of the pipe was approximately 5 ft inside the corner fence post of the outer security fence for TA-18. The underground pipe passed beneath the inner security fence surrounding structure 18-168 and nearby structure 18-23, a nuclear criticality facility (LANL 1997, 056355, pp. 1–3).

AOC 18-006 served structure 18-168, which was part of the Los Alamos Critical Experiment Facility. The liquid stored in the pipe was used in liquid-fueled reactor experiments for the former Kinglet liquid-fuel reactor. The Kinglet fission reactor used a 560-L solution of 93.2% enriched uranium dissolved in 0.5 M sulfuric acid, resulting in uranyl sulfate solution. This solution was stored in a noncritical configuration in the AOC 18-006 underground pipe, completely filling the horizontal portion of the pipe plus a few inches of the vertical part. The pipe was removed in 1997 (LANL 1997, 056355, p. 1).

4.15.1 Summary of Previous Investigations for AOC 18-006

An environmental investigation was conducted in the area surrounding AOC 18-006 in 1990. During the investigation, four shallow monitoring wells were drilled near structure 18-168 (one upgradient of the structure and the other three downgradient). During well construction, soil samples were collected at depths of 10 ft, 15 ft, and 20 ft bgs. All soil samples were analyzed for a suite of radionuclides that could have been released from adjacent structure 18-168 (LATA 1991, 012464, pp. 3–4).

In June 1997, two samples of residual liquid found in the pipe were collected via the fuel transfer tube at the eastern end of the pipe for waste characterization purposes. The samples were submitted to an off-site contract analytical laboratory for analyses of toxicity characteristic leaching procedure metals, VOCs, and isotopic uranium. The samples collected from the liquid contents of the pipe were solely for waste characterization (LANL 1998, 062676, pp. 10–11).

The VCA to remove the storage pipe at AOC 18-006 began on August 12, 1997, and concluded on August 18, 1997. The pipe and concrete pad were removed during VCA activities. Before soil was removed from the trench during the excavation, it was screened for radiological activity. Before the pipe was removed from the trench, it was cut, swiped, and screened for radiological activity. Three confirmatory soil samples were collected at three different locations directly beneath the pipe while the trench was open. The sampling interval for all three samples was 0–6 in. directly below the excavated pipe, which contained a combination of the original 2 in. of fill material and approximately 4 in. of native alluvial material. After the pipe was removed, the trench was backfilled with excavated materials. The samples were submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, organic chemicals, and radionuclides (LANL 1998, 062676, p. 15).

4.15.2 Summary of Data for AOC 18-006

Decision-level analytical data, samples collected, and analytes requested from the August 1997 VCA are presented in Tables 4.15-1 to 4.15-3.The results of the analyses of samples collected below the excavated pipe are as follows (LANL 1998, 062676, pp. 18–24):

- Zinc was detected above BV (Figure 4.15-2).
- VOCs were detected (Figure 4.15-3). No SVOCs were detected.
- No radionuclides were detected.

The nature and extent of contamination have not been defined for this site.

4.15.3 Scope of Activities for AOC 18-006

Eighteen subsurface samples will be collected from six locations beneath the former storage pipe (Figure 4.15-4). Samples will be collected from three depths at varying intervals because of the slope of the pipe. Sampling depth intervals at three sampling locations at the west end of the former pipe will be 3−4 ft, 5–6 ft, and 7–8 ft bgs; sampling depth intervals at one location in the center of the former pipe will be 4−5 ft, 6–7 ft, and 8–9 ft bgs; and sampling depth intervals at two locations at the east end of the former pipe will be 5–6 ft, 7–8 ft, and 9–10 ft bgs.

All samples will be analyzed for TAL metals, SVOCs, VOCs, isotopic uranium, and pH. Table 4.15-4 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.16 AOC 18-008, Former Underground Tank

AOC 18-008 (Figure 4.16-1) is a former 1000-gal. underground storage tank (UST), structure 18-104, which was located at TA-18 approximately 40 ft northeast of building 18-256 and 45 ft southeast of structure 18-26 (a vault). From approximately 1945 to 1955, the tank was used to store diesel fuel for a diesel-operated generator or for a boiler in building 18-1, but the tank was never connected to the buildings themselves. The tank was removed in 1996 (LANL 1996, 063045, p. 1).

4.16.1 Summary of Previous Investigations for AOC 18-008

An RFI was conducted at AOC 18-008 in September 1993 and May to October 1994 (LANL 1995, 052183, p. 1-6). The tank could not be located by surface inspection. Consequently, ground-penetrating radar (GPR) readings were taken in an attempt to establish the location of the tank. No samples were collected during this RFI because the tank could not be located with GPR or a geophysical survey (LANL 1996, 063045, p. 1).

In June 1996, the tank was discovered during the installation of a new gas line at TA-18 and a decision was made to remove the tank as part of a VCA. Before removing the tank, the New Mexico UST Bureau was contacted and concurred with the decision to remove the tank (LANL 1996, 063045, p. 1).

On July 3, 1996, the UST was excavated and removed. On the same day of the UST removal, two soil samples were collected from the bottom of the excavation at 6–7 ft bgs. The two samples were field-screened by a mobile laboratory for gross-alpha, -beta, and -gamma radioactivity and then submitted to an off-site contract analytical laboratory for analysis of total petroleum hydrocarbons−diesel range organics (TPH-DRO). The tank was removed and transferred to a commercial firm specializing in the treatment and reclamation of empty USTs. The excavation was backfilled without further remediation. As part of the VCA on September 4, 1996, two locations were sampled at the location of the former tank to investigate possible contamination based on the analytical results of two soil samples taken during the excavation. Two soil samples were collected from each of the two locations and submitted to an off-site contract analytical laboratory for analyses of SVOCs, TPH-DRO, and VOCs (LANL 1996, 063045, pp. 1−6 and F-1−F-3).

Following the VCA, the New Mexico UST Bureau mandated a 45-day report (LANL 1996, 055174) to determine the extent of diesel fuel contamination associated with the former UST. The report documented that on November 18 and 19, 1996, four locations were sampled near the location of the former tank to a depth of 28 ft bgs to investigate possible contamination based on previous sampling results. In the first location, samples were collected at 7 ft, 12 ft, 17 ft, 22 ft, and 28 ft bgs. At each of the remaining three locations, samples were collected at 9 ft, 14 ft, 19 ft, 24 ft, and 28 ft bgs. Twenty total samples were collected from the four locations and submitted to an off-site contract analytical laboratory for analyses of SVOCs, TPH, and VOCs (LANL 1996, 055174).

4.16.2 Summary of Data for AOC 18-008

Decision-level analytical data, samples collected, and analytes requested from the 1996 VCA and 45-day investigation are presented in Tables 4.16-1 and 4.16-2. No sampling was conducted at AOC 18-008 during the 1993−1994 RFI because the AOC could not be located.

The results of the analyses of samples collected during the VCA from the tank excavation in July 1996 and the samples collected from the two boreholes drilled in September 1996 (LANL 1996, 063045) found TPH-DROs and VOCs detected (Figure 4.16-2). SVOCs were not detected.

The results of the analyses of the 20 samples collected from the 4 locations sampled in November 1996 (LANL 1996, 055174) found TPH-DROs detected (Figure 4.16-2). SVOCs or VOCs were not detected.

The nature and extent of contamination have not been defined for this site.

4.16.3 Scope of Activities for AOC 18-008

Eight subsurface samples will be collected from two locations beneath the former UST (Figure 4.16-3). Samples will be collected from four depths (10–11 ft, 15–16 ft, 20–21 ft, and 30–31 ft bgs) and analyzed for TAL metals, SVOCs, TPH-DROs, VOCs, and pH.

Twenty subsurface samples will be collected from four locations around the perimeter of the former UST, shown in Figure 4.16-3. Samples will be collected from five depths (6–7 ft, 10–11 ft, 15–16 ft, 20–21 ft, and 30–31 ft bgs) and analyzed for TAL metals, SVOCs, TPH-DROs, VOCs, and pH. Table 4.16-3 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.17 AOC 18-010(b), Outfall

AOC 18-010(b) (Figure 4.17-1) is an outfall at TA-18 that receives stormwater discharge from an asphalt-paved drainage ditch running southward along the west side of the paved area west of building 18-30. The outfall discharges to a flat, grassy area at the fence southwest of building 18-30. The discharge point is approximately 25 ft north of the stream channel in Pajarito Canyon. The date this outfall became operational is unknown, but it is likely that the outfall has been operational from the time building 18-30 was constructed in 1951.

The 1993 RFI work plan (LANL 1993, 015310) for AOC 18-010(b) described a 1988 photograph that noted spillage from a refueling platform into the asphalt-paved drainage ditch (LANL 1993, 015310, p. 2-15).

4.17.1 Summary of Previous Investigations for AOC 18-010(b)

An RFI was conducted at AOC 18-010(b) from May to October 1994 (LANL 1995, 052183, p.1-6). Ten sediment samples were collected from 10 locations for field screening from the asphalt-paved drainage ditch upstream from the outfall. Five samples were chosen for analyses, based on the presence of elevated concentrations of inorganic chemicals, and were submitted to an off-site contract analytical laboratory for analyses of total uranium, other inorganic chemicals, and SVOCs (LANL 1995, 052183, p. 4-137). Two soil samples, one at the outfall and another 12 ft downstream of the outfall, were also collected from 0 to 6 in. bgs and submitted to an off-site contract analytical laboratory for analyses of total uranium, other inorganic chemicals, and SVOCs (LANL 1995, 052183, p. 4-137).

4.17.2 Summary of Data for AOC 18-010(b)

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.17.3 Scope of Activities for AOC 18-010(b)

Twelve surface and subsurface samples will be collected from one location at the outfall, two locations in the drainage below the outfall, and three locations in the main Pajarito Canyon drainage channel (Figure 4.17-2). Samples will be collected from two depths (0–1 ft and 2–3 ft bgs). Samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs, SVOCs, TPH-DRO, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.17-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.18 AOC 18-010(c), Outfall

AOC 18-010(c) (Figure 4.18-1) is an outfall at TA-18 that receives stormwater discharge in the form of sheet flow from the paved area east of building 18-30. The outfall discharges to a grassy depression southeast of building 18-30 and south of building 18-31. The discharge point is approximately 100 ft north of the stream channel in Pajarito Canyon. The date this outfall became operational is unknown, but it is likely that the outfall has been operational from the time building 18-30 was constructed in 1951 (LANL 1993, 015310, p. 5-65).

4.18.1 Summary of Previous Investigations for AOC 18-010(c)

An RFI was conducted at AOC 18-010(c) from May to October 1994 (LANL 1995, 052183, p. 1-6). Four sediment samples were collected for field screening from four locations at the outfall and at the drainage channel below the outfall. The samples were screened in the field for inorganic chemicals and SVOCs using a mobile laboratory. Two samples were chosen for analyses, based on the presence of elevated concentrations of inorganic chemicals, and submitted to an off-site contract analytical laboratory for analyses of total uranium, other inorganic chemicals, and SVOCs (LANL 1995, 052183, p. 4-146).

4.18.2 Summary of Data for AOC 18-010(c)

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.18.3 Scope of Activities for AOC 18-010(c)

Two surface and subsurface samples will be collected from one location at the outfall; fourteen surface and subsurface samples will be collected from seven locations in the drainage below the outfall; and four surface and subsurface samples will be collected from two locations in the main Pajarito Canyon drainage channel (Figure 4.18-2). Samples will be collected from two depths (0–1 ft and 2–3 ft bgs). Samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.18-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites. Data from canyon reach PA-3E (shaded in green) will be included in the investigation report to supplement the data collected from AOC 18-010(c) as needed to define the lateral extent of contamination.

4.19 AOC 18-010(d), Outfall

AOC 18-010(d) (Figure 4.18-1) is an outfall at TA-18 that receives discharge in the form of sheet flow from a storm drainage collection area that drains the paved area northeast of building 18-37. The outfall discharges to a flat graveled and grassy area southeast of building 18-37 and west of building 18-258. The discharge point is approximately 100 ft north of the stream channel in Pajarito Canyon. The date this outfall became operational is unknown, but it is likely that the outfall has been operational from the time building 18-37 was constructed in 1951 (LANL 1993, 015310, p. 5-65).

4.19.1 Summary of Previous Investigations for AOC 18-010(d)

An RFI was conducted at AOC 18-010(d) from May to October 1994 (LANL 1995, 052183, p. 1-6). Four sediment samples were collected from four locations for field screening from the outfall and the drainage below the outfall. The samples were screened in the field for inorganic chemicals and SVOCs using a mobile laboratory. Two samples were chosen for analyses, based on the presence of elevated concentrations of inorganic chemicals, and submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, SVOCs, and radionuclides (LANL 1995, 052183, p. 4-153).

4.19.2 Summary of Data for AOC 18-010(d)

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.19.3 Scope of Activities for AOC 18-010(d)

Two surface and subsurface samples will be collected from one location at the outfall; sixteen surface and subsurface samples will be collected from eight locations in the drainage below the outfall; and two surface and subsurface samples will be collected from one location in the main Pajarito Canyon drainage channel (Figure 4.18-2). Samples will be collected from two depths (0–1 ft and 2–3 ft bgs). Samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.19-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites. Data from canyon reach PA-3E (shaded in green) will be included in the investigation report to supplement the data collected from AOC 18-010(d) as needed to define the lateral extent of contamination.

4.20 AOC 18-010(e), Outfall

AOC 18-010(e) (Figure 4.20-1) is an outfall at TA-18 that receives discharge from a storm sewer drainage that drains the paved area between buildings 18-28 and 18-147. The drainage enters a storm drain that runs southeast under the paved area west of building 18-129 to a grating east of building 18-190 and turns south. The drain reaches the outfall south of building 18-129, which discharges to a small grassy gully leading to the main stream channel in Pajarito Canyon. The outfall is located approximately 200 ft north of the stream channel. The date this outfall became operational is unknown, but it is likely that the outfall has been operational from the time building 18-37 was constructed in 1951 (LANL 1993, 015310, p. 5-65).

4.20.1 Summary of Previous Investigations for AOC 18-010(e)

An RFI was conducted at AOC 18-010(e) from May to October 1994 (LANL 1995, 052183, p. 1-6). Fourteen sediment samples were collected from 14 locations for field screening from the outfall, the drainage below the outfall, and the Pajarito Canyon stream channel. The samples were screened in the field for inorganic chemicals and SVOCs using a mobile laboratory. Seven samples were chosen for analyses, based on the presence of elevated concentrations of inorganic chemicals, and submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, SVOCs, and radionuclides (LANL 1995, 052183, p. 4-158).

4.20.2 Summary of Data for AOC 18-010(e)

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.20.3 Scope of Activities for AOC 18-010(e)

Two surface and subsurface samples will be collected from one location at the outfall; and eighteen surface and subsurface samples will be collected from nine locations in the drainage below the outfall (Figure 4.20-2). Samples will be collected from two depths (0−1 ft and 2–3 ft bgs). Samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.20-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites. Data from canyon reach PA-3E (shaded in green) will be included in the investigation report to supplement the data collected from AOC 18-010(e) as needed to define the lateral extent of contamination.

4.21 AOC 18-010(f), Outfall

AOC 18-010(f) (Figure 4.21-1) is an outfall at TA-18 that received discharge from the roof and floor drains of building 18-32. The roof and floor drains discharge into a storm drain that exits the building under the pavement from the northeast corner of building 18-32. The storm drainline discharges through an outfall, approximately 100 ft north of building 18-32, located on a sandy, grassy bank on the south side of the stream channel in Threemile Canyon. Building 18-32 was built in 1951 and used for nuclear critical assembly work. The date this outfall became operational is unknown, but it is likely that the outfall has been operational from the time building 18-32 was constructed in 1951 (LANL 1993, 015310, p. 5-65).

4.21.1 Summary of Previous Investigations for AOC 18-010(f)

An RFI was conducted at AOC 18-010(f) from May to October 1994 (LANL 1995, 052183, p. 1-6). Four sediment samples were collected from four locations for field screening from the outfall and the drainage below the outfall. The samples were screened in the field for inorganic chemicals and SVOCs using a mobile laboratory. Two samples were chosen for analyses, based on the presence of elevated concentrations of inorganic chemicals, and submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, SVOCs, and radionuclides (LANL 1995, 052183, p. 4-167).

4.21.2 Summary of Data for AOC 18-010(f)

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.21.3 Scope of Activities for AOC 18-010(f)

Six surface and subsurface samples will be collected from three locations (at the outfall, 5 ft downgradient of the outfall, and 10 ft downgradient of the outfall) directly in the drainage below the outfall (Figure 4.21-2). Samples will be collected from two depths (0–1 ft and 2–3 ft bgs). Samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, zirconium, PCBs, SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.21-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.22 AOC 18-011, Area of Potential Soil Contamination from Former Building 18-22

AOC 18-011 (Figure 4.16-1) consists of an area of potential soil contamination at TA-18 beneath a former electrical generator building (former building 18-22) potentially contaminated by a mercury spill in the building. Former building 18-22 was located at the north end of the central area of TA-18. The building operated from 1946 until it was removed in 1950. The concrete floor pad of the building was left in place and is covered with approximately 2 ft of fill (LANL 1993, 015310, p. 5-52). The SWMU 1990 Report (LANL 1990, 007512) indicates that mercury was handled in former building 18-22, but according to an interview with a former Laboratory employee, mercury was only present in some of the switches on the generator. The employee indicated that on one occasion, a mercury-containing glass tube on one of the switches broke, spilling 1–2 mL of mercury onto the concrete pad and possibly onto the surrounding soil. The Laboratory's Health (H) Division reportedly cleaned up the mercury spill using sulfur powder; however, no historical documentation of the spill or any cleanup effort is available (LANL 1993, 015310, pp. 5-52–5-53).

4.22.1 Summary of Previous Investigations for AOC 18-011

An RFI was conducted at AOC 18-011 from May to October 1994 (LANL 1995, 052183, p. 1-6). Shortly before the start of sampling, nearby trenching for unrelated utility work exposed a corner of the buried concrete foundation of former building 18-22, allowing determination of its location and orientation. The trenching activities did not interfere with the areas selected for sampling. Four surface soil samples were collected 2 ft from the perimeter of each side of the square pad, and another surface sample was collected at the center, for a total of five samples. HE spot testing and a preliminary field screening for radioactivity were performed on the samples. HE spot testing of all samples produced negative results. The samples were submitted to an off-site contract analytical laboratory for analysis of mercury. Mercury was not detected above BV (LANL 1995, 052183, p. 4-134).

4.22.2 Summary of Data for AOC 18-011

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

The nature and extent of contamination have not been defined for this site.

4.22.3 Scope of Activities for AOC 18-011

Ten surface and subsurface samples will be collected from one location beneath former building 18-22 and four locations around the perimeter of building 18-22 (Figure 4.16-3). Samples will be collected from two depths (0–1 ft and 2–3 ft bgs) and analyzed for mercury. Table 4.22-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.23 SWMU 18-012(a), Outfall from Building 18-116

SWMU 18-012(a) (Figure 4.23-1) is an outfall at TA-18 for a combined industrial drain and storm sewer drain for building 18-116 (Kiva 3). Drainlines discharging to this outfall are connected to building 18-116 roof drains, floor drains, and sinks. The outfall, found during 1992 field inspections using a dye-trace test, is located approximately 120 ft northeast of building 18-116 and approximately 150 ft from the stream channel in Pajarito Canyon. Building 18-116 was built in 1960 and used for uranium mockup tests for the Rover Program—a nuclear rocket propulsion program conducted from 1955 to 1972 (LANL 1993, 015310, p. 2-10). The date this outfall became operational is unknown, but it is likely that the outfall has been operational from the time building 18-116 was completed in 1960 (LANL 1993, 015310, p. 5-14).

4.23.1 Summary of Previous Investigations for SWMU 18-012(a)

An RFI was conducted at SWMU 18-012(a) from May to October 1994 (LANL 1995, 052183, p. 1-6). Four surface soil samples were collected from four locations for field screening from the outfall and the drainage below the outfall. Using a mobile laboratory in the field the samples were screened for inorganic chemicals, SVOCs, and gross-alpha, -beta, and -gamma radioactivity. Two samples were chosen for analyses, based on the presence of elevated concentrations of field-screening analytes, and submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, SVOCs, and radionuclides (LANL 1995, 052183, p. 4-67).

4.23.2 Summary of Data for SWMU 18-012(a)

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

4.23.3 Scope of Activities for SWMU 18-012(a)

Four subsurface samples will be collected from two locations adjacent to the drainline between building 18-116 and the outfall (Figure 4.23-2). Samples will be collected from two depths (immediately below the level of the line and 5 ft below the level of the line). Samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, zirconium, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH.

Two surface and subsurface samples will be collected from one location at the outfall; and sixteen surface and subsurface samples will be collected from eight locations in the drainage below the outfall (Figure 4.23-2). Samples will be collected from two depths (0−1 ft and 2–3 ft bgs). Samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, zirconium, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.23-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites. Data from canyon reach PA-3E (shaded in green) will be included in the investigation report to supplement the data collected from SWMU 18-012(a) as needed to define the lateral extent of contamination.

4.24 AOC 18-012(c), Sump and Drainlines

AOC 18-012(c) (Figure 4.11-1) consists of an inactive sump at TA-18 and two drainlines from building 18-141. One drainline is a 4-in. cast-iron pipe attached to the floor drain of a sump located in the pit of building 18-141. This drainline exits the south side of the building and discharges through an outfall that empties into a former drainage ditch approximately 80 ft east of building 18-141. The second drainline is a 3-in. cast-iron pipe connected to floor drains and sinks in building 18-141. Building 18-141 housed an ultrasonic cleaner, located in a pit below the floor, which used ethanol and benzene to clean beryllium parts and possibly radioactive materials. The time period during which the ultrasonic cleaner was used is unknown. This drainline exits the northeast side of the building and discharges through an outfall that empties into a dry well sump approximately 50 ft east of building 18-141 (LANL 1993, 015310, p. 5-15).

4.24.1 Summary of Previous Investigations for AOC 18-012(c)

An RFI was conducted at AOC 18-012(c) from May to October 1994 (LANL 1995, 052183, p. 1-6). One surface sample was collected from the outfall of the 4-in. drainline. The discharge area of the 3-in. drainline was not sampled because the drainline received only potable water. The sample collected from the outfall was submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, SVOCs, and radionuclides (LANL 1995, 052183, p. 4-82).

4.24.2 Summary of Data for AOC 18-012(c)

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

4.24.3 Scope of Activities for AOC 18-012(c)

Four surface and subsurface samples will be collected from two locations at the points where the two drainlines exit building 18-141 (Figure 4.11-2). Samples will be collected from two depths (immediately below the level of the line and 5 ft below the level of the line) and analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH.

Three subsurface samples will be collected from one location downgradient of the dry well sump east of building 18-141 (Figure 4.11-2). Samples will be collected from three depths (directly below the base of the sump, 5 ft below the base of the sump, and 10 ft below the base of the sump) and analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH.

Two surface and subsurface samples will be collected from one location at the outfall; and ten surface and subsurface samples will be collected from five locations in the former drainage ditch that receives discharge from the outfall (Figure 4.11-2). Samples will be collected from two depths (0–1 ft and 2–3 ft bgs) and analyzed for TAL metals, nitrate, perchlorate, total cyanide, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, and pH. Table 4.24-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.25 AOC 18-013, Pit and Catch Tank

AOC 18-013 (Figure 4.15-1) is a small, inactive, pit and catch tank at TA-18. This concrete-walled and open-bottomed pit is located beneath the asphalt pavement on the north side of building 18-23. The pit contains a stainless-steel catch tank that reportedly received industrial wastes or radioactive liquids via a pipe from inside building 18-23. Building 18-23, built in 1947, was used for critical assembly operations.

This AOC was identified from a 1992 site inspection that found a capped drainpipe leading to the pit. Engineering drawings were also found. Discussions with site personnel and former employees could not establish the purpose of the drainpipe and catch tank or whether this system was ever used (LANL 1993, 052183, p. 4-64).

4.25.1 Summary of Previous Investigations for AOC 18-013

An RFI was conducted at AOC 18-013 from May to October 1994 (LANL 1995, 052183, p. 1-6). Initial investigation activities included an excavation to determine whether the pit and tank were present. Excavation through the asphalt pavement verified that the concrete-walled pit, which contained an 18-in.-diameter × 2.6-ft-high metal catch tank, was still in place. Both the pit and the tank were entirely backfilled with soil. The bottom of the concrete pit was 4.8 ft bgs and covered with gravel open to the soil below. After the excavation was completed, five samples were collected from the backfill at the site; two at the bottom of the catch tank, two beneath the drainline, and one from the gravel in the bottom of the pit.

The samples were screened in the field for radioactivity and submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, organic chemicals, and radionuclides (LANL 1995, 052183, p. 4-85).

4.25.2 Summary of Data for AOC 18-013

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

4.25.3 Scope of Activities for AOC 18-013

Two subsurface samples will be collected from one location beneath the pit and tank; and six subsurface samples will be collected from three locations around the perimeter of the former pit and tank (Figure 4.15-4). Samples will be collected from two depths (immediately below the level of the pit and tank and 5 ft below the level of the line or tank) and analyzed for TAL metals, nitrate, perchlorate, total cyanide, zirconium, PCBs, SVOCs, VOCs, americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic thorium, isotopic uranium, tritium, moisture content, and pH. Table 4.25-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.0 PROPOSED INVESTIGATION ACTIVITIES AT TA-27

5.1 SWMU 27-002, Firing Sites

SWMU 27-002 (Figure 5.1-1) is an inactive firing site in Pajarito Canyon used between 1944 and 1947 (LANL 1993, 015310, p. 5-53). The site consists of five firing pits situated on either side of Pajarito Road, approximately 0.9 mi southeast of TA-18. Firing Pit 1 is located in the grassy area approximately 100 ft south of the TA-36 fence. Firing Pits 2 and 3 are approximately 200 ft east of Firing Pit 1, between the fence and Pajarito Road. Firing Pit 4 has been impacted by the construction of Pajarito Road but is located on the north side of Pajarito Road. Firing Pit 5 is located on a small curve on the north side of Pajarito Road. The pits were used for explosives testing with materials such as beryllium, thorium, and uranium. A 1946 bullet sensitivity test at Firing Pit 1 caused a block of Composition B explosive to undergo a low-order explosion, scattering unexploded HE over a 250-yd radius (LANL 1995, 052183, p. 4-115).

5.1.1 Summary of Previous Investigations for SWMU 27-002

An RFI was conducted at SWMU 27-002 in June 1994. Surface samples were collected from around each firing pit, and subsurface samples were collected from boreholes drilled at each firing pit. The surface soil around the firing pits was screened for radioactivity using a field instrument for detection of low-energy radiation every 3 ft (up to 500 ft) on radials extended north, south, east, and west from the center of each firing point to bias sampling locations for field screening and the mobile laboratory analysis (LANL 1995, 052183, p. 4-115).

Eight grab samples of surface soil were collected for field screening from each of 14 locations and analyzed using mobile laboratory analysis for inorganic chemicals; HE; SVOCs; and gross-alpha, -beta, and -gamma radioactivity. An HE spot-test kit was used to ensure sample-handling safety and proper transport procedures. Four samples from each location were chosen for analyses based on elevated levels of barium, lead, tritium, and uranium. At 10 of the 14 sampling locations, a single composite sample was prepared using material from all 4 grab samples (10 total composite samples). At the four remaining sampling locations, two composite samples were prepared using material from all four grab samples (eight total composite samples).

Eighteen total composite samples were prepared from the four grab samples at each location and submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, HE, SVOCs, VOCs, and radionuclides. This method provided a statistical comparison of the variability of measurements for the average analyte concentration across the composite samples (LANL 1995, 052183, p. 4-115).

Fifty-eight samples were collected from the boreholes drilled in and around the firing pits and submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals, HE, organic chemicals, and radionuclides (LANL 1995, 052183, pp. 4-115−4-117).

5.1.2 Summary of Data for SWMU 27-002

The data collected during the 1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

5.1.3 Scope of Activities for SWMU 27-002

Seventy-two surface and subsurface samples will be collected at 36 locations around the former firing pits (Figure 5.1-2). These locations will be positioned at radial distances of approximately 50 ft, 100 ft, and 200 ft from the center of Firing Pit 1 and from the midway point between Firing Pits 2 and 3 and between Firing Pits 4 and 5. Samples will be collected from two depths (0–1 ft and 2–3 ft bgs). Ten additional subsurface samples will be collected from five locations at the center of the firing pits (4–5 ft and 9–10 ft bgs).

All samples will be analyzed for TAL metals, nitrate, perchlorate, total cyanide, dioxins/furans, explosive compounds, PCBs (20% of the samples), SVOCs, VOCs (except in surface samples), americium-241, gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, and pH. Table 5.1-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.2 SWMU 27-003, Bazooka Impact Area

SWMU 27-003 (Figure 5.2-1) is a former target practice area used by the U.S. Army between 1944 and 1947. The 0.5-mi-long region has been fenced and unused by the Laboratory since 1962. The area is located north of Pajarito Road within Pajarito Canyon, 0.2 mi east of the inactive TA-18 sanitary lagoons and 1.25 mi east of TA-18. Most of SWMU 27-003 lies on the steep slope of the south-facing wall of the canyon below the rim and is visible as a distinct light-colored patch of highly fragmented rock. The footprint of the impact area extends northward onto the top of Mesita del Buey within the TA-54 fence, extends southward downslope to the canyon floor across the Pajarito Canyon stream channel, and ends near Pajarito Road. Firing took place from a point located south of the curve in the road. Ordnance fired at the cliff face consisted of hundreds of 2.36-in. rocket-propelled bazooka rounds, typically with armor-piercing shaped-charge warheads (LANL 1993, 015310, p. 5-70; LANL 1995, 044014, p. 4-1).

5.2.1 Summary of Previous Investigations for SWMU 27-003

An RFI was conducted at SWMU 27-003 from October 5 to November 2, 1993, and in the summer of 1994. The east-west boundaries of the SWMU were determined by using visual inspection of surface debris and two types of metal detectors to locate subsurface metallic objects to an 18-in. depth. Sequential magnetic sweeps were conducted in 10-ft-wide adjoining lanes parallel to the cliff. Personnel rappelling from the mesa top visually and magnetically checked the cliff's vertical surfaces. Rocks, talus, cracks, and ravines were also checked for ordnance material. Sweeps were continued in the canyon bottom southward toward Pajarito Road until no further ordnance fragments were found. Minor amounts of debris were recovered on the mesa top within the TA-54 fence.

A total of 3200 pieces of ordnance debris were removed, including 646 tail assemblies and 14 unexploded ordnances (UXOs). The UXOs consisted of eight live bazooka rounds and six unexploded booster assemblies; all were detonated in place using C-4 plastic explosive in five separate firing operations. The Laboratory screened nine crates of ordnance debris for radioactive material and sent them to the TA-16 open-burning unit to destroy residual HE. Radioactive aluminum fragments associated with explosive testing at nearby firing sites were disposed of at TA-54. In the summer of 1994, six surface samples were collected from six locations near the base of the cliff and submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals and HE. However, results were reported only for five samples (LANL 1995, 044014, pp. 4-1−4-7).

The 1995 RFI report recommended NFA for SWMU 27-003 (LANL 1995, 044014, p. 4-7). The U.S. Environmental Protection Agency (EPA) reviewed the RFI report, concurred with the Laboratory's recommendation of NFA, and agreed that the Laboratory should request that SWMU 27-003 be removed from Module VIII of the Laboratory's Hazardous Waste Facility Permit (DOE 1995, 050058). In September 1996, the Laboratory submitted a request for a Class III permit modification to NMED that included removing SWMU 27-003 from Module VIII of the Laboratory's Hazardous Waste Facility Permit. The basis for this request was that the site had been characterized in accordance with applicable state and/or federal regulation, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use. The permit modification request presented the results of the ordnance survey and removal activities and soil sampling done during the RFI (LANL 1996, 055036). NMED reviewed the permit modification request and identified deficiencies in the information provided to support the permit modification. NMED requested that the Laboratory provide additional information concerning the results of sampling conducted at SWMU 27-003 (NMED 1997, 056369).

An investigation was conducted in 2001 at SWMU 27-003 to provide supplemental information in support of NMED's request. Additional confirmation sampling locations extended toward the south and southeast, within the drainage area of the site. Four soil and two sediment samples were collected at six locations and submitted to an off-site contract analytical laboratory for analyses of inorganic chemicals and HE. Samples were biased on the downhill side of the SWMU and in stormwater channels that may have transported contaminants from the site (LANL 2001, 071522). The Laboratory submitted the supplemental information requested by NMED, including results of the sampling conducted in 2001 and additional sampling for radioactive contamination conducted outside the boundary of SWMU 27-003 (LANL 2002, 072905). NMED reviewed the supplemental information provided by the Laboratory and stated that it "could not concur with NFA determination for SWMU 27-003 because NMED has no mechanism to enforce institutional controls at this time" (NMED 2002, 073362).

5.2.2 Summary of Data for SWMU 27-003

The data analyzed during the 1993−1994 RFI do not meet current data validation standards and are not decision-level data. The screening-level data from the samples are presented in Appendix B of the HIR (LANL 2010, 109639).

Decision-level analytical data, samples collected, and analytes requested from the 2001 investigation are presented in Tables 5.2-1 and 5.2-2. The results of samples collected during the 2001 investigation found zinc detected above BV (Figure 5.2-2) (LANL 2001, 071522; LANL 2002, 072905).

5.2.3 Scope of Activities for SWMU 27-003

No investigation activities are proposed in this investigation work plan for SWMU 27-003. As described above, SWMU 27-003 was previously investigated but could not be approved for NFA at that time because there was no mechanism to enforce institutional controls. The Consent Order provides mechanisms for enforcing institutional controls that were not available under Module VIII. Therefore, SWMU 27-003 will be recommended for corrective action complete with controls in the Lower Pajarito Canyon Aggregate Area investigation report.

6.0 PROPOSED INVESTIGATION ACTIVITIES AT TA-54

The Lower Pajarito Canyon Aggregate Area includes 30 sites that are located in TA-54: 9 have been approved for NFA or corrective action complete, 9 have been or will be closed under RCRA, and 9 are included in the Material Disposal Area (MDA) G investigation. No investigation activities are proposed in this investigation work plan for the three remaining sites: AOC 54-012(a), SWMU 54-012(b), and AOC 54-015(b). Rather, it is proposed that these sites be included in closure activities for TA-54 Areas G and L and the associated corrective actions for MDAs G and L. Brief descriptions of these sites and the rationale for including them in the TA-54 closure activities are provided below.

AOC 54-012(a) is a former waste compactor that was located inside building 54-2 at Area G. The compactor was used to compact radioactive solid waste. A roll-off container on rails inside the building was used to transfer compactable waste from dumpsters into the compactor. In 1994, the compactor was removed and replaced by a new compactor, located in building 54-281. Building 54-2 was then decontaminated and currently is used to store, assemble, and repair tools in support of Area G operations (LANL 2002, 072769, p.4).

Any releases from operation of the compactor would have been contained within building 54-2. The building was decontaminated after removal of the compactor, and there is low potential for releases from the compactor to the environment. Building 54-2 must be demolished and removed as part of Area G closure activities to support implementation of a corrective measure at MDA G. At that time, potential releases to the soil underlying the building will be characterized.

SWMU 54-012(b) is the location of a former drum compactor in the central portion of Area L. The compactor was previously used to crush empty, discarded 30-gal. and 55-gal. drums. Originally, the drum compactor was situated on bare soil. The compactor was relocated to a concrete containment pad (structure 54-82) in late 1989 or early 1990, and the stained soil from the previous location was removed. The location from which the stained soil was removed at SWMU 54-012(b) is now beneath the asphalt paving that is part of the RCRA-permitted hazardous waste container storage unit at Area L.

The hazardous waste storage unit overlying SWMU 54-012(b) will undergo closure at a future time according to the approved closure plan in the RCRA permit. Depending on the corrective measure selected for MDA L, the permitted closure may occur before implementation of the corrective measure, or it may occur at some later time. Closure activities will include characterization of releases from the permitted storage unit, including those to the underlying soil. Characterization of releases from SWMU 54-012(b) will be coordinated with these closure activities.

AOC 54-015(b) is a former surface storage area that was used to store transuranic (TRU) and low-level wastes. TRU waste was stored in 20-yd^3 retrievable containers and low-level waste was stored in dumpsters. The AOC 54-015(b) storage area was removed in 1992 when Pit 39, a low-level waste disposal pit, was constructed.

AOC 54-015(b) was removed when Pit 39 was excavated. Closure of Pit 39, which is located in the central part of Area G, will be included with the overall closure of the Area G low-level waste disposal units under DOE Order 435.1 and associated corrective measure activities for MDA G. Any residual contamination from AOC 54-015(b) would be intermingled with releases from the disposal units at Area G and will be addressed by Area G closure activities.

7.0 INVESTIGATION METHODS

A summary of investigation methods to be implemented is presented in Table 7.0-1. The standard operating procedures (SOPs) used to implement these methods are available at http://www.lanl.gov/environment/all/qa/adep.shtml.

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

Chemical 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 chemical analyses of analytical suites.

7.1 Sampling Locations

Proposed sampling locations are identified for each site based on engineering drawings, surveyed locations of existing structures (from the geographic information system database), previous sampling locations, and topography or other features identified in the field (e.g., drainage channels, sediment accumulation areas, etc.). The coordinates of proposed locations will be obtained by georeferencing the points from the proposed sampling maps. Those coordinates will be located and flagged or otherwise marked in the field using a differential global positioning system (GPS) unit. If any planned sampling locations are moved because of field conditions, utilities, or other unexpected reasons, the new locations will be surveyed immediately following sample collection as described in section 7.2.

7.2 Geodetic Surveys

Geodetic surveys will be conducted in accordance with the latest version of EP-ERSS-SOP-5028, Coordinating and Evaluating Geodetic Surveys, to locate historical structures and previous sampling locations and to document field activities such as sample collection. The surveyors will use a Trimble GeoXT hand-held 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 as per the National Geodetic Vertical Datum of 1929. All GPS equipment used will meet the accuracy requirements specified in the SOP.

7.3 Surface Sampling

Soil and rock samples will be collected by the most efficient and least invasive method practicable. The methods will be determined by the field team based on site conditions such as topography, the nature of the material to be sampled, the depth intervals required, accessibility, and level of disruption to Laboratory activities. Typically, samples will be collected using spade and scoop, hand auger, or drill rig.

7.3.1 Spade and Scoop Method

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. If the surface location is at bedrock, an axe or hammer and chisel may be used to collect samples. Samples collected for analyses will be placed in the appropriate sample containers depending on the analytical method requirement.

7.3.2 Sediment Samples

Sediment samples will be collected from areas of sediment accumulation that include sediments judged to be representative of the historical period of Laboratory operations (i.e., post-1943). The proposed sediment sampling locations were selected based on geomorphic relationships in areas likely to have been affected by discharges from Laboratory operations. Proposed sediment sampling locations have been selected and are shown in the figures that show the proposed sampling locations. However, because sediment is dynamic and subject to redistribution by runoff events, some locations may need to be adjusted when this work plan is implemented. In the course of collecting sediment samples, it may be determined, based on field conditions, that the selected location is not appropriate (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 will be adjusted as appropriate, any revised locations will be surveyed, and the updated coordinates will be submitted to the Laboratory for inclusion in the appropriate database.

7.4 Subsurface Sampling

Subsurface sampling is proposed to include surface soil and fill, sediment, and tuff. Any adjustments will be noted on sample collection logs and recorded in the subsequent investigation report as deviations from this investigation work plan. Subsurface samples will be collected following the current version of SOP-06.24, Sample Collection from Split-Spoon Samplers and Shelby-Tube Samplers, and SOP-06.26, Core-Barrel Sampling for Subsurface Earth Materials.

If saturation is encountered as a borehole advances, drilling will be stopped to determine whether sufficient water volume is available for analyzing the water quality. Generally, the total water volume required is approximately 0.5 to 1.0 L. If this minimum volume of groundwater cannot be collected, the borehole will be advanced to the targeted depth or until saturation is encountered again. The process will be repeated until the targeted depth is reached. A porous cup lysimeter or absorbent membrane will be installed at the depth of saturation to monitor the zone if the borehole is completed for pore-gas monitoring. Insufficient water sample volumes from discrete depths will not be composited to make up the required volume for screening analysis.

If a sufficient volume exists, a groundwater sample will be collected and analyzed for metals, anions, perchlorate, alkalinity, total organic carbon, total inorganic carbon, and total dissolved solids, on a rapid-turnaround basis at a Laboratory-certified geochemistry laboratory. Typically, results of groundwater screening samples are available within 48 h. During this time, the borehole may be advanced to the targeted depth, and the perched zone (and any subsequent perched zones encountered during drilling) will be isolated to prevent downhole migration.

Geophysical logging of the borehole will determine the thickness of the zone of saturation and the characteristics of the perching horizon. A monitoring well will be designed and submitted to NMED for approval. Following approval of the design, the well will be installed and a groundwater monitoring plan will be included in the investigation report.

7.4.1 Hollow-Stem Auger

A hollow-stem auger may be used to bore holes deeper than 15 ft or at shallower depths where hand-auger refusal is encountered. 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 it 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 that samples may be retrieved during drilling operations. The hollow stem also acts to case the borehole core temporarily so that a well casing (riser) may be inserted down through the center of the auger once the desired depth is reached, thus minimizing the risk of possible collapse of the borehole. A bottom plug or pilot bit can be fastened onto the bottom of the auger to keep out most of the soil and/or water that tends to clog the bottom of augers during drilling. Drilling without a center plug is acceptable if the soil plug, formed in the bottom of the auger, is removed before sampling or installing a well casing. The soil plug can be removed by washing out the plug using a side-discharge rotary bit or auguring out the plug with a solid-stem auger bit sized to fit inside the hollow-stem auger.

During sampling, the auger will be advanced to just above the desired sampling interval. The sample will be collected by driving a split-spoon sampler into undisturbed soil/tuff to the desired depth. Samples will be collected in accordance with SOP-06.26, Core-Barrel Sampling for Subsurface Earth Materials.

7.4.2 Hand Auger

Hand augers may be used to drill shallow holes. The hand auger is advanced by turning the auger into the soil or tuff until the barrel is filled. The auger is removed and the sample is placed in a stainless-steel bowl. Hand-auger samples will be collected in accordance with SOP-06.10, Hand Auger and Thin-Wall Tube Sampler.

7.4.3 Split-Spoon Sampling

Subsurface samples will be collected from core extracted in a split-spoon core barrel following the current version of SOP-06.24, Sample Collection from Split-Spoon Samplers and Shelby-Tube Samplers. Samples collected for analyses will be placed in the appropriate sample containers depending on the analytical method requirement. The analytical suites for the samples from each borehole will vary according to the data requirements as described in sections 4 and 5 and the tables presenting details on the proposed sampling.

Field documentation will include detailed borehole logs to document the matrix material in detail; fractures and matrix samples will be assigned unique identifiers.

7.4.4 Borehole Abandonment

All boreholes will be properly abandoned according to the most recent version of SOP-05.03, Monitoring Well and Borehole Abandonment.

Shallow boreholes, with a total depth of 20 ft or less, will be abandoned by filling the borehole with bentonite chips, which are subsequently hydrated. Chips will be hydrated in 1- to 2-ft lifts. The borehole will be visually inspected while the bentonite chips are being added to ensure that 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 provided in the investigation report.

7.5 Chain of Custody for Samples

The collection, screening, and transport of samples will be documented on standard forms generated by the SMO. These include sample collection logs, chain-of-custody forms, and sample container labels. Sample collection logs will be completed at the time of sample collection and signed by the sampler and a reviewer who will verify the logs for completeness and accuracy. Corresponding labels will be initialed and applied to each sample container, and custody seals will be placed around container lids or openings. Chain-of-custody forms will be completed and signed to verify that the samples are not left unattended.

7.6 Field-Screening Methods

7.6.1 Radiological Screening

Radiological field screening will be conducted to meet of U.S. Department of Transportation requirements for shipping samples. Each sample will be field-screened by a radiological control technician for gross-alpha, -beta, and -gamma radioactivity before transporting the samples to the SMO for processing as determined by the Laboratory’s Health Physics Operations Group. Instruments used for field screening will be calibrated in accordance with the Health Physics Operations Group procedures or equivalent procedures. All instrument calibration activities and field-screening results 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.

7.6.2 Organic-Vapor Field Screening

Organic-vapor screening of surface and subsurface samples will be conducted for health and safety purposes only, using a photoionization detector (PID) with an 11.7-electron-volt lamp. Before each day’s field work begins, the PID will be calibrated to the manufacturer’s standard for instrument operation. All daily calibration results will be documented, and PID results for each sample will be recorded on sample collection logs in accordance with EP-ERSS-SOP-5181, Notebook Documentation for Waste and Environmental Services Technical Field Activities.

7.7 Quality Assurance /Quality Control Samples

Quality assurance/quality control samples will include field duplicate, equipment rinsate, and field trip blank samples. These samples will be collected following the current version of EP-ERSS-SOP-5059, Field Quality Control Samples. Field duplicate samples will be collected at an overall frequency of at least 1 for every 10 regular samples as directed by Section IX.C.3.b of the Consent Order.

7.8 Laboratory Analytical Methods

The analytical suites for laboratory analyses are summarized in Table 7.8-1. Two criteria were used in selecting which samples will be analyzed for PCBs. The first criterion is spatial separation of the locations into areas that will define lateral extent for PCB contamination if present. The second criterion is to include PCB analysis for all depth intervals at locations selected by the first criterion to define vertical extent if necessary. All analytical methods are presented in the statement of work for analytical laboratories (LANL 2008, 109962). Sample collection and analysis will be coordinated with the SMO.

7.9 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 conducting fieldwork.

7.10 Equipment Decontamination

Equipment for drilling and sampling will be decontaminated before and after sampling activities to minimize the potential for cross-contamination. Drilling/exploration equipment that may come in contact with the borehole will be decontaminated by steam-cleaning, by hot-water pressure-washing, or by another method before each new borehole is drilled. All sampling equipment will be decontaminated as described in EP-ERSS-SOP-5061, Field Decontamination of Equipment. The equipment will be pressure-washed with 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.

7.11 Investigation-Derived Waste

IDW generated by the proposed investigation activities may include, but is not limited to, drill cuttings, excavated soil or other environmental media, excavated man-made debris, contact waste, decontamination fluids, 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 EPA and NMED regulations, DOE orders, and Laboratory requirements. Appendix B presents the IDW management plan.

8.0 MONITORING PROGRAMS

8.1 Groundwater

The Interim Facility-Wide Groundwater Monitoring Plan requires monitoring and sampling of all wells that contain alluvial, intermediate, and regional groundwater located in the Lower Pajarito Canyon Aggregate

Area. Alluvial groundwater observation wells 3MAO-1, 3MAO-2, 18-BG-4, 18-MW-8, 18-MW-9, 18-MW-11, 18-MW-18, PCAO-7A, PCAO-7B1, PCAO-7B2, PCAO-7C, PCAO-8, PCAO-9, PCO-1, PCO-2, and PCO-3 are located within the Lower Pajarito Canyon Aggregate Area. There are no intermediate wells located in the Lower Pajarito Canyon Aggregate Area. Regional wells R-19, R-20, R-22, R-32, R-40, and R-51 are located in the Lower Pajarito Canyon Aggregate Area. These wells are monitored as part of the Interim Facility-Wide Groundwater Monitoring Plan (LANL 2009, 106115). The results of groundwater sampling that may occur in 2011 will be reported in the respective periodic monitoring reports. The periodic monitoring reports will be referenced in the investigation report, and the results will be summarized, if appropriate. Plate 1 shows the locations of all alluvial and regional groundwater wells in the Lower Pajarito Canyon Aggregate Area.

8.2 Surface Water

Surface-water sampling locations E246, PBF-5, and E250 are located in the Lower Pajarito Canyon Aggregate Area and are monitored periodically. Plate 1 shows the locations of the surface-water sampling locations in the Lower Pajarito Canyon Aggregate Area.

Stormwater monitoring is being done at site monitoring areas located within the Lower Pajarito Canyon Aggregate Area. SWMUs 18-002(b), 18-003(c), and AOC 18-010(f) are being monitored by 3M-SMA-4. AOC 18-010(b) is being monitored by PJ-SMA-13.7. SWMU 18-012(b) is being monitored by PJ-SMA-14.2. SWMU 18-003(e) is being monitored by PJ-SMA-14.3. AOC 18-010(d) is being monitored by PJ-SMA-14.4. AOC 18-010(e) is being monitored by PJ-SMA-14.6. SWMU 18-012(a) is being monitored by PJ-SMA-14.8. SWMU 27-002 is being monitored by PJ-SMA-16.

9.0 SCHEDULE

The scheduled notice date for NMED to approve this investigation work plan is December 13, 2010. Preparation for investigation activities is anticipated to begin in April 2011. Fieldwork is expected to begin in July 2011 and be completed in December 2011. A submittal date of no later than July 31, 2012, is proposed for the investigation report.

10.0 REFERENCES AND MAP DATA SOURCES

10.1 References

The following list includes all documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

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

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10.2 Map Data Sources

Sampling location- er_location_ids_pnt; Point Feature Locations of the Environmental Restoration Project Database; Los Alamos National Laboratory, Waste and Environmental Services Division, EP2010-0035; 21 January 2010.

SWMU or AOC: er_prs_all_reg, Potential Release Sites; Los Alamos National Laboratory, Waste and Environmental Services Division, Environmental Data and Analysis Group, EP2009-0633; 1:2,500 Scale Data; 25 January 2010.

Structure or Building: ksl_structures_ply; Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Fence: ksl_fences_arc; Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Paved road: ksl_paved_rds_arc; Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Dirt road: ksl_dirt_rds_arc; Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Storm drain: ksl_stormdrn_arc; Storm Drain Line Distribution System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Contours: lanl_contour1991_; Hypsography, 2, 10, 20, 100 Foot Contour Interval; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1991.

Communication: ksl_comm_arc; Communication Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 08 August 2002; as published 28 May 2009.

Electric: ksl_electric_arc; Primary Electric Grid; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Gas: ksl_gas_arc; Primary Gas Distribution Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Industrial waste: wfm_indstrl_waste_arc; Primary Industrial Waste Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009.

Sewer: ksl_sewer_arc; Sewer Line System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Steam: ksl_steam_arc; Steam Line Distribution System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Water: ksl_water_arc; Water Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

(inset)LANL Boundary: plan_ownerclip_reg; Ownership Boundaries Around LANL Area; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; 19 September 2007; as published 04 December 2008.

(Inset)ROADS: lac_streets_arc; Streets; County of Los Alamos, Information Services; as published 16 May 2006.

Landscape: ksl_landscape_arc; Primary Landscape Features; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Former structures: frmr_structures_ply; 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.

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

Inactive Outfall: wqh_inact_outfalls_pnt; WQH Inactive Outfalls; Los Alamos National Laboratory, ENV Water Quality and Hydrology Group; Edition 2002.01; 01 September 2003.

NPDES Outfalls: wqh_npdes_outfalls_pnt: WQH NPDES Outfalls; Los Alamos National Laboratory, ENV Water Quality and Hydrology Group; Edition 2002.01; 01 September 2003.

Outfalls: er_outfalls_pnt: Outfalls; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; Unknown publication date.

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Drainage: wqh_drainage_arc: WQH Drainage_arc; Los Alamos National Laboratory, ENV Water Quality and Hydrology Group; 1:24,000 Scale Data; 03 June 2003.

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

Canyon Reaches: er_reaches_ply: Canyon Reaches; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2002-0592; 1:24,000 Scale Data; Unknown publication date.

Springs: er_springs_pnt: Locations of Springs; Los Alamos National Laboratory, Waste and Environmental Services Division in cooperation with the New Mexico Environment Department, Department of Energy Oversight Bureau, EP2008-0138; 1:2,500 Scale Data; 17 March 2008.

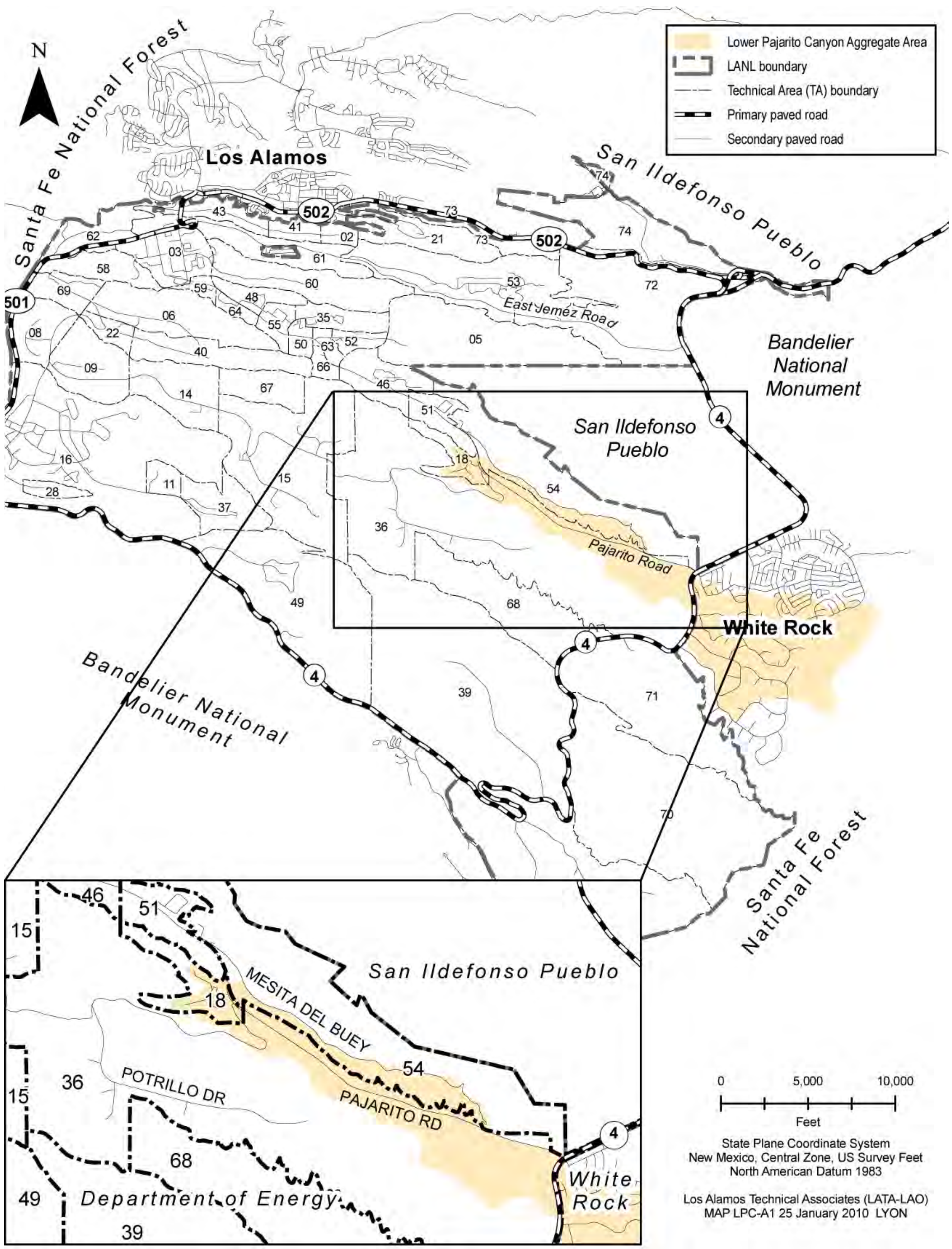

Figure 1.0-1 Location of Lower Pajarito Canyon Aggregate Area with respect to Laboratory technical areas

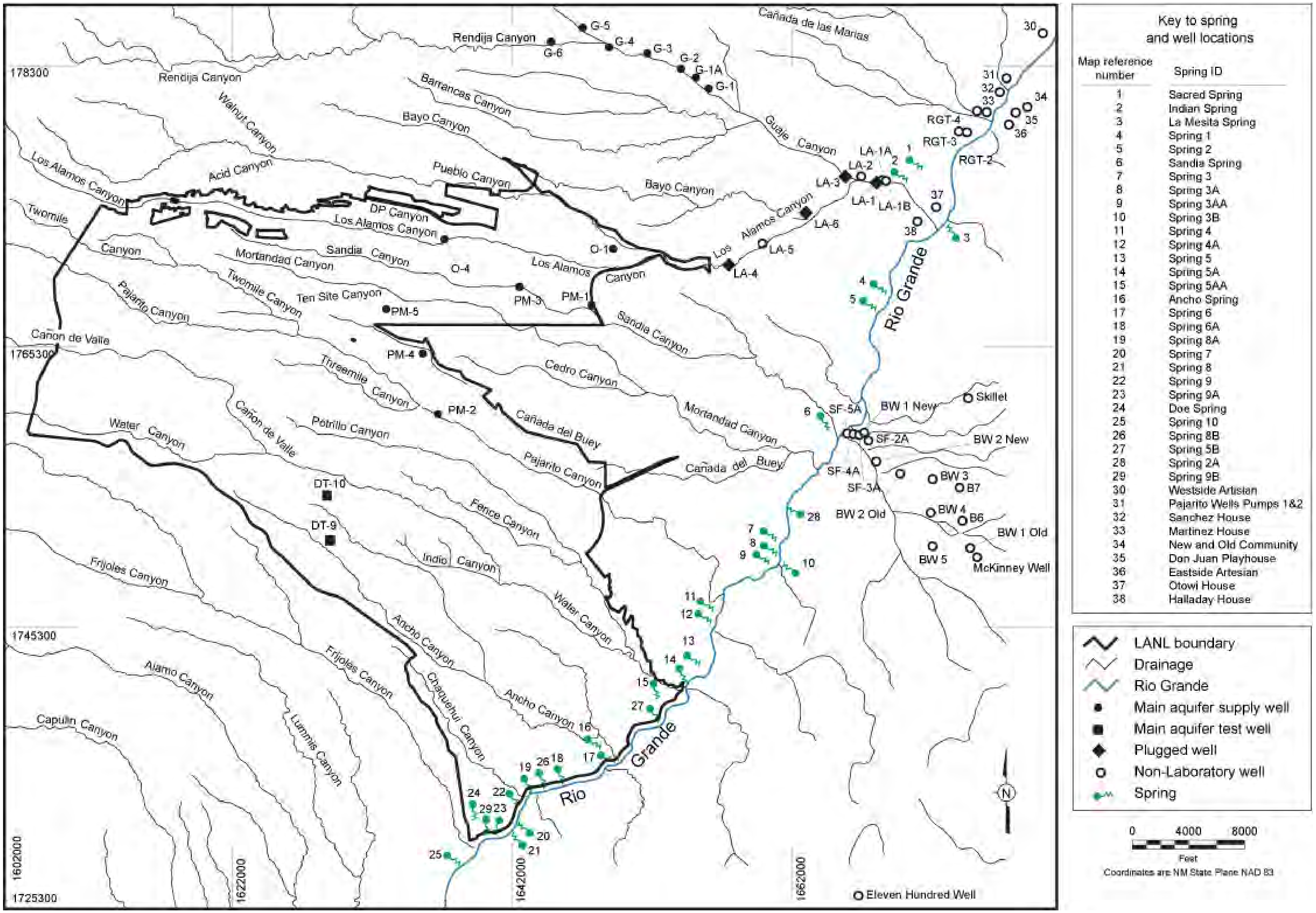

Figure 3.1-1 Surface-water drainage to the Rio Grande

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 and intercalated volcanic rocks	Fanglomerate	Fanglomerate facies includes sand, gravel, conglomerate, and tuffaceous sediments	
	Volcanic rocks	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 (called the ”Chaquehui Formation” by Purtymun 1995, 45344)	
	Basalt		
	Coarse sediments		
	Basalt		
	Coarse sediments		
	Basalt		
	Coarse sediments		
	Basalt		
	Coarse sediments		
	Arkosic clastic sedimentary deposits	Undivided Santa Fe Group (includes Chamita[?] and Tesuque Formations)	

Source: Baltz et al. 1963, 8402; Purtymun 1995, 45344; LANL 1998, 59599; Broxton and Reneau 1995, 49726.

Figure 3.2-1 Generalized stratigraphy of bedrock geologic units of the Pajarito Plateau

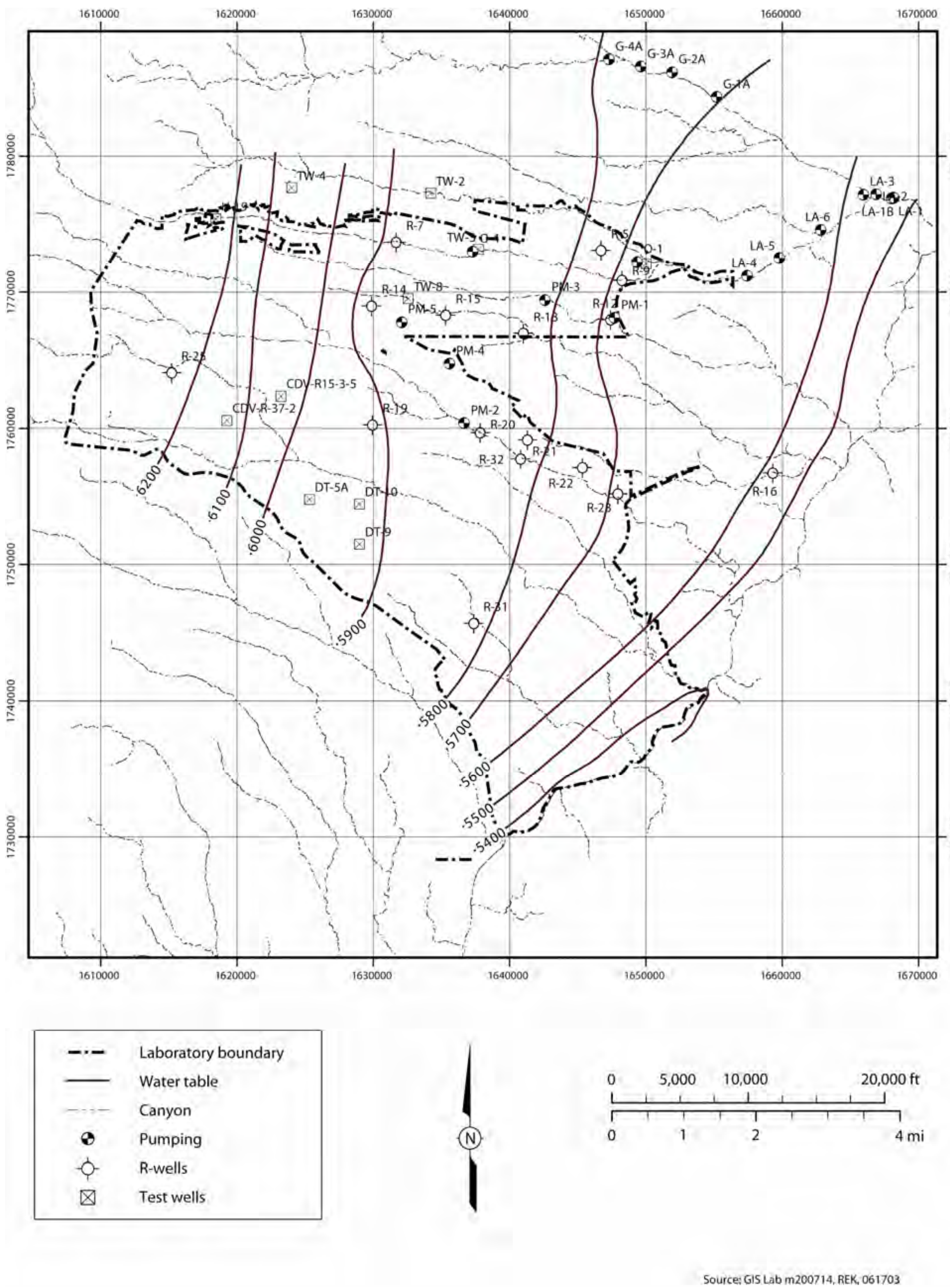

Figure 3.2-2 Depths to top of regional aquifer across the Laboratory

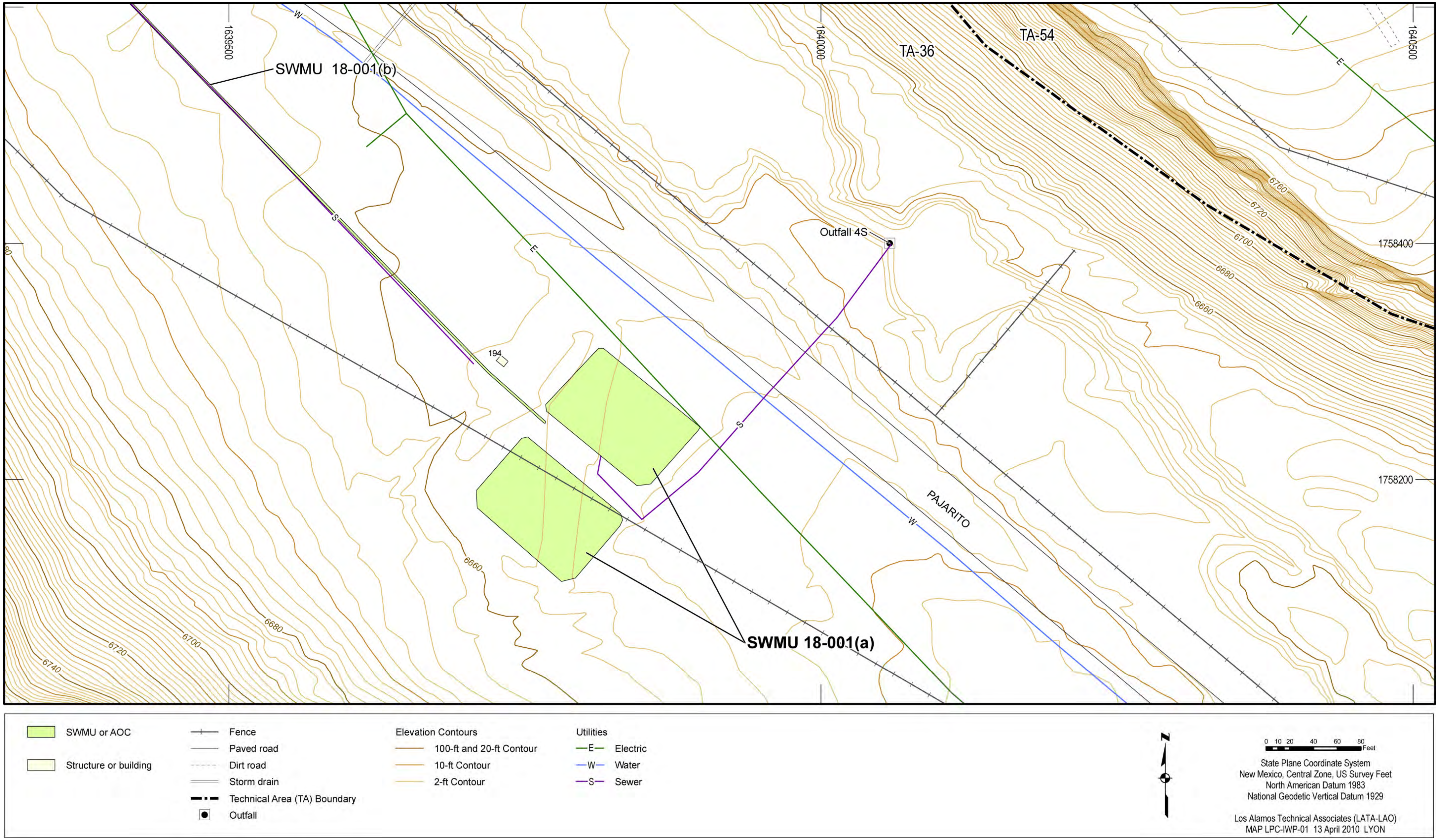

Figure 4.1-1 Site features of Consolidated Unit 18-001(a)-00 [SWMU 18-001(a)]

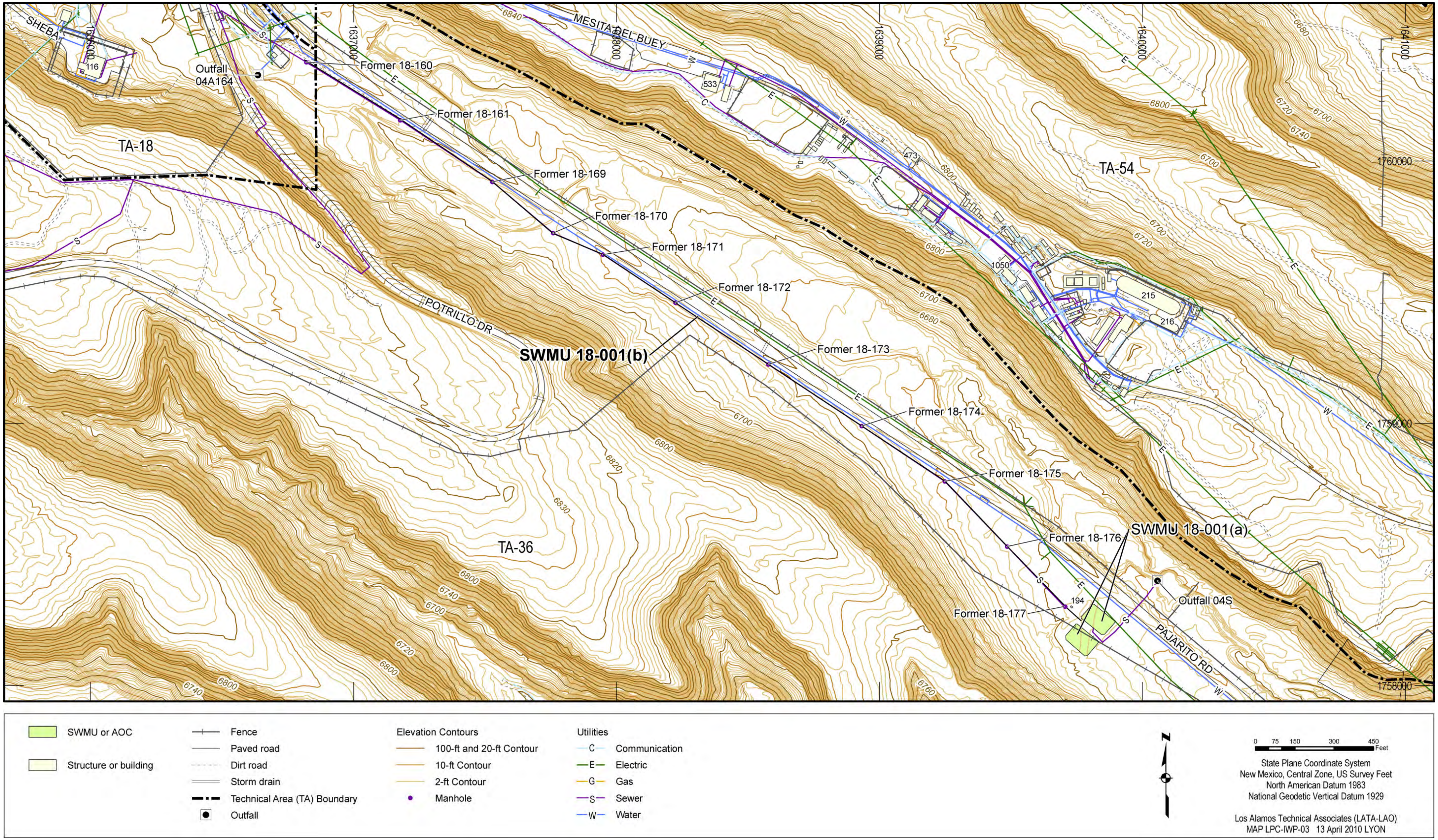

Figure 4.1-2 Site features of Consolidated Unit 18-001(a)-00 [SWMU 18-001(b)]

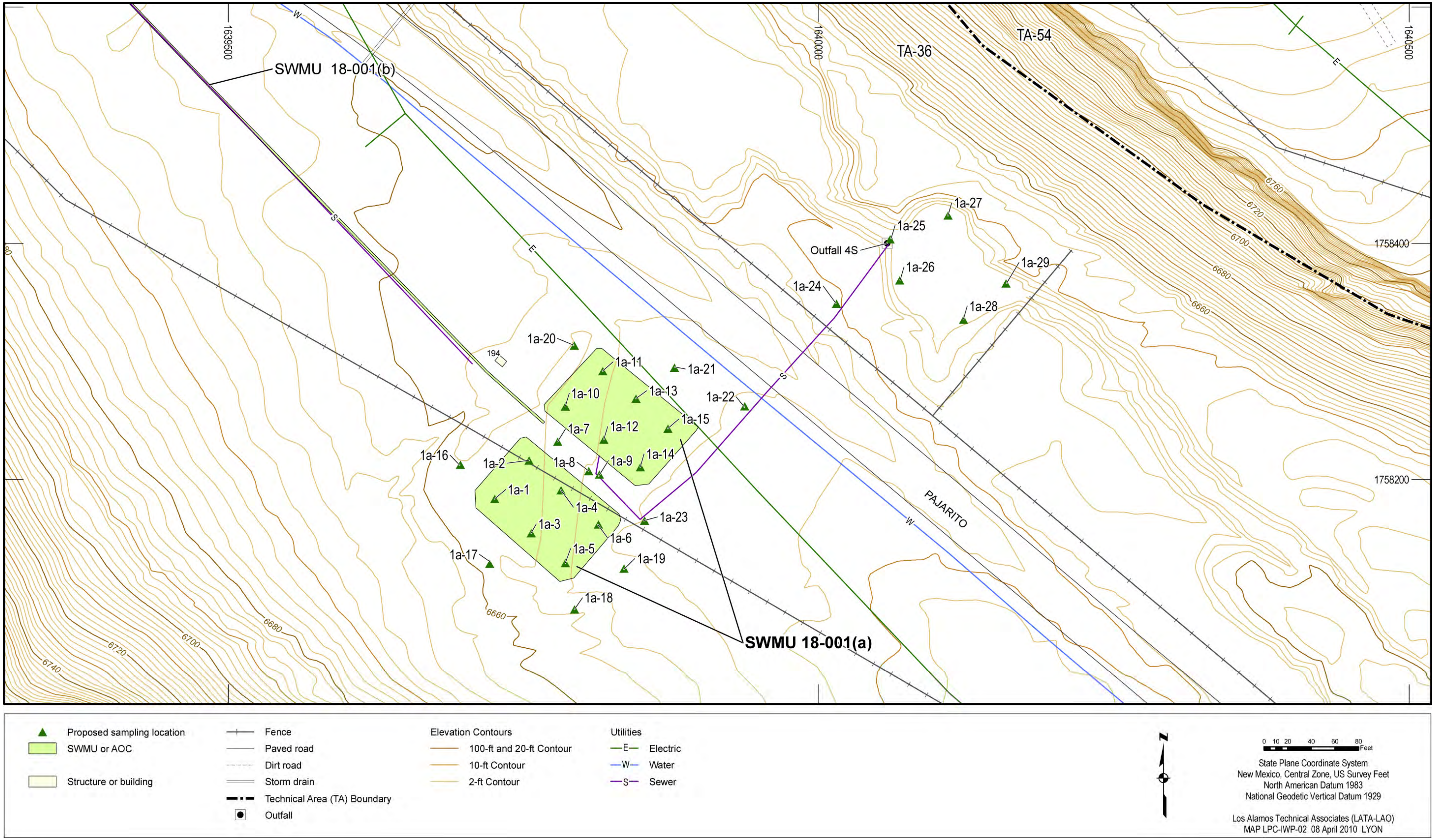

Figure 4.1-3 Proposed sampling locations for SWMU 18-001(a)

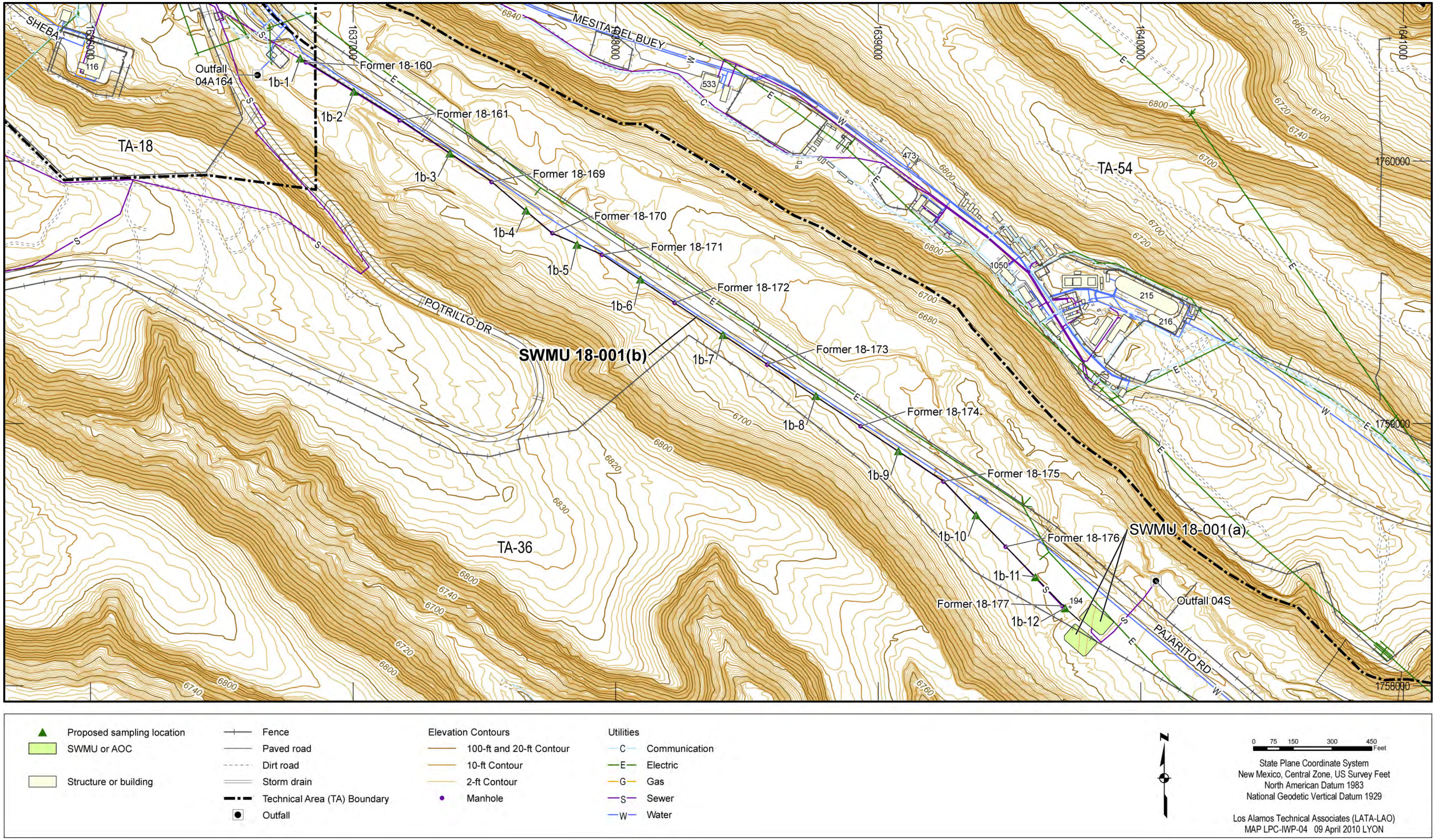

Figure 4.1-4 **Proposed sampling locations for SWMU 18-001(b)**

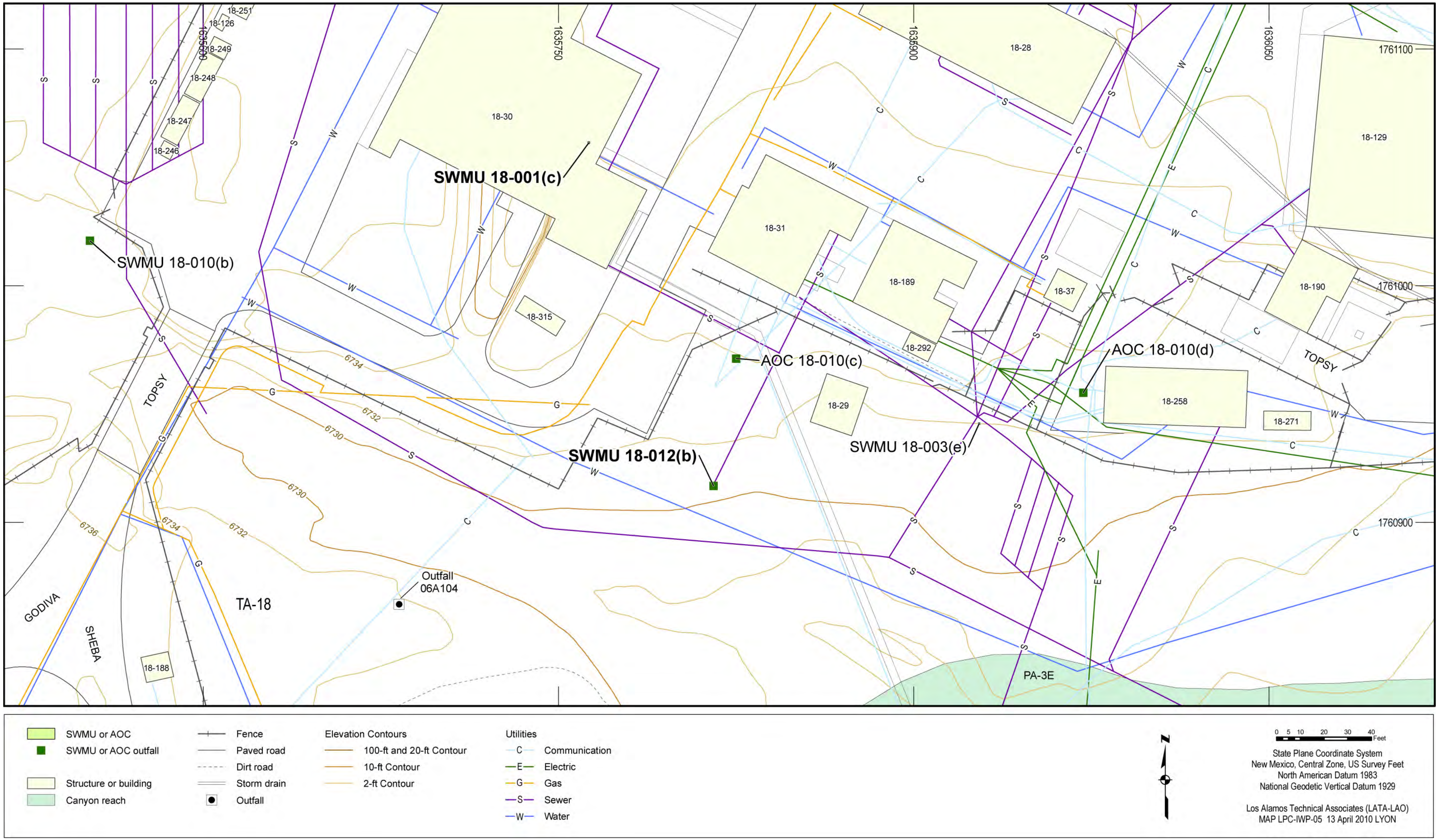

Figure 4.2-1 Site features of Consolidated Unit 18-001(c)-00 [SWMUs 18-001(c) and 18-012(b)]

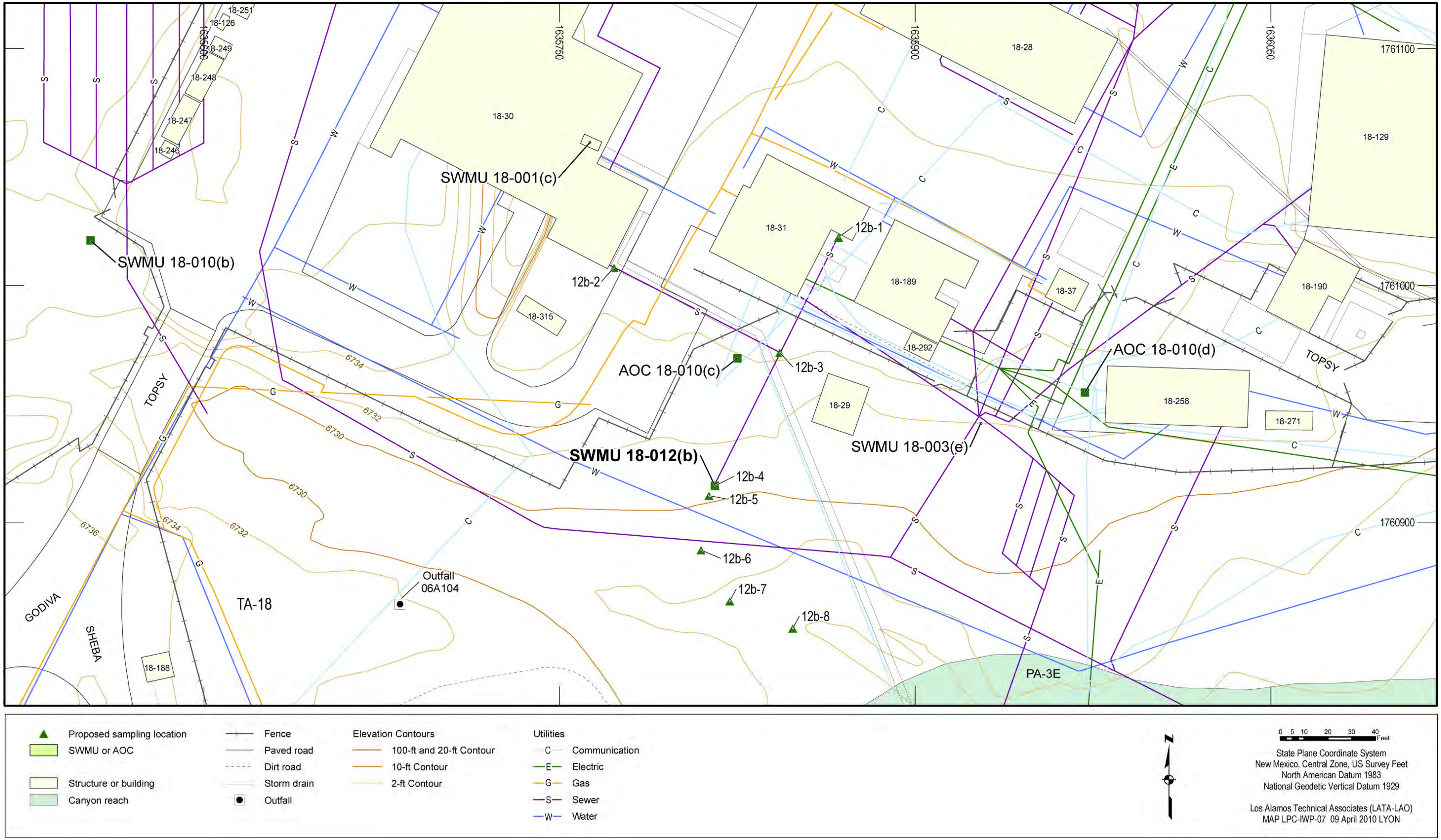

Figure 4.2-2 Proposed sampling locations for SWMU 18-012(b)

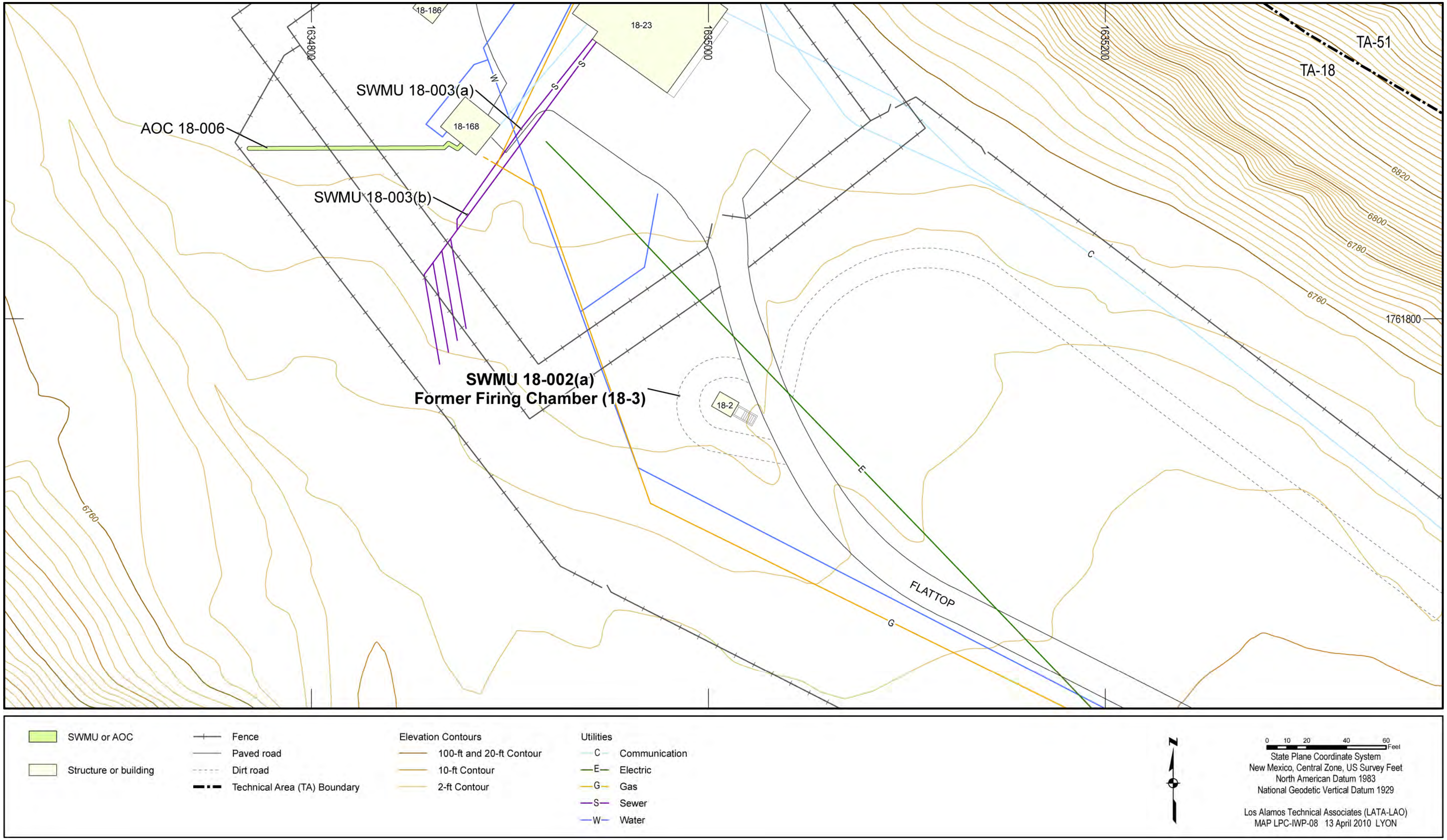

Figure 4.3-1 Site features of SWMU 18-002(a)

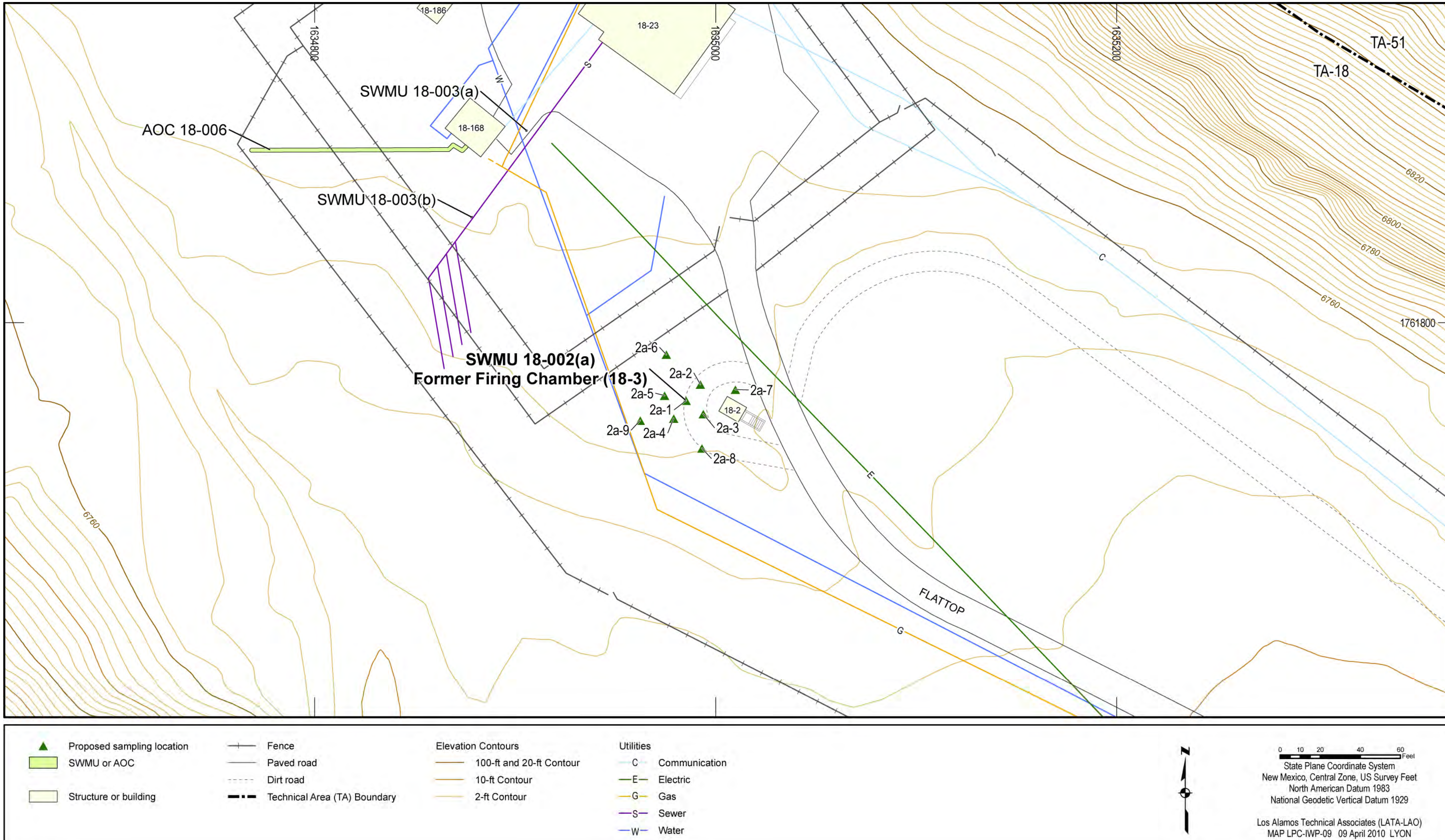

Figure 4.3-2 Proposed sampling locations for SWMU 18-002(a)

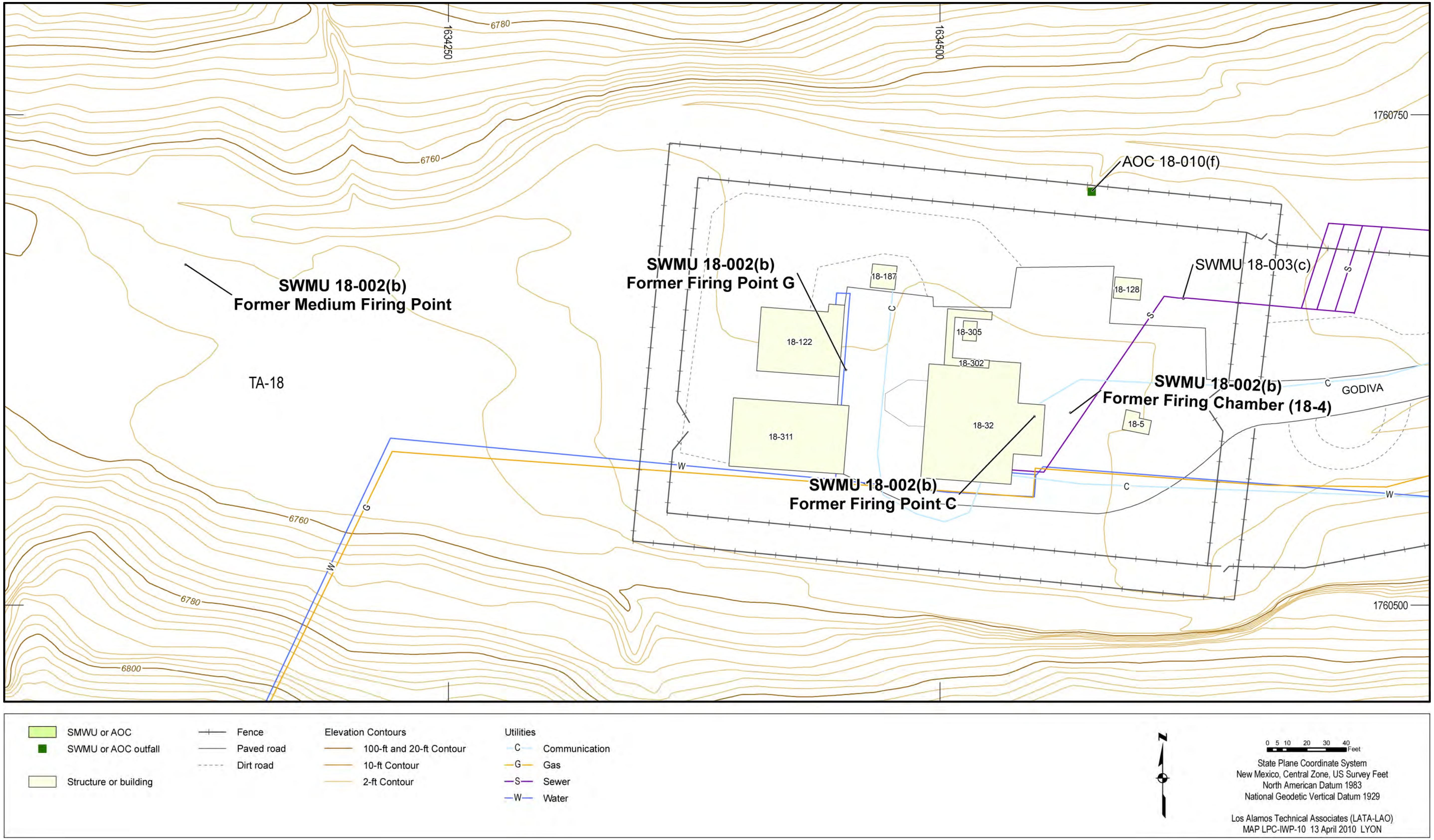

Figure 4.4-1 Site features of SWMU 18-002(b)

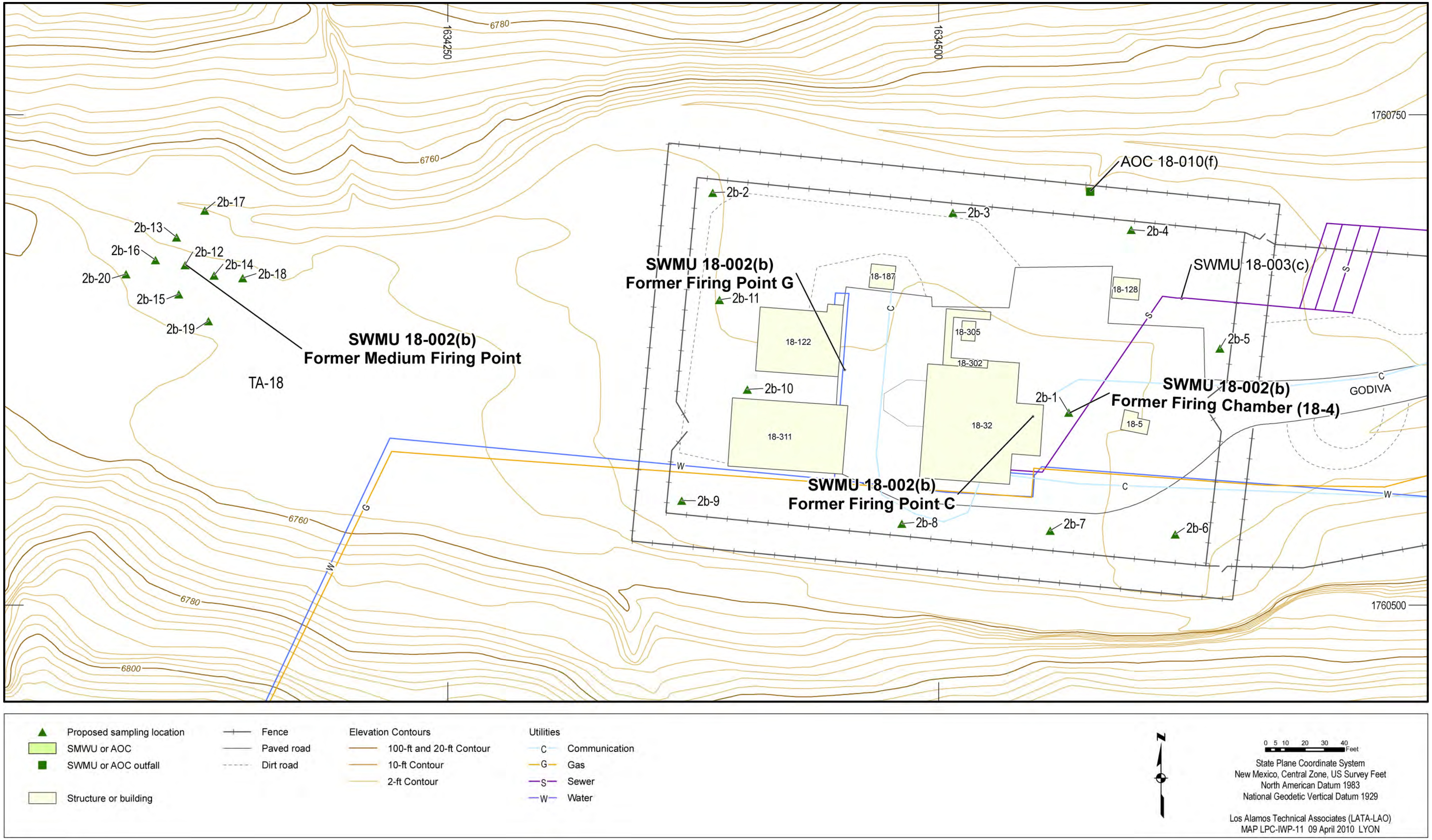

Figure 4.4-2 Proposed sampling locations for SWMU 18-002(b)

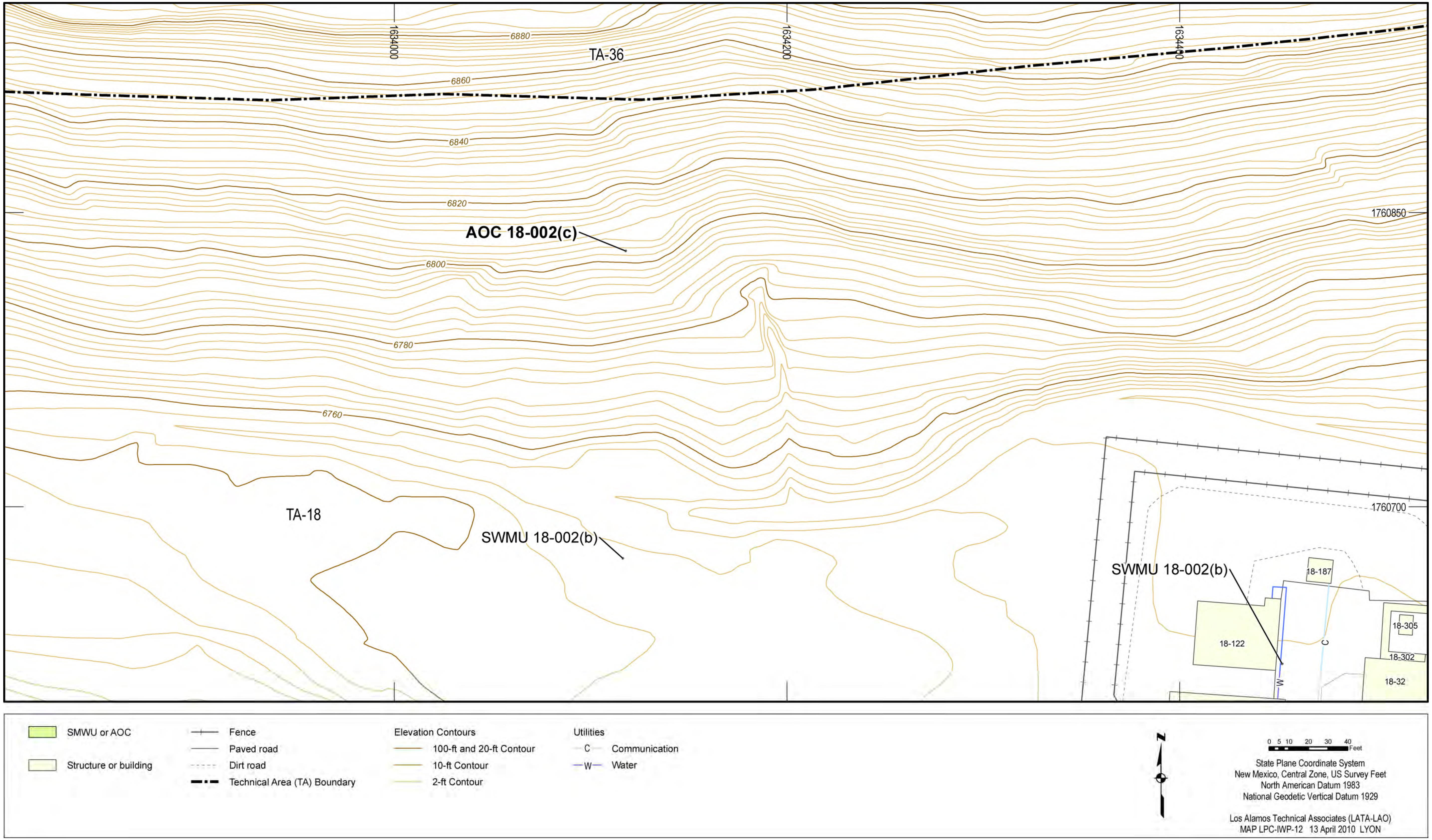

Figure 4.5-1 Site features of AOC 18-002(c)

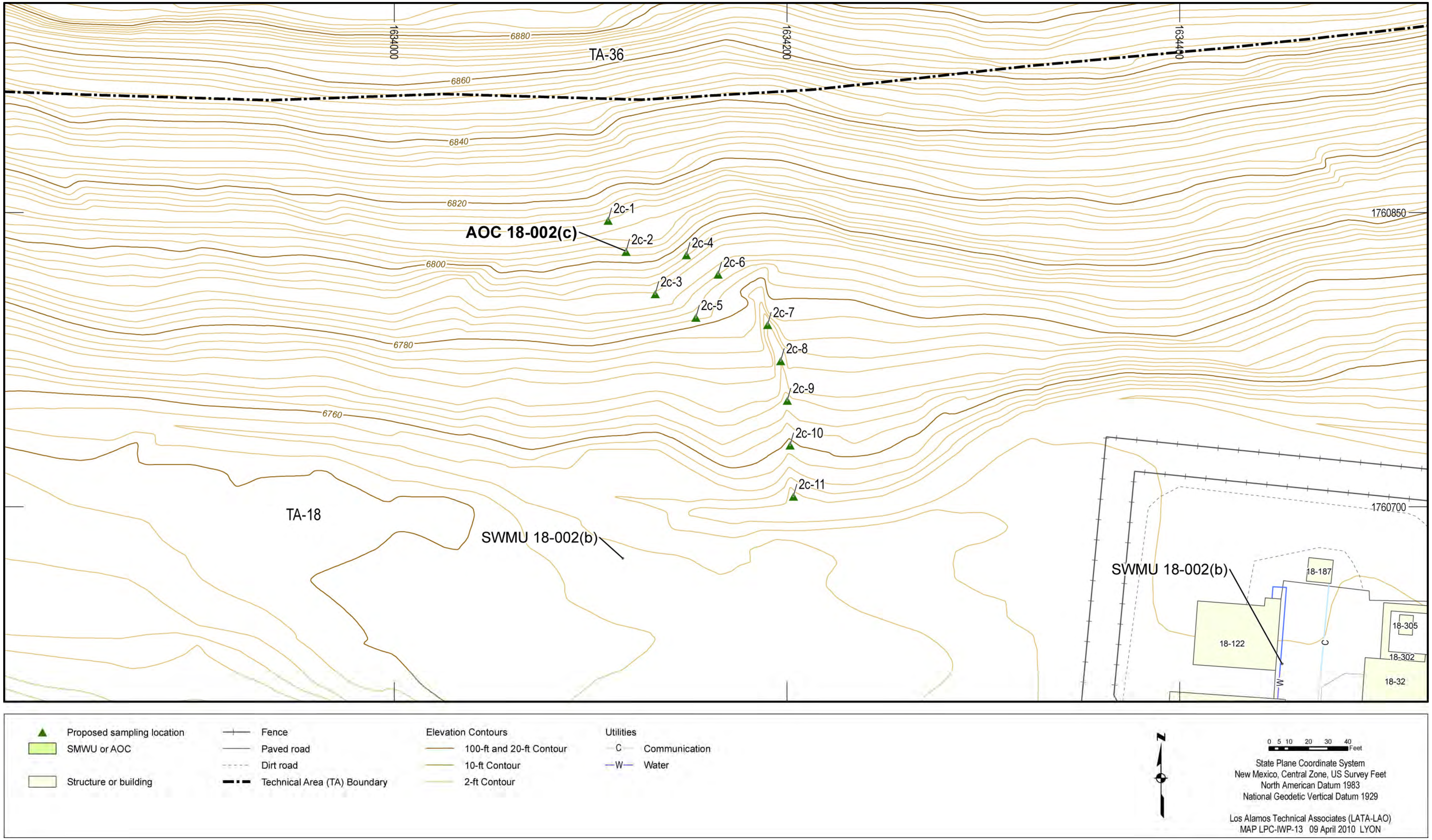

Figure 4.5-2 Proposed sampling locations for AOC 18-002(c)

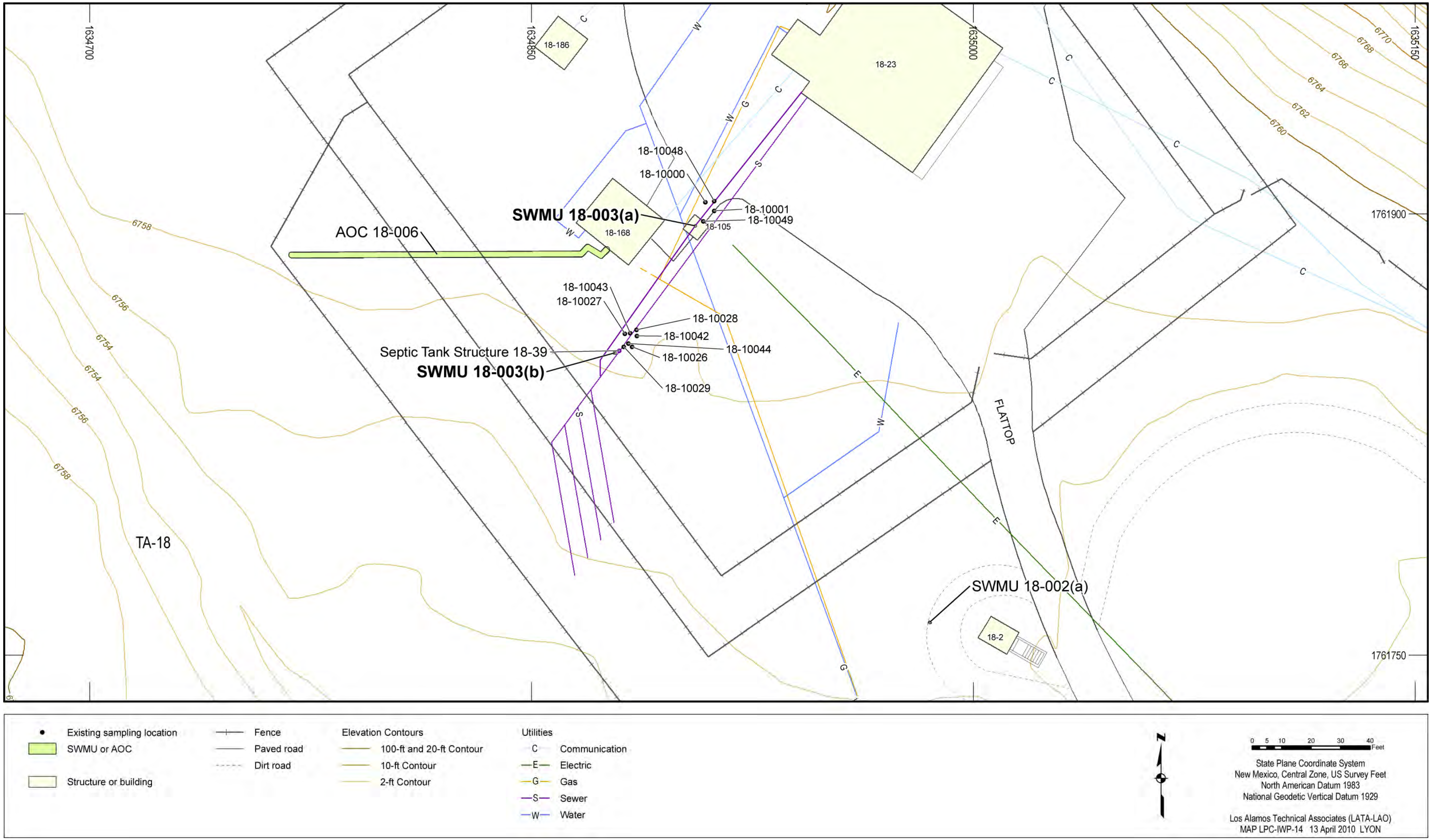

Figure 4.6-1 Site features of Consolidated Unit 18-003(a)-00 [SWMUs 18-003(a) and 18-003(b)]

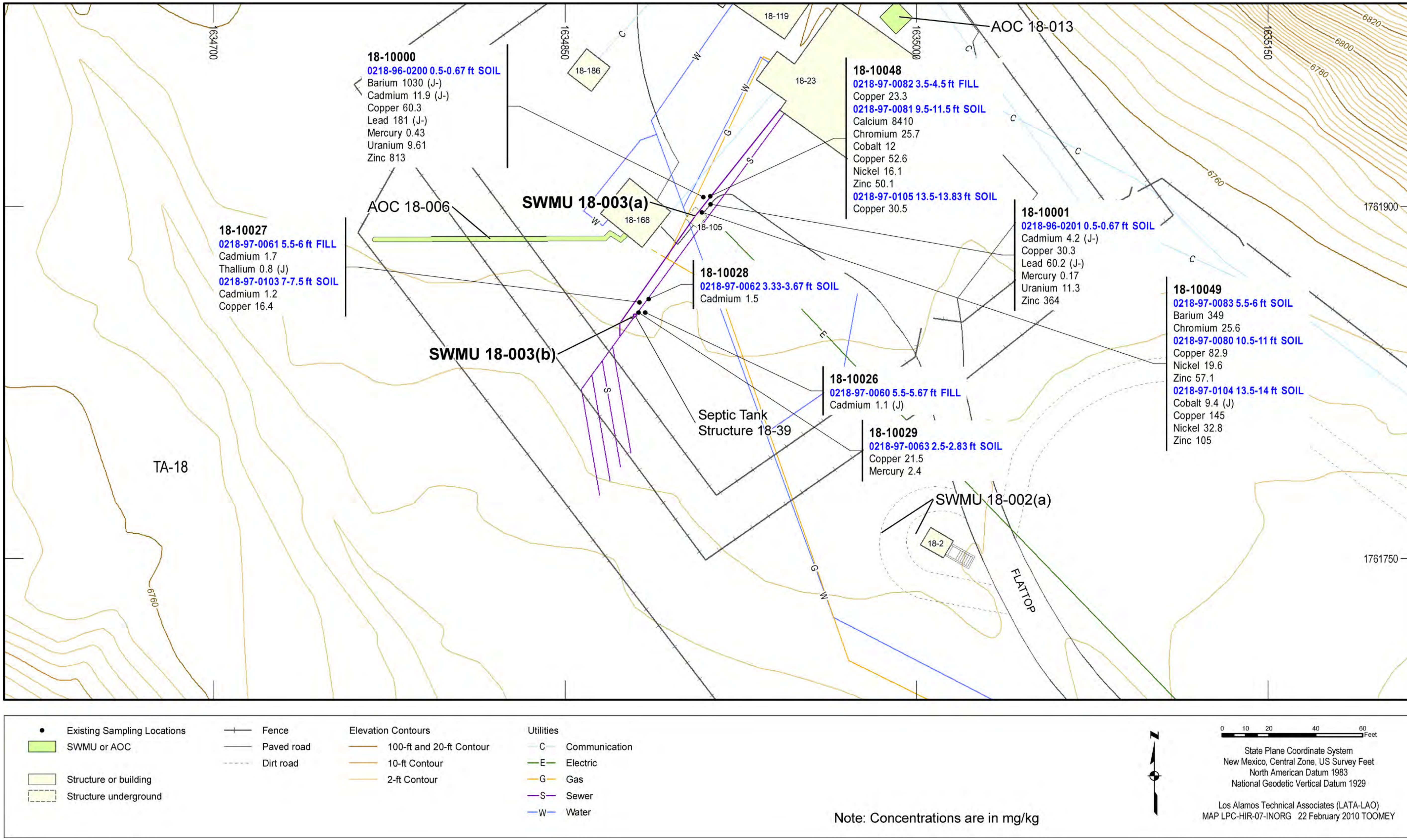

Figure 4.6-2 Inorganic chemicals detected above BVs at Consolidated Unit 18-003(a)-00 [SWMUs 18-003(a) and 18-003(b)]

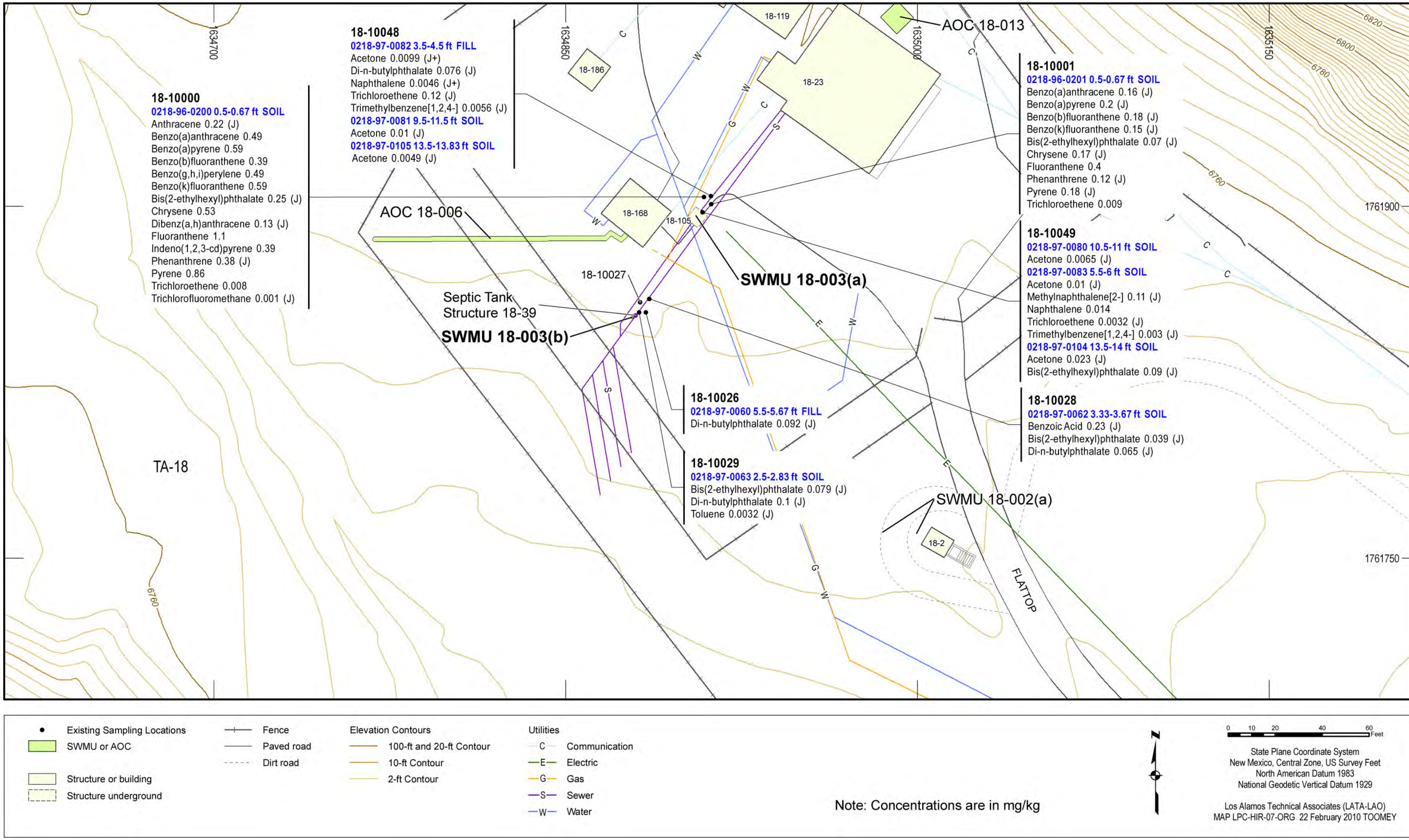

Figure 4.6-3 Organic chemicals detected at Consolidated Unit 18-003(a)-00 [SWMUs 18-003(a) and 18-003(b)]

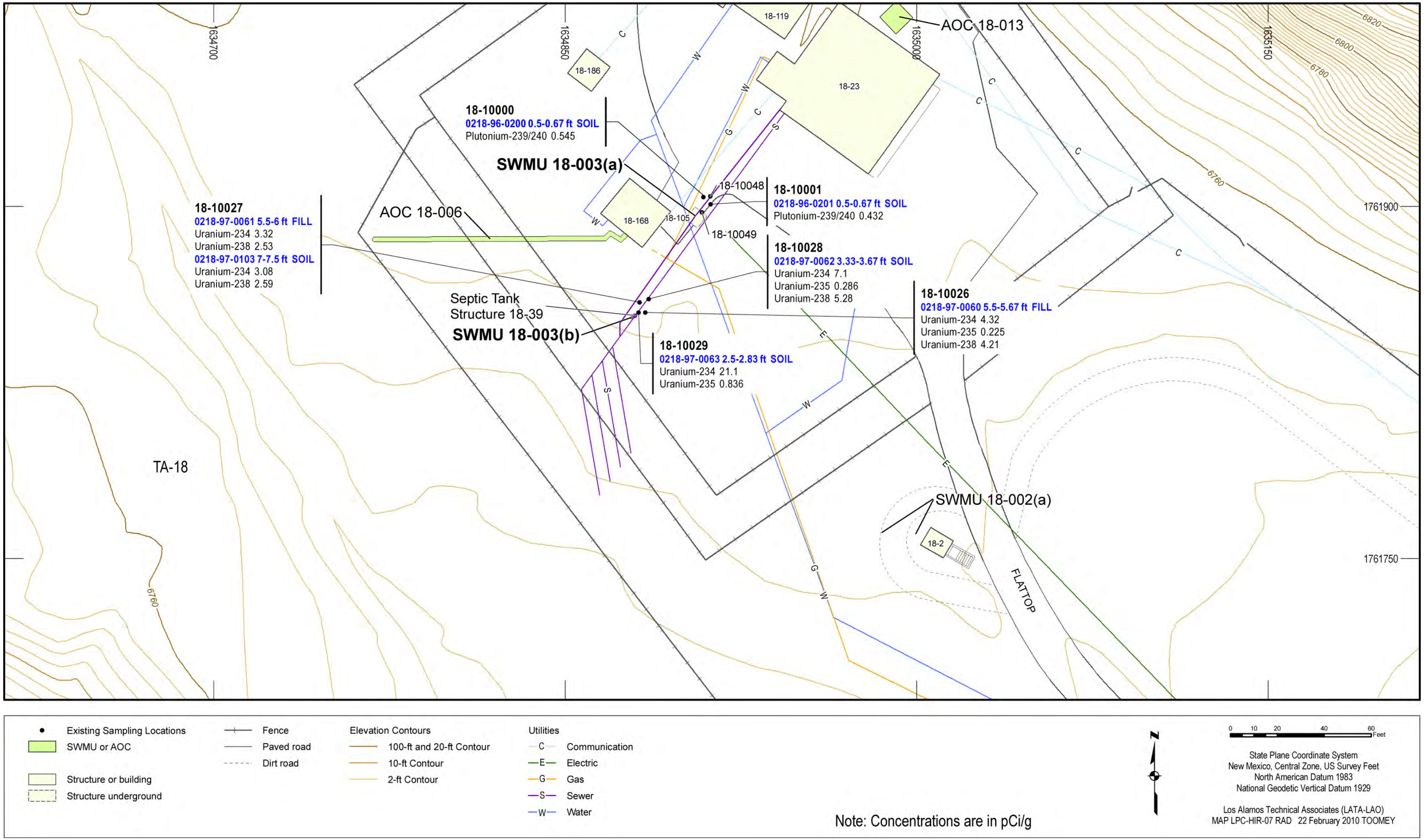

Figure 4.6-4 Radionuclides detected or detected above BVs/FVs at Consolidated Unit 18-003(a)-00 [SWMUs 18-003(a) and 18-003(b)]

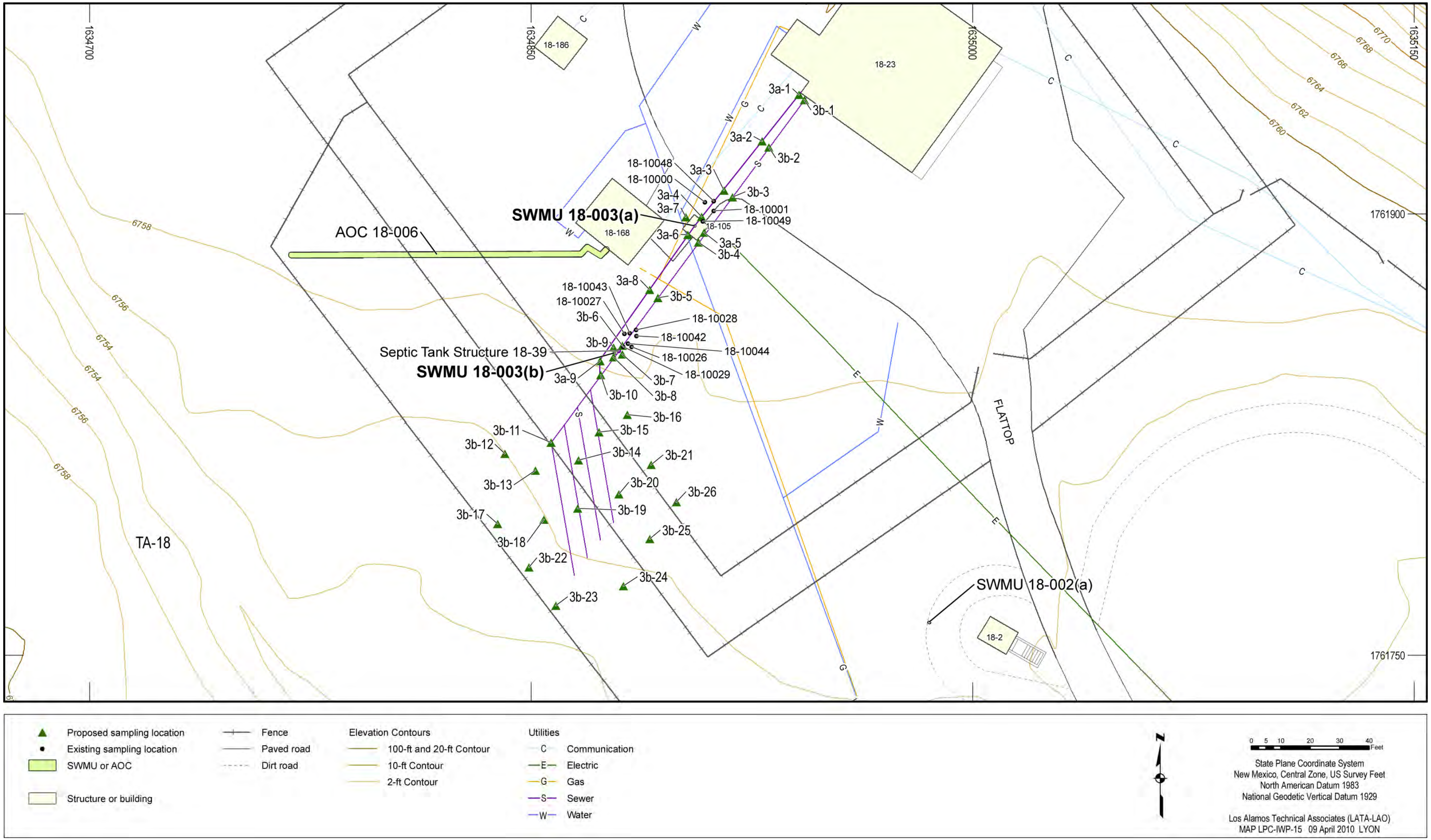

Figure 4.6-5 Proposed sampling locations for Consolidated Unit 18-003(a)-00 [SWMU 18-003(a) and SWMU 18-003(b)]

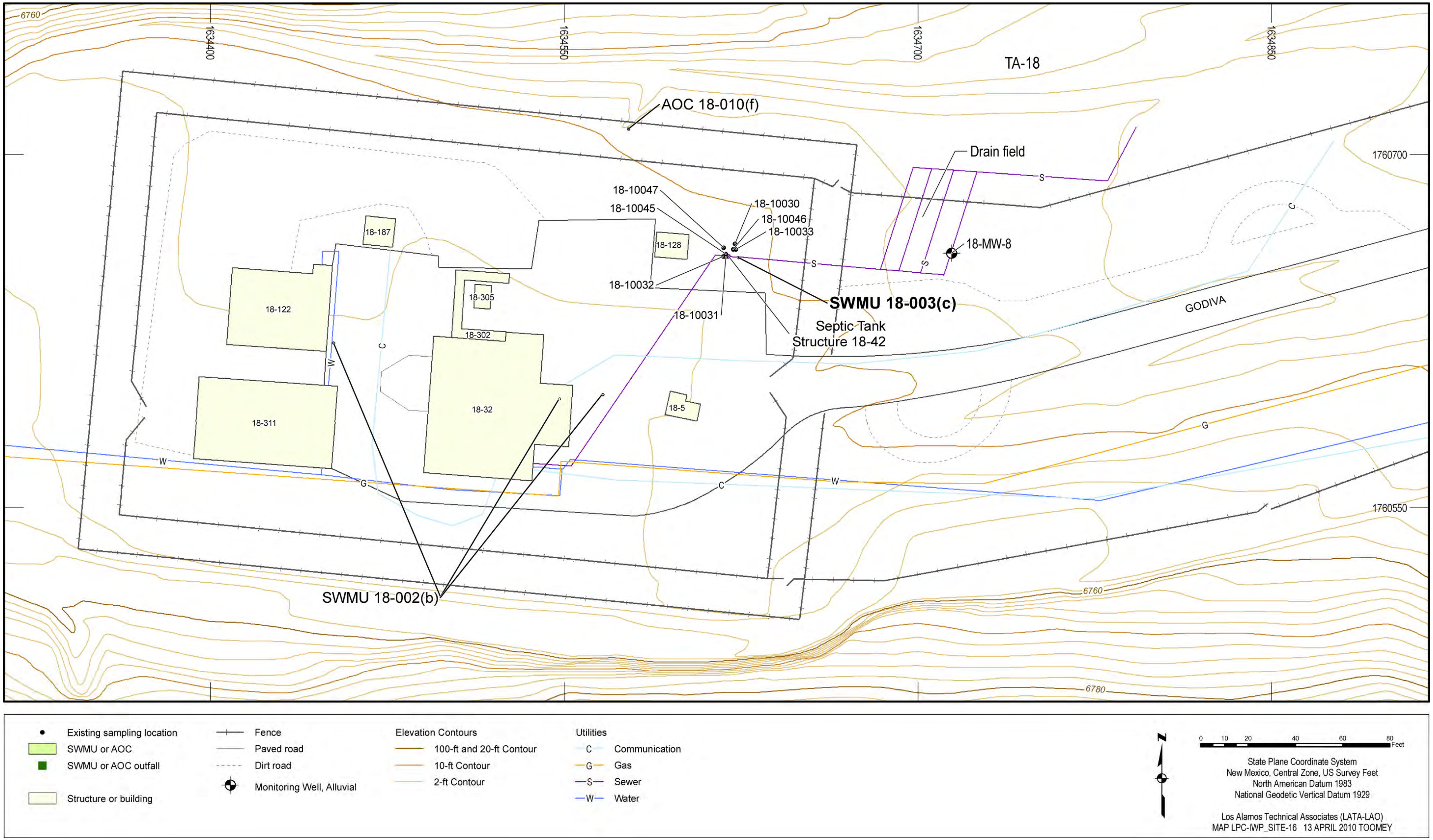

Figure 4.7-1 Site features of SWMU 18-003(c)

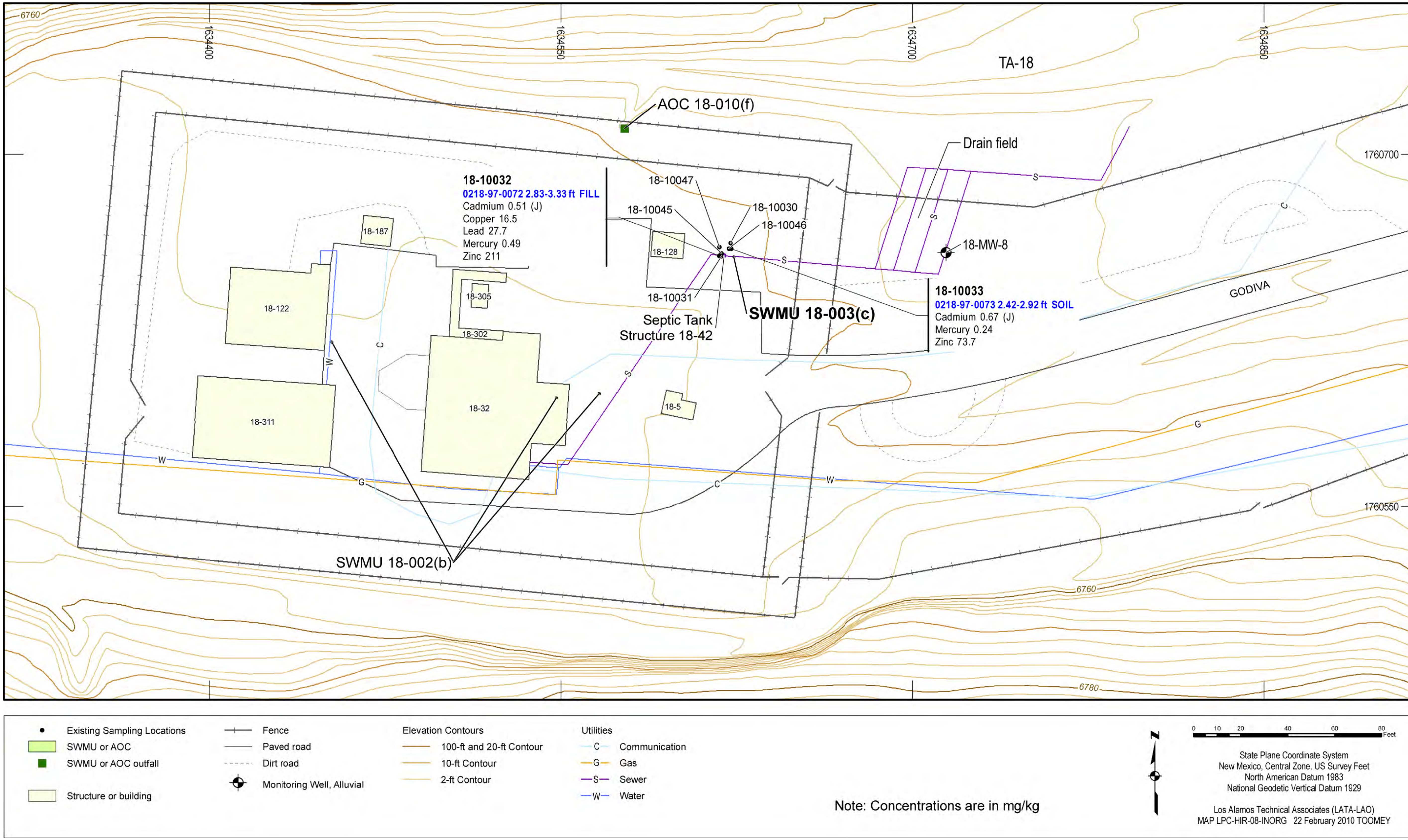

Figure 4.7-2 Inorganic chemicals detected above BVs at SWMU 18-003(c)

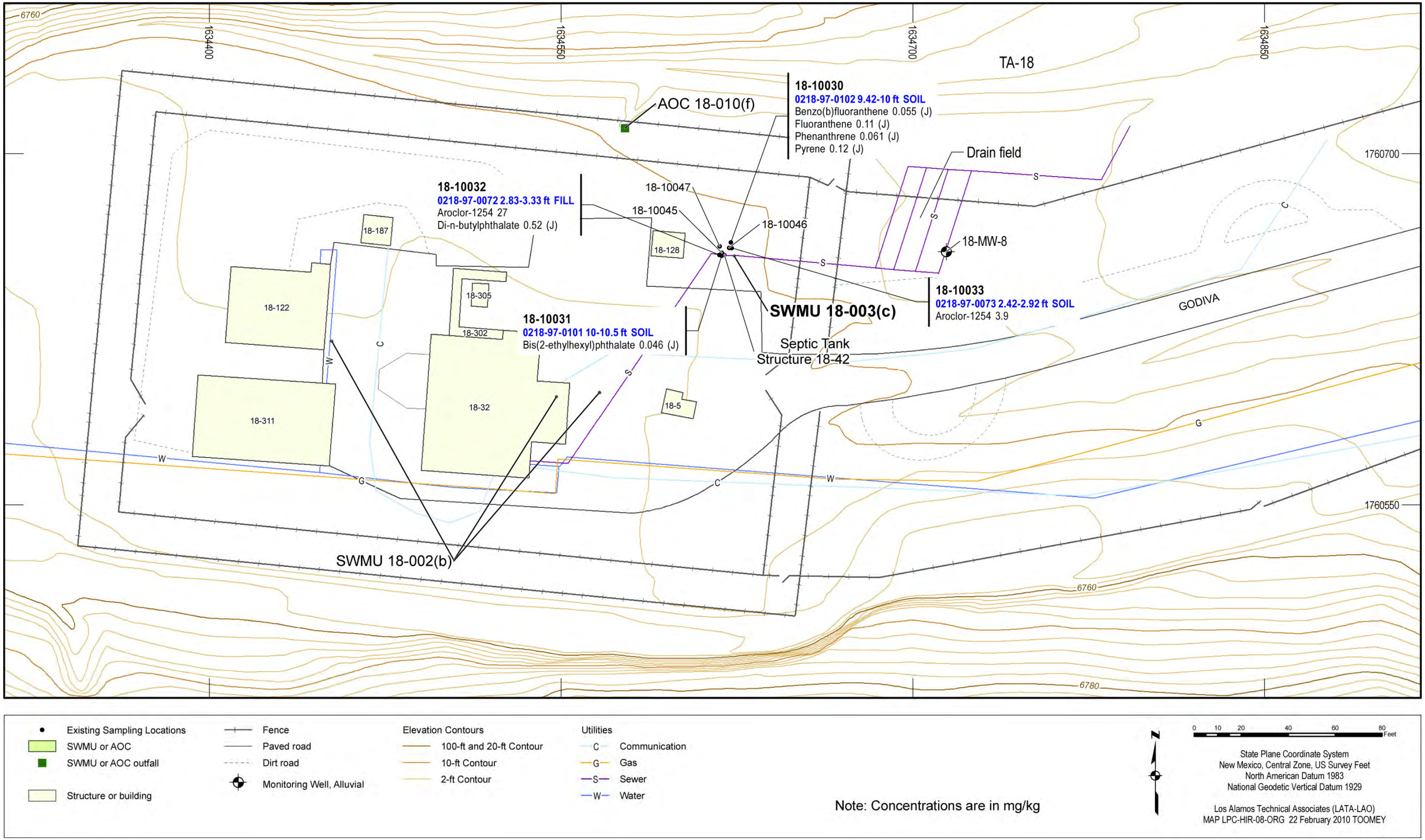

Figure 4.7-3 Organic chemicals detected at SWMU 18-003(c)

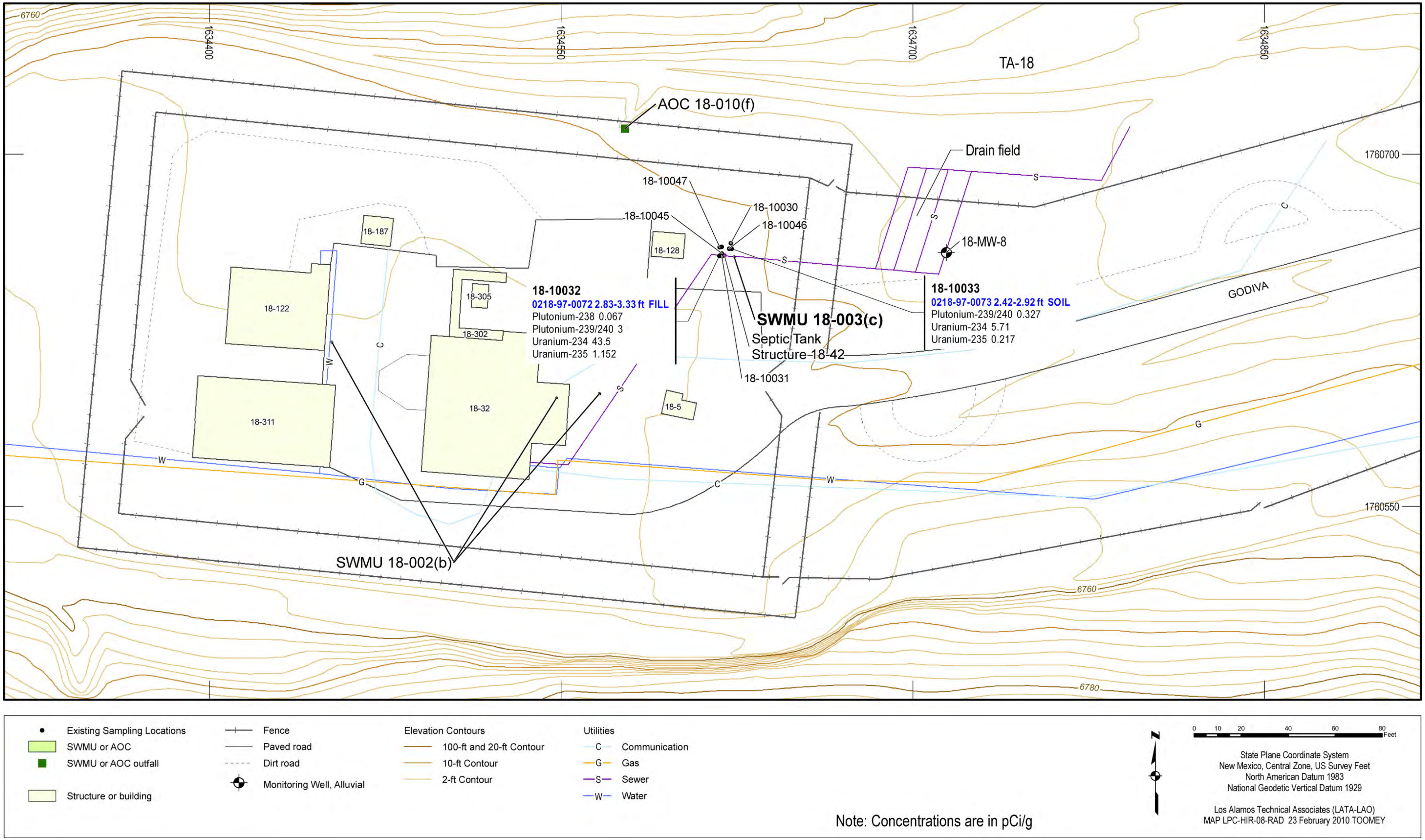

Figure 4.7-4 Radionuclides detected or detected above BVs/FVs at SWMU 18-003(c)

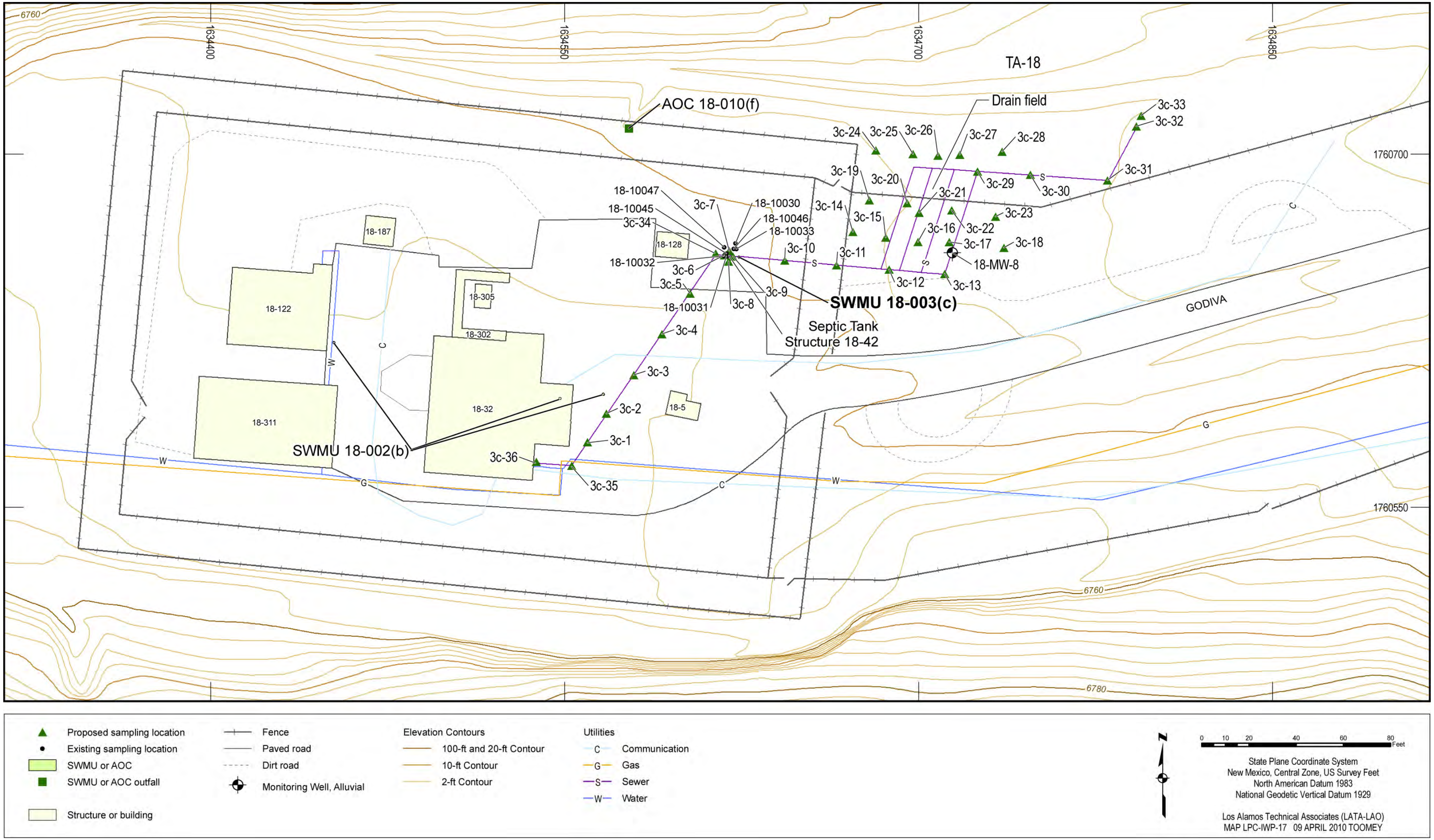

Figure 4.7-5 Proposed sampling locations for SWMU 18-003(c)

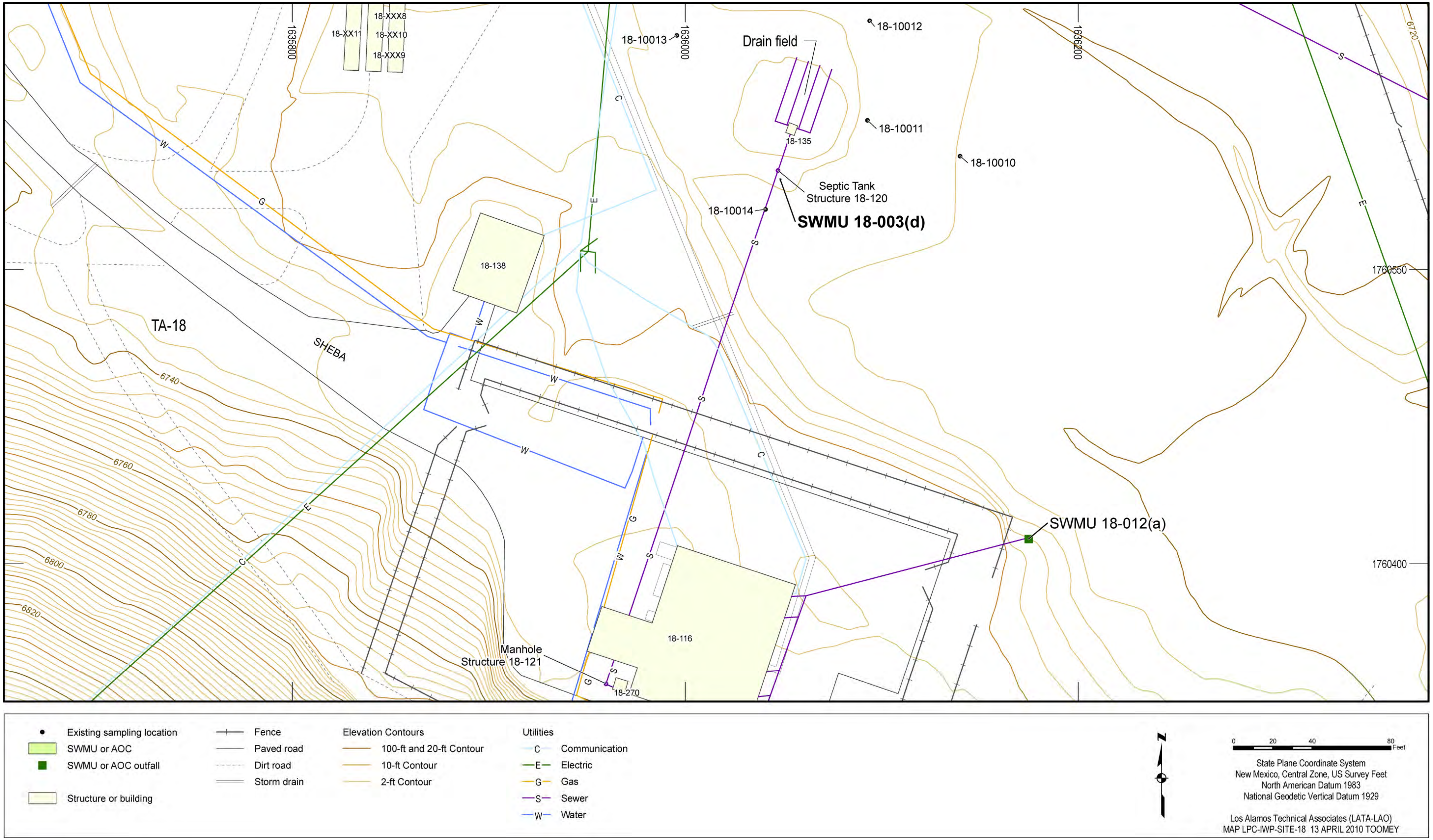

Figure 4.8-1 Site features of SWMU 18-003(d)

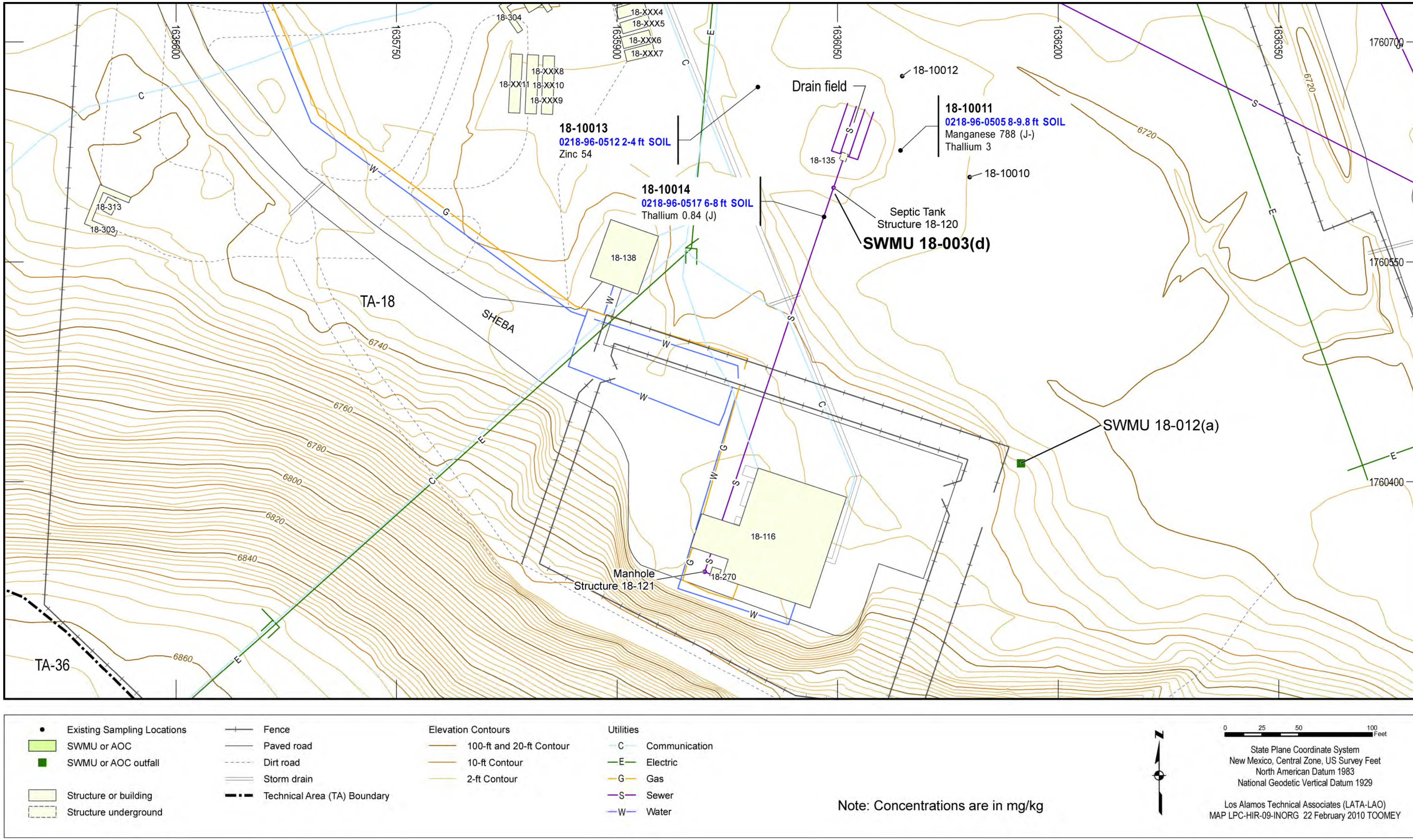

Figure 4.8-2 Inorganic chemicals detected above BVs at SWMU 18-003(d)

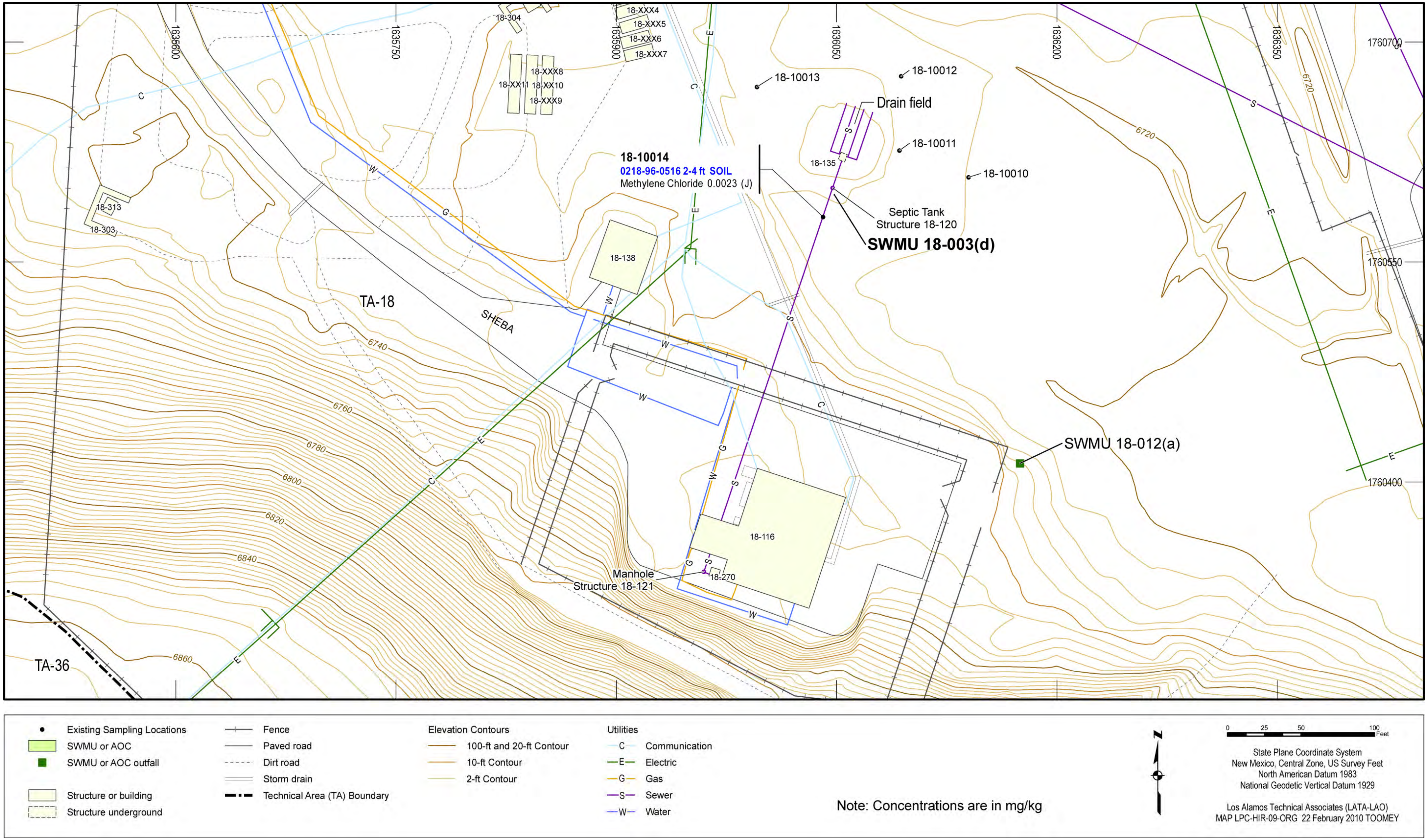

Figure 4.8-3 Organic chemicals detected at SWMU 18-003(d)

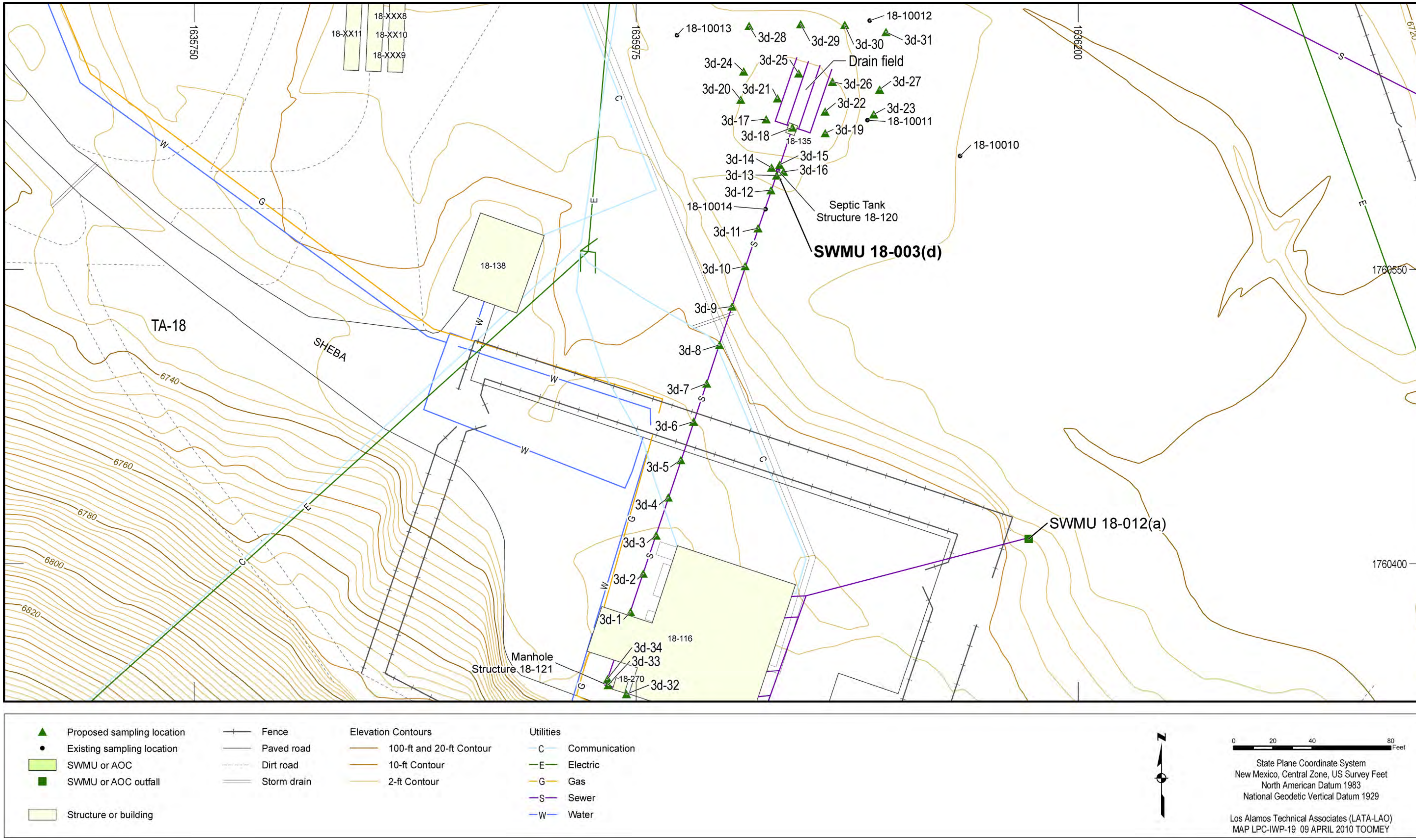

Figure 4.8-4 Proposed sampling locations for SWMU 18-003(d)

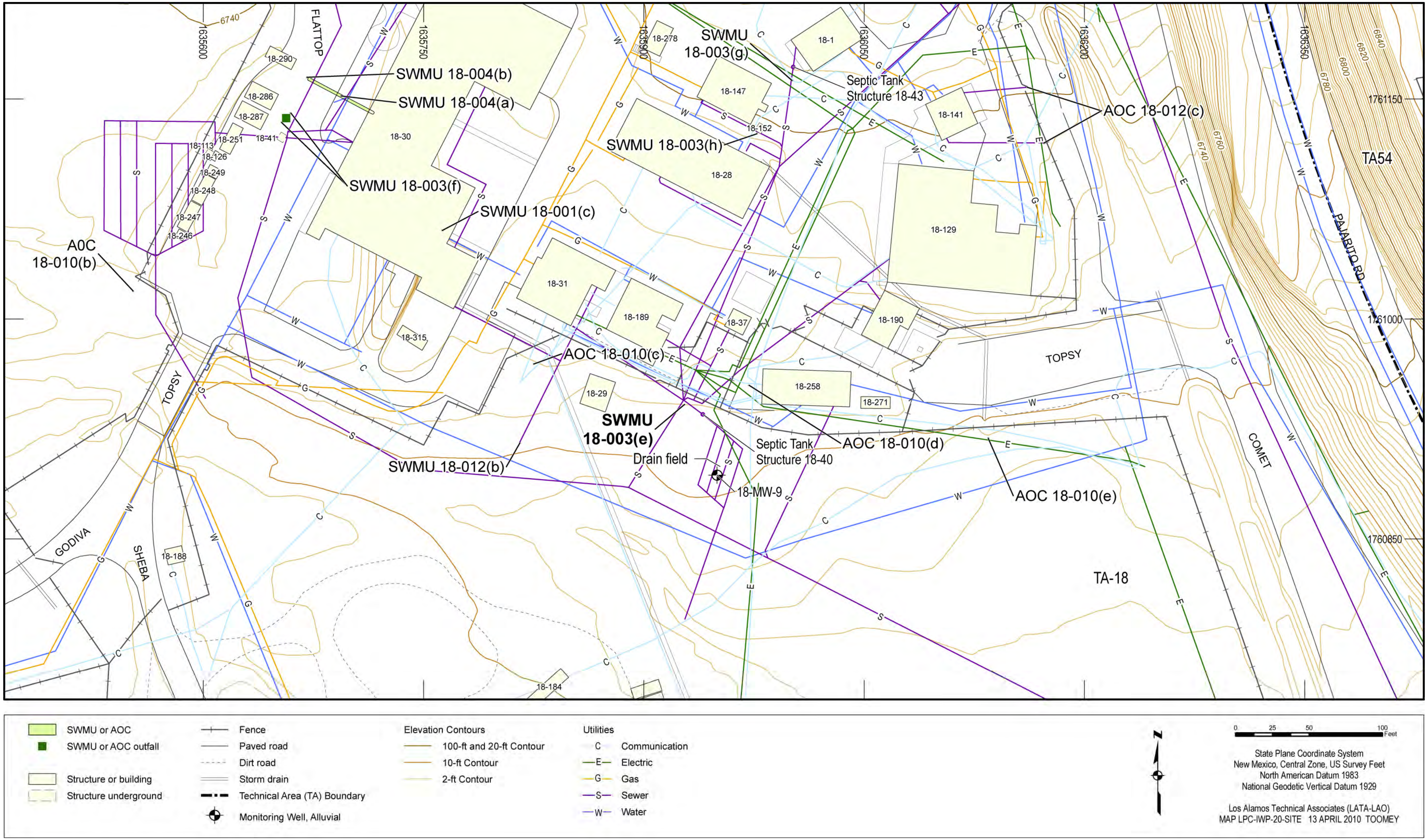

Figure 4.9-1 Site features of SWMU 18-003(e)

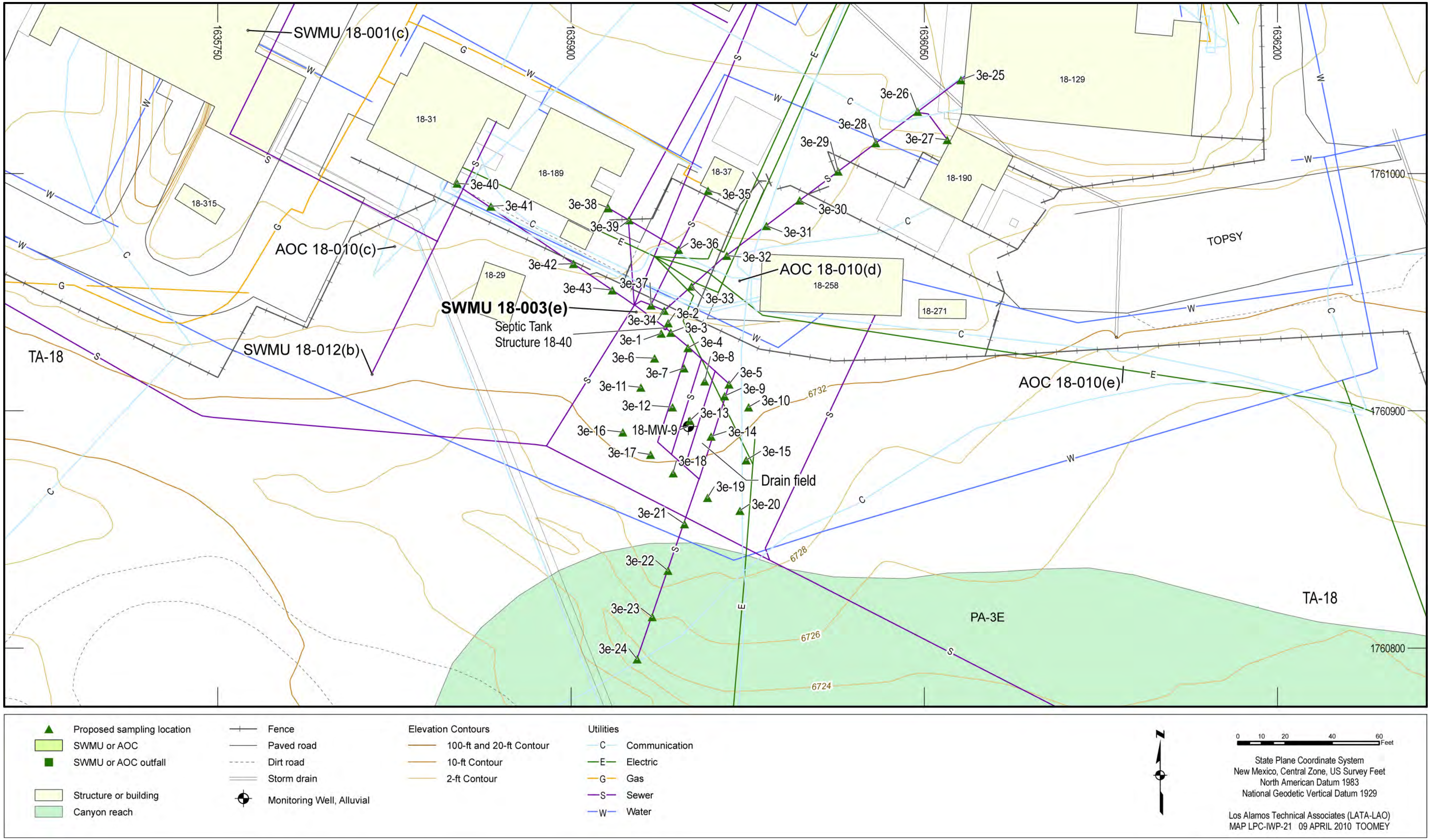

Figure 4.9-2 Proposed sampling locations for SWMU 18-003(e)

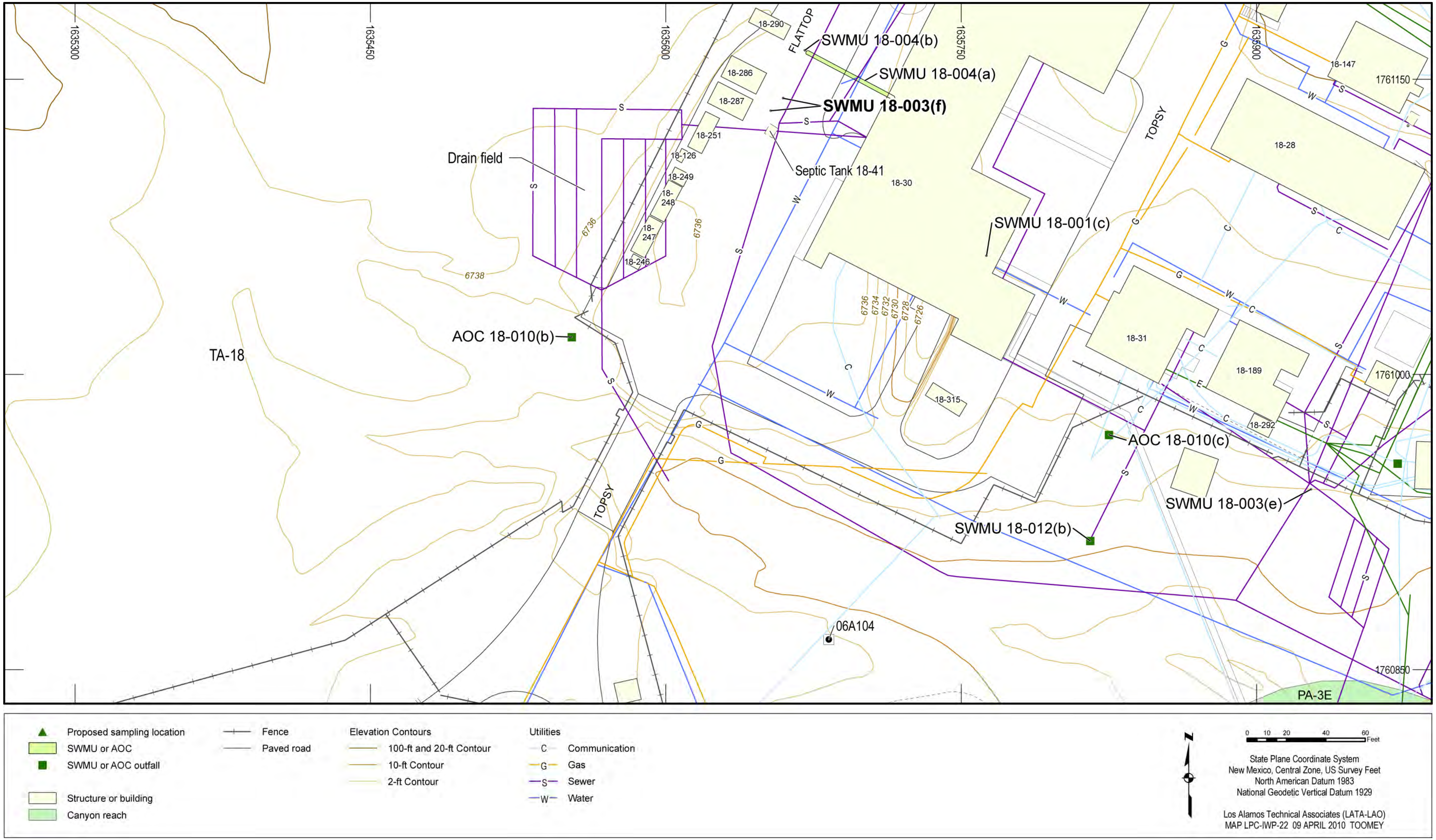

Figure 4.10-1 Site features of SWMU 18-003(f)

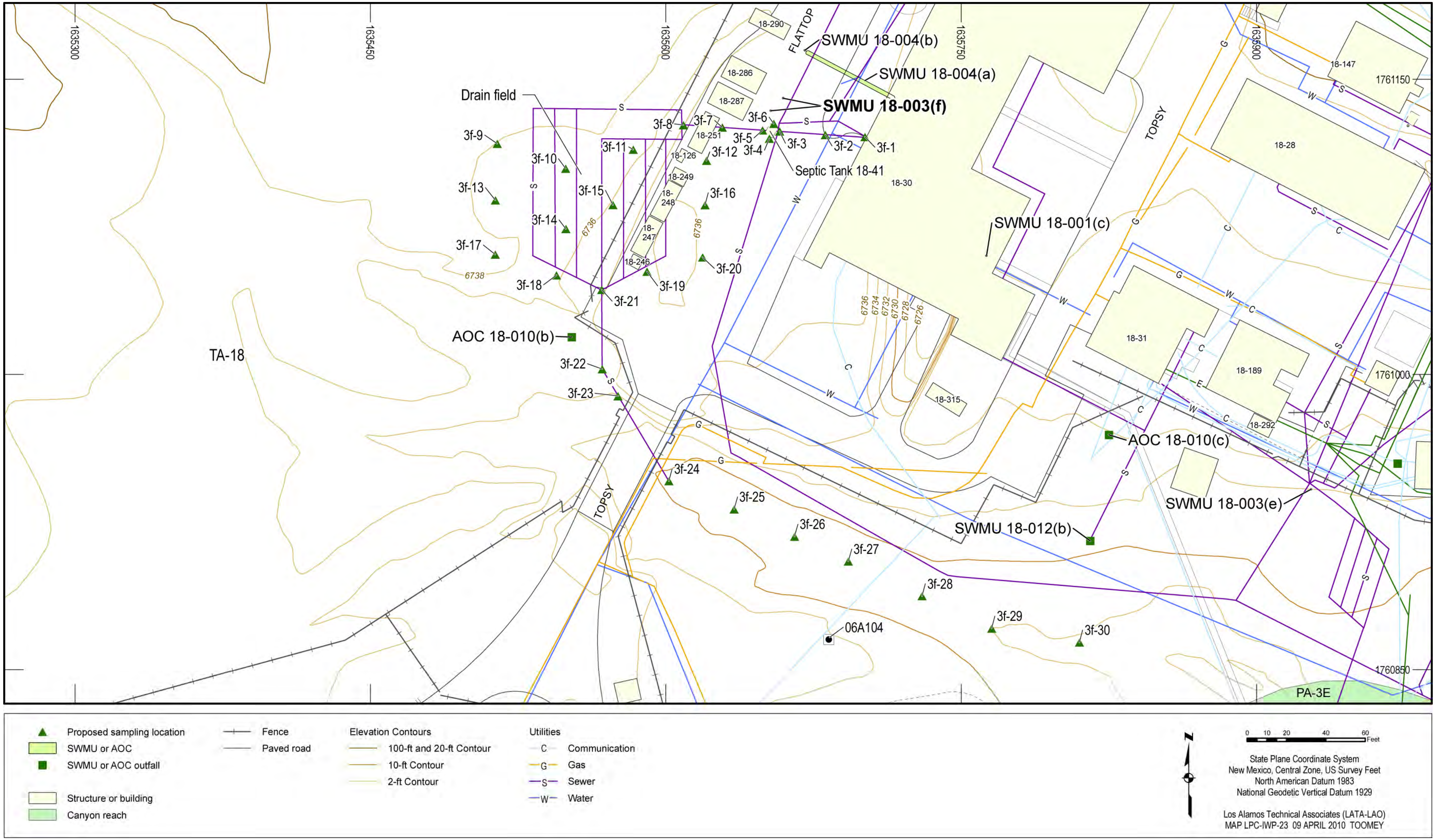

Figure 4.10-2 Proposed sampling locations for SWMU 18-003(f)

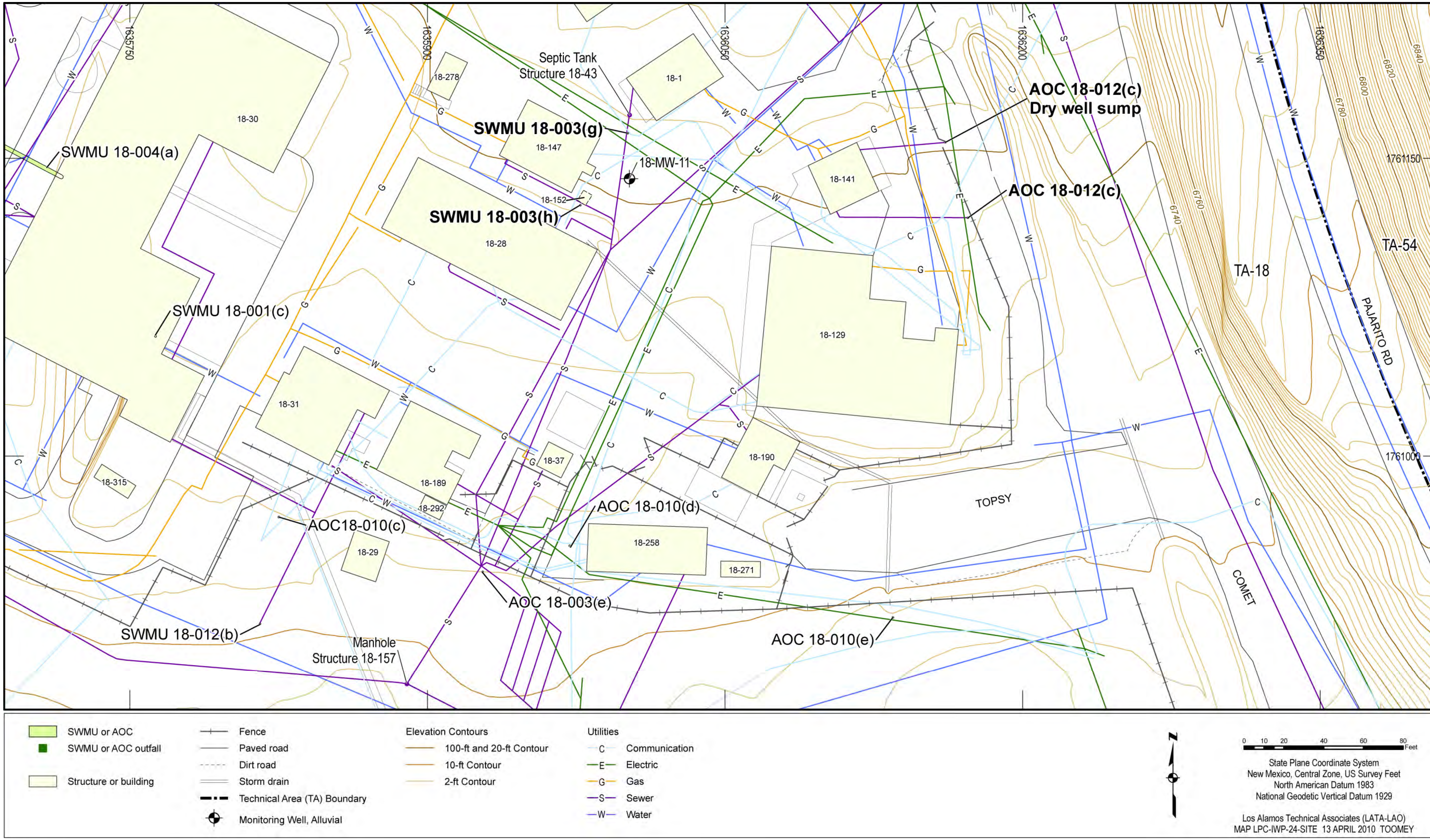

Figure 4.11-1 Site features of SWMU 18-003(g), SWMU 18-003(h), and AOC 18-012(c)

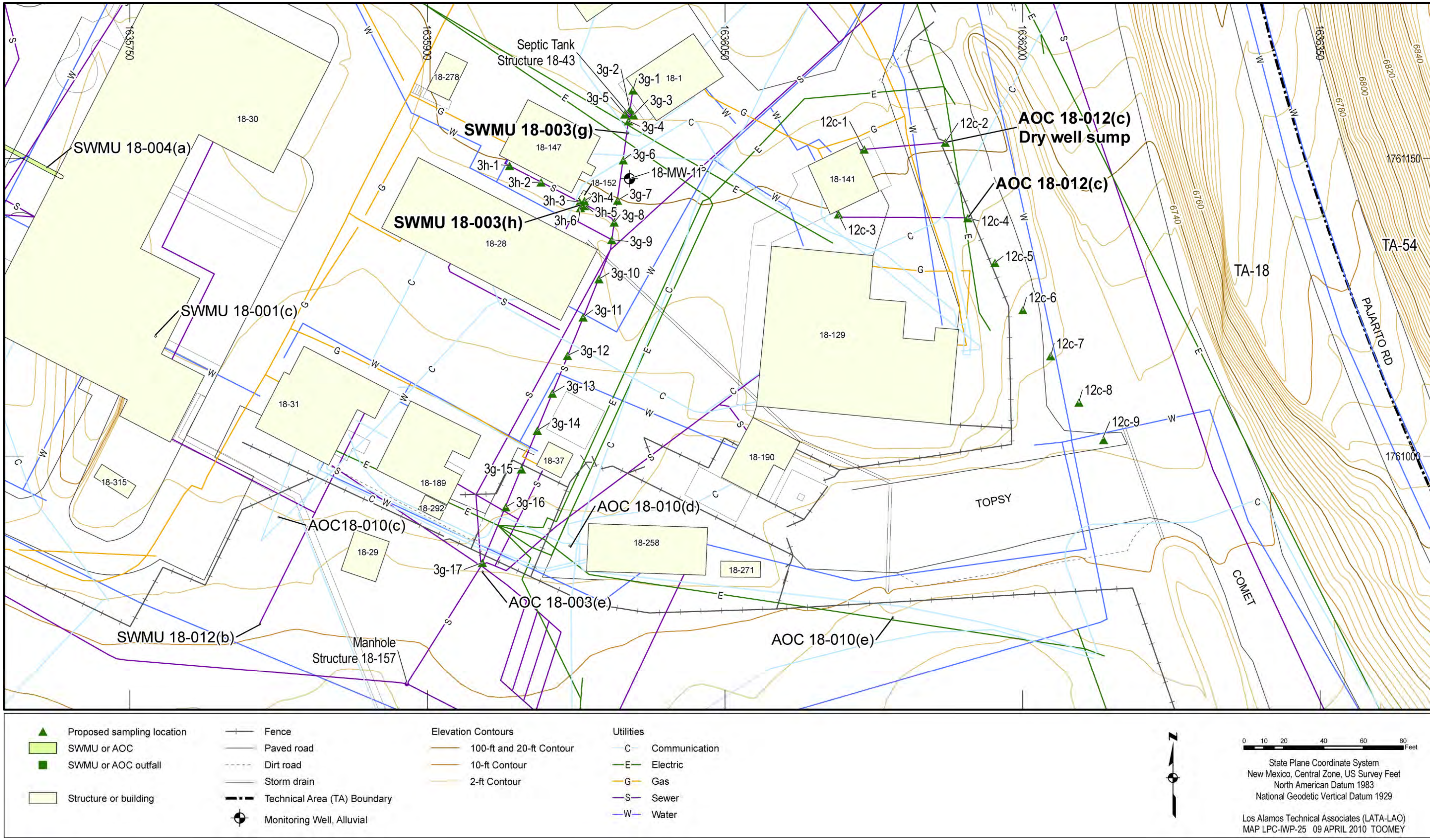

Figure 4.11-2 Proposed sampling locations for SWMU 18-003(g), SWMU 18-003(h), and AOC 18-012(c)

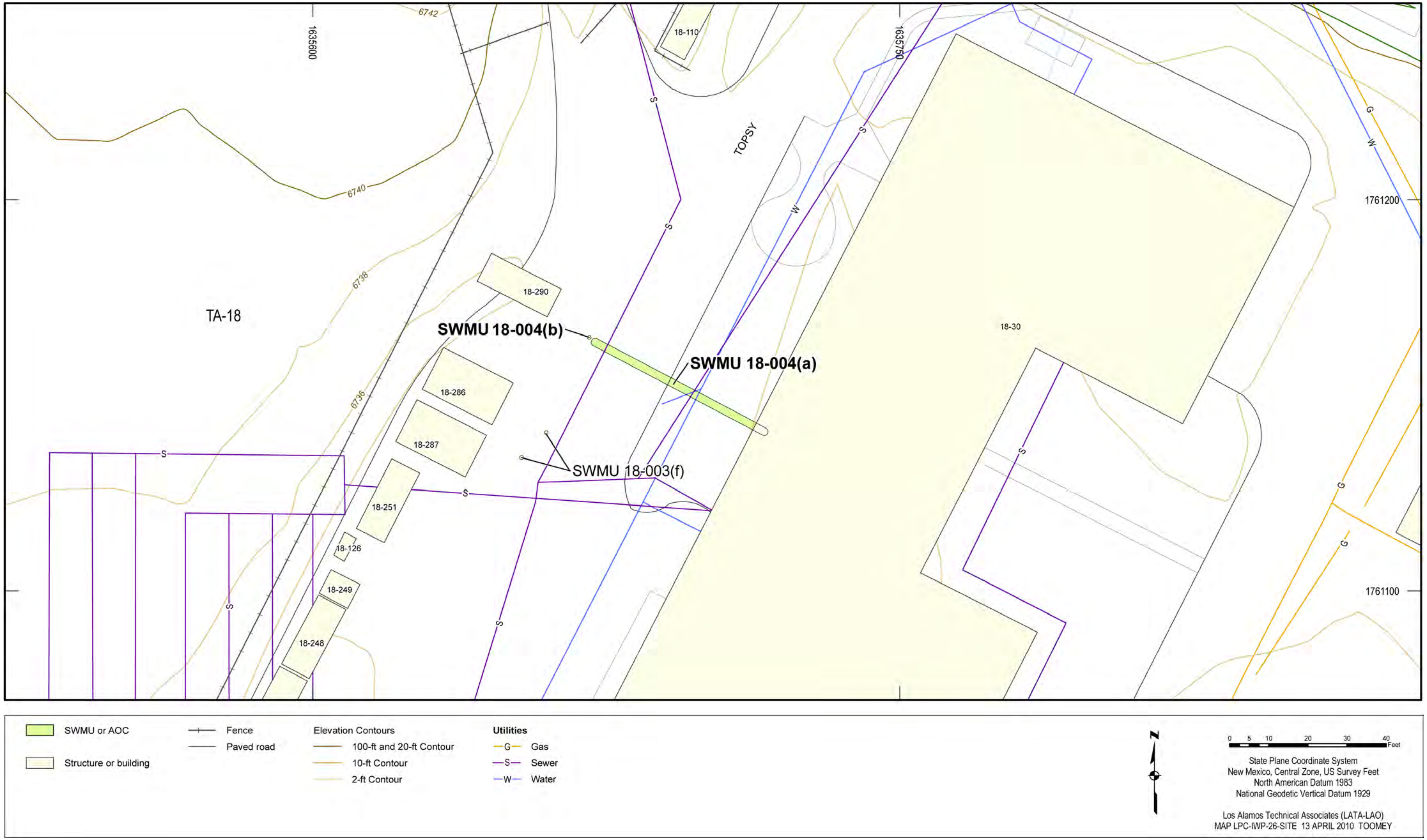

Figure 4.13-1 Site features of Consolidated Unit 18-004(a)-00 [SWMUs 18-004(a) and 18-004(b)]

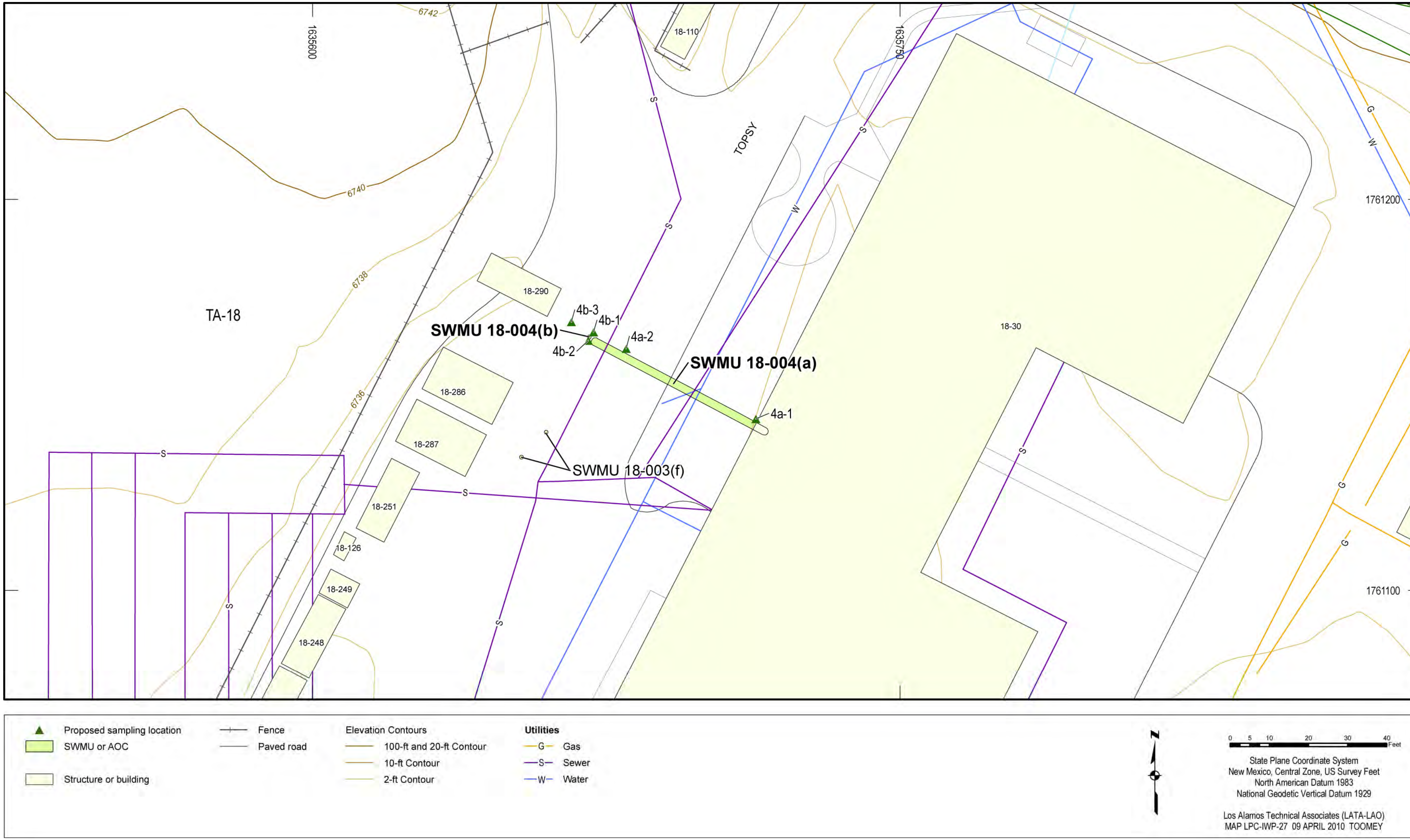

Figure 4.13-2 Proposed sampling locations for Consolidated Unit 18-004(a)-00 [SWMUs 18-004(a) and 18-004(b)]

Figure 4.14-1 Site features of SWMU 18-005(a)

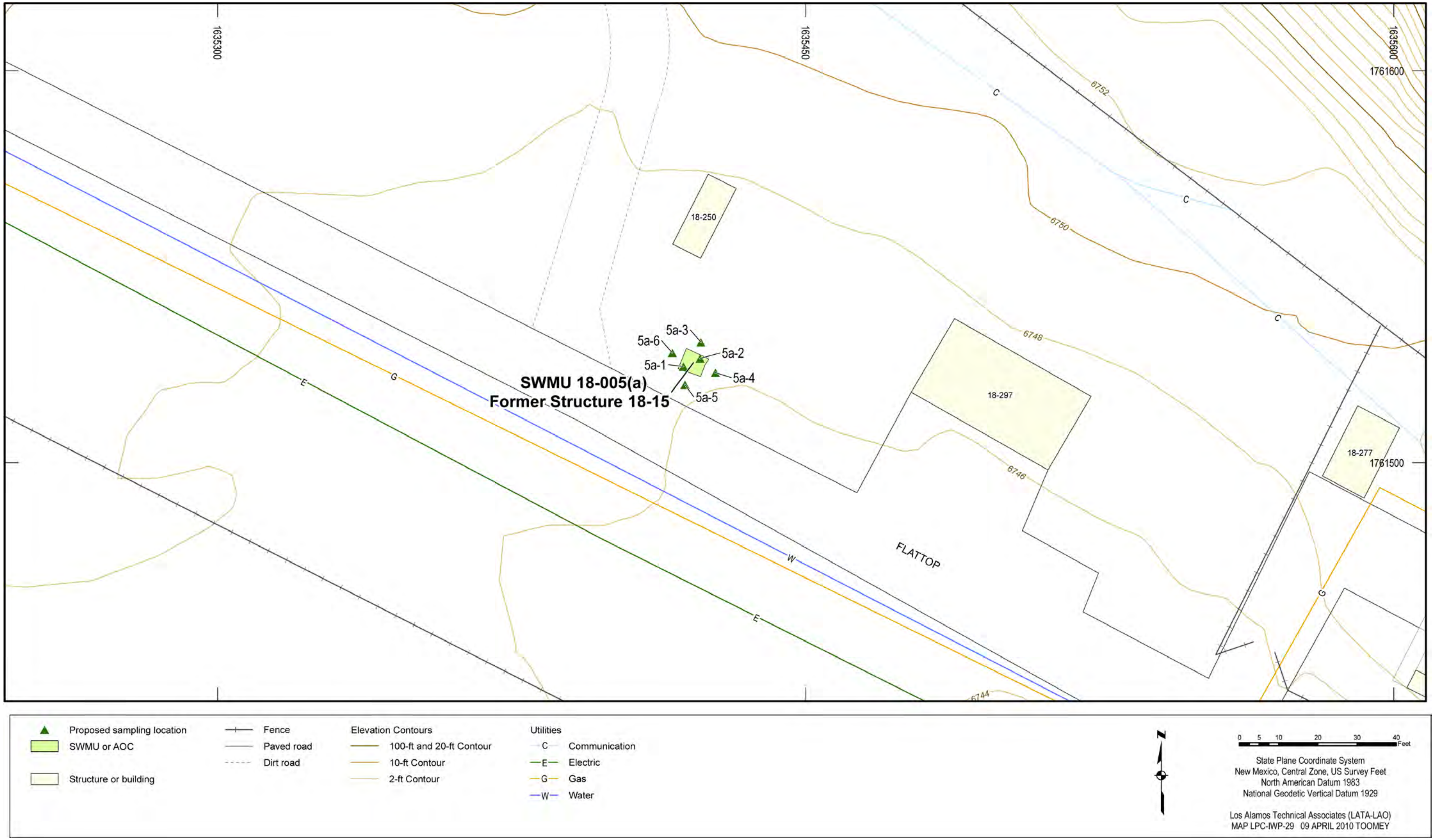

Figure 4.14-2 Proposed sampling locations for SWMU 18-005(a)

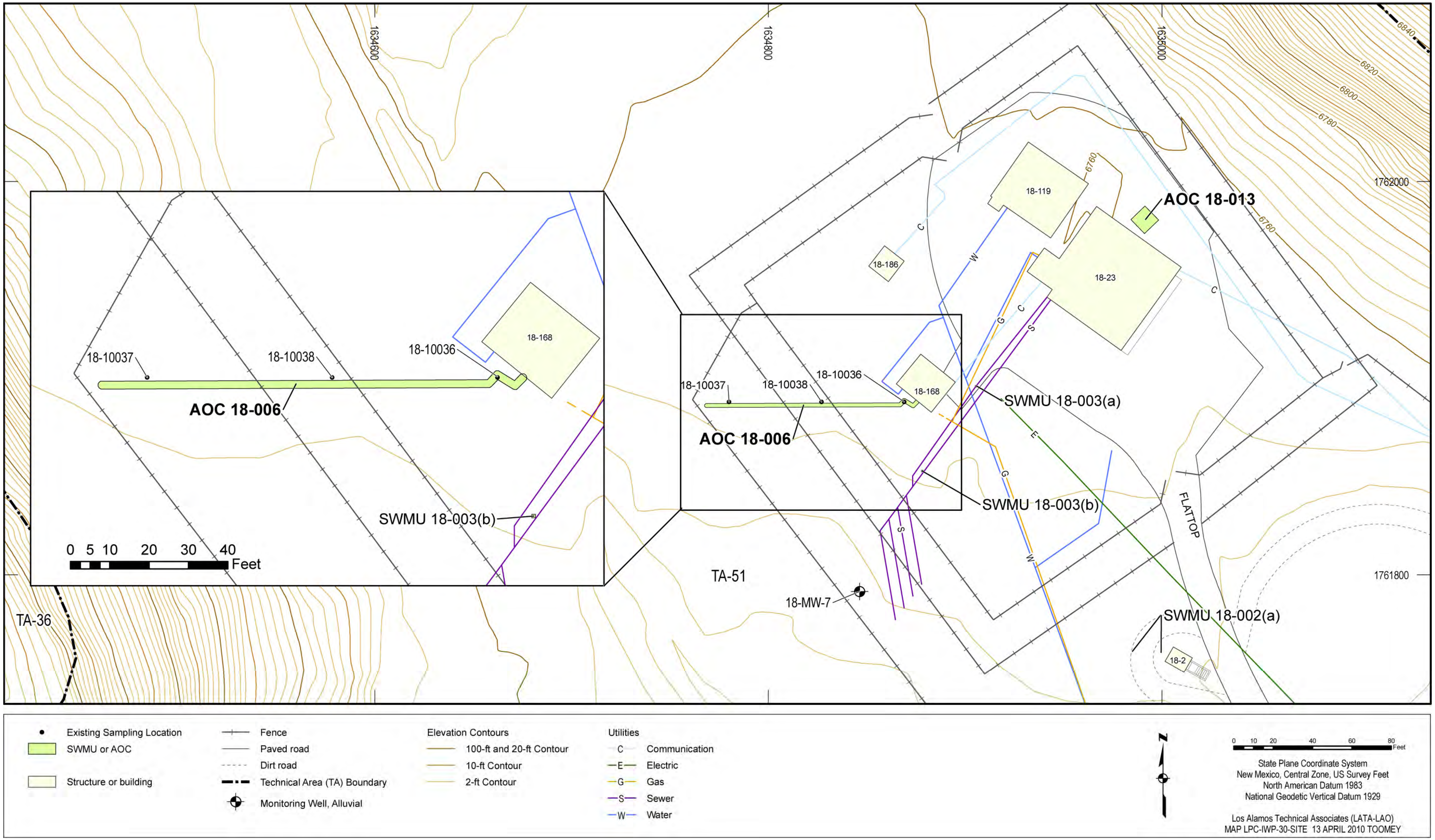

Figure 4.15-1 Site features of AOCs 18-006 and 18-013

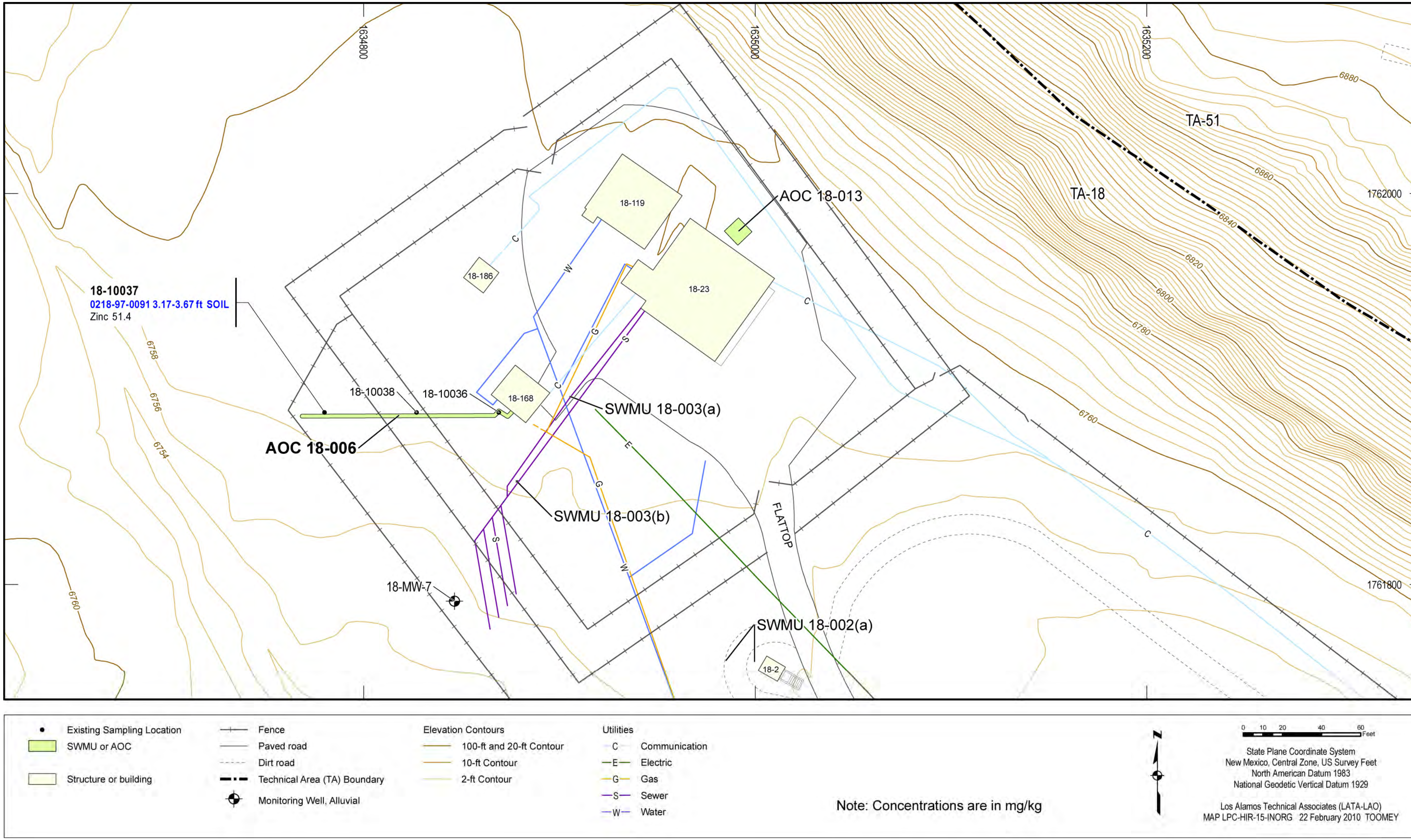

Figure 4.15-2 Inorganic chemicals detected above BVs at AOC 18-006

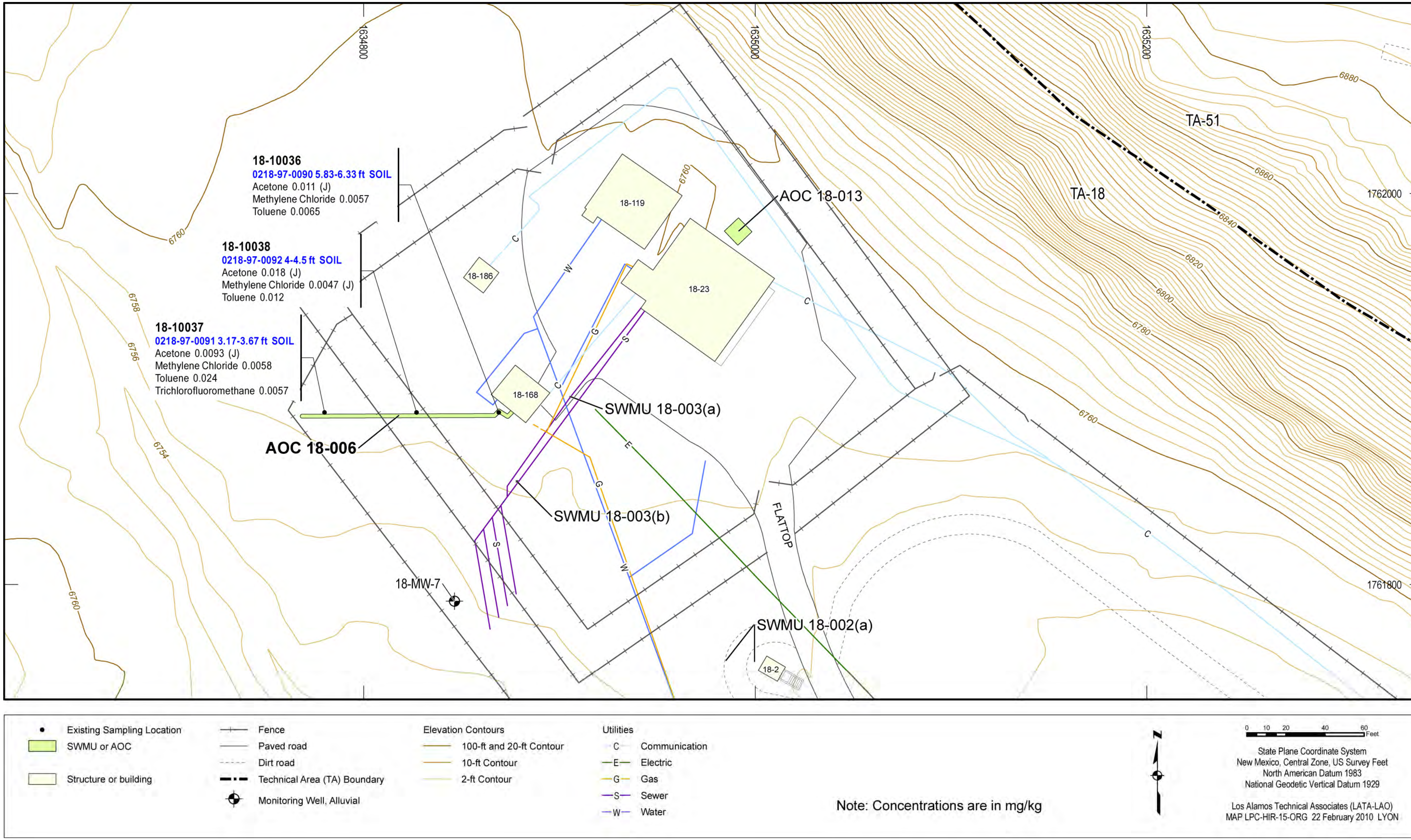

Figure 4.15-3 Organic chemicals detected at AOC 18-006

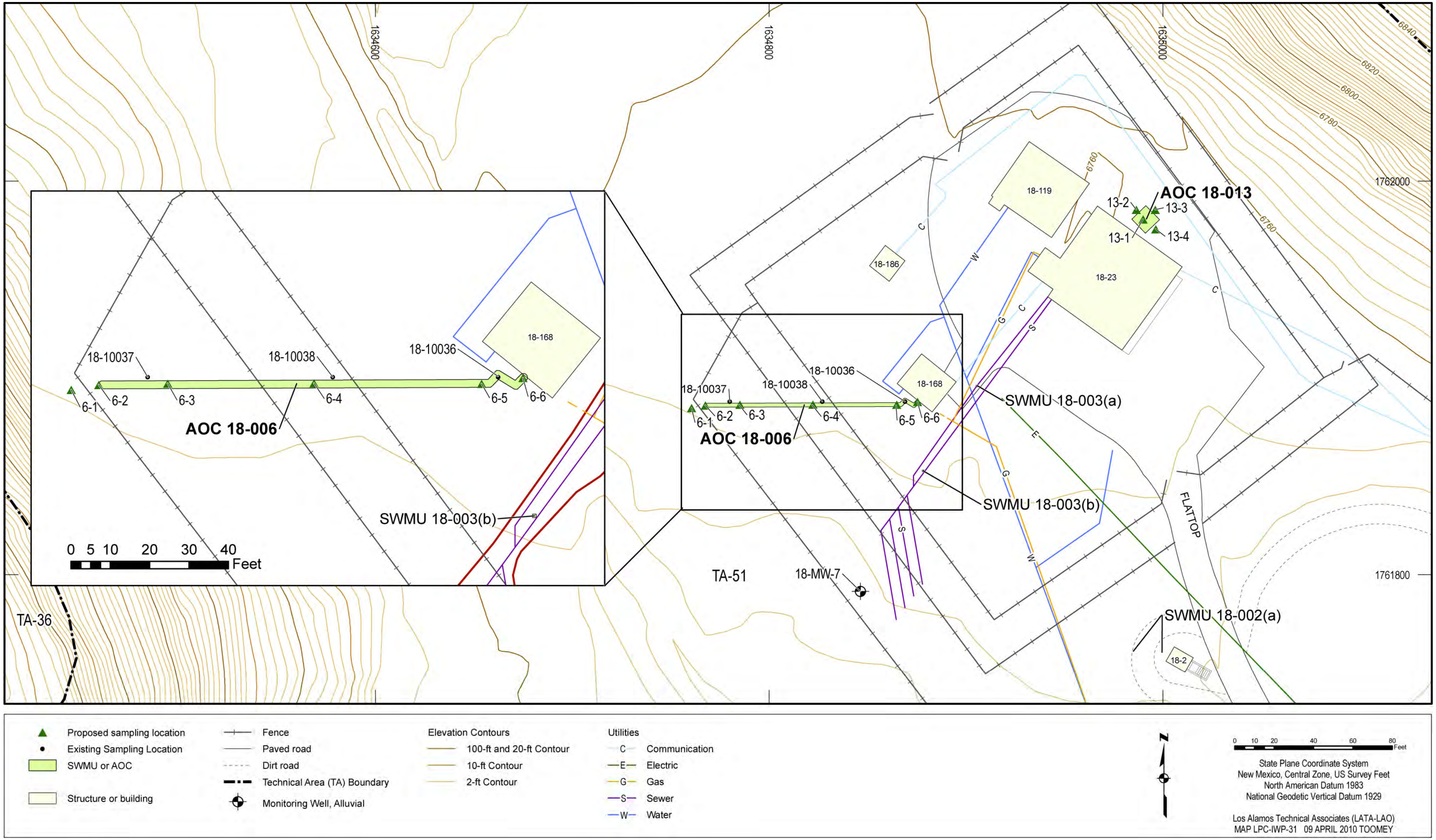

Figure 4.15-4 Proposed sampling locations for AOCs 18-006 and 18-013

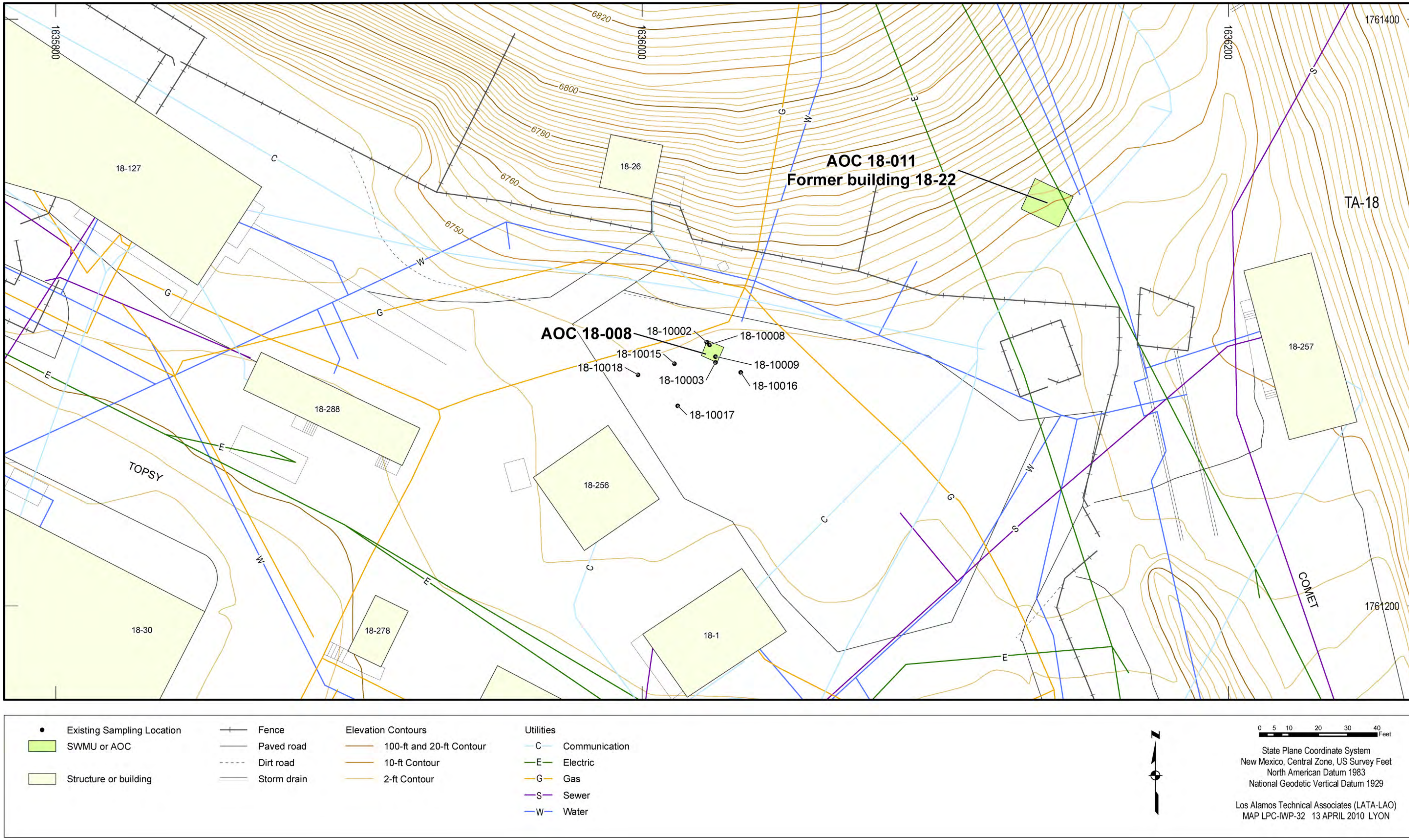

Figure 4.16-1 Site features of AOCs 18-008 and 18-011

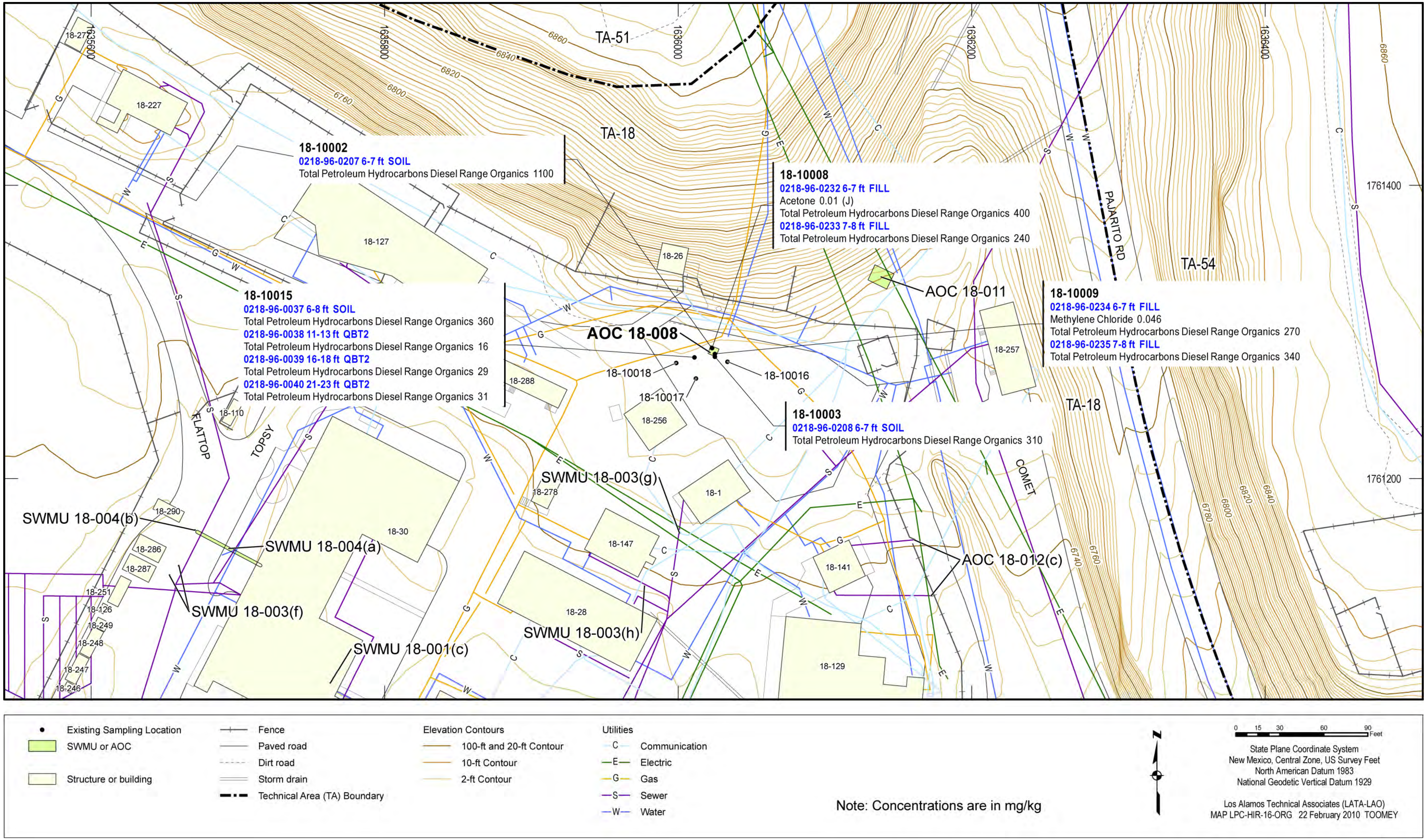

Figure 4.16-2 Organic chemicals detected at AOC 18-008

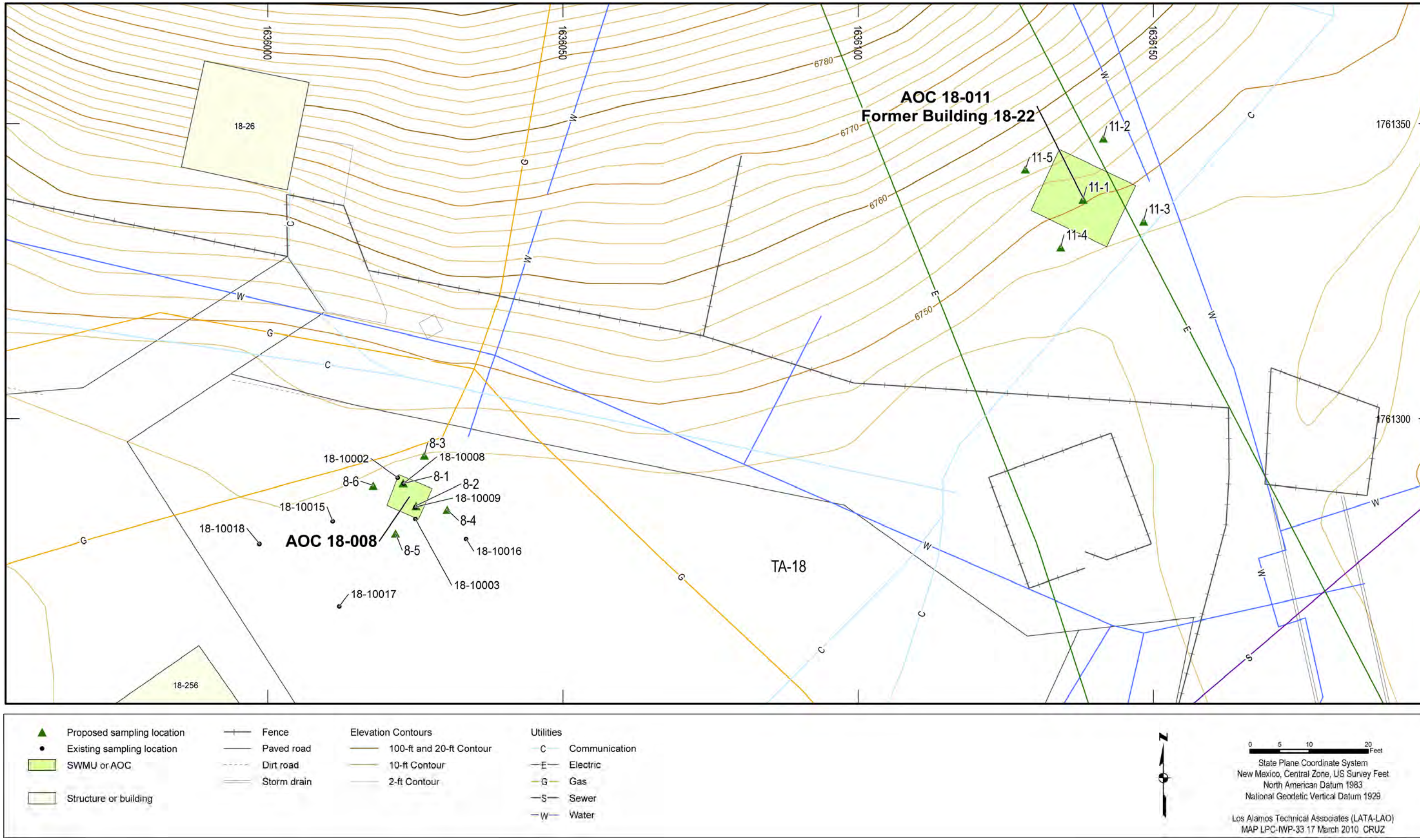

Figure 4.16-3 Proposed sampling locations for AOCs 18-008 and 18-011

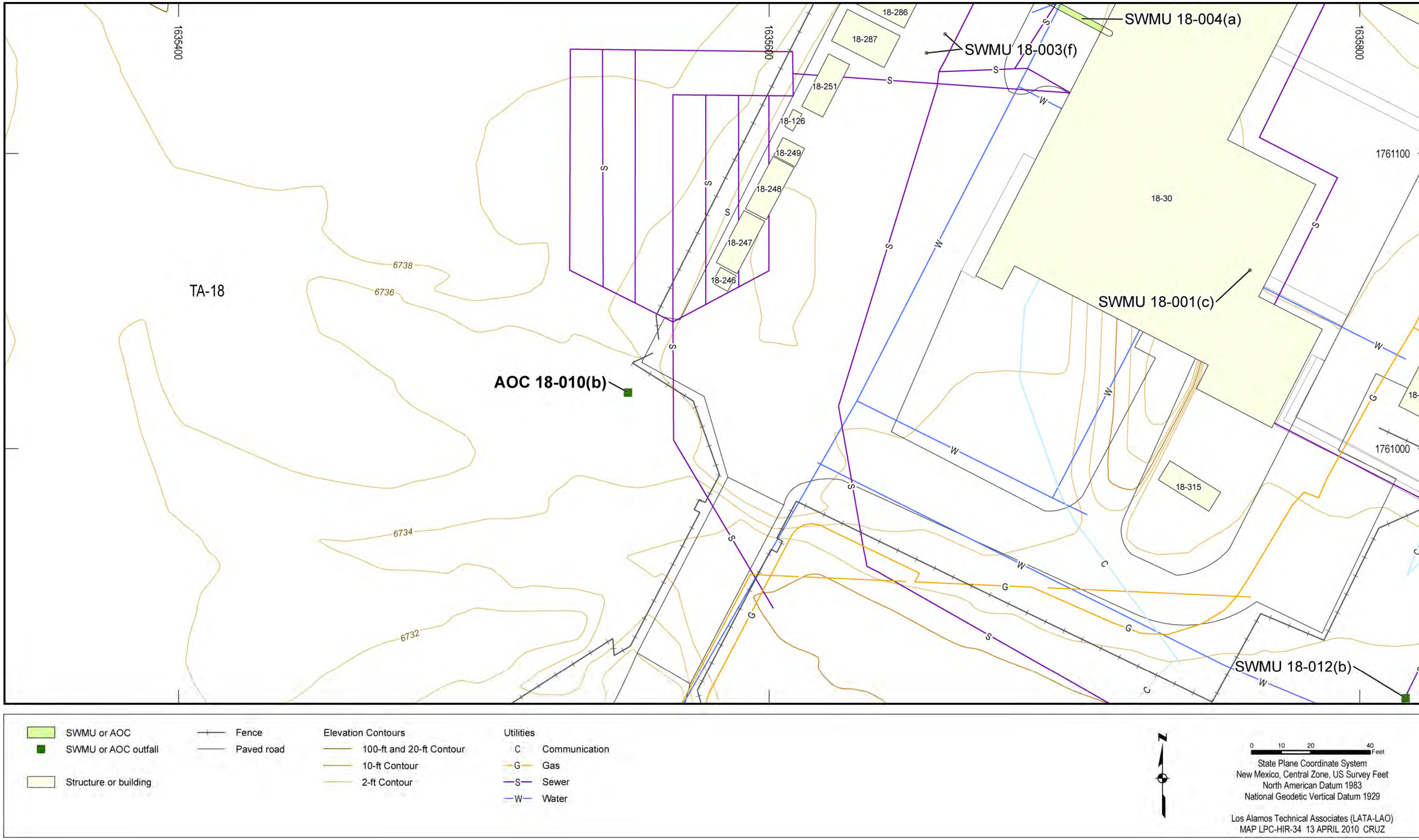

Figure 4.17-1 Site features of AOC 18-010(b)

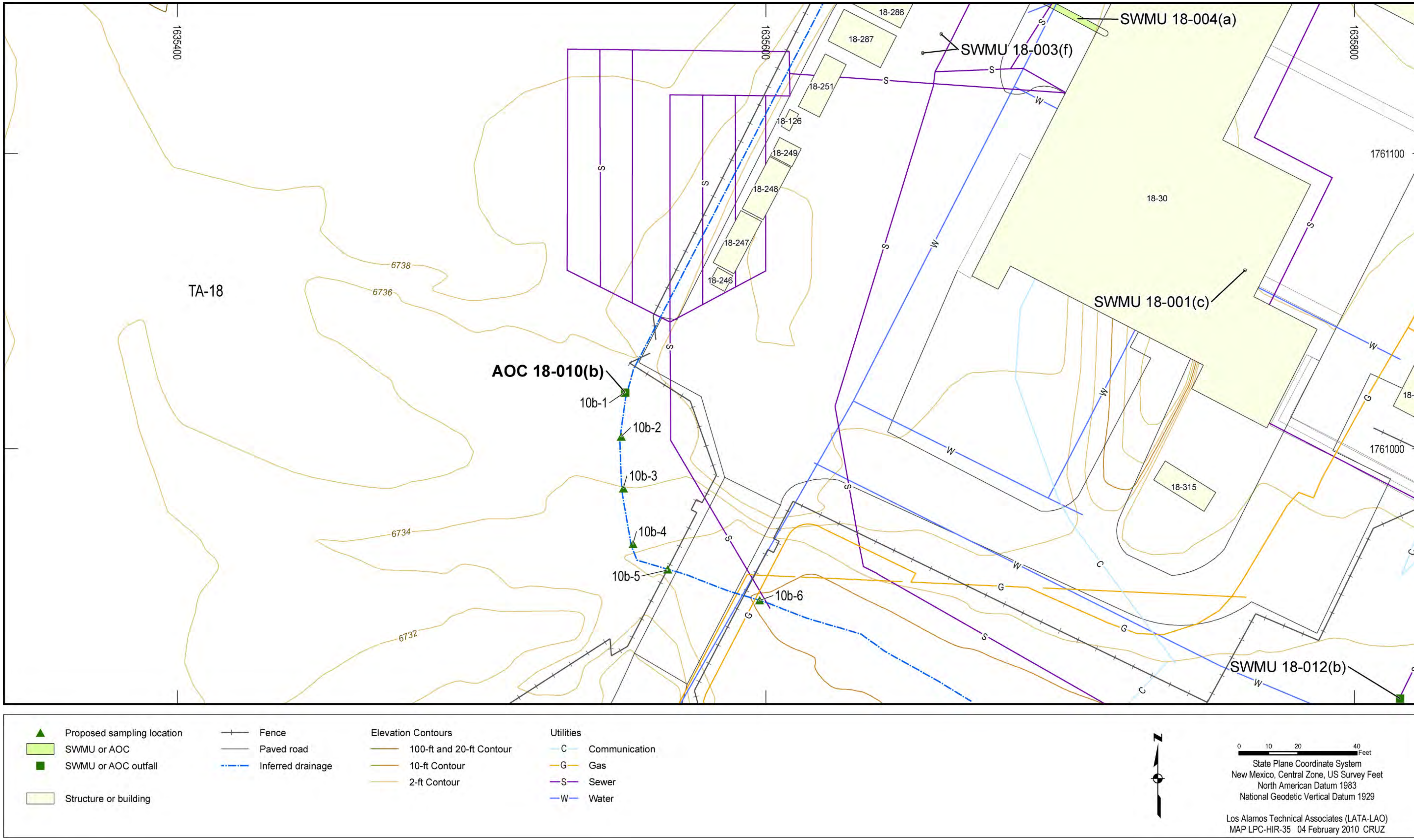

Figure 4.17-2 Proposed sampling locations for AOC 18-010(b)

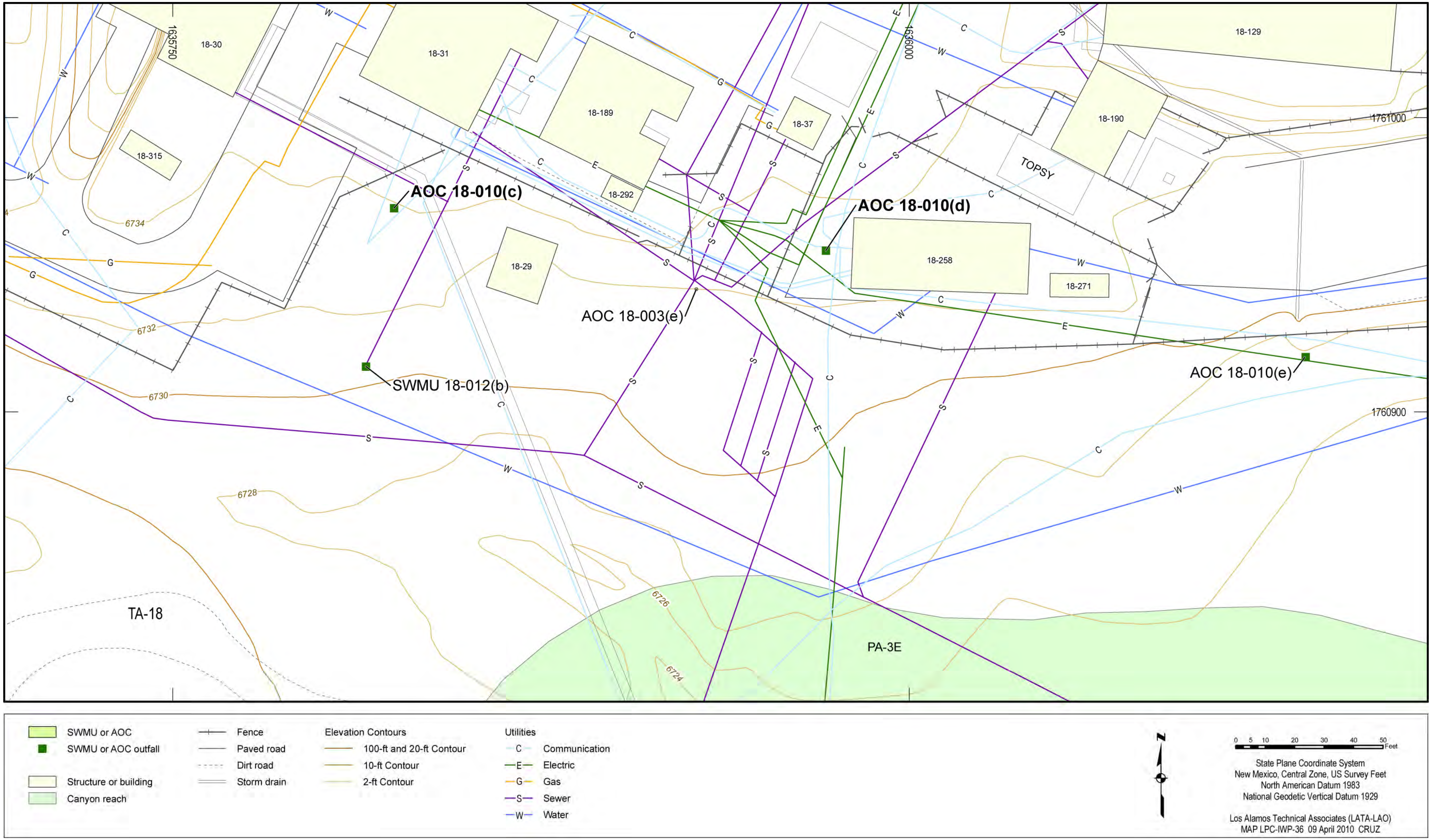

Figure 4.18-1 Site features of AOCs 18-010(c) and 18-010(d)

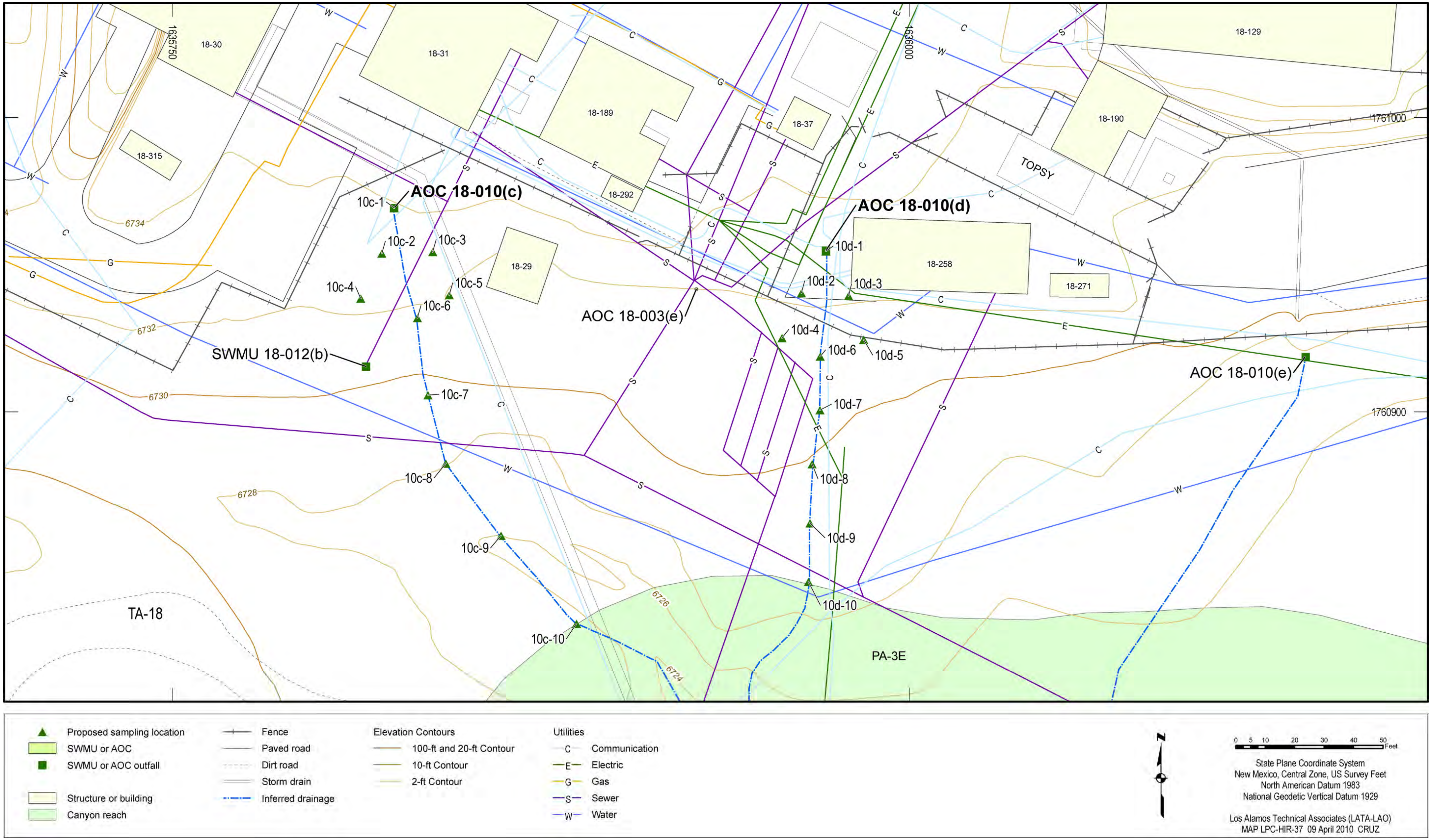

Figure 4.18-2 Proposed sampling locations for AOCs 18-010(c) and 18-010(d)

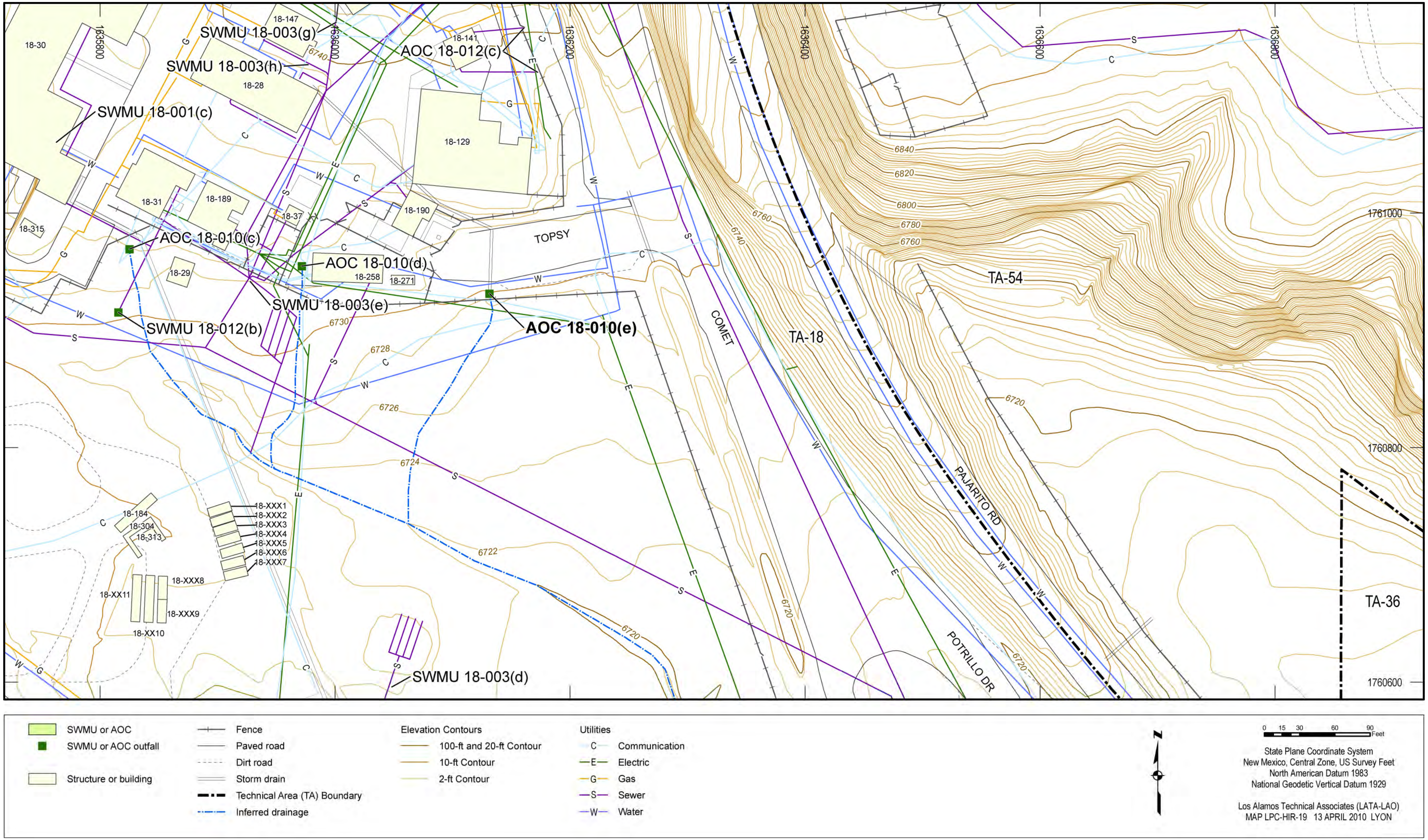

Figure 4.20-1 Site features of AOC 18-010(e)

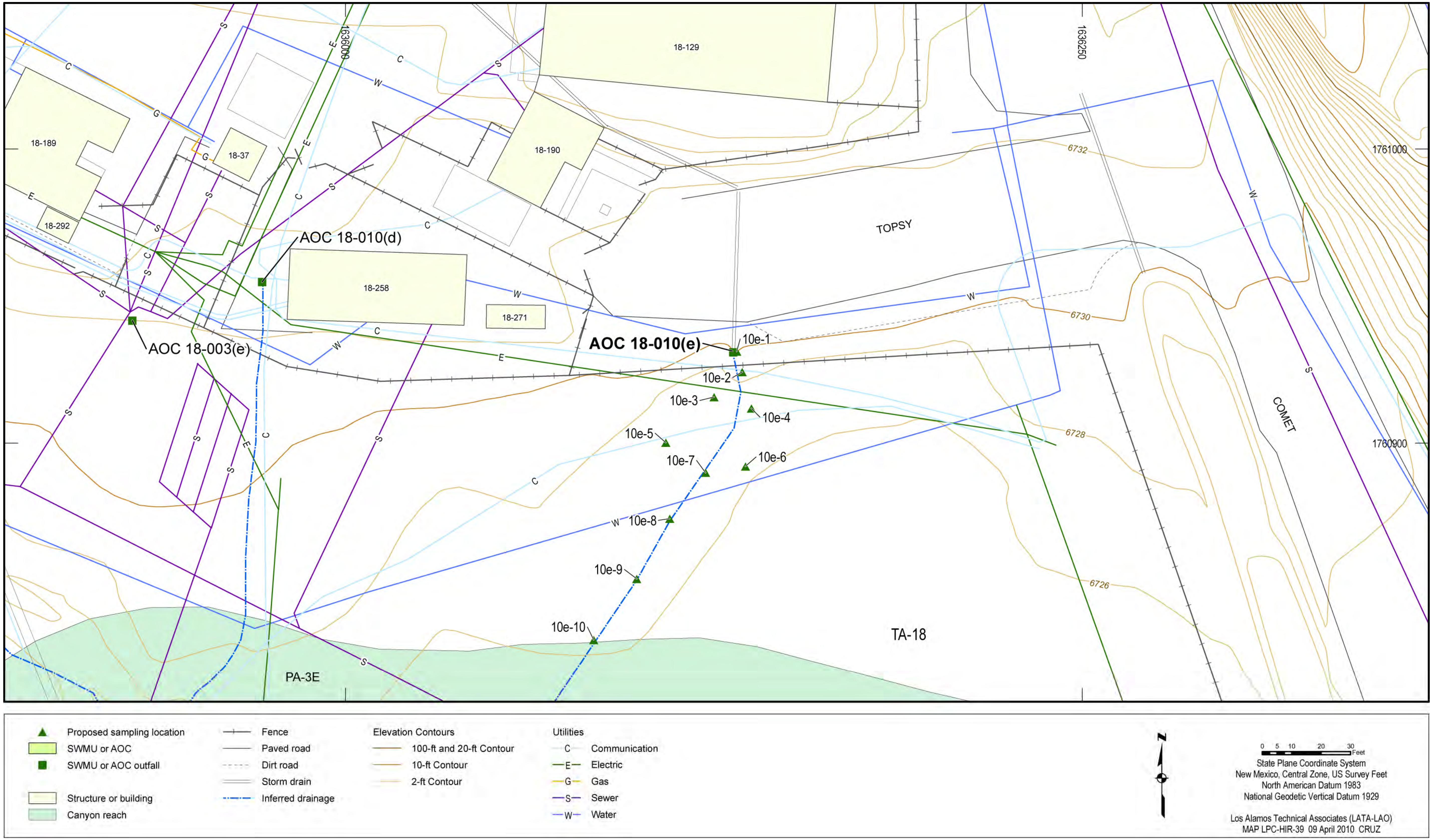

Figure 4.20-2 Proposed sampling locations for AOC 18-010(e)

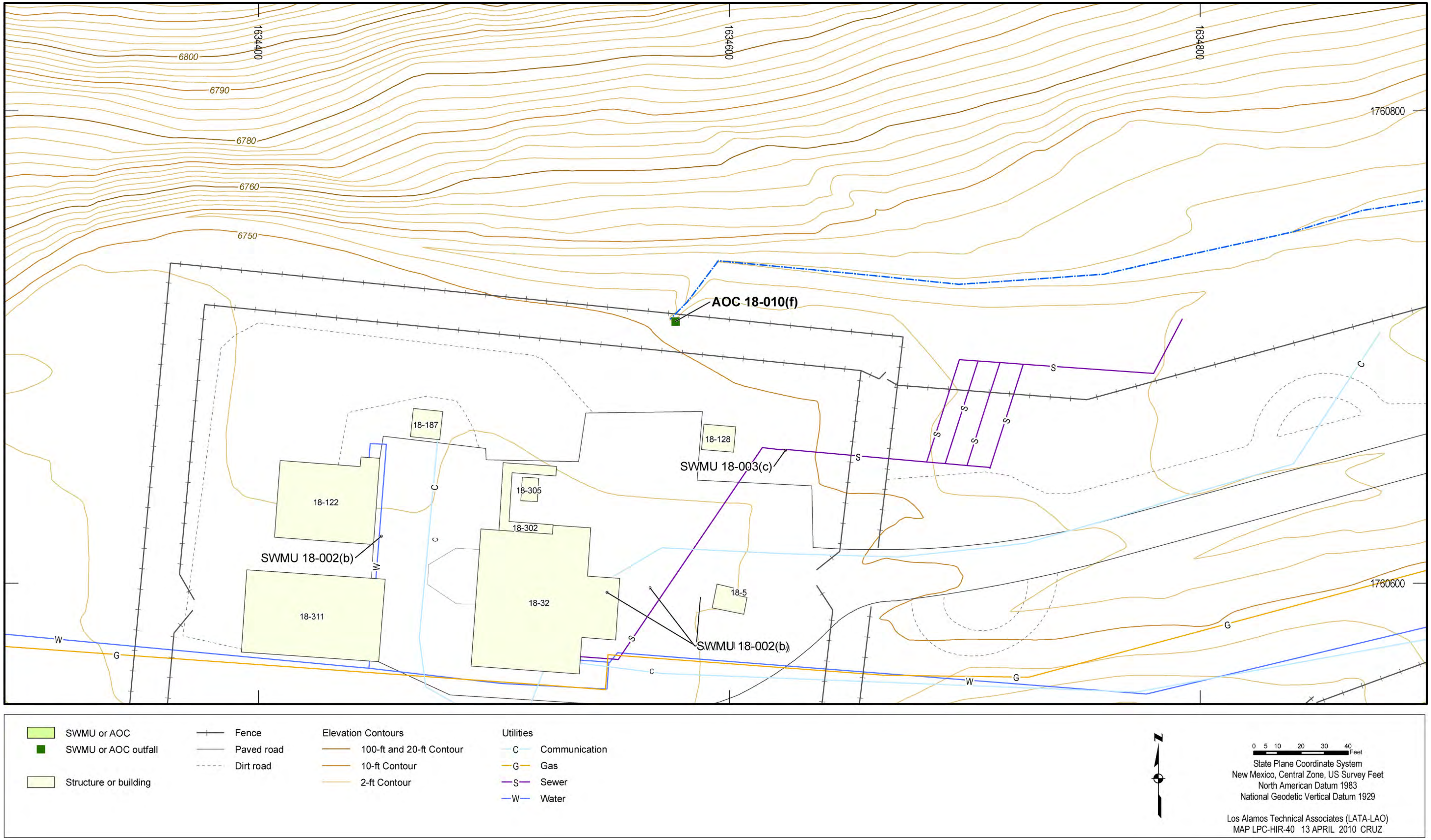

Figure 4.21-1 Site features of AOC 18-010(f)

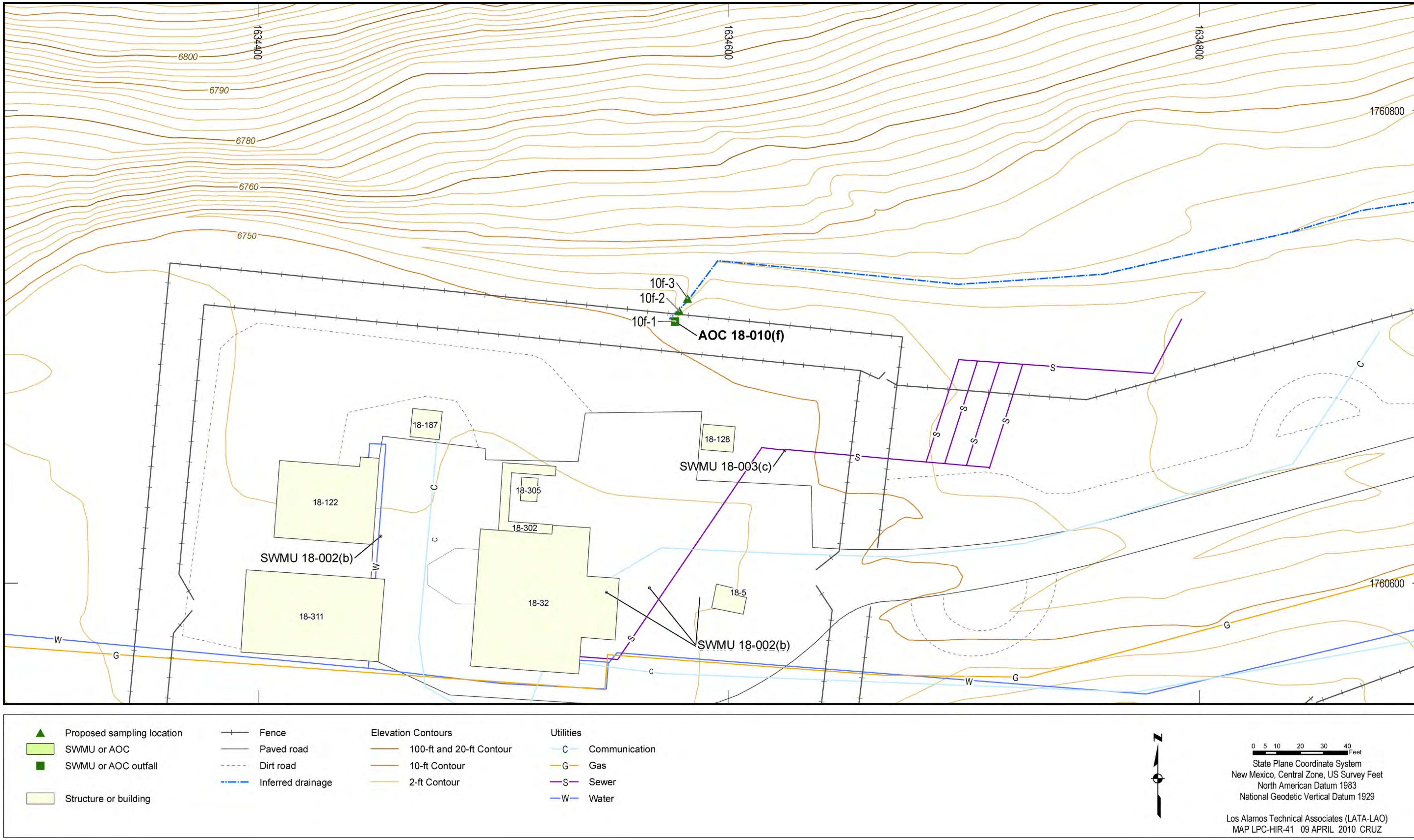

Figure 4.21-2 Proposed sampling locations for AOC 18-010(f)

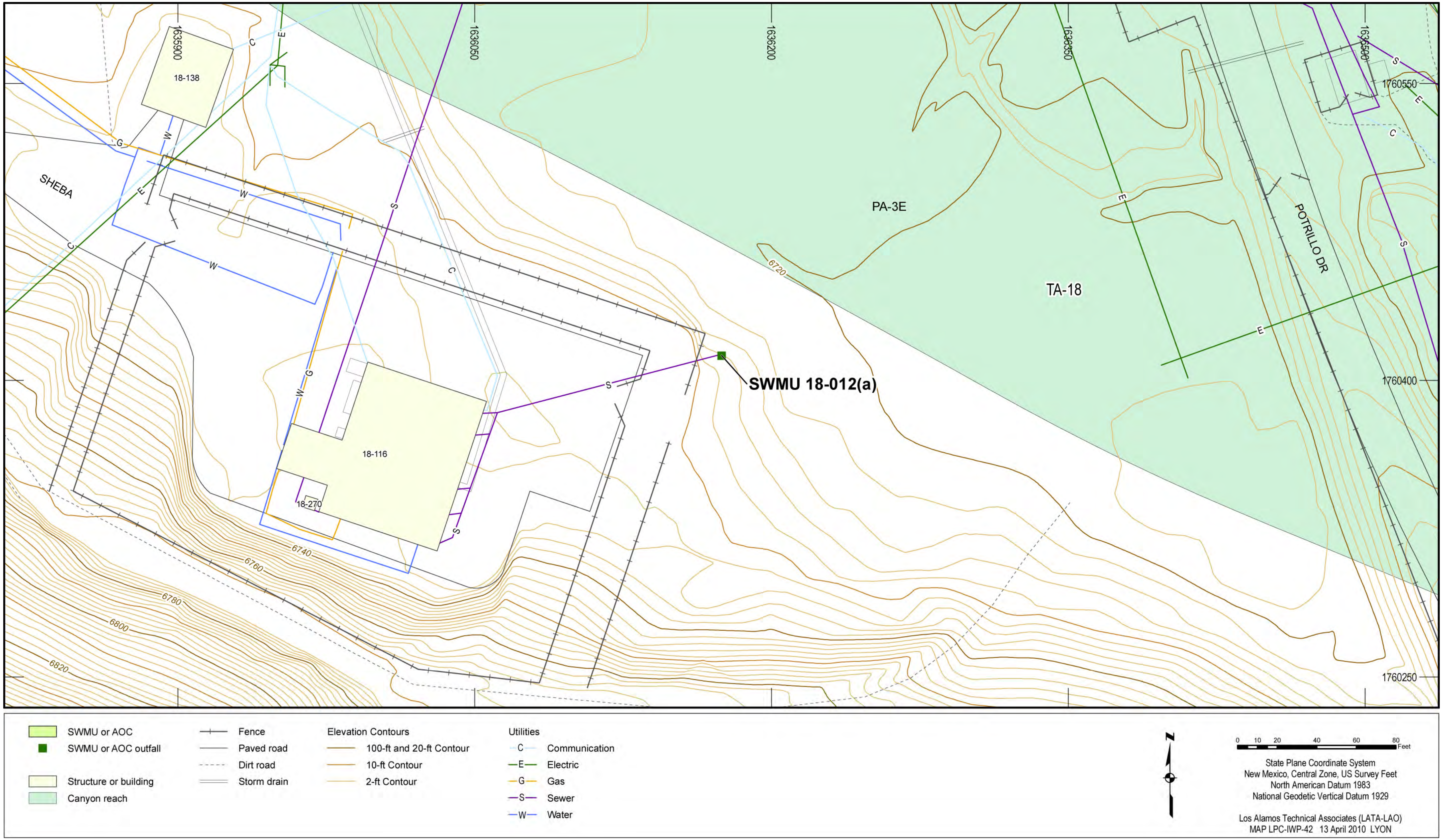

Figure 4.23-1 Site features of SWMU 18-012(a)

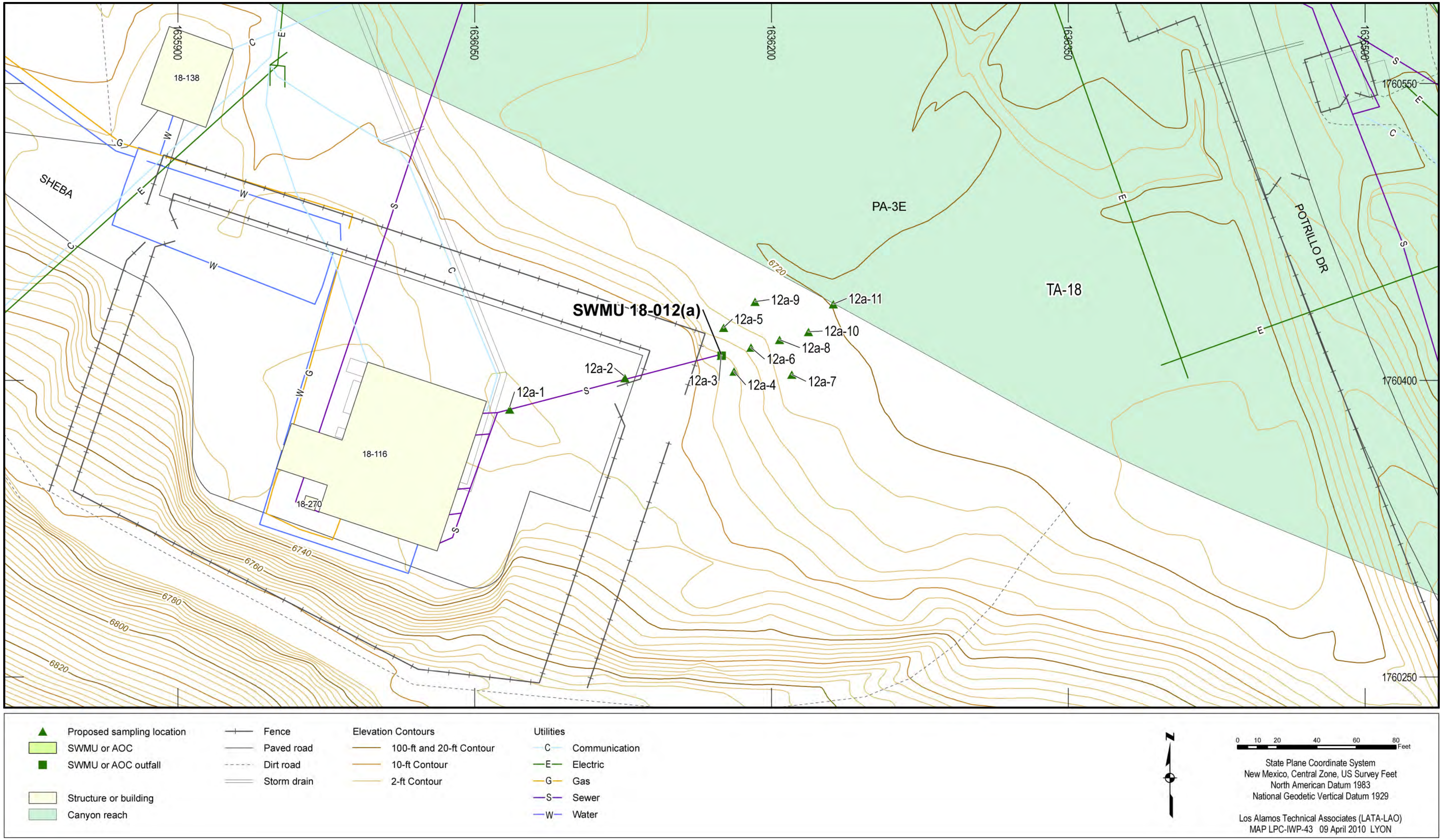

Figure 4.23-2 Proposed sampling locations for SWMU 18-012(a)

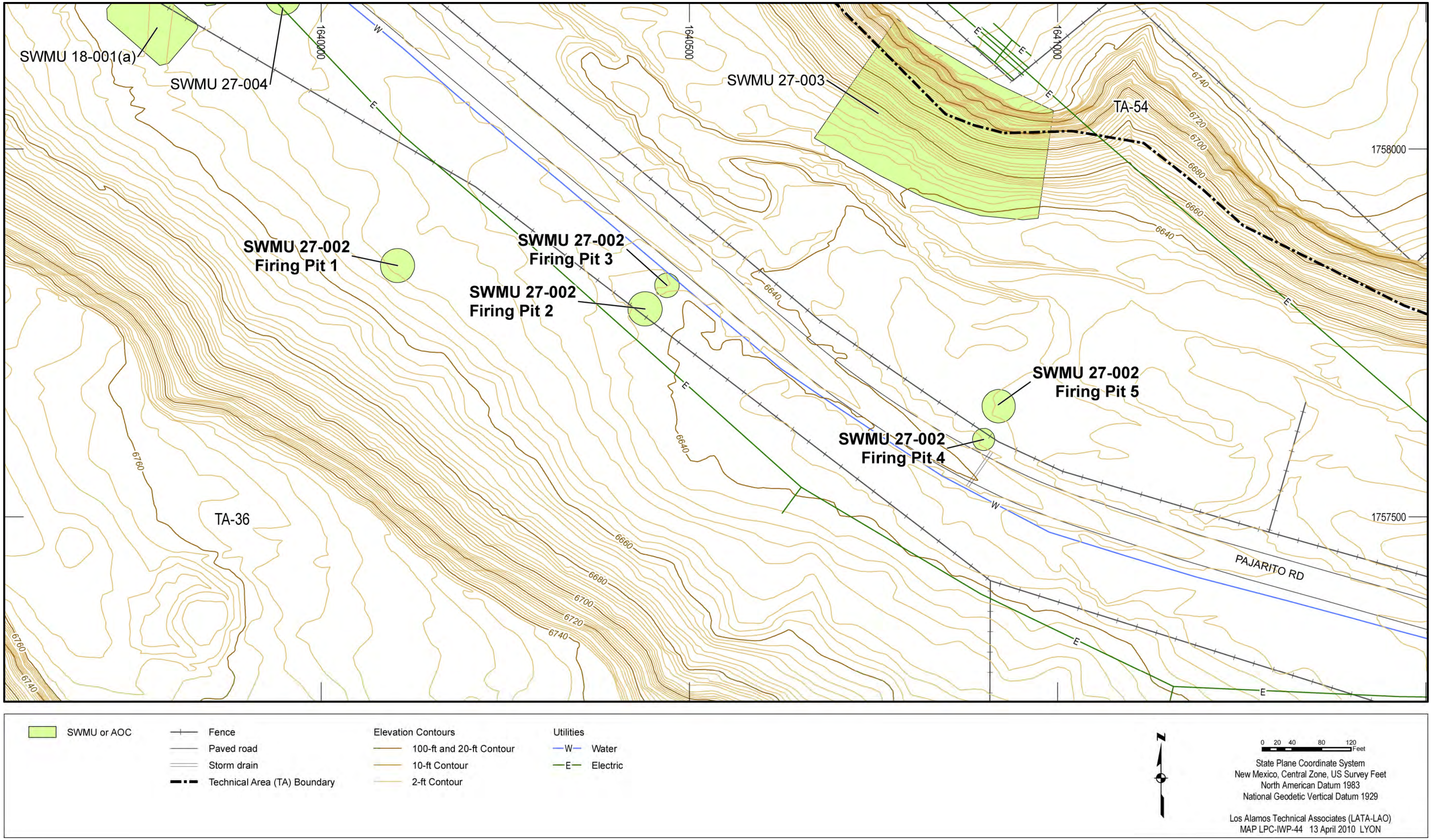

Figure 5.1-1 Site features of SWMU 27-002

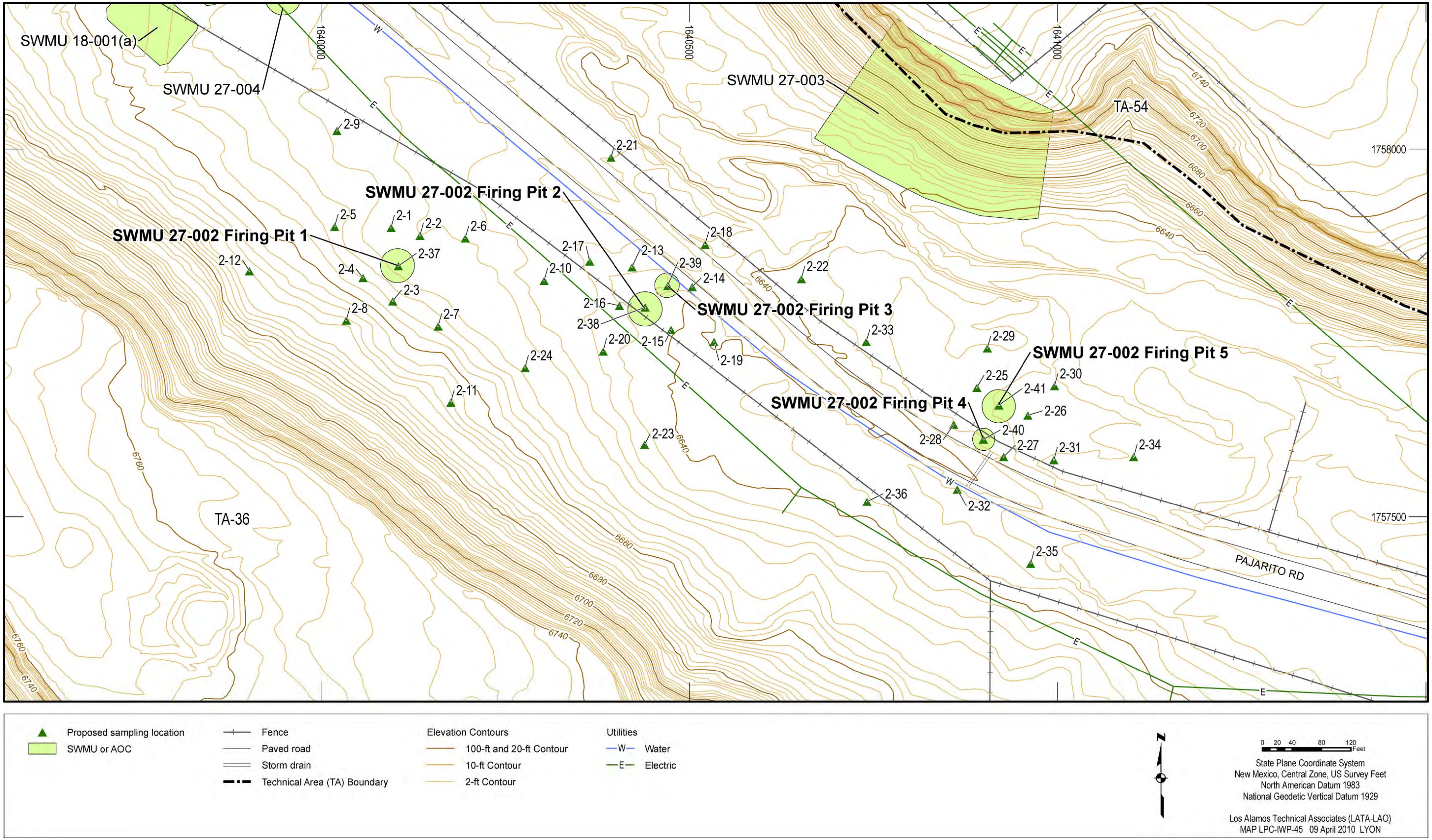

Figure 5.1-2 Proposed sampling locations for SWMU 27-002

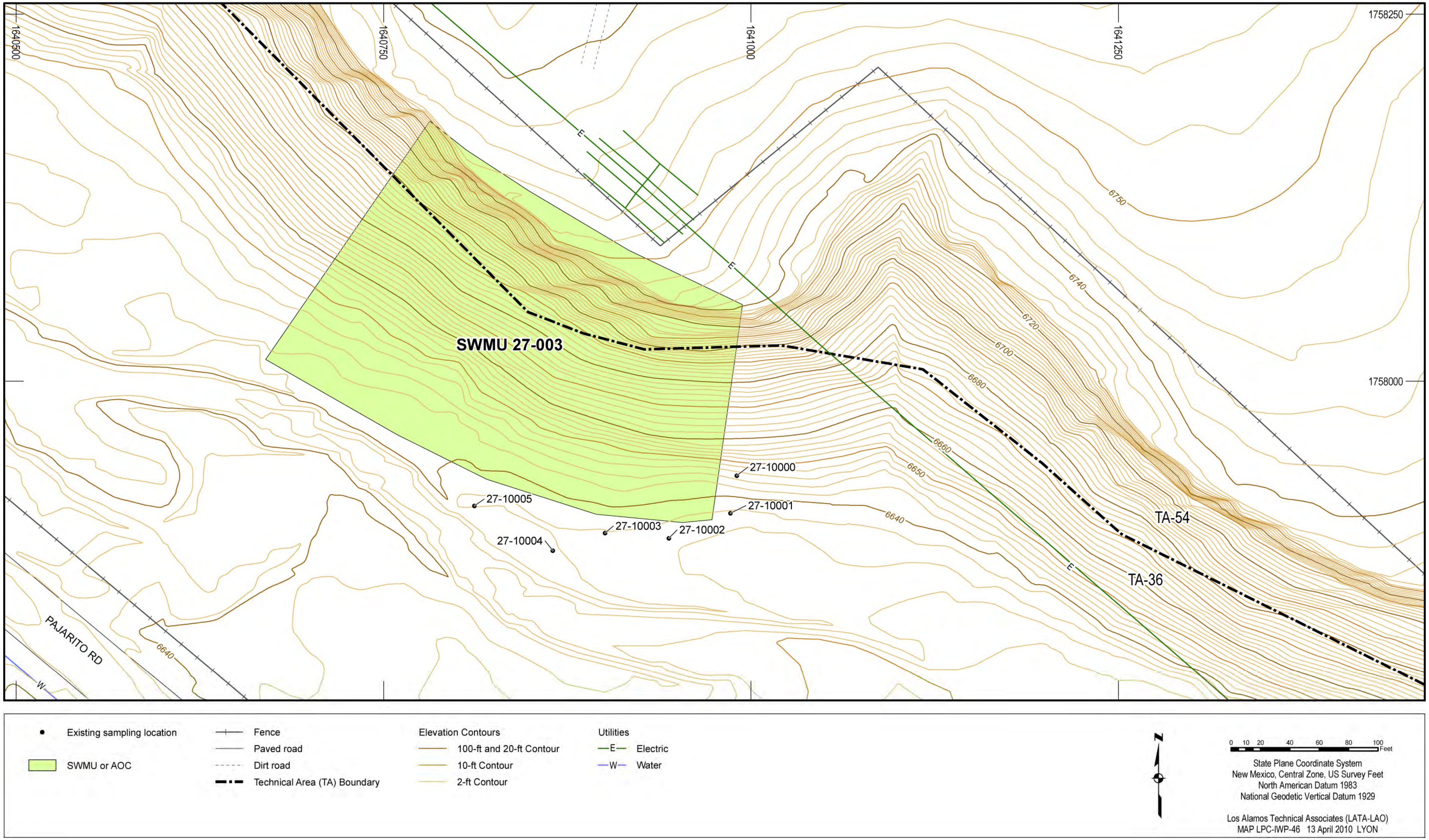

Figure 5.2-1 Site features of SWMU 27-003

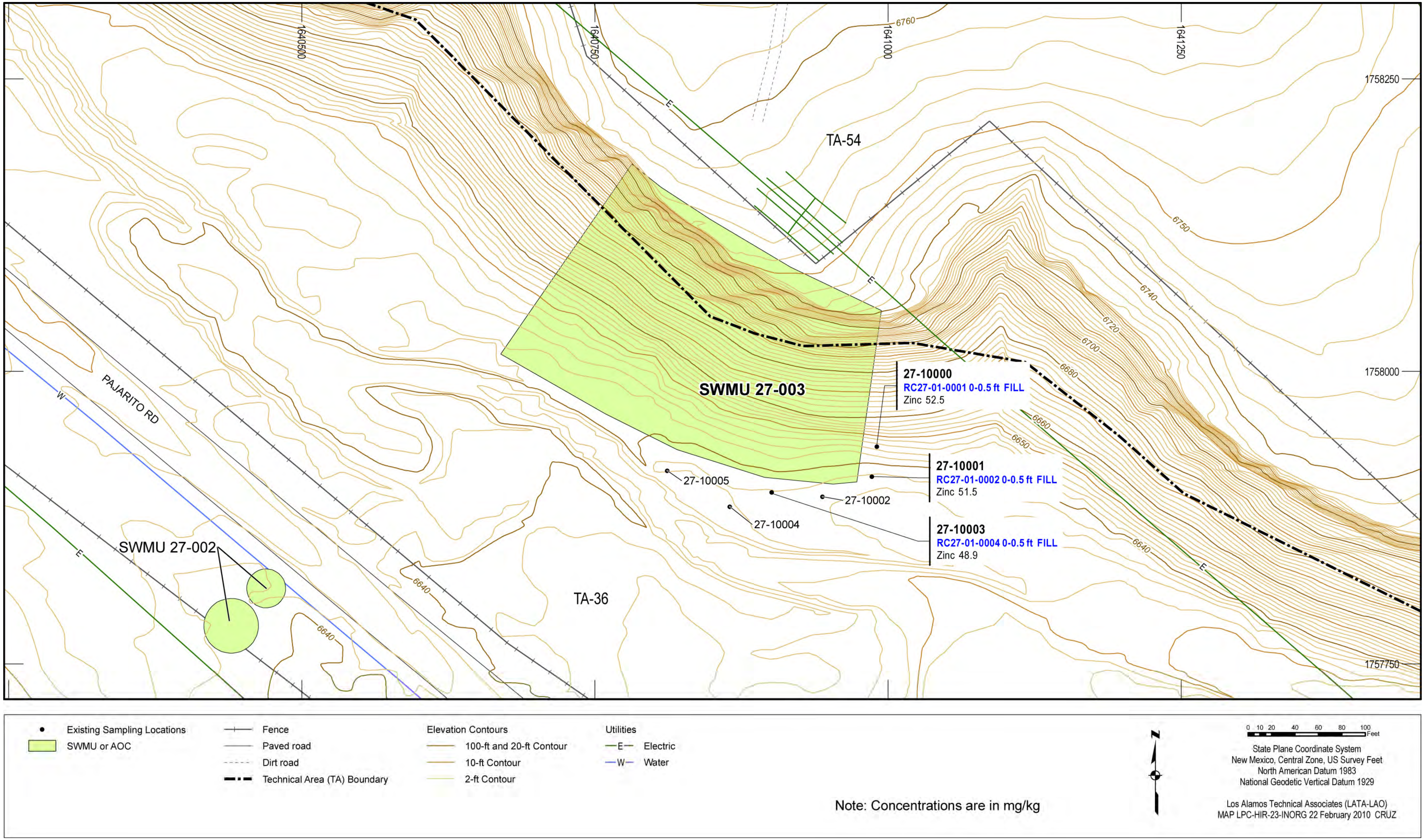

Figure 5.2-2 Inorganic chemicals detected above BVs at SWMU 27-003

Table 1.1-1
SWMUs and AOCs within the Lower Pajarito Canyon Aggregate Area

Consolidated Unit	Site ID	Brief Description	Site Status	Reference
TA-18				
18-001(a)-00	SWMU 18-001(a)	Lagoons	Investigation in progress	Work plan section 4.1.1
	SWMU 18-001(b)	Drainline	Investigation in progress	Work plan section 4.1.2
18-001(c)-00	SWMU 18-001(c)	Sump	Investigation in progress	Work plan section 4.2.1
	SWMU 18-012(b)	Outfall	Investigation in progress	Work plan section 4.2.2
	SWMU 18-002(a)	Firing site	Investigation in progress	Work plan section 4.3
	SWMU 18-002(b)	Firing site	Investigation in progress	Work plan section 4.4
	AOC 18-002(c)	Former drop tower	Investigation in progress	Work plan section 4.5
18-003(a)-00	SWMU 18-003(a)	Settling pit	Investigation in progress	Work plan section 4.6.1
	SWMU 18-003(b)	Septic system	Investigation in progress	Work plan section 4.6.2
	SWMU 18-003(c)	Septic system	Investigation in progress	Work plan section 4.7
	SWMU 18-003(d)	Septic system	Investigation in progress	Work plan section 4.8
	SWMU 18-003(e)	Septic system	Investigation in progress	Work plan section 4.9
	SWMU 18-003(f)	Septic system	Investigation in progress	Work plan section 4.10
	SWMU 18-003(g)	Septic system	Investigation in progress	Work plan section 4.11
	SWMU 18-003(h)	Septic system	Investigation in progress	Work plan section 4.12
18-004(a)-00	SWMU 18-004(a)	Waste line	Investigation in progress	Work plan section 4.13.1
	SWMU 18-004(b)	Area of potential soil contamination	Investigation in progress	Work plan section 4.13.2
	SWMU 18-005(a)	Area of potential soil contamination	Investigation in progress	Work plan section 4.14
	AOC 18-006	Former storage pipe	Investigation in progress	Work plan section 4.15
	AOC 18-008	Former underground tank	Investigation in progress	Work plan section 4.16
	AOC 18-009(a)	Transformer	NFA approved	EPA 2005, 088464
	AOC 18-009(b)	Transformer	NFA approved	EPA 2005, 088464
	AOC 18-009(c)	Transformer	NFA approved	EPA 2005, 088464
	AOC 18-009(d)	Transformer	NFA approved	EPA 2005, 088464
	AOC 18-009(e)	Transformer	NFA approved	EPA 2005, 088464
	AOC 18-010(a)	Outfall	NFA approved	EPA 2005, 088464
	AOC 18-010(b)	Outfall	Investigation in progress	Work plan section 4.17
	AOC 18-010(c)	Outfall	Investigation in progress	Work plan section 4.18
	AOC 18-010(d)	Outfall	Investigation in progress	Work plan section 4.19

Table 1.1-1 (continued)

Consolidated Unit	Site ID	Brief Description	Site Status	Reference
	AOC 18-010(e)	Outfall	Investigation in progress	Work plan section 4.20
	AOC 18-010(f)	Outfall	Investigation in progress	Work plan section 4.21
	AOC 18-011	Area of potential soil contamination	Investigation in progress	Work plan section 4.22
	SWMU 18-012(a)	Outfall	Investigation in progress	Work plan section 4.23
	AOC 18-012(c)	Sump and drainlines	Investigation in progress	Work plan section 4.24
	AOC 18-012(d)	Drainline	NFA approved	EPA 2005, 088464
	AOC 18-013	Pit and catch tank	Investigation in progress	Work plan section 4.25
	AOC C-18-001	Former photoprocessing laboratory	NFA approved	EPA 2005, 088464
	AOC C-18-003	Storage area	NFA approved	EPA 2005, 088464
TA-27				
	SWMU 27-001	Buried naval guns	Removed from Module VIII of the Laboratory's Hazardous Waste Facility Permit, 5/02/01	NMED 2001, 070010
	SWMU 27-002	Firing sites	Investigation in progress	Work plan section 5.1
	SWMU 27-003	Bazooka impact area	Investigation in progress	Work plan section 5.2
	AOC 27-004	Former control building	NFA approved	EPA 2005, 088464
TA-54				
	AOC 54-001(f)	Storage area	NFA approved	EPA 2005, 088464
	SWMU 54-007(a)	Former septic system	Certificate of completion received 5/29/2007	NMED 2007, 096477
	SWMU 54-007(b)	Septic system (inactive)	Removed from Module VIII of the Laboratory's Hazardous Waste Facility Permit, 5/02/01	NMED 2001, 070010
	AOC 54-008	Underground tank	NFA approved	EPA 2005, 088464
	AOC 54-009	Former aboveground tanks	Investigation complete; closed under RCRA. Pending final NMED approval	LANL 2003, 094315
	AOC 54-010	Underground tank	NFA approved	EPA 2005, 088464
	AOC 54-012(a)	Former drum compactor	Delayed until TA-54 closure	Work plan section 6.0
	SWMU 54-012(b)	Drum compactor	Delayed until TA-54 closure	Work plan section 6.0
54-013(b)-99	SWMU 54-013(b)	Vehicle monitoring/decon-tamination area (MDA G)	Included under MDA G investigations	LANL 2005, 090513; LANL 2007, 096110.
	SWMU 54-014(b)	Retrievable TRU waste storage pit (MDA G)	Included under MDA G investigations	LANL 2005, 090513; LANL 2007, 096110.
	SWMU 54-014(c)	Retrievable TRU waste storage shafts (MDA G)	Included under MDA G investigations	LANL 2005, 090513; LANL 2007, 096110.

Table 1.1-1 (continued)

Consolidated Unit	Site ID	Brief Description	Site Status	Reference
	SWMU 54-014(d)	Retrievable TRU waste storage trenches (MDA G)	Included under MDA G investigations	LANL 2005, 090513; LANL 2007, 096110.
	SWMU 54-015(k)	Subsurface retrievable TRU waste storage (MDA G)	Included under MDA G investigations	LANL 2005, 090513; LANL 2007, 096110.
	SWMU 54-017	Disposal pits (MDA G)	Included under MDA G investigations	LANL 2005, 090513; LANL 2007, 096110.
	SWMU 54-018	Disposal pits (MDA G)	Included under MDA G investigations	LANL 2005, 090513; LANL 2007, 096110.
	SWMU 54-019	Disposal shafts (MDA G)	Included under MDA G investigations	LANL 2005, 090513; LANL 2007, 096110.
	SWMU 54-020	Disposal shafts (MDA G)	Included under MDA G investigations	LANL 2005, 090513; LANL 2007, 096110.
	AOC 54-014(a)	Storage shafts at Area L	Investigation complete; closed under RCRA. Pending final NMED approval	LANL 2006, 098199
	AOC 54-015(a)	Mixed waste storage area	In progress; active RCRA unit to be closed under RCRA closure requirements	DOE 2009, 109234
	AOC 54-015(b)	TRU waste storage area	Delayed until TA-54 closure	Work plan section 6.0
	AOC 54-015(c)	TRU waste storage area	In progress; active RCRA unit to be closed under RCRA closure requirements	DOE 2009, 109234
	AOC 54-015(d)	TRU waste storage area	In progress; active RCRA unit to be closed under RCRA closure requirements	DOE 2009, 109234
	AOC 54-015(e)	TRU waste storage area	In progress; active RCRA unit to be closed under RCRA closure requirements	DOE 2009, 109234
	AOC 54-015(f)	TRU waste storage area	In progress; active RCRA unit to be closed under RCRA closure requirements	DOE 2009, 109234
	AOC 54-015(g)	Storage area	NFA approved	EPA 2005, 088464
	AOC 54-015(i)	Storage area	NFA approved	EPA 2005, 088464
	AOC 54-015(j)	Mixed-waste storage area	In progress; active RCRA unit to be closed under RCRA closure requirements	DOE 2009, 109234

Table 1.1-1 (continued)

Consolidated Unit	Site ID	Brief Description	Site Status	Reference
	AOC 54-016(b)	Sump	In progress; active RCRA unit to be closed under RCRA closure requirements	DOE 2009, 109234
	AOC 54-021	Aboveground oil storage tanks (6)	NFA approved	EPA 2005, 088464
	AOC 54-022	Transformer spill site	NFA approved	EPA 2005, 088464

Note: Shading denotes NFA approved.

Table 2.3-1
Industrial Soil Screening Levels and Screening Action Levels

Chemical	Residential SSL[a] (inorganic and organic chemicals) or Residential SAL[b] (radionuclides)	Industrial SSL[a] (inorganic and organic chemicals) or Industrial SAL[b] (radionuclides)	Construction Worker SSL[a] (inorganic and organic chemicals) or Construction Worker SAL[b] (radionuclides)
Inorganic Chemicals (mg/kg)			
Aluminum	78,100	1,130,000	4070
Antimony	31.3	454	124
Arsenic	3.9	17.7	65.4
Barium	15,600	224,000	4350
Beryllium	156	2260	144
Cadmium	77.9	1120	309
Calcium	na[c]	na	na
Chromium	219[d]	2920[d]	449[d]
Cobalt	23[e]	300[e]	na
Copper	3130	45,400	12,400
Iron	54,800	795,000	217,000
Lead	400	800	800
Manganese	10,700	145,000	463
Mercury	23[e]	310[e]	na
Nickel	1560	22,700	6190
Selenium	391	5680	1550
Silver	391	5680	1550
Sodium	na	na	na
Thallium	5.16	74.9	20.4
Uranium	235	3410	929
Vanadium	391	5680	1550
Zinc	23,500	341,000	9290
Organic Chemicals (mg/kg)			
Acenaphthene	3440	36,700	18,600
Acenaphthylene	1720[f]	18,300[f]	6680[f]
Acetone	67,500	851,000	263,000
4-Amino-2,6-dinitrotoluene	150[e]	1900[e]	na
2-Amino-4,6-dinitrotoluene	150[e]	2000[e]	na
Anthracene	17,200	183,000	66,800
Aroclor-1254	1.12	8.26	4.36
Aroclor-1260	2.22	8.26	75.8
Benzo(a)anthracene	6.21	23.4	213
Benzo(a)pyrene	0.621	2.34	2.13

Table 2.3-1 (continued)

Chemical	Residential SSL[a] (inorganic and organic chemicals) or Residential SAL[b] (radionuclides)	Industrial SSL[a] (inorganic and organic chemicals) or Industrial SAL[b] (radionuclides)	Construction Worker SSL[a] (inorganic and organic chemicals) or Construction Worker SAL[b] (radionuclides)
Benzo(b)fluoranthene	6.21	23.4	213
Benzo(g,h,i)perylene	1720[g]	18,300[g]	6680[g]
Benzo(k)fluoranthene	62.1	234	2060
Benzoic acid	240,000[e]	2,500,000[e]	na
Bis(2-chloroethyl)ether	2.56	13.6	147
Bis(2-ethylhexyl)phthalate	347	1370	4760
2-Butanone	3960	369,000	148,000
Butylbenzylphthalate	260[e]	9100[e]	na
Chloroform	5.72	31.9	671
4-Chloro-3-methylphenol	6100[e]	62,000[e]	na
2-Chloronaphthalene	6260	90,800	24,800
Chrysene	621	2340	20,600
Di-n-butylphthalate	6110	68,400	23,800
Di-n-octylphthalate	6100[h]	68,400[h]	23,800[h]
Dibenz(a,h)anthracene	0.621	2.34	21.3
Dibenzofuran	142[i]	1620[i]	552[i]
1,2-Dichlorobenzene	3010	14,300	9710
1,4-Dichlorobenzene	32.2	180	3780
1,2-Dichloroethane	7.74	42.8	751
Cis-1,2-Dichloroethene	782	11,400	3100
Diethylphthalate	48,900	547,000	191,000
2,4-Dinitrotoluene	15.7	103	476
2,6-Dinitrotoluene	61.2	687	239
Ethylbenzene	69.7	385	6630
Fluoranthene	2290	24,400	8910
Fluorene	2290	24,400	8910
Hexachloroethane	61.1	684	238
HMX	3060	34,200	11,900
Indeno(1,2,3-cd)pyrene	6.21	23.4	213
Methylene chloride	199	1090	10,600
2-Methylnaphthalene	310[e]	4100[e]	na
4-Methylphenol	310[e]	3100[e]	na
Naphthalene	45	252	702
Pentachlorophenol	29.8	100	1030
Phenanthrene	1830	20,500	7150

Table 2.3-1 (continued)

Chemical	Residential SSL[a] (inorganic and organic chemicals) or Residential SAL[b] (radionuclides)	Industrial SSL[a] (inorganic and organic chemicals) or Industrial SAL[b] (radionuclides)	Construction Worker SSL[a] (inorganic and organic chemicals) or Construction Worker SAL[b] (radionuclides)
Pyrene	1720	18,300	6680
RDX	44.2	174	715
Toluene	5570	57,900	21,100
1,1,2-Trichloro-1,2,2-trifluoroethane	104,000	339,000	298,000
1,2,4-Trichlorobenzene	143	525	427
Trichloroethene	45.7	253	4600
Trichlorofluoromethane	2010	6760	5820
2,4,6-Trichlorophenol	61.1	684	238
Trimethylbenzene[1,2,4-]	62[e]	260[e]	na
2,4,6-Trinitrotoluene	35.9	469	141
Xylene (total)	1090	3610	3130
Radionuclides (pCi/g)			
Americium-241	30	180	34
Cesium-137	5.6	23	18
Plutonium-238	37	240	40
Plutonium-239/240	33	210	36
Sodium-22	1.6	6.5	5.2
Uranium-234	170	1500	220
Uranium-235/236	17	87	43
Uranium-238	87	430	160

[a] Soil screening levels (SSLs) from NMED 2009, 108070, unless otherwise noted.

[b] Soil action levels (SALs) from LANL 2009, 107655.

[c] na = Not available.

[d] SSL is for hexavalent chromium.

[e] SSL is from the EPA regional screening table (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[f] SSL is for pyrene, which is a surrogate for acenaphthylene.

[g] SSL is for pyrene, which is a surrogate for benzo(g,h,i)perylene.

[h] SSL is for di-n-butylphthalate, which is a surrogate for di-n-octylphthalate.

[i] SSL from NMED 2006, 092513.

Table 4.1-1
Proposed Sampling at SWMU 18-001(a)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	1a-6, 1a-10	Beneath the former sanitary sewage lagoons.	0 to 1 ft bgs	X[a]	X	X	X	X	X	—[b]	X	X	X	X	X	X
			4 to 5 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
			11 to 12 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
			14 to 15 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
			19 to 20 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	1a-1 through 1a-5, 1a-11 through 1a-15	Beneath the former sanitary sewage lagoons.	0 to 1 ft bgs	X	X	X	X	—	X	—	X	X	X	X	X	X
			4 to 5 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
			11 to 12 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
			14 to 15 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
			19 to 20 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	1a-7	Beneath the former berm separating the former sanitary sewage lagoons	0 to 1 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X
			4 to 5 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
			11 to 12 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
			14 to 15 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
			19 to 20 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	1a-8, 1a-9	Beneath the former berm separating the former sanitary sewage lagoons. Will also serve as effluent pipe characterization	0 to 1 ft bgs	X	X	X	X	—	X	—	X	X	X	X	X	X
			4 to 5 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
			11 to 12 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
			14 to 15 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
			19 to 20 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X

Table 4.1-1 (continued)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	1a-16, 1a-23	Around the perimeter of the former sanitary sewage lagoons. Location 1a-23 will also serve as effluent pipe characterization	0 to 1 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X
			14 to 15 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
			29 to 30 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination. Sample intervals may be added to ensure a sample is collected from every geologic unit encountered. See section 4.1.1.3	1a-20	Around the perimeter of the former sanitary sewage lagoons.	0 to 1 ft bgs	X	X	X	X	—	X	—	X	X	X	X	X	X
			14 to 15 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
			29 to 30 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
			50 to 51 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
			25 ft intervals; thereafter to a depth of 180 ft bgs or contact between Cerro Toledo Interval and Otowi Member	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	1a-17 through 1a-19, 1a-21, 1a-22	Around the perimeter of the former sanitary sewage lagoons. Location 1a-22 will also serve as effluent pipe characterization	0 to 1 ft bgs	X	X	X	X	—	X	—	X	X	X	X	X	X
			14 to 15 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
			29 to 30 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	1a-24	Effluent pipe	5 to 6 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X
			10 to 11 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	1a-25 1a-26 through 1a-29	Outfall Drainage below the outfall	0 to 1 ft bgs	X	X	X	X	—	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.1-2
Proposed Sampling at SWMU 18-001(b)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	1b-1, 1b-5, 1b-12	Beneath sewer line	5 to 6 ft bgs	X[a]	X	X	X	X	X	X	X	X	X	X	X	X
			10 to 11 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	1b-2 through 1b-4, 1b-6 through 1b-11	Beneath sewer line	5 to 6 ft bgs	X	X	X	X	—[b]	X	X	X	X	X	X	X	X
			10 to 11 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.2-1
Proposed Sampling at SWMU 18-012(b)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	12b-1	Drainline exit from building 18-31	Immediately below level of drainline	X[a]	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below level of drainline	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	12b-2	Drainline exit from building 18-30	Immediately below level of drainline	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below level of drainline	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	12b-3	Beneath sewer line	Immediately below level of drainline	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below level of drainline	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	12b-4	Outfall	0 to 1 ft bgs	X	X	X	X	X	X	—[b]	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	12b-5, 12b-6, 12b-7, 12b-8	Drainage below the outfall Pajarito Canyon drainage channel	0 to 1 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.3-1
Proposed Sampling at SWMU 18-002(a)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Dioxins/furans	Explosive Compounds	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	2a-2 through 2a-5	Radial distance of 10 ft	0 to 1 ft bgs	X[a]	X	X	X	X	X	—[b]	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2a-6	Radial distance of 25 ft	0 to 1 ft bgs	X	X	X	X	X	X	X	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2a-7 through 2a-9	Radial distance of 25 ft	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2a-1	Center of firing chamber	4 to 5 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			9 to 10 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.
[b] — = Analysis will not be performed.

Table 4.4-1
Proposed Sampling at SWMU 18-002(b)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Dioxins/furans	Explosive Compounds	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	2b-2	Perimeter fence of building 18-32 area	0 to 1 ft bgs	X[a]	X	X	X	X	X	X	X	—[b]	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2b-3 through 2b-11	Perimeter fence of building 18-32 area	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2b-1	Center of firing chamber	4 to 5 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			9 to 10 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2b-13	Radial distance of 15 ft from medium firing point	0 to 1 ft bgs	X	X	X	X	X	X	X	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2b-14 through 2b-16	Radial distance of 15 ft from medium firing point	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2b-17 through 2b-20	Radial distance of 30 ft from medium firing point	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2b-12	Center of medium firing point	4 to 5 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			9 to 10 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.5-1
Proposed Sampling at AOC 18-002(c)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Dioxins/furans	Explosive Compounds	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	2c-1, 2c-2	Upgradient of former drop tower Former drop tower	0 to 1 ft bgs	X[a]	X	X	X	X	X	X	X	—[b]	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2c-3 through 2c-6	Downgradient of former drop tower	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2c-11	Downgradient of former drop tower in drainage	0 to 1 ft bgs	X	X	X	X	X	X	X	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2c-7 through 2c-10	Downgradient of former drop tower in drainage	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.6-1
Samples Collected and Analyses Requested at SWMU 18-003(a)

Sample ID	Location ID	Depth (ft)	Media	HE	Isotopic Plutonium	Isotopic Uranium	TAL Metals	SVOCs	VOCs
0218-96-0200	18-10000	0.50–0.67	Soil	—*	2163	—	2162, 2163	2161	2161
0218-96-0201	18-10001	0.50–0.67	Soil	—	2163	—	2162, 2163	2161	2161
0218-97-0082	18-10048	3.50–4.50	Fill	3679R	3681R	3681R	3680R	3678R	3678R
0218-97-0081	18-10048	9.50–11.50	Soil	3679R	3681R	3681R	3680R	3678R	3678R
0218-97-0105	18-10048	13.50–13.83	Soil	3679R	3681R	3681R	3680R	3678R	3678R
0218-97-0083	18-10049	5.50–6.00	Soil	3668R	3670R	3670R	3669R	3667R	3667R
0218-97-0080	18-10049	10.50–11.00	Soil	3668R	3670R	3670R	3669R	3667R	3667R
0218-97-0104	18-10049	13.50–14.00	Soil	3668R	3670R	3670R	3669R	3667R	3667R

Note: Numbers in the analyte columns are analytical request numbers.
*— = Analyses not requested.

Table 4.6-2
Inorganic Chemicals above BVs at SWMU 18-003(a)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Barium	Cadmium	Calcium	Chromium	Cobalt	Copper	Lead	Mercury	Nickel	Silver	Uranium	Zinc
Soil BV[a]				**0.83**	**295**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**22.3**	**0.1**	**15.4**	**1**	**1.82**	**48.8**
Construction Worker SSL[b]				**124**	**4350**	**309**	**na[c]**	**449**	**34.6d**	**12400**	**800**	**92.9[d]**	**6190**	**1550**	**929**	**92900**
Industrial SSL[b]				**454**	**224000**	**1120**	**na**	**2920**	**300[d]**	**45400**	**800**	**310[d]**	**22700**	**5680**	**3410**	**341000**
Recreational SSL[e]				**317**	**158000**	**784**	**na**	**1910**	**238**	**31700**	**560**	**238**	**15800**	**3960**	**2380**	**238000**
Residential SSL[b]				**31.3**	**15600**	**77.9**	**na**	**219**	**23[d]**	**3130**	**400**	**23[d]**	**1560**	**391**	**235**	**23500**
0218-96-0200	18-10000	0.50–0.67	Soil	6.8 (U)	1030 (J-)	11.9 (J-)	—[f]	—	—	60.3	181 (J-)	0.43	—	1.2 (U)	9.61	813
0218-96-0201	18-10001	0.50–0.67	Soil	7.1 (U)	—	4.2 (J-)	—	—	—	30.3	60.2 (J-)	0.17	—	1.3 (U)	11.3	364
0218-97-0082	18-10048	3.50–4.50	Fill	—	—	—	—	—	—	23.3	—	—	—	—	NA[g]	—
0218-97-0081	18-10048	9.50–11.50	Soil	—	—	—	8410	25.7	12	52.6	—	—	16.1	—	NA	50.1
0218-97-0105	18-10048	13.50–13.83	Soil	—	—	—	—	—	—	30.5	—	—	—	—	NA	—
0218-97-0083	18-10049	5.50–6.00	Soil	—	349	—	—	25.6	—	—	—	—	—	—	NA	—
0218-97-0080	18-10049	10.50–11.00	Soil	—	—	—	—	—	—	82.9	—	—	19.6	—	NA	57.1
0218-97-0104	18-10049	13.50–14.00	Soil	—	—	—	—	—	9.4 (J)	145	—	—	32.8	—	NA	105

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

[a] BVs are from LANL 1998, 059730.

[b] SSLs from NMED 2009, 108070, unless otherwise noted.

[c] na = Not available.

[d] EPA regional screening level (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[e] SSLs from LANL 2010, 108613.

[f] — = Not detected or not above BV.

[g] NA = Not analyzed.

Table 4.6-3
Organic Chemicals Detected at SWMU 18-003(a)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Bis(2-ethylhexyl)phthalate	Chrysene	Di-n-butylphthalate	Dibenz(a,h)anthracene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Methylnaphthalene[2-]	Naphthalene	Phenanthrene	Pyrene	Trichloroethene	Trichlorofluoromethane	Trimethylbenzene[1,2,4-]
Construction Worker SSL[a]				**263000**	**66800**	**213**	**21.3**	**213**	**6680[b]**	**2060**	**4760**	**20600**	**23800**	**21.3**	**8910**	**213**	**1240[c]**	**702**	**7150**	**6680**	**4600**	**5820**	**688[c]**
Industrial SSL[a]				**851000**	**183000**	**23.4**	**2.34**	**23.4**	**18300[b]**	**234**	**1370**	**2340**	**68400**	**2.34**	**24400**	**23.4**	**4100[c]**	**252**	**20500**	**18300**	**253**	**6760**	**260[c]**
Recreational SSL[d]				**702000**	**104000**	**30.1**	**3.01**	**30.1**	**10400[b]**	**301**	**1830**	**3010**	**39900**	**3.01**	**13900**	**30.1**	**3170**	**1950**	**12000**	**10400**	**1450**	**49800**	**6880**
Residential SSL[a]				**67500**	**17200**	**6.21**	**0.621**	**6.21**	**1720[b]**	**62.1**	**347**	**621**	**6110**	**0.621**	**2290**	**6.21**	**310[c]**	**45**	**1830**	**1720**	**45.7**	**2010**	**62[c]**
0218-96-0200	18-10000	0.50–0.67	Soil	—[e]	0.22 (J)	0.49	0.59	0.39	0.49	0.59	0.25 (J)	0.53	—	0.13 (J)	1.1	0.39	—	—	0.38 (J)	0.86	0.008	0.001 (J)	—
0218-96-0201	18-10001	0.50–0.67	Soil	—	—	0.16 (J)	0.2 (J)	0.18 (J)	—	0.15 (J)	0.07 (J)	0.17 (J)	—	—	0.4	—	—	—	0.12 (J)	0.18 (J)	0.009	—	—
0218-97-0082	18-10048	3.50–4.50	Fill	0.0099 (J+)	—	—	—	—	—	NA[f]	—	—	0.076 (J)	—	—	—	—	0.0046 (J+)	—	—	0.12 (J)	—	0.0056 (J)
0218-97-0081	18-10048	9.50–11.50	Soil	0.01 (J)	—	—	—	—	—	NA	—	—	—	—	—	—	—	—	—	—	—	—	—
0218-97-0105	18-10048	13.50–13.83	Soil	0.0049 (J)	—	—	—	—	—	NA	—	—	—	—	—	—	—	—	—	—	—	—	—
0218-97-0083	18-10049	5.50–6.00	Soil	0.01 (J)	—	—	—	—	—	NA	—	—	—	—	—	—	0.11 (J)	0.014	—	—	0.0032 (J)	—	0.003 (J)
0218-97-0080	18-10049	10.50–11.00	Soil	0.0065 (J)	—	—	—	—	—	NA	—	—	—	—	—	—	—	—	—	—	—	—	—
0218-97-0104	18-10049	13.50–14.00	Soil	0.023 (J)	—	—	—	—	—	NA	0.09 (J)	—	—	—	—	—	—	—	—	—	—	—	—

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

[a] SSLs from NMED 2009, 108070, unless otherwise noted.

[b] Pyrene used as a surrogate.

[c] EPA regional screening level (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[d] SSLs from LANL 2010, 108613.

[e] — = Not detected.

[f] NA = Not analyzed.

Table 4.6-4
Radionuclides Detected or
Detected above BVs/FVs at SWMU 18-003(a)

Sample ID	Location ID	Depth (ft)	Media	Plutonium-239/240
Soil BV[a]				**0.054**[b]
Construction Worker SAL[c]				**36**
Industrial SAL[c]				**210**
Recreational SAL[c]				**300**
Residential SAL[c]				**33**
0218-96-0200	18-10000	0.50–0.67	Soil	0.545
0218-96-0201	18-10001	0.50–0.67	Soil	0.432

Note: Results are in pCi/g.

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

[b] BV applies only to samples collected from 0–1 ft.

[c] SALs from LANL 2009, 107655.

Table 4.6-5
Proposed Sampling at SWMU 18-003(a)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Zirconium	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	3a-8	Outlet line	Immediately below the line	X[a]	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3a-2, 3a-3, 3a-5, 3a-6	Inlet line, settling pit, pit outlet	Immediately below the line or pit	X	X	X	X	X	—[b]	X	X	X	X	X	X	X	X
			5 ft below the line or pit	X	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3a-4	Pit inlet	Immediately below the pit	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the pit	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			10 ft below the pit	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3a-1, 3a-7, 3a-9	Inlet line, settling pit, outlet line	Immediately below the line or pit	X	X	X	X	X	—	X	X	X	X	X	X	X	X
			5 ft below the line or pit	X	X	X	X	X	—	X	X	X	X	X	X	X	X
			10 ft below the line or pit	X	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.6-6
Samples Collected and Analyses Requested at SWMU 18-003(b)

Sample ID	Location ID	Depth (ft)	Media	HE	Isotopic Plutonium	Isotopic Uranium	TAL Metals	SVOCs	VOCs
0218-97-0060	18-10026	5.50–5.67	Fill	3684R	3686R	3686R	3685R	3683R	3683R
0218-97-0100	18-10026	7.17–7.50	Fill	3684R	3686R	3686R	3685R	3683R	3683R
0218-97-0061	18-10027	5.50–6.00	Fill	3684R	3686R	3686R	3685R	3683R	3683R
0218-97-0103	18-10027	7.00–7.50	Soil	3684R	3686R	3686R	3685R	3683R	3683R
0218-97-0062	18-10028	3.33–3.67	Soil	3672R	3674R	3674R	3673R	3671R	3671R
0218-97-0063	18-10029	2.50–2.83	Soil	3672R	3674R	3674R	3673R	3671R	3671R

Note: Numbers in the analyte columns are analytical request numbers.

Table 4.6-7
Inorganic Chemicals above BVs at SWMU 18-003(b)

Sample ID	Location ID	Depth (ft)	Media	Cadmium	Copper	Mercury	Thallium
Soil BV[a]				**0.4**	**14.7**	**0.1**	**0.73**
Construction Worker SSL[b]				**309**	**12400**	**92.9**[c]	**20.4**
Industrial SSL[b]				**1120**	**45400**	**310**[c]	**74.9**
Recreational SSL[d]				**784**	**31700**	**238**	**52.3**
Residential SSL[b]				**77.9**	**3130**	**23**[c]	**5.16**
0218-97-0060	18-10026	5.50–5.67	Fill	1.1 (J)	—[e]	—	—
0218-97-0061	18-10027	5.50–6.00	Fill	1.7	—	—	0.8 (J)
0218-97-0103	18-10027	7.00–7.50	Soil	1.2	16.4	—	—
0218-97-0062	18-10028	3.33–3.67	Soil	1.5	—	—	—
0218-97-0063	18-10029	2.50–2.83	Soil	—	21.5	2.4	—

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

[a] BVs are from LANL 1998, 059730.

[b] SSLs from NMED 2009, 108070, unless otherwise noted.

[c] EPA regional screening level (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[d] SSLs from LANL 2010, 108613.

[e] — = Not detected or not above BV.

Table 4.6-8
Organic Chemicals Detected at SWMU 18-003(b)

Sample ID	Location ID	Depth (ft)	Media	Benzoic Acid	Bis(2-ethylhexyl)phthalate	Di-n-butylphthalate	Toluene
Construction Worker SSL[a]				**952000**	**4760**	**23800**	**21100**
Industrial SSL[a]				**2500000**	**1370**	**68400**	**57900**
Recreational SSL[b]				**1590000**	**1830**	**39900**	**60800**
Residential SSL[a]				**245000**	**347**	**6110**	**5570**
0218-97-0060	18-10026	5.50–5.67	Fill	—[c]	—	0.092 (J)	—
0218-97-0062	18-10028	3.33–3.67	Soil	0.23 (J)	0.039 (J)	0.065 (J)	—
0218-97-0063	18-10029	2.50–2.83	Soil	—	0.079 (J)	0.1 (J)	0.0032 (J)

Notes: Results are in mg/kg. Data qualifiers are defined in Appendix A.
[a] SSLs from NMED 2009, 108070, unless otherwise noted.
[b] SSLs from LANL 2010, 108613.
[c] — = Not detected.

Table 4.6-9
Radionuclides Detected or Detected above BVs/FVs at SWMU 18-003(b)

Sample ID	Location ID	Depth (ft)	Media	Uranium-234	Uranium-235	Uranium-238
Soil BV[a]				**2.59**	**0.2**	**2.29**
Construction Worker SAL[b]				**220**	**43**	**160**
Industrial SAL[b]				**1500**	**87**	**430**
Recreational SAL[b]				**3200**	**520**	**2100**
Residential SAL[b]				**170**	**17**	**87**
0218-97-0060	18-10026	5.50–5.67	Fill	4.32	0.225	4.21
0218-97-0061	18-10027	5.50–6.00	Fill	3.32	—[c]	2.53
0218-97-0103	18-10027	7.00–7.50	Soil	3.08	—	2.59
0218-97-0062	18-10028	3.33–3.67	Soil	7.1	0.286	5.28
0218-97-0063	18-10029	2.50–2.83	Soil	21.1	0.836	—

Note: Results are in pCi/g.
[a] BVs/FVs are from LANL 1998, 059730.
[b] SALs from LANL 2009, 107655.
[c] — = Not detected or not above BV.

Table 4.6-10
Proposed Sampling at SWMU 18-003(b)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Zirconium	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	3b-1, 3b-10, 3b-23, 3b-26	Inlet line, outlet line, drain field	Immediately below the line or drain field	X[a]	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3b-3, 3b-5, 3b-6, 3b-7, 3b-15 through 3b-20, 3b-22, 3b-25	Inlet line, tank inlet, septic tank, drain field	Immediately below the line, tank, or drain field	X	X	X	X	X	—[b]	X	X	X	X	X	X	X	X
			5 ft below the line, tank, or drain field	X	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3b-8, 3b-12,	Tank outlet, drain field	Immediately below the tank or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the tank or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			10 ft below the tank or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3b-2, 3b-4, 3b-9, 3b-11, 3b-13, 3b-14, 3b-21, 3b-24	Inlet line, septic tank, outlet line, drain field	Immediately below the line, tank, or drain field	X	X	X	X	X	—	X	X	X	X	X	X	X	X
			5 ft below the line, tank, or drain field	X	X	X	X	X	—	X	X	X	X	X	X	X	X
			10 ft below the line, tank, or drain field	X	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.7-1
Samples Collected and Analyses Requested at SWMU 18-003(c)

Sample ID	Location ID	Depth (ft)	Media	HE	Isotopic Plutonium	Isotopic Uranium	TAL Metals	PCBs	SVOCs	VOCs
0218-97-0070	18-10030	7.00–8.42	Soil	3659R	3661R	3661R	3660R	3658R	3658R	3658R
0218-97-0102	18-10030	9.42–10.00	Soil	3659R	3661R	3661R	3660R	3658R	3658R	3658R
0218-97-0071	18-10031	7.00–7.50	Soil	3659R	3661R	3661R	3660R	3658R	3658R	3658R
0218-97-0101	18-10031	10.00–10.50	Soil	3659R	3661R	3661R	3660R	3658R	3658R	3658R
0218-97-0072	18-10032	2.83–3.33	Fill	3659R	3661R	3661R	3660R	3658R	3658R	3658R
0218-97-0073	18-10033	2.42–2.92	Soil	3659R	3661R	3661R	3660R	3658R	3658R	3658R

Note: Numbers in the analyte columns are analytical request numbers.

Table 4.7-2
Inorganic Chemicals above BVs at SWMU 18-003(c)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Cadmium	Copper	Lead	Mercury	Zinc
Soil BV[a]				**0.83**	**0.4**	**14.7**	**22.3**	**0.1**	**48.8**
Construction Worker SSL[b]				**124**	**309**	**12400**	**800**	**92.9**[c]	**92900**
Industrial SSL[b]				**454**	**1120**	**45400**	**800**	**310**[c]	**341000**
Recreational SSL[d]				**317**	**784**	**31700**	**560**	**238**	**238000**
Residential SSL[b]				**31.3**	**77.9**	**3130**	**400**	**23c**	**23500**
0218-97-0102	18-10030	9.42–10.00	Soil	0.87 (U)	—[e]	—	—	—	—
0218-97-0101	18-10031	10.00–10.50	Soil	0.87 (U)	—	—	—	—	—
0218-97-0072	18-10032	2.83–3.33	Fill	—	0.51 (J)	16.5	27.7	0.49	211
0218-97-0073	18-10033	2.42–2.92	Soil	—	0.67 (J)	—	—	0.24	73.7

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

[a] BVs are from LANL 1998, 059730.

[b] SSLs from NMED 2009, 108070, unless otherwise noted.

[c] EPA regional screening level (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[d] SSLs from LANL 2010, 108613.

[e] — = Not detected or not above BV.

Table 4.7-3
Organic Chemicals Detected at SWMU 18-003(c)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Di-n-butylphthalate	Fluoranthene	Phenanthrene	Pyrene
Construction Worker SSL[a]				**4.36**	**213**	**4760**	**23800**	**8910**	**7150**	**6680**
Industrial SSL[a]				**8.26**	**23.4**	**1370**	**68400**	**24400**	**20500**	**18300**
Recreational SSL[b]				**6.65**	**30.1**	**1830**	**39900**	**13900**	**12000**	**10400**
Residential SSL[a]				**1.12**	**6.21**	**347**	**6110**	**2290**	**1830**	**1720**
0218-97-0102	18-10030	9.42–10.00	Soil	—[c]	0.055 (J)	—	—	0.11 (J)	0.061 (J)	0.12 (J)
0218-97-0101	18-10031	10.00–10.50	Soil	—	—	0.046 (J)	—	—	—	—
0218-97-0072	18-10032	2.83–3.33	Fill	27	—	—	0.52 (J)	—	—	—
0218-97-0073	18-10033	2.42–2.92	Soil	3.9	—	—	—	—	—	—

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

[a] SSLs from NMED 2009, 108070, unless otherwise noted.

[b] SSLs from LANL 2010, 108613.

[c] — = Not detected.

Table 4.7-4
Radionuclides Detected or Detected above BVs/FVs at SWMU 18-003(c)

Sample ID	Location ID	Depth (ft)	Media	Plutonium-238	Plutonium-239/240	Uranium-234	Uranium-235
Soil BV[a]				**0.023[b]**	**0.054[b]**	**2.59**	**0.2**
Construction Worker SAL[c]				**40**	**36**	**220**	**43**
Industrial SAL[c]				**240**	**210**	**1500**	**87**
Recreational SAL[c]				**330**	**300**	**3200**	**520**
Residential SAL[c]				**37**	**33**	**170**	**17**
0218-97-0072	18-10032	2.83–3.33	Fill	0.067	3	43.5	1.152
0218-97-0073	18-10033	2.42–2.92	Soil	—[d]	0.327	5.71	0.217

Note: Results are in pCi/g.

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

[b] BV applies only to samples collected from 0–1 ft.

[c] SALs from LANL 2009, 107655.

[d] — = Not detected or not above BV.

Table 4.7-5
Proposed Sampling at SWMU 18-003(c)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Zirconium	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	3c-36	Drainline exit from building 18-32	Immediately below the line	X[a]	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3c-6, 3c-23, 3c-24, 3c-31	Tank inlet, drain field	Immediately below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3c-2, 3c-4, 3c-34, 3c-35, 3c-8, 3c-10, 3c-12, 3c-14 through 3c-16, 3c-21, 3c-22, 3c-25, 3c-26, 3c-28 through 3c-30	Inlet line, septic tank, outlet line, drain field	Immediately below the line, tank, or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line, tank, or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3c-1, 3c-27	Inlet line, drain field	Immediately below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			10 ft below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4.7-5 (continued)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Zirconium	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	3c-3, 3c-5, 3c-7, 3c-9, 3c-11, 3c-13, 3c-17 through 3c-20	Inlet line, septic tank, tank outlet, outlet line, drain field	Immediately below the line, tank, or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line, tank, or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			10 ft below the line, tank, or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3c-32	Outfall	0 to 1 ft bgs	X	X	X	X	X	X	X	—[b]	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3c-33	Drainage below outfall	0 to 1 ft bgs	X	X	X	X	X	X	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.8-1
Samples Collected and Analyses Requested at SWMU 18-003(d)

Sample ID	Location ID	Depth (ft)	Media	TAL Metals	SVOCs	VOCs
0218-96-0500	18-10010	2.00–4.00	Soil	2756	2756	2756
0218-96-0501	18-10010	6.00–8.00	Soil	2756	2756	2756
0218-96-0504	18-10011	2.00–4.00	Soil	2772	2772	2772
0218-96-0505	18-10011	8.00–9.80	Soil	2772	2772	2772
0218-96-0506	18-10011	37.50–38.50	Soil	—*	—	2772
0218-96-0508	18-10012	2.00–4.00	Soil	2765	2765	2765
0218-96-0509	18-10012	6.00–8.00	Soil	2765	2765	2765
0218-96-0510	18-10012	42.00–42.50	QBT2	—	—	2765
0218-96-0512	18-10013	2.00–4.00	Soil	2769	2769	2769
0218-96-0513	18-10013	8.00–9.00	Soil	2769	2769	2769
0218-96-0514	18-10013	38.00–38.50	QAL	—	—	2769
0218-96-0516	18-10014	2.00–4.00	Soil	2755	2755	2755
0218-96-0517	18-10014	6.00–8.00	Soil	2755	2755	2755
0218-96-0518	18-10014	30.00–30.50	QBT2	—	—	2755

Note: Numbers in the analyte columns are analytical request numbers.
*— = Analyses not requested.

Table 4.8-2
Inorganic Chemicals above BVs at SWMU 18-003(d)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Cadmium	Manganese	Mercury	Silver	Thallium	Zinc
Soil BV[a]				**0.83**	**0.4**	**671**	**0.1**	**1**	**0.73**	**48.8**
Construction Worker SSL[b]				**124**	**309**	**463**	**92.9[c]**	**1550**	**20.4**	**92900**
Industrial SSL[b]				**454**	**1120**	**145000**	**310[c]**	**5680**	**74.9**	**341000**
Recreational SSL[d]				**317**	**784**	**110000**	**238**	**3960**	**52.3**	**238000**
Residential SSL[b]				**31.3**	**77.9**	**10700**	**23[c]**	**391**	**5.16**	**23500**
0218-96-0500	18-10010	2.00–4.00	Soil	11 (U)	0.57 (U)	—[e]	0.11 (U)	2.3 (U)	—	—
0218-96-0501	18-10010	6.00–8.00	Soil	11 (U)	0.56 (U)	—	0.11 (U)	2.2 (U)	—	—
0218-96-0504	18-10011	2.00–4.00	Soil	1 (UJ)	—	—	—	—	0.77 (U)	—
0218-96-0505	18-10011	8.00–9.80	Soil	0.94 (UJ)	—	788 (J-)	—	—	3	—
0218-96-0508	18-10012	2.00–4.00	Soil	11 (U)	0.53 (U)	—	0.11 (U)	2.1 (U)	—	—
0218-96-0509	18-10012	6.00–8.00	Soil	11 (U)	0.53 (U)	—	0.11 (U)	2.1 (U)	—	—
0218-96-0512	18-10013	2.00–4.00	Soil	11 (UJ)	0.57 (U)	—	0.11 (U)	2.3 (U)	—	54
0218-96-0513	18-10013	8.00–9.00	Soil	11 (UJ)	0.56 (U)	—	0.11 (U)	2.2 (U)	—	—
0218-96-0516	18-10014	2.00–4.00	Soil	0.96 (U)	—	—	—	—	—	—
0218-96-0517	18-10014	6.00–8.00	Soil	0.94 (U)	—	—	—	—	0.84 (J)	—

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

[a] BVs are from LANL 1998, 059730.

[b] SSLs from NMED 2009, 108070, unless otherwise noted.

[c] EPA regional screening level (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm).

[d] SSLs from LANL 2010, 108613.

[e] — = Not detected or not above BV.

Table 4.8-3
Organic Chemicals Detected at SWMU 18-003(d)

Sample ID	Location ID	Depth (ft)	Media	Methylene Chloride
Construction Worker SSL[a]				**10600**
Industrial SSL[a]				**1090**
Recreational SSL[b]				**4520**
Residential SSL[a]				**199**
0218-96-0516	18-10014	2.00–4.00	Soil	0.0023 (J)

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

[a] SSLs from NMED 2009, 108070.

[b] SSLs from LANL 2010, 108613.

Table 4.8-4
Proposed Sampling at SWMU 18-003(d)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Zirconium	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	3d-26, 3d-28, 3d-31	Drain field	Immediately below the drain field	X[a]	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3d-32	Drainline exit from building 18-116	Immediately below the drainline	X	X	X	X	X	—[b]	X	X	X	X	X	X	X	X
			5 ft below the drainline	X	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3d-2, 3d-4, 3d-6, 3d-8, 3d-10, 3d-12, 3d-33, 3d-34 3d-14, 3d-16, 3d-15, 3d-17, 3d-21 through 3d-25, 3d-29, 3d-30	Inlet line, septic tank, tank outlet, outlet line, drain field	Immediately below the line, tank, or drain field	X	X	X	X	X	—	X	X	X	X	X	X	X	X
			5 ft below the line, tank, or drain field	X	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3d-1, 3d-13, 3d-20	Inlet line, tank inlet, drain field	Immediately below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			10 ft below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4.8-4 (continued)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Zirconium	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	3d-3, 3d-5, 3d-7, 3d-9, 3d-11, 3d-18, 3d-19, 3d-27	Inlet line, outlet line, drain field	Immediately below the line or drain field	X	X	X	X	X	—	X	X	X	X	X	X	X	X
			5 ft below the line or drain field	X	X	X	X	X	—	X	X	X	X	X	X	X	X
			10 ft below the line or drain field	X	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.9-1
Proposed Sampling at SWMU 18-003(e)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	3e-7, 3e-20, 3e-24	Drain field, former outfall	Immediately below the drain field or outfall	X[a]	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the drain field or outfall	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination. Sample intervals may be added to ensure a sample is collected from every geologic unit encountered. See section 4.9.3	3e-23	Drain field	Immediately below the line, tank, or drain field	X	X	X	X	—[b]	X	X	X	X	X	X	X	X
			5 ft below the line, tank, or drain field	X	X	X	X	—	X	X	X	X	X	X	X	X
			25 to 26 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
			25-ft intervals thereafter to a depth of 180 ft bgs or contact between the Cerro Toledo Interval and Otowi Member	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3e-2, 3e-5, 3e-9, 3e-11 through 3e-16, 3e-18, 3e-21,	Septic tank, outlet line, drain field	Immediately below the line, tank, or drain field	X	X	X	X	—	X	X	X	X	X	X	X	X
			5 ft below the line, tank, or drain field	X	X	X	X	—	X	X	X	X	X	X	X	X

Table 4.9-1 (continued)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	3e-1, 3e-17	Septic tank, drain field	Immediately below the tank or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the tank or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X
			10 ft below the tank or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3e-3, 3e-4, 3e-6, 3e-8, 3e-10, 3e-19, 3e-22	Septic tank, outlet line, drain field	Immediately below the line, tank, or drain field	X	X	X	X	—	X	X	X	X	X	X	X	X
			5 ft below the line, tank, or drain field	X	X	X	X	—	X	X	X	X	X	X	X	X
			10 ft below the line, tank, or drain field	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3e-27 3e-35 3e-38	Drainline exit from buildings: 18-190 18-37 18-189	Immediately below the line	X	X	X	X	—	X	X	X	X	X	X	X	X
			5 ft below the line	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3e-26, 3e-28 through 3e-33, 3e-37, 3e-39, 3e-41, 3e-42, 3e-43	Inlet lines	Immediately below the line	X	X	X	X	—	X	X	X	X	X	X	X	X
			5 ft below the line	X	X	X	X	—	X	X	X	X	X	X	X	X

Table 4.9-1 (continued)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination		Drainline exit from buildings:	Immediately below the line	X	X	X	X	X	X	X	X	X	X	X	X	X
	3e-25 3e-40 3e-34 and 3e-36	18-129 18-31 Inlet lines	5 ft below the line	X	X	X	X	X	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.10-1
Proposed Sampling at SWMU 18-003(f)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	3f-6, 3f-8, 3f-30	Septic tank, outlet line, drainage below outfall	Immediately below the line, tank, or drain field	X[a]	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line, tank, or drainage	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3f-2, 3f-4, 3f-10, 3f-12, 3f-14, 3f-16, 3f-17, 3f-21, 3f-23, 3f-24 3f-25 through 3f-29	Inlet line, septic tank, drain field Former outfall Drainage below outfall	Immediately below the line, tank, drain field, outfall, or drainage	X	X	X	X	—[b]	X	X	X	X	X	X	X	X
			5 ft below the line, tank, drain field, outfall, or drainage	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3f-1, 3f-9, 3f-18	Inlet line, drain field	Immediately below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X
			10 ft below the line or drain field	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3f-3, 3f-5, 3f-7, 3f-11, 3f-13, 3f-15, 3f-19, 3f-20, 3f-22	Tank inlet, tank outlet, outlet line, drain field	Immediately below the line, tank, or drain field	X	X	X	X	—	X	X	X	X	X	X	X	X
			5 ft below the line, tank, or drain field	X	X	X	X	—	X	X	X	X	X	X	X	X
			10 ft below the line, tank, or drain field	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.11-1
Proposed Sampling at SWMU 18-003(g)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	3g-3, 3g-16	Septic tank, outlet line	Immediately below the line or tank	X[a]	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line or tank	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3g-2, 3g-6 through 3g-8, 3g-10, 3g-12, 3g-14, 3g-16, 3g-17	Tank inlet, outlet line	Immediately below the line or tank	X	X	X	X	—[b]	X	X	X	X	X	X	X	X
			5 ft below the line or tank	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3g-1, 3g-9	Inlet line, outlet line	Immediately below the line	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line	X	X	X	X	X	X	X	X	X	X	X	X	X
			10 ft below the line	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3g-4, 3g-5, 3g-11, 3g-13, 3g-15	Tank outlet septic tank, outlet line	Immediately below the line or tank	X	X	X	X	—	X	X	X	X	X	X	X	X
			5 ft below the line or tank	X	X	X	X	—	X	X	X	X	X	X	X	X
			10 ft below the line or tank	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.12-1
Proposed Sampling at SWMU 18-003(h)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	3h-5	Tank outlet	Immediately below the tank	X*	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the tank	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3h-2, 3h-4, 3h-6	Inlet line, septic tank	Immediately below the line or tank	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line or tank	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3h-1	Inlet line	Immediately below the line	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line	X	X	X	X	X	X	X	X	X	X	X	X	X
			10 ft below the line	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	3h-3	Tank inlet	Immediately below the tank	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the tank	X	X	X	X	X	X	X	X	X	X	X	X	X
			10 ft below the tank	X	X	X	X	X	X	X	X	X	X	X	X	X

*X = Analysis will be performed.

Table 4.13-1
Proposed Sampling at SWMU 18-004(a)

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	4a-1, 4a-2	Below waste line	Immediately below the line	X*	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below the line	X	X	X	X	X	X	X	X	X	X	X	X	X

*X = Analysis will be performed.

Table 4.13-2
Proposed Sampling at SWMU 18-004(b)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	4b-1 through 4b-3	Below former pit and tanks	8 to 9 ft bgs	X*	X	X	X	X	X	X	X	X	X	X	X	X
			13 to 14 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X

*X = Analysis will be performed.

Table 4.14-1
Proposed Sampling at SWMU 18-005(a)

Objective Addressed	Location Number	Location	Sample Interval[a]	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Explosive Compounds	SVOCs	VOCs	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	5a-1, 5a-2	Beneath former structure 18-15	0 to 1 ft	X[b]	X	X	X	X	X	—[c]	X	X	X	X
			4 to 5 ft	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	5a-3 through 5a-6	Perimeter of former structure 18-15	0 to 1 ft	X	X	X	X	X	X	—	X	X	X	X
			4 to 5 ft	X	X	X	X	X	X	X	X	X	X	X

[a] Samples will be collected from native soil and tuff from 0−1 ft and 4−5 ft as determined in the field.

[b] X = Analysis will be performed.

[c] — = Analysis will not be performed.

Table 4.15-1
Samples Collected and Analyses Requested at AOC 18-006

Sample ID	Location ID	Depth (ft)	Media	H3	Isotopic Uranium	TAL Metals	SVOCs	VOCs
0218-97-0090	18-10036	5.83–6.33	Soil	3573R	3573R	3572R	3571R	3571R
0218-97-0091	18-10037	3.17–3.67	Soil	3573R	3573R	3572R	3571R	3571R
0218-97-0092	18-10038	4.00–4.50	Soil	3573R	3573R	3572R	3571R	3571R

Note: Numbers in the analyte columns are analytical request numbers.

Table 4.15-2
Inorganic Chemicals above BVs at AOC 18-006

Sample ID	Location ID	Depth (ft)	Media	Thallium	Zinc
Soil BV[a]				**0.73**	**48.8**
Construction Worker SSL[b]				**20.4**	**92900**
Industrial SSL[b]				**74.9**	**341000**
Recreational SSL[c]				**52.3**	**238000**
Residential SSL[b]				**5.16**	**23500**
0218-97-0090	18-10036	5.83–6.33	Soil	1.8 (U)	—[d]
0218-97-0091	18-10037	3.17–3.67	Soil	—	51.4
0218-97-0092	18-10038	4.00–4.50	Soil	0.85 (U)	—

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

[a] BVs are from LANL 1998, 059730.

[b] SSLs from NMED 2009, 108070.

[c] SSLs from LANL 2010, 108613.

[d] — = Not detected or not above BV.

Table 4.15-3
Organic Chemicals Detected at AOC 18-006

Sample ID	Location ID	Depth (ft)	Media	Acetone	Methylene Chloride	Toluene	Trichlorofluoromethane
Construction Worker SSL[a]				**263000**	**10600**	**21100**	**5820**
Industrial SSL[a]				**851000**	**1090**	**57900**	**6760**
Recreational SSL[b]				**702000**	**4520**	**60800**	**49800**
Residential SSL[a]				**67500**	**199**	**5570**	**2010**
0218-97-0090	18-10036	5.83–6.33	Soil	0.011 (J)	0.0057	0.0065	—[c]
0218-97-0091	18-10037	3.17–3.67	Soil	0.0093 (J)	0.0058	0.024	0.0057
0218-97-0092	18-10038	4.00–4.50	Soil	0.018 (J)	0.0047 (J)	0.012	—

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

[a] SSLs from NMED 2009, 108070.

[b] SSLs from LANL 2010, 108613.

[c] — = Not detected.

Table 4.15-4
Proposed Sampling at AOC 18-006

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	SVOCs	VOCs	Isotopic Uranium	pH
Determine nature and extent of potential contamination	6-1	West end of former storage pipe	3 to 4 ft bgs	X*	X	X	X	X
			5 to 6 ft bgs	X	X	X	X	X
			7 to 8 ft bgs	X	X	X	X	X
Determine nature and extent of potential contamination	6-2, 6-3	West end of former storage pipe	3 to 4 ft bgs	X	X	X	X	X
			5 to 6 ft bgs	X	X	X	X	X
			7 to 8 ft bgs	X	X	X	X	X
Determine nature and extent of potential contamination	6-4	Center of former storage pipe	4 to 5 ft bgs	X	X	X	X	X
			6 to 7 ft bgs	X	X	X	X	X
			8 to 9 ft bgs	X	X	X	X	X
Determine nature and extent of potential contamination	6-6	East end of former storage pipe	5 to 6 ft bgs	X	X	X	X	X
			7 to 8 ft bgs	X	X	X	X	X
			9 to 10 ft bgs	X	X	X	X	X
Determine nature and extent of potential contamination	6-5	East end of former storage pipe	5 to 6 ft bgs	X	X	X	X	X
			7 to 8 ft bgs	X	X	X	X	X
			9 to 10 ft bgs	X	X	X	X	X

*X = Analysis will be performed.

Table 4.16-1
Samples Collected and Analyses Requested at AOC 18-008

Sample ID	Location ID	Depth (ft)	Media	SVOCs	TPH-DRO	VOCs
0218-96-0207	18-10002	6.00–7.00	Soil	—*	2388	—
0218-96-0208	18-10003	6.00–7.00	Soil	—	2388	—
0218-96-0232	18-10008	6.00–7.00	Fill	2587	2587	2587
0218-96-0233	18-10008	7.00–8.00	Fill	2587	2587	2587
0218-96-0234	18-10009	6.00–7.00	Fill	2587	2587	2587
0218-96-0235	18-10009	7.00–8.00	Fill	2587	2587	2587
0218-96-0037	18-10015	6.00–8.00	Soil	—	2781	—
0218-96-0038	18-10015	11.00–13.00	QBT2	—	2781	—
0218-96-0039	18-10015	16.00–18.00	QBT2	—	2781	—
0218-96-0040	18-10015	21.00–23.00	QBT2	—	2781	—
0218-96-0053	18-10015	26.00–28.00	QBT2	—	2781	—
0218-96-0042	18-10016	13.00–15.00	QBT2	—	2782	—
0218-96-0043	18-10016	18.00–20.00	QBT2	—	2782	—
0218-96-0044	18-10016	23.00–25.00	QBT2	—	2782	—
0218-96-0055	18-10016	26.00–28.00	QBT2	—	2782	—
0218-96-0045	18-10017	8.00–10.00	Soil	—	2781	—
0218-96-0046	18-10017	13.00–15.00	QBT2	—	2781	—
0218-96-0047	18-10017	18.00–20.00	QBT2	—	2781	—
0218-96-0048	18-10017	23.00–25.00	QBT2	—	2781	—
0218-96-0054	18-10017	26.00–28.00	QBT2	—	2781	—
0218-96-0049	18-10018	8.00–10.00	Soil	—	2782	—
0218-96-0050	18-10018	13.00–15.00	QBT2	—	2782	—
0218-96-0051	18-10018	18.00–20.00	QBT2	—	2782	—
0218-96-0052	18-10018	23.00–25.00	QBT2	—	2782	—
0218-96-0056	18-10018	26.00–28.00	QBT2	—	2782	—

Note: Numbers in the analyte columns are analytical request numbers.
*— = Analyses not requested.

Table 4.16-2
Organic Chemicals Detected at AOC 18-008

Sample ID	Location ID	Depth (ft)	Media	Acetone	Methylene Chloride	TPH-DRO
Construction Worker SSL[a]				**263000**	**10600**	**na**[b]
Industrial SSL[a]				**851000**	**1090**	**na**
Recreational SSL[c]				**702000**	**4520**	**na**
Residential SSL[a]				**67500**	**199**	**na**
0218-96-0207	18-10002	6.00–7.00	Soil	NA[d]	NA	1100
0218-96-0208	18-10003	6.00–7.00	Soil	NA	NA	310
0218-96-0232	18-10008	6.00–7.00	Fill	0.01 (J)	—[e]	400
0218-96-0233	18-10008	7.00–8.00	Fill	—	—	240
0218-96-0234	18-10009	6.00–7.00	Fill	—	0.046	270
0218-96-0235	18-10009	7.00–8.00	Fill	—	—	340
0218-96-0037	18-10015	6.00–8.00	Soil	NA	NA	360
0218-96-0038	18-10015	11.00–13.00	QBT2	NA	NA	16
0218-96-0039	18-10015	16.00–18.00	QBT2	NA	NA	29
0218-96-0040	18-10015	21.00–23.00	QBT2	NA	NA	31

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

[a] SSLs from NMED 2009, 108070.

[b] na = Not available.

[c] SSLs from LANL 2010, 108613.

[d] NA = Not analyzed.

[e] — = Not detected.

Table 4.16-3
Proposed Sampling at AOC 18-008

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	SVOCs	TPH-DROs	VOCs	pH
Determine nature and extent of potential contamination	8-2	Beneath former UST	10 to 11 ft bgs	X*	X	X	X	X
			15 to 16 ft bgs	X	X	X	X	X
			20 to 21 ft bgs	X	X	X	X	X
			30 to 31 ft bgs	X	X	X	X	X
Determine nature and extent of potential contamination	8-1	Beneath former UST	10 to 11 ft bgs	X	X	X	X	X
			15 to 16 ft bgs	X	X	X	X	X
			20 to 21 ft bgs	X	X	X	X	X
			30 to 31 ft bgs	X	X	X	X	X
Determine nature and extent of potential contamination	8-5	Perimeter of former UST	6 to 7 ft bgs	X	X	X	X	X
			10 to 11 ft bgs	X	X	X	X	X
			15 to 16 ft bgs	X	X	X	X	X
			20 to 21 ft bgs	X	X	X	X	X
			30 to 31 ft bgs	X	X	X	X	X
Determine nature and extent of potential contamination	8-3, 8-4, 8-6	Perimeter of former UST	6 to 7 ft bgs	X	X	X	X	X
			10 to 11 ft bgs	X	X	X	X	X
			15 to 16 ft bgs	X	X	X	X	X
			20 to 21 ft bgs	X	X	X	X	X
			30 to 31 ft bgs	X	X	X	X	X

*X = Analysis will be performed.

Table 4.17-1
Proposed Sampling at AOC 18-010(b)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	TPH-DRO	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	10b-1	Outfall	0 to 1 ft bgs	X[a]	X	X	X	X	X	X	—[b]	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	10b-5	Pajarito Canyon drainage channel	0 to 1 ft bgs	X	X	X	X	X	X	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	10b-2, 10b-3, 10b-4, 10b-6	Drainage below outfall Pajarito Canyon drainage channel	0 to 1 ft bgs	X	X	X	X	X	X	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.18-1
Proposed Sampling at AOC 18-010(c)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	10c-1	Outfall	0 to 1 ft bgs	X[a]	X	X	X	X	X	—[b]	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	10c-10	Pajarito Canyon drainage channel	0 to 1 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	10c-2 through 10c-8, 10c-9	Drainage below outfall	0 to 1 ft bgs	X	X	X	X	—	X	—	X	X	X	X	X	X
		Pajarito Canyon drainage channel	2 to 3 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.19-1
Proposed Sampling at AOC 18-010(d)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	10d-1	Outfall	0 to 1 ft bgs	X[a]	X	X	X	X	X	—[b]	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	10d-10	Pajarito Canyon drainage channel	0 to 1 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	10d-2 through 10d-9	Drainage below outfall	0 to 1 ft bgs	X	X	X	X	—	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.20-1
Proposed Sampling at AOC 18-010(e)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	10e-1	Outfall	0 to 1 ft bgs	X[a]	X	X	X	X	X	—[b]	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	10e-10	Drainage below outfall	0 to 1 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	10e-2 through 10e-9	Drainage below outfall	0 to 1 ft bgs	X	X	X	X	—	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.21-1
Proposed Sampling at AOC 18-010(f)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Zirconium	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	10f-1	Outfall	0 to 1 ft bgs	X[a]	X	X	X	X	X	X	—[b]	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	10f-2, 10f-3	Drainage below outfall	0 to 1 ft bgs	X	X	X	X	X	X	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.22-1
Proposed Sampling at AOC 18-011

Objective Addressed	Location Number	Location	Sample Interval	Mercury
Determine nature and extent of potential contamination	11-1	Below former building 18-22	0 to 1 ft bgs	X*
			2 to 3 ft bgs	X
Determine nature and extent of potential contamination	11-2 through 11-5	Perimeter of former building 18-22	0 to 1 ft bgs	X
			2 to 3 ft bgs	X

*X = Analysis will be performed.

Table 4.23-1
Proposed Sampling at SWMU 18-012(a)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Zirconium	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	12a-1, 12a-2	Drainline from building 18-116	Immediately below the line	X[a]	X	X	X	X	X	X	—[b]	X	X	X	X	X	X
			5 ft below the line	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	12a-3	Outfall	0 to 1 ft bgs	X	X	X	X	X	X	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	12a-11	Drainage below outfall	0 to 1 ft bgs	X	X	X	X	X	X	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	12a-4 through 12a-10	Drainage below outfall	0 to 1 ft bgs	X	X	X	X	X	—	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.24-1
Proposed Sampling at AOC 18-012(c)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	12c-9	Former drainage ditch	0 to 1 ft bgs	X[a]	X	X	X	X	X	—[b]	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	12c-4 12c-5 through 12c-8	Outfall Former drainage ditch	0 to 1 ft bgs	X	X	X	X	—	X	—	X	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	—	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	12c-2	Downgradient of dry well sump	Base of Sump	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below base	X	X	X	X	X	X	X	X	X	X	X	X	X
			10 ft below base	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	12c-1, 12c-3	Drainlines exit from building 18-141	Immediately below the line	X	X	X	X	—	X	—	X	X	X	X	X	X
			5 ft below the line	X	X	X	X	—	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 4.25-1
Proposed Sampling at AOC 18-013

Objective Addressed	Location Number	Location	Beginning Depth of Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Zirconium	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	13-1, 13-4	Below the pit and tank Perimeter of pit and tank	Immediately below level of pit and tank	X*	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below level of line or tank	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	13-2, 13-3	Perimeter of pit and tank	Immediately below level of pit and tank	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			5 ft below level of line or tank	X	X	X	X	X	X	X	X	X	X	X	X	X	X

*X = Analysis will be performed.

Table 5.1-1
Proposed Sampling at SWMU 27-002

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Dioxins/furans	Explosive Compounds	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	2-1 through 2-4	50 ft radius from center of Firing Pit 1	0 to 1 ft bgs	X[a]	X	X	X	X	X	—[b]	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-5 through 2-8	100 ft radius from center of Firing Pit 1	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-9	200 ft radius from center of Firing Pit 1	0 to 1 ft bgs	X	X	X	X	X	X	X	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-10 through 2-12	200 ft radius from center of Firing Pit 1	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-13 through 2-16	50 ft radius from midway between Firing Pits 2 and 3	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-17 through 2-20	100 ft radius from midway between Firing Pits 2 and 3	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-21 through 2-24	200 ft radius from midway between Firing Pits 2 and 3	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-25 through 2-28	50 ft radius from midway between Firing Pits 4 and 5	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-29 through 2-32	100 ft radius from midway between Firing Pits 4 and 5	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X

Table 5.1-1 (continued)

Objective Addressed	Location Number	Location	Sample Interval	TAL Metals	Nitrate	Perchlorate	Total Cyanide	Dioxins/furans	Explosive Compounds	PCBs	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Uranium	pH
Determine nature and extent of potential contamination	2-34	200-ft radius from midway between Firing Pits 4 and 5	0 to 1 ft bgs	X	X	X	X	X	X	X	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-33, 2-35, 2-36	200-ft radius from midway between Firing Pits 4 and 5	0 to 1 ft bgs	X	X	X	X	X	X	—	X	—	X	X	X	X	X
			2 to 3 ft bgs	X	X	X	X	X	X	—	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-37	Center of Firing Pit 1	4 to 5 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			9 to 10 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-38	Center of Firing Pit 2	4 to 5 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			9 to 10 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-39	Center of Firing Pit 3	4 to 5 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			9 to 10 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-40	Center of Firing Pit 4	4 to 5 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			9 to 10 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine nature and extent of potential contamination	2-41	Center of Firing Pit 5	4 to 5 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			9 to 10 ft bgs	X	X	X	X	X	X	X	X	X	X	X	X	X	X

[a] X = Analysis will be performed.

[b] — = Analysis will not be performed.

Table 5.2-1
Samples Collected and Analyses Requested at SWMU 27-003

Sample ID	Location ID	Depth (ft)	Media	HE	TAL Metals
RC27-01-0001	27-10000	0.00–0.50	Fill	9418R	9419R
RC27-01-0002	27-10001	0.00–0.50	Fill	9418R	9419R
RC27-01-0003	27-10002	0.00–0.50	Fill	9418R	9419R
RC27-01-0004	27-10003	0.00–0.50	Fill	9418R	9419R
RC27-01-0005	27-10004	0.00–0.50	Fill	9418R	9419R
RC27-01-0006	27-10005	0.00–0.50	Fill	9418R	9419R

Note: Numbers in the analyte columns are analytical request numbers.

Table 5.2-2
Inorganic Chemicals above BVs at SWMU 27-003

Sample ID	Location ID	Depth (ft)	Media	Zinc
Soil BV[a]				**48.8**
Construction Worker SSL[b]				**92900**
Industrial SSL[b]				**341000**
Recreational SSL[c]				**238000**
Residential SSL[b]				**23500**
RC27-01-0001	27-10000	0.00–0.50	Fill	52.5
RC27-01-0002	27-10001	0.00–0.50	Fill	51.5
RC27-01-0004	27-10003	0.00–0.50	Fill	48.9

Note: Results are in mg/kg.

[a] BVs are from LANL 1998, 059730.

[b] SSLs from NMED 2009, 108070.

[c] SSLs from LANL 2010, 108613.

Table 7.0-1
Summary of Investigation Methods

Method	Summary
Spade and Scoop Collection of Soil Samples	This method is typically used to collect shallow (e.g., approximately 0–12 in.) soil or sediment samples. The “spade-and-scoop” method involves digging a hole to the desired depth, as prescribed in the sampling and analysis plan, and collecting a discrete grab sample. The sample is typically placed in a clean, stainless-steel bowl for transfer into various sample containers.
Hand-Auger Sampling	This method is typically used for sampling soil or sediment at depths of less than 10–15 ft but may in some cases be used for collecting samples of weathered or nonwelded tuff. The method involves hand-turning a stainless-steel bucket auger (typically 3–4-in. inner diameter), creating a vertical hole that can be advanced to the desired sample depth. When the desired depth is reached, the auger is decontaminated before advancing the hole through the sample depth. The sample material is transferred from the auger bucket to a stainless-steel sampling bowl before filling the various required sample containers.
Handling, Packaging, and Shipping of Samples	Field team members seal and label samples before packing and ensure that the sample containers and the containers used for transport are free of external contamination. Field team members package all samples so as to minimize the possibility of breakage during transportation. After all environmental samples are collected, packaged, and preserved; a field team member transports the samples to either the SMO or an SMO-approved radiation screening laboratory under chain of custody. The SMO arranges for shipping samples to analytical laboratories. The field team member must inform the SMO and/or the radiation screening laboratory coordinator when levels of radioactivity are in the action-level or limited-quantity ranges.
Sample Control and Field Documentation	The collection, screening, and transport of samples are documented on standard forms generated by the SMO. These include sample collection logs, chain-of-custody forms, and sample container labels. Collection logs are completed at the time of sample collection and are signed by the sampler and a reviewer who verifies the logs for completeness and accuracy. Corresponding labels are initialed and applied to each sample container, and custody seals are placed around container lids or openings. Chain-of-custody forms are completed and assigned to verify that the samples are not left unattended. Site attributes (e.g., former and proposed soil sampling locations, sediment sampling locations) are located by using a global positioning system. Horizontal locations will be measured to the nearest 0.5 ft. The survey results for this field event will be presented as part of the investigation report. Sample coordinates will be uploaded into the Environmental Restoration database.
Field Quality-Control Samples	Field quality-control samples are collected as directed in the Consent Order as follows. Field duplicate: At a frequency of 10%; collected at the same time as a regular sample and submitted for the same analyses. Equipment rinsate blank: At a frequency of 10%; collected by rinsing sampling equipment with deionized water, which is collected in a sample container and submitted for laboratory analysis. Trip blanks: Required for all field events that include the collection of samples for VOC analysis. Trip blanks are containers of certified clean sand that are opened and kept with the other sample containers during the sampling process.

Table 7.0-1 (continued)

Method	Summary
Field Decontamination of Drilling and Sampling Equipment	Dry decontamination is the preferred method to minimize generating liquid waste. Dry decontamination may include the use of a wire brush or other tool to remove soil or other material adhering to the sampling equipment, followed by use of a commercial cleaning agent (nonacid, waxless cleaners) and paper wipes. Dry decontamination may be followed by wet decontamination if necessary. Wet decontamination may include washing with a nonphosphate detergent and water, followed by a water rinse and a second rinse with deionized water. Alternatively, steam cleaning may be used.
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 quality assurance. Specific requirements for each sample are printed on the sample collection logs provided by the sample management office (size and type of container [glass, amber glass, polyethylene, preservative, etc.]). All samples are preserved by placing in insulated containers with ice to maintain a temperature of 4°C. Other requirements such as nitric acid or other preservatives may apply to different media or analytical requests.
Management, Characterization, and Storage of IDW	IDW is 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 shall be adequate to comply with on-site or off-site waste acceptance criteria. All stored IDW will be marked with appropriate signage and labels, as appropriate. Drummed IDW will be stored on pallets to prevent the containers from deterioration. Generators are required to reduce the volume of waste generated as much as technically and economically feasible. Means to store, control, and transport each potential waste type and classification shall be determined before field operations that generate waste begin. A waste storage area shall be established before generating waste. Waste storage areas located in controlled areas of the Laboratory shall be controlled as needed to prevent inadvertent addition or management of wastes by unauthorized personnel. Each container of waste generated shall be individually labeled as to waste classification, item identification number, and radioactivity (if applicable), immediately following containerization. All waste shall be segregated by classification and compatibility to prevent cross-contamination. See Appendix B for additional information.
Geodetic Surveys	This method describes the methodology for coordinating and evaluating geodetic surveys and establishing quality assurance (QA) and quality control (QC) for geodetic survey data. The procedure covers evaluating geodetic survey requirements, preparing to perform a geodetic survey, performing geodetic survey field activities, preparing geodetic survey data for QA review, performing QA review of geodetic survey data, and submitting geodetic survey data.
Hollow-Stem Auger Drilling Methods	In this method, hollow-stem augers (sections of seamless pipe with auger flights welded to the pipe) act as a screw conveyor to bring cuttings of sediment, soil, and/or rock to the surface. Auger sections are typically 5 ft in length and have outside diameters of 4.25 to 14 in. Drill rods, split-spoon core barrels, Shelby tubes, and other samplers can pass through the center of the hollow-stem auger sections for collection of discrete samples from desired depths. Hollow-stem augers are used as temporary casings when setting wells to prevent cave-ins of the borehole walls.

Table 7.8-1
Summary of Analytical Methods

Analyte	Analytical Method
TAL metals	SW-846:6010B; SW-846:6020
Total cyanide	SW-846:9012A
Mercury	SW-846:7471A
Nitrate	EPA:300.0
Perchlorate	SW-846:6850
Dioxins/furans	SW-846:8280A; SW-846:8290
Explosive compounds	SW-846:8321A_MOD
PCBs	SW-846:8082
SVOCs	SW-846:8270C
VOCs	SW-846:8260B
Americium-241	HASL-300:AM-241
Gamma-emitting radionuclides	EPA:901.1
Isotopic plutonium	HASL-300:ISOPU
Isotopic uranium	HASL-300:ISOU
Isotopic thorium	HASL-300:ISOTH
pH	SW-846:9045C

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
Consent Order	Compliance Order on Consent
COPC	chemical of potential concern
CST	Chemical Science and Technology
D&D	decontamination and decommissioning
DOE	Department of Energy (U.S.)
DRO	diesel range organic
EC	expedited cleanup
EP	Environmental Programs Directorate
EPA	Environmental Protection Agency (U.S.)
FV	fallout value
GPR	ground-penetrating radar
GPS	global positioning system
H	Health Division
HE	high explosives
HIR	historical investigation report
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IA	interim action
IDW	investigation-derived waste
LANL	Los Alamos National Laboratory
MDA	material disposal area
NOI	notice of intent
NFA	no further action
NMED	New Mexico Environment Department
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pH	potential of hydrogen
PID	photoionization detector
QA	quality assurance

QC	quality control
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RFI	Resource Conservation and Recovery Act Facility Investigation
RPF	Records Processing Facility
SAL	screening action level
SMO	Sample Management Office
SOP	standard operating procedure
SSL	soil screening level
SVOC	semivolatile organic compound
SWMU	solid waste management unit
SWSC	Sanitary Wastewater Systems Consolidation
TA	technical area
TAL	target analyte list
TPH	total petroleum hydrocarbon
TRU	transuranic
UST	underground storage tank
UXO	unexploded ordnance
VCA	voluntary corrective action
VCM	voluntary corrective measure
VOC	volatile organic compound
WAC	waste acceptance criteria
WCSF	waste characterization strategy form

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 (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
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 Lower Pajarito Canyon Aggregate Area investigation will be managed. IDW may include, but is not limited to, drill cuttings, contact waste, decontamination fluids, and all other waste that has potentially come into contact with contaminants.

B-2.0 INVESTIGATION-DERIVED WASTE

All IDW generated during investigation activities will be managed in accordance with applicable standard operating procedures (SOPs). These SOPs incorporate the requirements of all applicable U.S. Environmental Protection Agency and New Mexico Environment Department (NMED) regulations, U.S. Department of Energy Orders, and Laboratory requirements. The SOP applicable to the characterization and management of IDW is

- SOP-5238, Characterization and Management of Environmental Program Waste, (http://www.lanl.gov/environment/all/qa.shtml).

The most recent version of the Los Alamos National Laboratory's (the Laboratory's or LANL's) Hazardous Waste Minimization Report will be implemented during the investigation to minimize waste generation. The 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 SOP-5238, Characterization and Management of Environmental Program 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 or subsurface soil). Waste characterization may include a review of historical information and process knowledge to identify whether listed hazardous waste may be present (i.e., due diligence reviews). If low levels of listed hazardous waste are identified, a "contained in" determination may be submitted for approval to NMED.

Wastes will be containerized and placed in clearly marked and appropriately constructed waste accumulation areas. Waste accumulation area postings, regulated storage duration, and inspection requirements will be based on the type of IDW and its classification. Container and storage requirements will be detailed in the WCSF and approved before the waste is generated. Transportation and disposal requirements will also be detailed in the WCSF and approved before waste is generated. Table B-2.0-1 summarizes the estimated IDW waste streams, waste types, waste volumes, and other data.

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 drilling 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 initially placed in containers at a hazardous waste accumulation area until the cuttings are characterized. If the drill cuttings are found to be nonhazardous, they will be stored as nonhazardous waste. Cuttings will be land applied on a drill pad, unpaved road, or any other surface that meets the criteria in the NMED-approved NOI Decision Tree for Land Application of IDW

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), radionuclides, total metals, and if needed, toxicity characteristic metals. If process knowledge, odors, or staining indicate that the cuttings may be contaminated with petroleum products, the materials will also be analyzed for total petroleum hydrocarbons and polychlorinated biphenyls. 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 an approved off-site facility.

B-2.2 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 such as gloves, decontamination wastes such as paper wipes, and disposable sampling supplies. Characterization of this waste stream will use acceptable knowledge (AK) of the waste materials, the methods of generation, and analysis of the material contacted (e.g., drill cuttings, soil, or sumps). Contact waste will be initially placed in containers at a hazardous waste accumulation area until they are characterized. If the waste is found to be nonhazardous, it will be stored as nonhazardous waste. The Laboratory expects most of the contact waste to be designated as nonhazardous, nonradioactive waste that will be disposed of at an authorized facility.

B-2.3 Decontamination Fluids

Dry decontamination methods will be used between sampling locations to avoid the generation of liquid waste and to minimize the IDW. Decontamination will be completed using a dry decontamination method with disposable paper towels and over-the-counter cleaner such as Fantastik or its equivalent. All sampling and measuring equipment, including but not limited to stainless-steel sampling tools, split-barrel or core samplers, well developing or purging equipment, groundwater quality measurement instruments, and water-level measurement instruments, will be decontaminated in accordance with SOP-01.08, Field Decontamination of Drilling and Sampling Equipment.

If necessary, dry decontamination may be followed by wet decontamination. Wet decontamination may include washing with a nonphosphate detergent and water, followed by a water rinse and a second rinse with deionized water. Alternatively, steam-cleaning may be used. 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, 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 where WAC allow the waste to be received.

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

Waste Stream	Expected Waste Type	Estimated Volume	Characterization Method	On-Site Management	Expected Disposition
Drill cuttings and soil	Industrial, nonhazardous, nonradioactive	20 yd^3	Analytical results from waste and core samples	Accumulation in 55-gal. drums, covered roll-off containers, or soft-sided containers	Land application, or permitted off-site facility for which waste meets acceptance criteria
Spent personal protective equipment and disposable sampling supplies	Industrial, nonhazardous, nonradioactive	0.5 yd^3	Acceptable knowledge	Accumulation in 55-gal. drums	Permitted off-site facility for which waste meets acceptance criteria
Decontamination fluids	Industrial, nonhazardous, nonradioactive	10 gal.	Acceptable knowledge	Accumulation in 30-gal. plastic drums	Treatment at an on-site facility for which waste meets acceptance criteria