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Date: OCT 25 2013
Refer To: EP2013-0202

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Subject: NPDES Permit No. NM0030759 – Request for Permit Modification, Site Monitoring Requirements for Site 72-001 (S-SMA-6)

Dear Mses. Walker and McDonald:

The U.S. Department of Energy (DOE) and Los Alamos National Security, LLC (LANS) (the Permittees) are submitting this letter to request approval by Region 6 of the U.S. Environmental Protection Agency (EPA) to modify Appendix B, Site Monitoring Requirements for Site 72-001, located in Sandia Canyon. Storm water samples collected in 2011 from the S-SMA-6 sampler pursuant the National Pollutant Discharge Elimination System (NPDES) Permit No. NM0030759 (the Individual Permit or Permit) exceeded the applicable target action levels (TALs) for aluminum, copper, cyanide, gross-alpha radioactivity, radium-226 and radium-228, and total polychlorinated biphenyls (PCBs).

New and substantial information and data presented in the attached report demonstrate (1) Site 72-001 is not the source of aluminum, cyanide, PCBs, gross-alpha radioactivity, or radium-226 and radium-228 detected in storm water; (2) upstream sources, including solid waste management units, areas of concern, and electrical equipment that was decommissioned under Toxic Substances Control Act requirements, are the source of the PCB exceedance in storm water at S-SMA-6; (3) upstream sources, including historical releases at Technical Area 03 (TA-03) and the TA-03 wetland, are the likely source of the cyanide exceedance in storm water at S-SMA-6; (4) the source of the aluminum exceedance is associated with unique geochemical conditions in the TA-03 wetland and is naturally occurring; and (5) the source of the adjusted gross-alpha radioactivity and isotopic radium exceedances is likely naturally occurring alpha-emitting radionuclides derived from the local rock unit within the watershed and canyon bottom.

This permit modification request, seeks the following change pursuant to 40 Code of Federal Regulations §122.62 (a)(2) and Part III.A.5 of the Individual Permit:

> *Appendix B, p. 4: Delete monitoring requirements for aluminum, cyanide, polychlorinated biphenyls (PCBs), gross-alpha radioactivity, and radium-226 and -228 at Site 72-001 (S-SMA-6).*

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NPDES PERMIT NO. NM0030759
REQUEST FOR PERMIT MODIFICATION,
SITE MONITORING REQUIREMENTS FOR SITE 72-001 (S-SMA-6)

1.0 INTRODUCTION

On February 13, 2009, Region 6 of the U.S. Environmental Protection Agency (EPA) issued Individual Industrial Storm Water National Pollutant Discharge Elimination System (NPDES) Permit No. NM0030759 (the Individual Permit or Permit) to the U.S. Department of Energy (DOE) and Los Alamos National Security, LLC (LANS) (collectively, the Permittees). The Individual Permit was subsequently modified on September 30, 2010, and became effective on November 1, 2010. The Individual Permit regulates storm water discharges associated with industrial activities from specified solid waste management units (SWMUs) and/or areas of concern (AOCs) (collectively, "Sites").

The Permittees request a modification to the Individual Permit, pursuant to 40 Code of Federal Regulations (CFR) §122.62 (a)(2) and Part III.5, to specifically approve the following change:

- Appendix B, p. 4: Delete monitoring requirements for aluminum, cyanide, polychlorinated biphenyls (PCBs), gross-alpha radioactivity, and radium-226 and radium-228 at Site 72-001 (S-SMA-6).

Site 72-001 was identified as a High Priority Site under Part I.E.4(a) of the Individual Permit based on information submitted in the 2005 permit application indicating that PCBs collected from storm water samples showed detections of Aroclor-1254 and Aroclor-1260 at the maximum concentrations of 1.4 µg/L and 1.7 µg/L, respectively. Storm water samples collected in 2011 from the S-SMA-6 sampler pursuant to the Individual Permit exceeded the applicable target action levels (TALs) for aluminum, copper, cyanide, gross-alpha radioactivity, radium-226 and radium-228, and total PCBs.

As discussed below, however, new and substantial information not available at the time the Permit was issued demonstrates that Site 72-001 is not the industrial source of PCBs; further, PCBs were not previously handled, stored, disposed of, treated, or otherwise managed at the Site. In addition, new and substantial information not available at the time the Permit was issued demonstrates this Site is also not the industrial source of five of the remaining six constituents that exceeded TALs in storm water (i.e., aluminum, cyanide, gross-alpha radioactivity, and radium-226 and radium-228); further, cyanide was not previously handled, stored, disposed of, treated, or otherwise managed at the site. Finally, data indicate concentrations of aluminum, gross-alpha radioactivity, or radium-226 and radium-228 are consistent with natural background levels and are not related to Site activities.

Upon approval of this permit modification request, Site 72-001 will no longer be a High Priority Site, thereby extending the deadline for completion of corrective action for copper, which is the remaining potential Site-related constituent, until November 1, 2015.

1.1 Site Description

Site 72-001 (also known as AOC 72-001, subject to the requirements of the March 1, 2005, Compliance Order on Consent [Consent Order]) is an active small-arms firing and training range used by Los Alamos National Laboratory's (the Laboratory's) security force and has operated as a firing range since 1966 (Plate 1 in Attachment 1 to this appendix). The firing range is located in Sandia Canyon at the east end of Technical Area 72 (TA-72). The site includes a 175- × 250-ft pistol firing range surrounded by earthen berms and an adjacent 50-m firing range (Range 3) to the north. The drainage channel and flood plain of

Sandia Canyon run between the pistol range and the 50-m range. There is no record of aluminum, cyanide, PCBs, or alpha-emitting radionuclides (including radium-226 and radium-228) having been handled, managed, or stored at Site 72-001 (LANL 1990). No other Laboratory activities have been conducted at the site (Figure 1 in Attachment 2 of this appendix).

1.2 Site Monitoring Area Description

Under the Individual Permit, storm water monitoring for Site 72-001 is conducted at S-SMA-6. The Site is an approximately 280-acre drainage area consisting of the majority of the TA-53 active operating area, Lower Sandia Canyon east of gage station E124, and the western two-thirds of TA-72 (Figure 2). S-SMA-6 contains only Site 72-001. The mesa-top component of the area (within TA-53) is flat, sloping to the north and east toward Lower Sandia Canyon. The majority of this portion of the site monitoring area (SMA) is covered by structures and impervious surfaces (primarily asphalt paving and concrete). Runoff from this developed area flows south then east toward Lower Sandia Canyon. The main drainage of Lower Sandia Canyon east of gage E124 receives storm water runoff from Upper Sandia Canyon.

1.3 Description of Sandia Watershed

Sandia Canyon heads on the Pajarito Plateau in TA-03, has a maximum elevation of 2320 m (7600 ft) above sea level (asl), and extends 17.6 km (10.9 mi) to the Rio Grande at an elevation of 1660 m (5445 ft asl). Bedrock geologic units exposed within the Sandia Canyon watershed consist largely of the Tshirege Member of the Bandelier Tuff and basaltic rocks of the Cerros del Rio volcanic field (Griggs and Hem 1964; Smith et al. 1970; Dethier 1997). The Sandia watershed has a drainage area of 5.5 mi^2, of which 45% is on Laboratory land, 39% is on Pueblo de San Ildefonso land, 15% is within Bandelier National Monument, and 1% is on private land. The part of the watershed upstream of Site 72-001 and the S-SMA-6 monitoring location consists primarily of Laboratory land with a 2.6-mi^2 area that drains into/through Site 72-001 and the S-SMA-6 monitoring location (Plate 1).

2.0 SUMMARY OF THE PERMIT MODIFICATION REQUEST

EPA Region 6 may approve a permit modification based on “new information not available at the time of permit issuance” pursuant to 40 CFR §122.62 (a)(2). The Individual Permit application was submitted to EPA Region 6 on February 2, 2005, as required by the Federal Facility Compliance Agreement (FFCA). The Individual Permit was issued in 2009 and modified in 2010. Since the Permit was issued, however, significant new information has become available as a result of extensive investigations conducted under the Consent Order entered into among New Mexico Environment Department (NMED), DOE, and LANS. The Consent Order was issued pursuant to the New Mexico Hazardous Waste Act and New Mexico Solid Waste Act and prescribes requirements for corrective action, including investigation and cleanup of SWMUs and AOCs in accordance with New Mexico Hazardous Waste Regulations.

The Permittees identified Site 72-001 as a High Priority Site based on storm water sampling results (2004–2007) from FFCA sampler SS1248, located at the east fence of the Site 72-001 firing range in the middle of the Lower Sandia Canyon drainage channel. FFCA sampler SS1248 was located at the same location as the current S-SMA-6 sampler (Figure 2). When the application for the Individual Permit was submitted to EPA Region 6 in 2005 and the Sites subject to the Permit were being selected, the information presented in this request was not available. The Permittees have since obtained additional information on the sources of aluminum, cyanide, PCBs, gross-alpha radioactivity, and radium isotopes in the Sandia Canyon watershed that was not available at the time the Permit was issued. The primary

source of the new information discussed in this document is soil, sediment, and surface water data collected pursuant to the Consent Order.

As stated previously, storm water samples collected in 2011 from the S-SMA-6 sampler pursuant to the Individual Permit exceeded the applicable TALs for aluminum, copper, cyanide, gross-alpha radioactivity, radium-226 and radium-228, and total PCBs. The S-SMA-6 sampler is located at the same location as FFCA sampler SS1248. Because of the TAL exceedances, the Permittees are required to implement corrective action in accordance with Part I.E.2(a) through 2(d) or E.3 for Site 72-001. The deadline for completing corrective action is November 1, 2013, because Site 72-001 is listed as a High Priority Site in Part I.E.4(a) of the Permit.

As detailed in this permit modification request, extensive information and data collected to determine the potential sources of aluminum, cyanide, PCBs, gross-alpha radioactivity, and radium isotopes detected in storm water downstream of Site 72-001 support the following conclusions.

- Site 72-001 is not the source of PCBs, and there is no record of PCBs having been handled, managed, or stored at the Site.
- Upstream sources, including SWMUs, AOCs, and electrical equipment that was decommissioned under the Toxic Substances Control Act (TSCA), are the likely sources of the PCB exceedance in storm water at S-SMA-6.
- Site 72-001 is not the source of aluminum, cyanide, gross-alpha radioactivity, or radium-226 and radium-228 detected in storm water.
- There is no record of aluminum, cyanide, or alpha-emitting radionuclides (including radium-226 and radium-228) having been handled, managed, or stored at Site 72-001.
- The source of the aluminum exceedance is associated with unique geochemical conditions in the TA-03 wetland and is naturally occurring.
- Upstream sources, including SWMUs and AOCs in TA-03, and the TA-03 wetland, are the likely sources of the cyanide exceedance in storm water at S-SMA-6.
- The source of the gross-alpha radioactivity and isotopic radium exceedances is likely naturally occurring alpha-emitting radionuclides derived from the local rock unit within the watershed and canyon bottom.

This permit modification request summarizes data from the investigations conducted to date to determine the source(s), nature, and extent of contaminants, including PCBs, aluminum, cyanide, gross-alpha radioactivity, and radium, found in Sandia Canyon. It is organized in nine sections, including this introduction. Section 2 provides an overview of the information sources used for this report. Section 3 describes the inventory and distribution of PCBs in sediments and surface water in the Sandia watershed, where Site 72-001 is located. Section 4 describes where PCBs were detected in storm water and sediment upstream of Site 72-001 and the likely sources of PCBs in Laboratory TAs upstream of Site 72-001. Section 5 describes where gross-alpha radioactivity/alpha-emitting radionuclides were detected in storm water and sediment upstream of Site 72-001 and the likely source of gross-alpha radioactivity and alpha-emitting radionuclides, including radium-226 and radium-228, in Laboratory TAs upstream of Site 72-001. Section 6 describes where aluminum was detected in storm water and sediment upstream of Site 72-001 and the likely source of aluminum upstream of Site 72-001. Section 7 describes where cyanide was detected in surface water and sediment upstream of Site 72-001 and the likely sources of cyanide in the Sandia Canyon Watershed. Section 8 presents the conclusions of the report. Section 9 presents a list of references cited in this request.

Numerous studies have been conducted to investigate potential contamination within the Sandia watershed from Laboratory operations, including aluminum, cyanide, PCBs, and alpha-emitting radionuclides in sediment and surface water. The investigations were conducted to fulfill the requirements of several NMED-approved work plans and reports prepared by the Laboratory in accordance with the Consent Order. The sediment investigations focused on characterizing the nature, extent, and inventory of potential Laboratory contamination in 12 reaches in Sandia Canyon. Data from these reaches are used to evaluate potential human health and ecological risks and to identify spatial trends in contamination at a watershed scale, including variations in contaminant concentrations and inventories at increasing distances from source areas and temporal trends in contamination.

3.0 PCB INVENTORY IN SANDIA CANYON UPSTREAM OF SITE 72-001

New information and data updating the PCB inventory and PCB distribution in sediment and surface water in Sandia Canyon are summarized below.

Results of recent Sandia Canyon and watershed investigations estimate that the inventories of PCBs in Sandia Canyon sediment deposits range from approximately 3 kg (7 lb) for Aroclor-1248 to 35 kg (78 lb) for Aroclor-1254 (LANL 2010; LANL 2011; LANL 2012a). Most of this mass, ranging from an estimated 81% for Aroclor-1260 to 99.6% for Aroclor-1248, is contained within Reach S-2 within the wetland located in TA-03 in Upper Sandia Canyon (Plate 1) well upstream of AOC 72-001.

3.1 PCB Distribution in Sediment in Sandia Canyon

PCBs were detected in sediment samples collected from every Sandia Canyon reach, except the two easternmost reaches, Reaches S-6W and S-6E, located on San Ildefonso Pueblo, east of Reach S-5E and TA-72 (Plate 1). PCBs have low solubilities and a strong affinity for organic material and sediment particles. PCBs were widely used in electric transformers and other industrial applications, and their widespread use primarily in electrical equipment around the Laboratory and in nearby non-Laboratory developed areas is consistent with their spatial distribution measured in sediments in Sandia Canyon. The highest concentrations were measured in sediment below the former transformer storage area at TA-03, SWMU 03-056(c), although the sediment data indicate PCBs were also derived from other sources in the watershed, as discussed below. Two PCBs (Aroclor-1254 and Aroclor-1260) were detected in Sandia Canyon sediment samples collected from nine reaches (S-1N through S-5E). Aroclor-1242 was detected only at low concentrations in sediment samples from Reach S-2 at the TA-03 wetland and in sediment samples from Reaches S-5C and S-5E downgradient of TA-72. Aroclor-1012 and Aroclor-1048 were detected only in sediment samples from Reach S-2 at the TA-03 wetland (Plate 1 and Tables 1 through 3 in Attachment 3 to this appendix).

3.2 PCB Distribution in Surface Water in Sandia Canyon

The bulk of the sediment inventories of Aroclor-1254 and Aroclor-1260 resides in Reach S-2 in TA-03, including the wetland, and distributions of these two PCBs in sediment are dispersed downgradient as far as Reach S-5E in TA-72 (Plate 1). Aroclor-1254 and Aroclor-1260 are consistently detected in surface water immediately downgradient of the TA-03 wetland at gage E123 at concentrations that exceed the human health criterion for perennial water (0.00064 µg/L). PCBs (Aroclor-1254 and Aroclor-1260) were detected in surface water at gages E124 and E125, downstream of gage station E123. (Tables 4 through 7). Gage E124 is located in Lower Sandia Canyon directly south of the west end of TA-53, and gage E125 is located east of Site 72-001 near the Laboratory boundary (Plate 1).

Storm water data from NMED DOE Oversight Bureau (NMED-DOE OB) sampling locations in the main drainage near the east end of TA-53 confirm TA-53 is also a source of PCBs detected in Lower Sandia Canyon (Figure 3).

4.0 SOURCES OF PCBS IN THE SANDIA CANYON WATERSHED UPSTREAM OF SITE 72-001

The following sections summarize known or potential releases of PCBs to the Sandia watershed starting at the west end of the watershed and working east (downgradient) to Site 72-001/S-SMA-6. The following discussion of the sources of the PCB TAL exceedance at Site 72-001/S-SMA-6 demonstrates that Site 72-001 is not the source of this TAL exceedance.

Data from recent Sandia Canyon investigations indicate PCBs in sediment that were originally released from sources in TA-03, TA-60, and TA-61 (at the west end of the watershed) and in TA-53 (in middle of the watershed) extend for approximately 10 to 12 km (6 to 7 mi) downcanyon (to the east) from the sources (Plate 1). Storm water runoff and surface-water flow from daily effluent releases generally infiltrate alluvium in the middle portion of Sandia Canyon, resulting in the deposition of contaminated sediment in that area. The most important sediment deposition area is in the upper canyon within TA-03 where a broad wetland exists (Reach S-2).

4.1.1 TA-03

TA-03 was originally built as a firing site in 1945 that was decommissioned and cleared in 1949. In the early 1950s, operational facilities from former TA-01 (located in the Los Alamos townsite) were relocated to TA-03. Early TA-03 facilities included the Van de Graaff accelerator building, a laboratory and support structures, the communications building, the Chemistry and Metallurgy Research Building, the general and chemical warehouses, the cryogenics laboratory, the administration building, the Sigma Building, a fire house, and the physics building. Additional new construction continued through the 1960s and 1970s, when storage areas, shops, office buildings, a wastewater treatment plant (WWTP), asphalt batch plant, and numerous transportable structures were added. Support structures for these facilities included an automotive repair garage, a gas station, steam-cleaning facility, and warehouses. A computer facility and several national centers for various scientific activities were constructed in the 1990s. The National Security Sciences Building (03-1400) and associated parking structure (03-1402) were completed in 2006.

Much of the PCB contamination related to Laboratory releases is associated with historical releases from sites at TA-03 around the upper portion of Sandia Canyon. The majority of these PCB sources have been removed and/or remediated in accordance with TSCA requirements and/or under the Consent Order; however, some of the contamination has been dispersed downcanyon in sediments and surface water. EPA acknowledged in the June 26, 2013, fact sheet for the proposed reissuance of NPDES permit number NM0028355 (the Laboratory's industrial permit) that "PCBs have been prohibited [at the Laboratory] for decades and LANL is not using PCBs in any process." Sources of Laboratory-derived PCBs in TA-03 include the former transformer storage area [SWMU 03-056(c)] along the South Fork of Sandia Canyon, former PCB transformer and/or capacitor locations including the TA-03 steam plant, the former TA-03 WWTP, and storm water drains and outfalls that collect storm water runoff from developed areas throughout TA-03.

The Laboratory is working with NMED under the Consent Order to ensure the wetland in Upper Sandia Canyon within TA-03 (Reach S-2) continues to maintain the hydrologic and geochemical conditions that minimize contaminant (PCBs) migration downstream. In 2011, NMED directed the Laboratory to submit a work plan to stabilize the wetland (NMED 2011a). This work is now being

implemented and includes constructing a series of three-stepped grade-control structures, followed by a cascade pool to arrest a headcut taking place in the lower portion of the wetland (Plate 1). Construction began in April 2013 and was completed in mid-September 2013. Because of the lapse in government funding, a force majeure request was submitted to NMED to delay the submittal of the completion report to NMED.

4.1.2 TA-60

TA-60, also known as Sigma Site, was created from the eastern portion of TA-03 and lies on Sigma Mesa between Sandia and Mortandad Canyons (Plate 1). All the buildings at TA-60 are located on the western end of the mesa and contain Laboratory support and maintenance operations and contractor service facilities. The Nevada Test Site (NTS) test fabrication facility (building 60-0017), the NTS test tower (building 60-0018), several small abandoned experimental areas, including a solar pond and a test drill hole, a new asphalt batch plant, a former small outdoor scrap storage area, and storage sites for pesticides, topsoil, and tuff are also located at TA-60. Several SWMUs and AOCs are former storage or staging areas for debris (e.g., concrete, treated wood poles, asphalt, and pipes); containers of petroleum products; and drilling equipment. All SWMUs and AOCs at TA-60 have been investigated and/or remediated where necessary under either the Hazardous and Solid Waste Amendments (HSWA) module of the Laboratory's Hazardous Waste Facility Permit (before 2005) or the Consent Order (after 2005).

4.1.3 TA-61

TA-61 was created north and east of TA-03 in the 1960s and lies on Sigma Mesa between Los Alamos and Sandia Canyons (Plate 1). Physical support and infrastructure facilities, such as a sanitary landfill, sewer pump stations, and paved parking lots, are currently located at TA-61. SWMU 61-002, the former electrical equipment storage area at TA-61, east of the former Radio Repair Shop (building 61-0023, formerly building 03-0282) on East Jemez Road, is the likely primary source of Laboratory-derived PCBs in TA-61 (Upper Sandia Canyon Aggregate Area). Historically, the area was used to store capacitors and transformers. In 1986, elevated PCB concentrations (Aroclor-1254 and Aroclor-1260) were detected in soil samples, and the storage area was characterized and remediated in accordance with TSCA requirements. After the 1986 remediation efforts, the east side of the storage area was used to store electrical equipment, some of which contained PCBs. All storage operations were discontinued in 1992, and the site was subsequently investigated and remediated under the Consent Order in 2005 and 2006.

4.1.4 TA-53

The Los Alamos Neutron Science Center (LANSCE) consists of a 0.8-km- (0.5-mi-) long linear proton accelerator and associated experimental research areas, offices, laboratories, and shops. Construction of the accelerator began in 1968, and it reached full operation in 1974. The accelerator is used to produce subatomic particles for basic research, isotope production, radiochemistry, solid state physics research, and accelerator technology development. The main activity at TA-53 currently centers around LANSCE and associated experimental areas. Source areas for Laboratory-derived PCBs (Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260) at TA-53 (Lower Sandia Canyon Aggregate Area) include numerous former equipment storage areas, numerous former PCB transformer locations, and an inactive disposal pit. TA-53 operations were conducted for only a short period of time before TSCA PCB regulations were implemented in 1979. The majority of these PCB sources have been removed and/or remediated in accordance with TSCA requirements; however, runoff and effluent from TA-53 may have carried contaminants, including PCBs, into Lower Sandia Canyon. SWMUs and AOCs at TA-53, previously regulated and closed under TSCA, were approved for no further action (NFA) under the HSWA

module by EPA (2005). Those SWMUs and AOCs not approved for NFA by EPA were sampled under the Consent Order in 2010 in accordance with the Lower Sandia Canyon Aggregate Area investigation. Arolcor-1254 and Arolcor-1260 were detected at low concentrations (well below residential soil screening levels [SSLs]) in multiple samples at SWMUs 53-001(a), 53-001(b), 53-005, and 53-006(f) and AOC 53-012(e) at the west end of TA-53 and at AOCs 53-008, 53-009, 53-010, and 53-013 at the east end of TA-53. Aroclor-1242 was also detected in two samples at AOC 53-009, and Arolcor-1248 was detected in one and two samples, respectively, at AOCs 53-008 and 53-012(e) (Figures 4 through 12 and Tables 8 through 15).

In 2012, the NMED-DOE OB installed storm water samplers at eight locations in drainages downgradient of TA-53. PCBs exceeded the TAL in storm water samples collected in 2013 from four of the NMED-DOE OB samplers located in the main drainage near the east end of TA-53 (Figure 3). Seventeen former TSCA-regulated PCB transformer locations are near the head of this drainage; storm water flowing down the drainage travels directly over SWMU 20-003(b) and AOC C-20-003 and into lower Sandia Canyon directly upstream of Site 72-001.

4.1.5 Former TA-20

Former TA-20 was used during the Manhattan Project to test initiators (devices that generate neutrons to initiate nuclear explosions) from the mid- to late-1940s. Former TA-20 is now located partly within TA-53 and partly within TA-72. The only potential PCB source identified for TA-20 was an elevated transformer station (former structure 20-30) constructed in 1945 and removed in 1948. The station supported a laboratory (former structure 20-1) and was located directly north of SWMU 20-005.

Although there is no indication that PCBs were used or released, Aroclor-1254 and Aroclor-1260 were detected at low concentrations (well below residential SSLs) in multiple samples at SWMUs 20-001(a), 20-002(c), 20-002(d), and 20-005, and Arolcor-1242 and Aroclor-1248 were each detected in one sample at SWMU 20-002(d) (well below residential SSLs). The approved Lower Sandia Canyon Aggregate Area investigation report, Revision 1, concluded that although Aroclors were detected at low concentrations in multiple samples at several former TA-20 sites, there is no indication that PCBs were ever used at those sites (LANL 2011; NMED 2011b). It is likely the detected concentrations reflect widespread but very low concentration contamination from multiple potential sources upstream of this site, including sites at TA-03, TA-61, and TA-53 and developed areas on Laboratory and Los Alamos County or private property (LANL 2009b, pp. 5–8) (Figures 13 through 17 and Tables 16 through 20).

4.1.6 TA-72

TA-72 is the site of the Laboratory's active firing range used by protective force personnel since 1966 for required training exercises.

There is no record of PCBs having been handled, managed, or stored at Site 72-001. Investigations under the Consent Order were not performed at AOC 72-001 in 2010 as part of the Lower Sandia Canyon Aggregate Area investigation; delayed investigation was proposed for AOC 72-001 because this site is an active small-arms firing range. Before the Consent Order went into effect in March 2005, a Phase I Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) was conducted in 1995 at AOC 72-001 (LANL 1996). Seven surface sediment samples were collected from seven locations downstream of the small-arms firing range (Site 72-001). All seven samples were submitted for laboratory analysis of EPA target analyte list metals. Selenium was the only inorganic chemical detected above the sediment background value (BV) in one sample. The 1995 Phase I RFI samples collected at Site 72-001 were not analyzed for PCBs because they were not associated with site operations (LANL 2011).

4.2 Conclusions: Source of PCB TAL Exceedance at S-SMA-6 Is Not Site 72-001

Although PCBs are present in sediment and surface water in Sandia Canyon, recent Laboratory investigation data and supplemental historical information described above demonstrate Site 72-001 is not the source of these PCBs or the PCB TAL exceedance.

The PCBs detected are derived from multiple sources, primarily historical Laboratory operations in TAs upgradient of Site 72-001. Sediment data from the recent Phase I and Phase II Sandia Canyon investigations indicate the primary source of PCBs in Sandia Canyon is TA-03 (along with TA-60 and TA-61). TA-53 is a minor source of PCBs that have mixed with PCBs derived from TA-03 within the canyon reach directly downstream of the drainage channel at the east end of TA-53 (Reach S-5W). Storm water sampling data from four of the NMED-DOE OB samplers located in the main drainage near the east end of TA-53 confirm the conclusions presented in the recent Sandia Canyon investigation reports: TA-53 is a minor source of PCBs detected in sediment samples from the two canyon reaches directly downgradient of TA-53.

PCBs in sediment originally released from TA-03 extend for approximately 10 km to 12 km (6 mi to 7 mi) downcanyon and were detected in sediment samples collected from every Sandia Canyon reach, except the two easternmost reaches, Reaches S-6W and S-6E (Plate 1). The highest PCB concentrations were measured in sediment below the former transformer storage area at TA-03, SWMU 03-056(c). PCB concentrations in sediment decreased downstream from TA-03 in reaches within Lower Sandia Canyon confirming downstream migration of PCBs to S-SMA-6/Site 72-001.

5.0 SOURCES OF ALPHA-EMITTING RADIONUCLIDES IN SANDIA CANYON UPSTREAM OF SITE 72-001

The Individual Permit contains TALs for the total amount of alpha-emitting radionuclides in water (gross-alpha radioactivity) as well as the sum of two specific alpha-emitting radionuclides (radium-226 and radium-228). Because gross-alpha radioactivity and radium isotopes are related, they are discussed together in this section. The results of recent Sandia Canyon and watershed investigations indicate the likely source of alpha-emitting radionuclides detected in Sandia Canyon sediments, surface water, and storm water is likely naturally occurring and derived from the local bedrock unit (Bandelier Tuff) (LANL 2010; LANL 2012a; LANL 2013).

Alpha radiation is one type of energy released when certain radioactive elements decay or break down over time. Radioactive elements such as uranium and thorium are found naturally in rocks and minerals in varying amounts in the Earth's crust. Uranium and thorium slowly transform into radium and radon through the release of energy. One form of this energy is alpha radiation. Gross-alpha radioactivity is the result of the measurement of all alpha particles present in a specific sample and does not identify specific radionuclides such as radium-226 and -228. This type of measurement is a screening tool to indicate the total amount, but not the type, of alpha-emitting radionuclides that may be present in a sample. Groundwater and storm water flows through and over bedrock and sediment and soils created from the weathering of bedrock. Some bedrock formations such as the tuff that makes up the Pajarito Plateau naturally have radioactive elements, including uranium and thorium, that dissolve into groundwater and storm water and are detectable as gross-alpha radioactivity.

The known or potential sources of alpha-emitting radionuclides in Sandia Canyon upstream from Site 72-001 are discussed below.

5.1 Bandelier Tuff

The bedrock (local rock unit) at or near the surface of the mesa top within the Sandia Canyon Watershed is the Bandelier Tuff (Qbt). The only stratigraphic unit encountered during the Sandia Canyon investigations and the Lower Sandia Canyon Aggregate Area investigation of former TA-20 sites was unit 3 of the Tshirege Member of the Bandelier Tuff (Qbt 3) bedrock. The Bandelier Tuff was deposited during volcanic eruptions and is composed of pumice, minor rock fragments, and crystals supported in an ashy matrix. This rock unit is exposed throughout the bottom of lower Sandia Canyon as seen in surface samples collected during the Lower Sandia Canyon Aggregate Area investigation of former TA-20 sites (LANL 2011). The Tshirege Member is the most widespread and youngest stratigraphic unit on the Pajarito Plateau and underlies a majority of the Laboratory (LANL 1999; LANL 2006, p. 13). Radionuclide background data collected for soils, canyon sediments, and Bandelier Tuff at the Laboratory show thorium and uranium are actinide elements that occur naturally in the Bandelier Tuff bedrock and in soil and sediment forming on the Pajarito Plateau (LANL 1998). Uranium has three naturally occurring isotopes, uranium-234, uranium-235, and uranium-238, and thorium has six naturally occurring isotopes, including thorium-228, thorium-232, and thorium-238. These naturally occurring radionuclides decay through alpha emission to other radionuclides including radium-226 and radium-228. The Laboratory has established BVs for these naturally occurring radionuclides in soil, sediment, and tuff units (LANL 1998).

5.2 Fallout from Nuclear Weapons Testing

Some alpha-emitting radionuclides (i.e., isotopes of americium and plutonium) may be present in soils and sediments as a result of fallout from historical nuclear weapons testing. The Laboratory has collected data on background concentrations of fallout radionuclides. These data have been used to develop media-specific fallout values (FVs) (LANL 1998).

5.3 Alpha-Emitting Radionuclides Detected in Sediment in Sandia Canyon

A total of 11 radionuclides were detected above BVs and FVs in sediment samples collected in Sandia Canyon reaches, including alpha-emitting radionuclides americium-24, and isotopes of plutonium, thorium, and uranium. Only one radionuclide, thorium-228, had a maximum detected concentration (2.47 pCi/g) that exceeded the residential screening action level (SAL) (2.28 pCi/g) in Reach S-4W, upstream of Site 72-001. Thorium-228 was also detected above the residential SAL at a concentration of 2.35 pCi/g in the sediment sample collected from Reach S-5E downstream of Site 72-001 (LANL 2009b). All other alpha-emitting radionuclides detected above sediment BVs and FVs in Sandia Canyon were detected in Reaches S-2 and S-4W upstream of Site 72-001 (Tables 21 through 23).

Reaches S-4W and S-5E are incised into unit Qbt 1g of the Bandelier Tuff, which has relatively high BVs for thorium-228 and thorium-232 (4.90 pCi/g for both), indicating the thorium-228 and thorium-232 and radium-228 (the decay product of thorium-232) at Site 72-001 are most likely naturally occurring and derived from the local rock unit. This same conclusion has been reached in other canyons at the Laboratory (LANL 2012a).

5.4 Radionuclides Detected in Surface Water in Sandia Canyon

Maximum detected concentrations of radionuclides in filtered and nonfiltered surface water samples collected in Sandia Canyon were compared with applicable water-quality standards. None of the radionuclides detected in surface water samples collected in Sandia Canyon had maximum concentrations exceeding a water-quality standard, indicating the likely source of the gross-alpha radioactivity detected in nonfiltered storm water samples is naturally occurring and derived from the local rock unit (LANL 2012a) (Tables 24 through 30).

5.5 Sources of Gross-Alpha Radioactivity in the Sandia Canyon Watershed Upstream of Site 72-001

The following sections summarize potential sources of radionuclides in the Sandia watershed starting at the west end of the watershed and working east (downstream) to Site 72-001/S-SMA-6. There are no known sources of alpha-emitting radionuclides at TA-60 or TA-61, and Consent Order samples from these TAs were not analyzed for alpha-emitting radionuclides. Therefore, TA-60 and TA-61 are not discussed further. Radium isotopes are considered to be naturally occurring, with radium-226 and radium-228 produced in the decay chain of thorium-232 and uranium-238, respectively, and are not the results of historical Laboratory activities. Therefore, samples collected in accordance with the Consent Order were not analyzed for isotopic radium.

5.5.1 TA-03

Radionuclides were detected in soil samples at SWMUs and AOCs associated with the former TA-03 WWTP, Consolidated Unit 03-014(a)-99. Consolidated Unit 03-014(a)-99 consists of 20 of the 30 SWMUs and AOCs associated with the former WWTP that operated at TA-03 from 1951 to 1992. The former WWTP is next to, and east of, the utilities control center (building 03-223) on the southern rim near the head of Sandia Canyon (Plate 1). The WWTP served TA-03, TA-43, TA-59, and TA-60, the trailer park on East Jemez Road, and holding tank and septic system wastes throughout the Laboratory. Smaller sources associated with floor drains include potential historical releases depleted uranium– (DU-) processing facilities (LANL 2008). By 1987, most floor drains were routed to the Laboratory's sanitary sewer line and no longer discharge to outfalls. Alpha-emitting radionuclides were detected in less than 10 samples at fewer than 5 of the sites associated with the former TA-03 WWTP during the 2009–2010 Consent Order investigation of the Upper Sandia Canyon Aggregate Area. Detected concentrations were only slightly above BVs/FVs, and the lateral and vertical extent of these radionuclides are defined; therefore, these sites are likely not a source of gross alpha detected in storm water at Site 72-001 (LANL 2010).

5.5.2 TA-53

Radionuclides associated with TA-53 operations are primarily beta- and gamma-emitting radionuclides produced by the accelerator. Several SWMUs and AOCs at TA-53 are former storage areas of radioactive activation products, former underground storage tanks (with associated drain lines) that were used to temporarily store radioactive liquid waste (RLW); and an inactive aboveground neutralization tank for neutralized RLW. The former TA-53 surface impoundments [Consolidated Unit 53-002(a)-99] may have contributed radionuclides, including beta- and gamma-emitting activation products, to Sandia Canyon. These surface impoundments received treated sanitary and radioactive waste from TA-53 facilities. These impoundments have been remediated and since 2006 their status is "corrective action complete with controls" (NMED 2006); they are no longer a potential source of contamination to the watershed. Runoff and effluent from TA-53 may have carried radionuclides into Sandia Canyon. Alpha-emitting radionuclides

were detected at two mesa-top sites at TA-53 [AOC 53-008 and AOC 53-012(e)] at concentrations slightly above BVs. The lateral and vertical extent of these radionuclides are defined on the mesa top; therefore, these sites are not a likely source of gross-alpha radioactivity detected in storm water at Site 72-001 (LANL 2011) (Figures 18 and 19 and Tables 31 through 33).

5.5.3 Former TA-20

Only limited known or suspected sources of radionuclides are associated with former TA-20. Activities conducted during the Manhattan Project used polonium-210, an alpha-emitter. Polonium-210, however, has a half-life of 138 d and decays to a stable lead isotope; therefore, it is no longer present at sites within former TA-20. DU and/or natural uranium may also have been used in several experiments conducted at former TA-20 in 1945 and 1946. Former TA-20 site was released for unrestricted access in 1949 following multiple surveys to identify and remove all hazardous and radioactive materials. Total uranium was measured above soil BVs in most samples collected at SWMUs and AOCs in former TA-20 during the 1995 RFI (LANL 1996). The total uranium results were attributed to natural background. Other contaminants detected, but at lower frequency and at fewer sites, included uranium isotopes. Alpha-emitting radionuclides (naturally occurring isotopes, uranium-234, uranium-235, and uranium-238) were detected at concentrations above Qbt 3 BVs primarily in Consent Order samples collected in 2010 at SWMUs in AOCs located in the bottom of Sandia Canyon within former TA-20, directly upstream of Site 72-001. The detected alpha-emitting radionuclides were determined to reflect natural background variability in tuff (LANL 2011) (Figures 20 through 24 and Tables 34 through 42).

5.5.4 TA-72

There are no known or suspected sources of alpha-emitting radionuclides at TA-72. Investigations under the Consent Order were not performed at AOC 72-001 in 2010 as part of the Lower Sandia Canyon Aggregate Area investigation; delayed investigation was proposed for AOC 72-001 because this site is an active small-arms firing range. Before the Consent Order went into effect in March 2005, a Phase I RFI was conducted at Site 72-001 in 1995. Seven surface sediment samples were collected from seven locations downstream of the small-arms firing range (Site 72-001). All seven samples were submitted for laboratory analysis of EPA target analyte list metals. The 1995 Phase I RFI samples collected at Site 72-001 were not analyzed for alpha-emitting radionuclides because they were not associated with site operations (LANL 2009a). Recent interviews with the range master of the Site 72-001 firing range and many long-time Laboratory radiological control technicians confirm that no ammunition containing any type of radionuclides has been used at the firing range.

5.5.5 Run-on from Developed Areas

Results of a study initiated by the Laboratory in 2009 measured background levels of metals and radioactivity in storm water from areas of the Pajarito Plateau unaffected by Laboratory activities (known as the “Reference Area”) and storm water running off urban landscapes with buildings, roads, parking lots, and associated infrastructure. All storm water sampling locations in this study were distant from developed areas of the Laboratory and any known areas of contamination. The results reflect background runoff conditions from landscapes with surficial geological materials derived from Bandelier Tuff and related tuff formations (LANL 2013). The gross-alpha radioactivity upper tolerance limit (UTL) from developed urban landscape storm water run-on is 82.1 pCi/g; the gross-alpha radioactivity UTL for background storm water containing sediment derived from Bandelier Tuff is 184 pCi/g. The Laboratory BV for gross-alpha radioactivity in canyon sediment is 58.8 pCi/g (LANL 1998). Therefore, storm water run-on from areas of the Pajarito Plateau unaffected by Laboratory activities and from landscapes with surficial

geological materials derived from Bandelier Tuff and related tuff formations upstream of Site 72-001 likely contributed to elevated gross-alpha radioactivity and naturally occurring radium isotopes in storm water at Site 72-001/S-SMA-6.

5.6 Conclusions: Source of Gross-Alpha TAL Exceedance at S-SMA-6 Is Not Site 72-001

As discussed above, data from recent Sandia Canyon investigations, the Lower Sandia Canyon Aggregate Area investigation, and background report for metals and radionuclides in storm water on the Pajarito Plateau indicate the likely source of gross-alpha radioactivity and alpha-emitting radionuclides detected in Sandia Canyon sediments, surface water, and storm water is naturally occurring and derived from the local geological bedrock unit exposed within the Sandia Canyon watershed. Uranium and thorium, which have alpha-emitting isotopes and decay to radium-226 and radium-228, are not known to be associated with industrial materials historically managed at the Lower Sandia Canyon sites, other than the possible use of small amounts of uranium at former TA-20 in 1945 and 1946. Uranium and thorium isotopes were detected above BVs in sediment and tuff samples, although the source was attributed to variability in natural background. In addition, uranium and thorium isotopes are excluded from the definition of adjusted gross-alpha radioactivity. Historical site information and the data presented in this report confirm that Site 72-001 is not the source of the adjusted gross-alpha radioactivity and radium-226 and radium-228 exceedances measured in storm water at S-SMA-6.

6.0 SOURCES OF ALUMINUM IN SANDIA CANYON UPSTREAM OF SITE 72-001

Results of recent Sandia Canyon watershed and aggregate area investigations indicate the likely source of aluminum detected in Sandia Canyon sediments, surface water, and storm water is naturally occurring (LANL 2010; LANL 2012a; LANL 2013).

6.1 Aluminum Detected in Sediment in Sandia Canyon

Aluminum was detected only in sediment samples collected from Reach S-2 in the TA-03 wetland. The maximum detected aluminum concentration in Reach S-2, 20,000 mg/kg, is only 30% higher than the sediment BV of 15,400 mg/kg. The BV was exceeded in only 5% of the Reach S-2 sediment samples (four samples), all of which were collected in 1998 from the TA-03 wetland. These data suggest the elevated aluminum is associated with unique geochemical conditions in the wetland, although the high values from 1998 were not reproduced in more recent samples from the wetland in 2007 and 2008. Differences in analytical laboratories between 1998 and 2007–2008 may contribute to the higher concentrations in 1998. These results, combined with the absence of aluminum detected in sediment above the BV upstream of Reach S-2, indicate the elevated aluminum in Reach S-2 is not the result of Laboratory releases (Tables 43 through 45).

6.2 Aluminum Detected in Storm Water in Sandia Canyon

The maximum concentration of aluminum in storm water samples collected in Sandia Canyon was detected at gage station E125 within reach S-5E, east and downstream of Site 72-001 near the east Laboratory boundary. The next two highest aluminum concentrations were measured in storm water samples at gage stations E121 and E122, located upstream of the TA-03 wetland (Plate 1). Concentrations then decreased downstream in storm water samples at gage stations E123 below the TA-03 wetland and at gage station E124 upstream of Site 72-001. The Sandia Canyon investigation reports concluded the aluminum detected in storm water samples in Sandia Canyon is naturally occurring (LANL 2010; LANL 2012a; LANL 2013) (Tables 46 through 52).

6.3 Sources of Aluminum in the Sandia Canyon Watershed Upstream of Site 72-001

The known or potential sources of aluminum in the Sandia Canyon watershed, upstream from Site 72-001, starting at the west end of the watershed and working east (downstream) to Site 72-001/S-SMA-6, are discussed below.

6.3.1 TA-03

TA-03 is considered to be the primary source for most chemicals of potential concern (COPCs) in Sandia Canyon sediment. Sediment data, combined with historical records, indicate releases of inorganic chemicals from multiple sites into both the North Fork and South Fork of Sandia Canyon. However, aluminum was not identified as a COPC associated with sites in TA-03.

6.3.2 TA-60

There are no known or suspected sources of industrial materials containing aluminum exposed to storm water at TA-60 sites. Aluminum metal associated with building materials and containers may be exposed to storm water. Aluminum was detected slightly above the maximum tuff BV in 17 samples at 6 of the 7 SWMUs and AOCs sampled at TA-60 in 2009 under the Consent Order (Plate 2, Figures 25 and 26, and Tables 53 through 58).

6.3.3 TA-61

There are no known or suspected sources of industrial materials containing aluminum exposed to storm water at TA-61 sites. Aluminum metal associated with building materials and containers may be exposed to storm water. Aluminum was detected slightly above the maximum tuff BV in three samples at the one AOC sampled at TA-61 in 2009 under the Consent Order (Plate 3 and Table 59).

6.3.4 TA-53

There are no known or suspected sources of industrial materials containing aluminum exposed to storm water at TA-53. Aluminum metal associated with building materials and containers may be exposed to storm water. Aluminum was detected slightly above the maximum tuff BV in three samples at two of the nine sites sampled at TA-53 in 2010 under the Consent Order (Figures 27 and 28 and Tables 60 and 61).

6.3.5 Former TA-20

There are no known or suspected sources of industrial materials containing aluminum exposed to storm water at former TA-20. Aluminum was detected slightly above the maximum tuff BV in four samples at 3 of the 11 sites sampled at former TA-20 in 2010 under the Consent Order (Figures 29 through 32 and Tables 62 through 65).

6.3.6 TA-72

There are no known or suspected sources of industrial materials containing aluminum exposed to storm water at TA-72. Aluminum metal associated with building materials and containers may be exposed to storm water. Investigations under the Consent Order were not performed at AOC 72-001 in 2010 as part of the Lower Sandia Canyon Aggregate Area investigation; delayed investigation was proposed for AOC 72-001 because this site is an active small-arms firing range. Before the Consent Order went into effect in March 2005, a Phase I RFI was conducted at Site 72-001 in 1995. Seven surface sediment

samples were collected from seven locations downstream of the small arms firing range (Site 72-001). All seven samples were submitted for laboratory analysis of target analyte list metals. Aluminum was not detected above BVs.

6.3.7 Run-on from Developed Areas

Results of a study initiated by the Laboratory in 2009 measured background levels of metals and radioactivity in storm water from areas of the Pajarito Plateau unaffected by Laboratory activities (known as the “Reference Area”) and storm water running off urban landscapes with buildings, roads, parking lots, and associated infrastructure. All storm water sampling locations in this study were distant from developed areas of the Laboratory and any known areas of contamination. The results reflect background runoff conditions from landscapes with surficial geological materials derived from Bandelier Tuff and related tuff formations (LANL 2013).The dissolved aluminum UTL from developed urban landscape storm water run-on is 245 µg/L; the dissolved aluminum UTL for background storm water containing sediment derived from Bandelier Tuff is 1780 µg/L, which is greater than the maximum dissolved aluminum concentration detected at S-SMA-2 (1470 µg/L). Therefore, storm water run-on from areas of the Pajarito Plateau unaffected by Laboratory activities and from landscapes with surficial geological materials derived from Bandelier Tuff and related tuff formations upstream of Site 72-001 likely contributed to elevated aluminum in storm water at Site 72-001/S-SMA-6.

6.4 Conclusions: Source of Aluminum Exceedance at S-SMA-6 Is Not Site 72-001

As discussed above, the data from recent Sandia Canyon investigations, the Upper and Lower Sandia Canyon Aggregate Area investigations, and background report for metals and radionuclides in storm water on the Pajarito Plateau indicate the likely source of aluminum is dominantly or entirely derived from naturally occurring material, representing locally elevated background levels and not releases from Laboratory sites.

7.0 SOURCES OF CYANIDE IN SANDIA CANYON UPSTREAM OF SITE 72-001

Results of recent Sandia Canyon and watershed investigations indicate the likely source of cyanide detected in Sandia Canyon sediments, surface water, and storm water is historical releases from TA-03 (LANL 2010; LANL 2012a; LANL 2013).

7.1 Cyanide Detected in Sediment in Sandia Canyon

Cyanide was detected at a maximum concentrations above the sediment BV of 0.82 mg/kg in four investigation reaches (S-1N, S-1S, S-2, and S-3E), and the highest concentration was detected in reach S-2 (11.6 mg/kg). Similar to other COPCs, the highest concentrations were measured in Reach S-2 at the TA-03 wetland. Highest average concentrations are in Reach S-2, and the next highest are in Reach S-1S upstream of the TA-03 wetland (Plate 1). These spatial variations in cyanide concentrations indicate releases from TA-03 into the South Fork of Sandia Canyon and downstream transport (Tables 66 through 68).

7.2 Cyanide Detected in Surface Water in Sandia Canyon

Cyanide was detected in surface water at three gage stations upstream of Site 72-001. The farthest downstream gage station where cyanide was detected in surface water samples collected in Sandia Canyon was gage station E123 in Reach S-2 in the TA-03 wetland. The highest concentration of

cyanide in surface water was detected at gage 122 in the South Fork of Sandia Canyon, upstream of gage station 123 (Plate 1). Sandia Canyon investigation reports concluded the source of cyanide detected in surface water samples in Sandia Canyon was TA-03 (LANL 2010; LANL 2012a; LANL 2013) (Tables 69 through 73).

7.3 Sources of Cyanide in the Sandia Canyon Watershed Upstream of Site 72-001

The following discusses the known or potential sources of cyanide in the Sandia Canyon watershed upstream from Site 72-001, starting at the west end of the watershed and working east (downstream) to Site 72-001/S-SMA-6. There are no known sources of cyanide at former TA-20, TA-60, or TA-61, and cyanide was not detected above BV in Consent Order samples from these TAs. Therefore, former TA-20, TA-60, and TA-61 are not likely sources of cyanide.

7.3.1 TA-03

TA-03 is considered to be the primary source for most COPCs in Sandia Canyon sediment. Sediment data, combined with historical records, indicate releases of inorganic chemicals from multiple sites into both the North Fork and South Fork of Sandia Canyon. Cyanide was identified as a COPC associated with sites in TA-03 (LANL 2010). However, cyanide was not detected in storm water samples from any Sandia Canyon Watershed SMAs located in TA-03 (S-SMA-0.25, S-SMA-1.1, S-SMA-2, and S-SMA-2.01). The presence of cyanide as a COPC in canyon sediments, therefore, appears to be associated with historical releases rather than ongoing activities.

7.3.2 TA-53

There are no known or suspected sources of cyanide at TA-53. Of the nine sites sampled at TA-53 in 2010 under the Consent Order, cyanide was detected above the maximum tuff BV in three samples at one site and above the soil BV in one sample from another site (Figures 33 and 34 and Tables 74 and 75).

7.3.3 TA-72

There are no known or suspected sources of cyanide at TA-72. Investigations under the Consent Order were not performed at AOC 72-001 in 2010 as part of the Lower Sandia Canyon Aggregate Area investigation; delayed investigation was proposed for AOC 72-001 because this site is an active small-arms firing range. Before the Consent Order went into effect in March 2005, a Phase I RFI was conducted at Site 72-001 in 1995 (LANL 1996). Seven surface sediment samples were collected from seven locations downstream of the small-arms firing range (Site 72-001). All seven samples were submitted for laboratory analysis of EPA target analyte list metals. The 1995 Phase I RFI samples collected at Site 72-001 were not analyzed for cyanide because it was not associated with site operations (LANL 2009).

7.3.4 Run-on from Developed Areas

Cyanide UTLs were not calculated for developed for the 2009 Laboratory background study for metals and radioactivity in storm water because the number of detections was not sufficient to calculate a statistical distribution (LANL 2013).

7.4 Conclusions: Source of Cyanide Exceedance at S-SMA-6 Is Not Site 72-001

As shown above, the data from recent Sandia Canyon investigations, the Lower Sandia Canyon Aggregate Area investigation, and storm water samples indicate the likely source of cyanide is from historical releases from sites within TA-03.

8.0 CONCLUSIONS

This report was prepared to support DOE and LANS's request to the EPA to amend Appendix B by removing aluminum, cyanide, PCBs, adjusted gross-alpha radioactivity, and radium-226 and radium-228 as monitoring requirements for Site 72-001/S-SMA-6 and to amend Part I.E.4(b) by removing S-SMA-6 from the table listing High Priority Sites. EPA Region 6 may approve a permit modification request based on "new information not available at the time of permit issuance" pursuant to 40 CFR §122.62 (a)(2). New and substantial information and data presented in this report demonstrate (1) Site 72-001 is not the source of aluminum, cyanide, PCBs, gross-alpha radioactivity, or radium-226 and radium-228 detected in storm water; (2) upstream sources, including SWMUs, AOCs, and electrical equipment that was decommissioned under TSCA requirements, are the source of the PCB exceedance in storm water at S-SMA-6; (3) upstream sources including historical releases at TA-03 and the TA-03 wetland are the likely source of the cyanide exceedance in storm water at S-SMA-6; (4) the source of the aluminum exceedance is associated with unique geochemical conditions in the TA-03 wetland and is naturally occurring; and (5) the source of the adjusted gross-alpha radioactivity and isotopic radium exceedances is likely naturally occurring alpha-emitting radionuclides derived from the local rock unit within the watershed and canyon bottom.

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Attachment 1

Plates

Plate 1 - Sandia Canyon

New Mexico State Plane Coordinate System Central Zone (3002)
North American Datum, 1983 (NAD 83)

US Survey Ft

GIS: Dave Frank, dff@lanl.gov, 665-8182
Date: 07-August-2013
Revision: 0.0
Revised:
Map Number: 13-0072-02

DISCLAIMER: This map was created for work processes associated with EP-ET-ER division. All other uses for this map should be confirmed with LANL staff.

Feet: 0 1,000 2,000
Miles: 0 0.125 0.25

- Gage station
- SMA sampler
- PRS
- Wetland
- Structure
- Sandia Canyon reach
- Sandia watershed boundary
- Watershed
- Los Alamos landfill
- LANL boundary
- Perennial reach
- Drainage
- TA-03
- TA-53
- TA-60
- TA-61
- TA-72
- Major road
- Paved road
- TA boundary outline
- Index contour, 40-ft interval
- Contour, 2-ft interval

Private Land

Private Land

Royal Crest Trailer Park

TA-03

TA-61

TA-60

TA-53

TA-72

Bandelier National Monument

Los Alamos National Laboratory

San Illdefonso Pueblo

S-1N

S-1S

S-2

S-3W

S-3E

S-4W

S-4E

S-5W

S-5E

E122

E123

E124

E125

S-SMA-3.71

S-SMA-3.7

S-SMA-3.72

S-SMA-3.95

S-SMA-4.1

S-SMA-4.5

S-SMA-5

S-SMA-5.2

S-SMA-5.5

S-SMA-6

PAJARITO RD

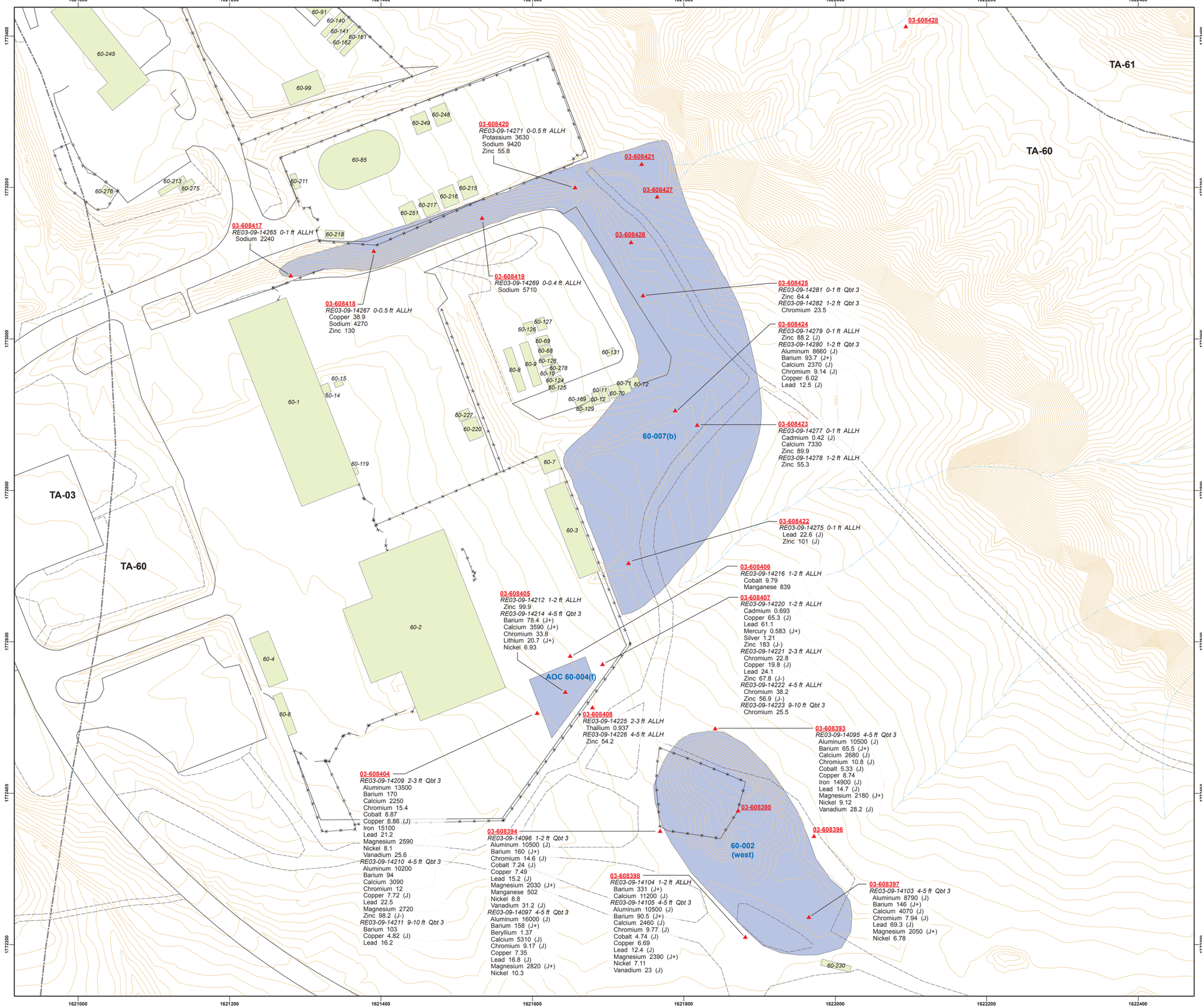
DIAMOND DR

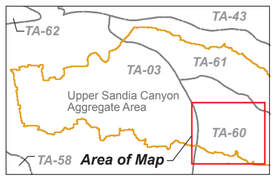
NM 502

1

2

3





This map was created for work processes associated with the Sandia Canyon Aggregate Area Investigation Report. All other uses for this map should be confirmed with the LANL EP-CAP Division.

0 15 30 60 90 120 150 180 Feet

contour interval = 2 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

- Sampling location
- Historical sampling location
- SWMU or AOC (*AOC noted*)
- LANL structure
- Fence
- Paved road/parking
- Dirt road
- Inferred drainage
- LANL TA boundary
- 2 ft contour

Location ID (*2009/10* - red or underlined, *historical* - black or not underlined)

Sample description (sample ID, depth (ft), media)

49-608402
RE10-07-5304 0.00-0.50 SOIL
Copper 5.5
Selenium 0.5 (J)

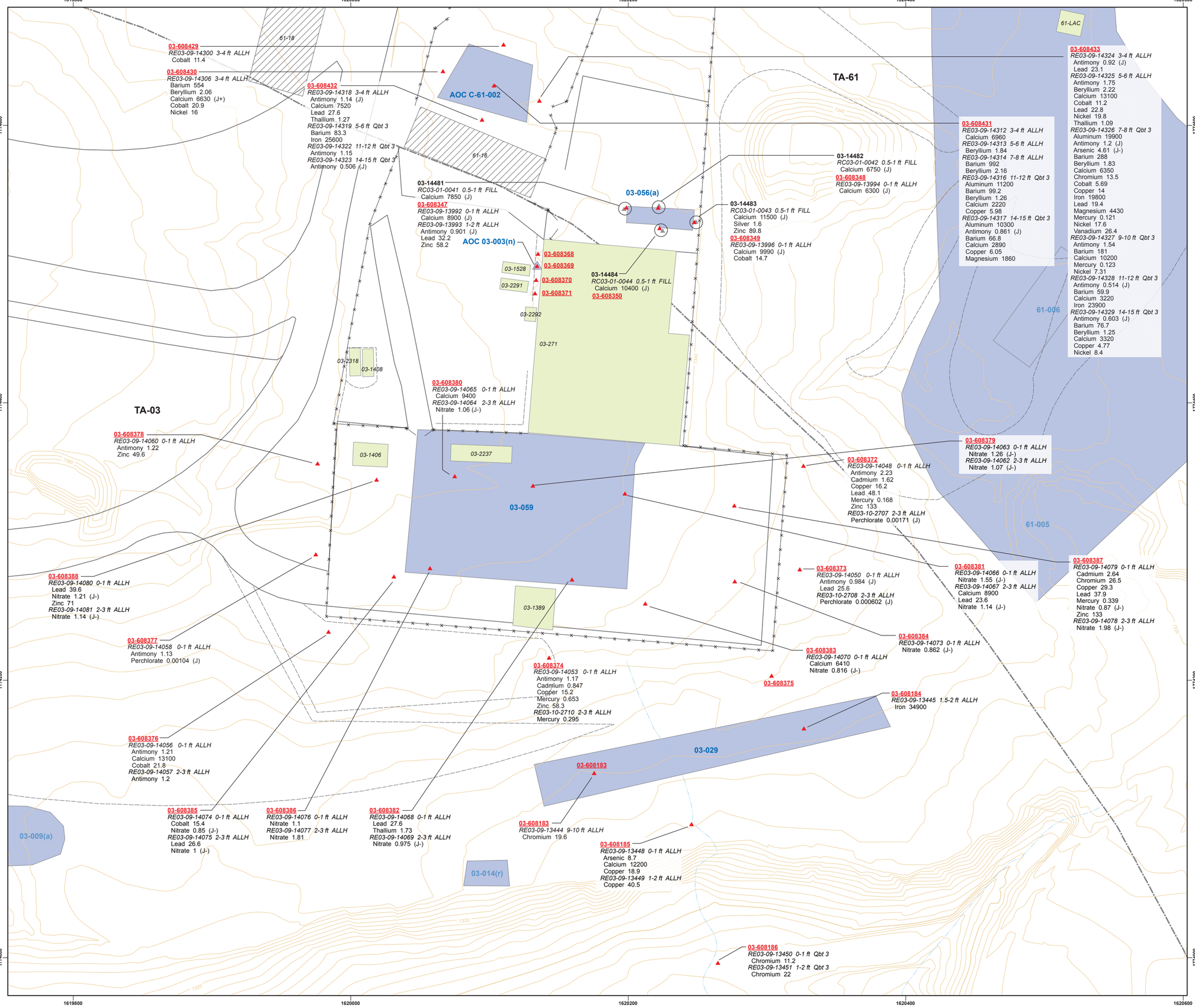
Analyte data (analyte, result, optional qualifier code)

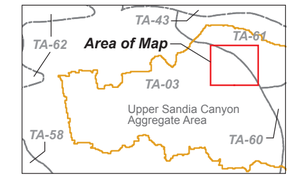
Result Qualifiers:
J = Estimated value
J+= Estimated value biased high
J- = Estimated value biased low

Note: All analytical results reported in milligrams per kilogram (mg/kg) or in picocuries per gram (pCi/g) except as noted.

PLATE 2
Inorganic chemical concentrations detected or detected above BVs at SWMUs 60-002 (west) and 60-007(b) and AOC 60-004(f)

Map Number:TPMC_041410B
Date: April 14,2010 Rev:May 13,2010
DraftedBy:TPMC File Name: USCAA_HITS_MapQT





This map was created for work processes associated with the Sandia Canyon Aggregate Area Investigation Report. All other uses for this map should be confirmed with the LANL EP-CAP Division.

0 10 20 40 60 80 100 Feet

contour interval = 2 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

- Sampling location
- Historical sampling location
- SWMU or AOC (*AOC noted*)
- Former structure
- LANL structure
- Fence
- Paved road/parking
- Dirt road
- Inferred drainage
- LANL TA boundary
- 2 ft contour

Location ID (2009/10 - red or underlined, historical - black or not underlined)

Sample description (sample ID, depth (ft), media)

49-608402
RE10-07-5304 0.00-0.50 SOIL
Copper 5.5
Selenium 0.5 (J)

Analyte data (analyte, result, optional qualifier code)

Result Qualifiers:
J = Estimated value
J+= Estimated value biased high
J- = Estimated value biased low

Note: All analytical results reported in milligrams per kilogram (mg/kg) or in picocuries per gram (pCi/g) except as noted.

PLATE 3
Inorganic chemical concentrations detected or detected above BVs at SWMUs 03-029, 03-059, and 03-056(a) and AOCs 03-003(n) and C-61-002

Map Number: TPMC_040610A
Date: April 6, 2010 Rev: May 14, 2010
DraftedBy: TPMC File Name: USCAA_HITS_MapE

Attachment 2

Figures

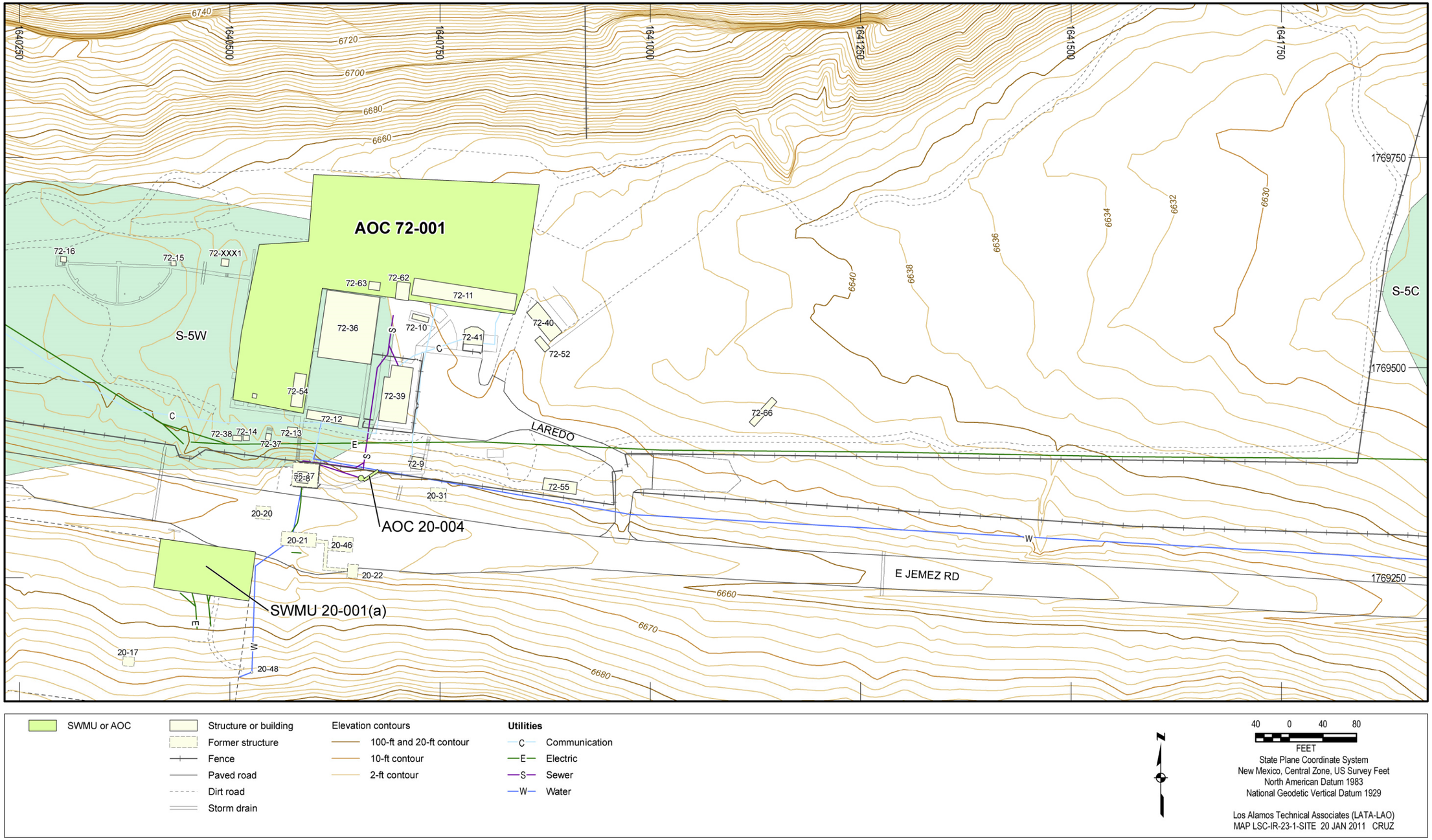


Figure 1 Site map of AOC 72-001

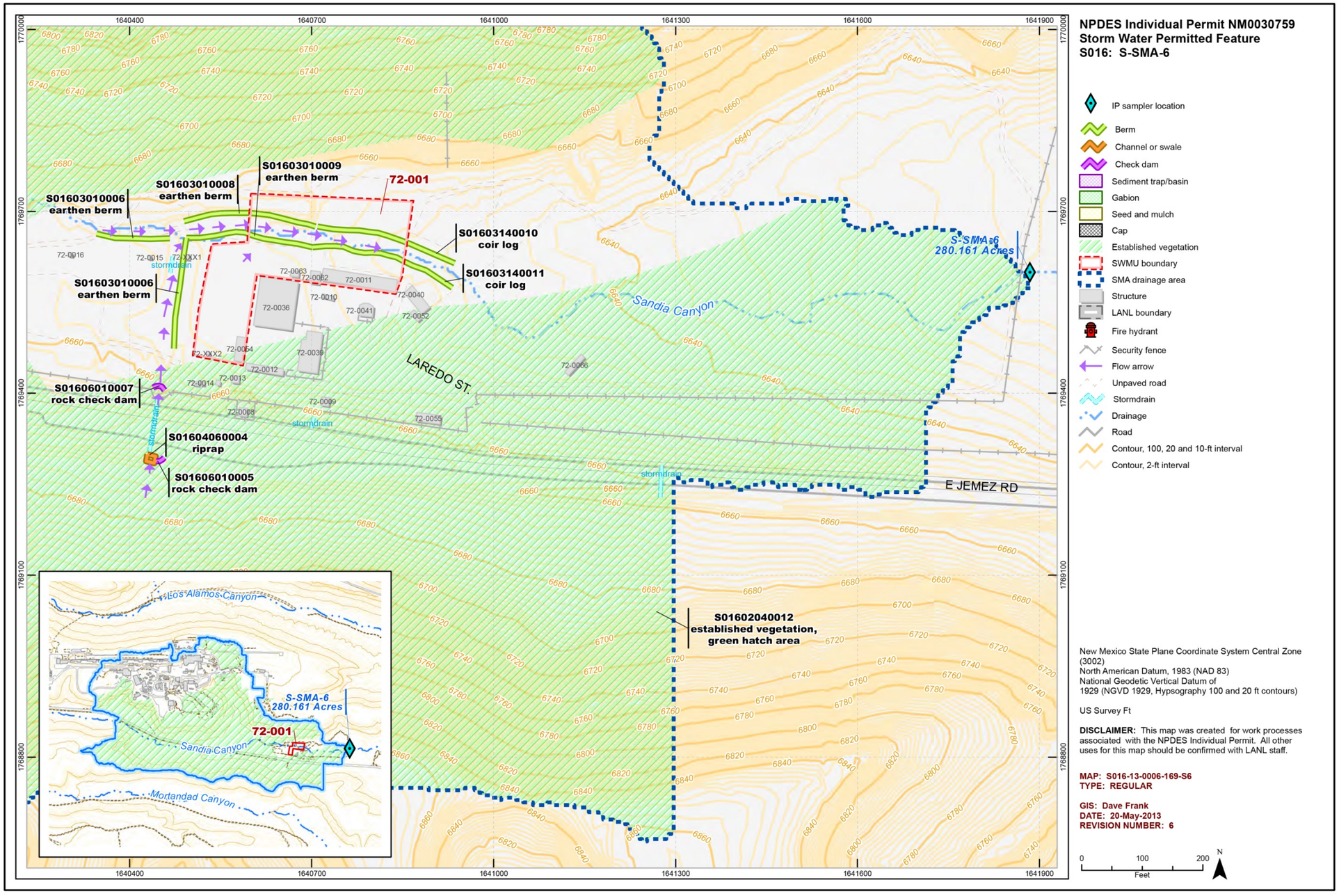


Figure 2 **S-SMA-6 drainage area location and features**

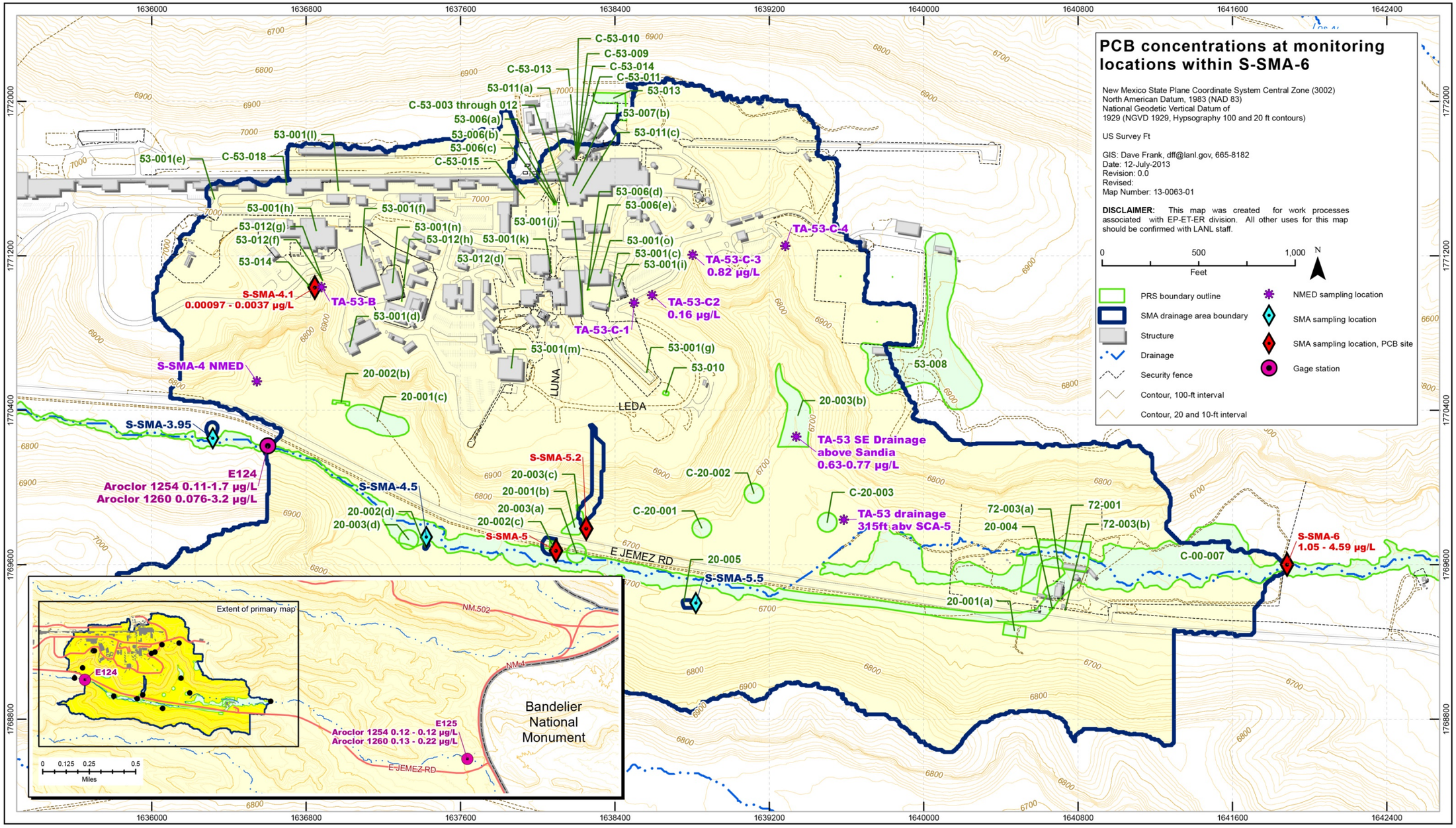


Figure 3 **PCB sampling locations and results within S-SMA-6 drainage area**

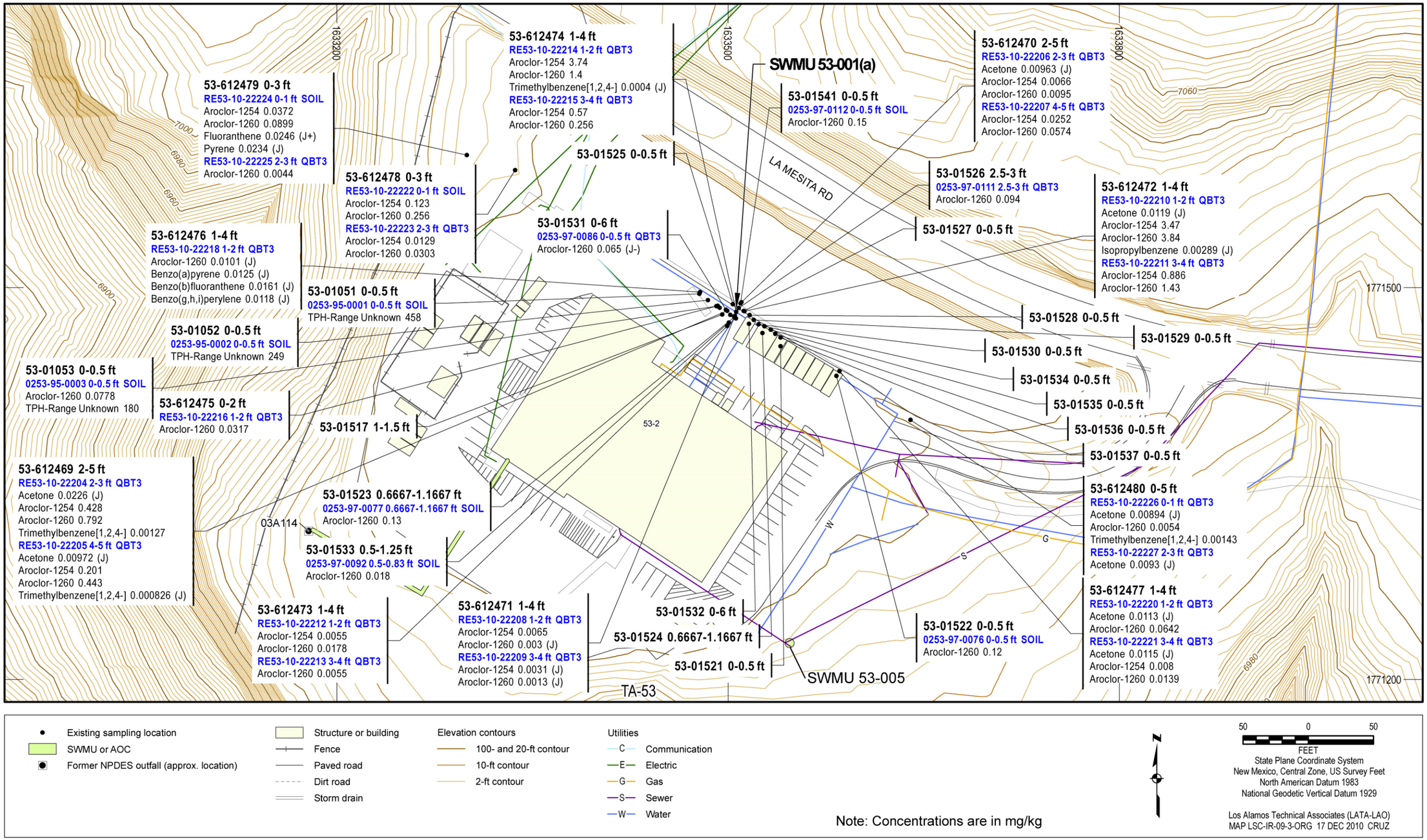


Figure 4 **Organic chemicals detected at SWMU 53-001(a)**

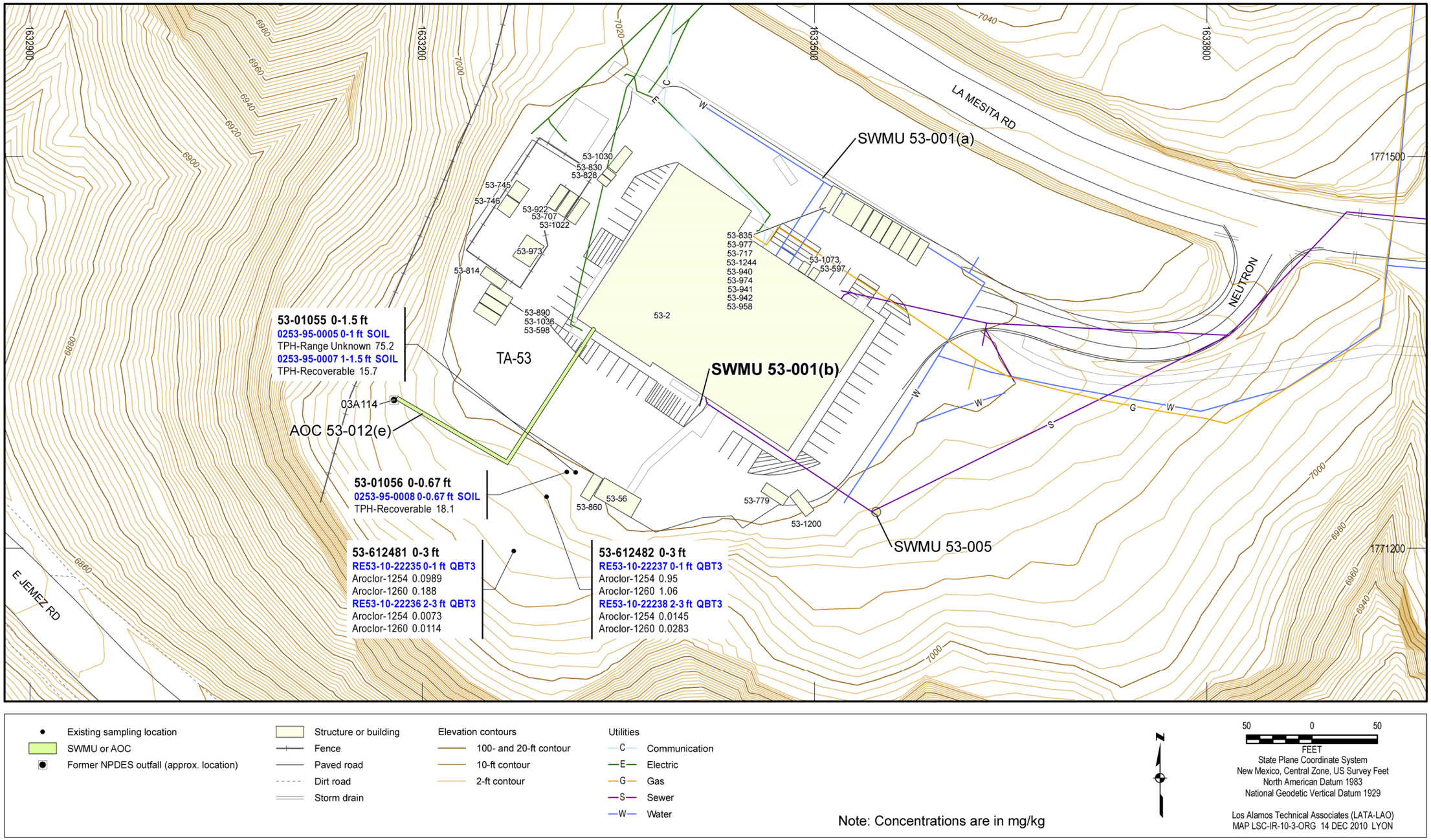


Figure 5 Organic chemicals detected at SWMU 53-001(b)

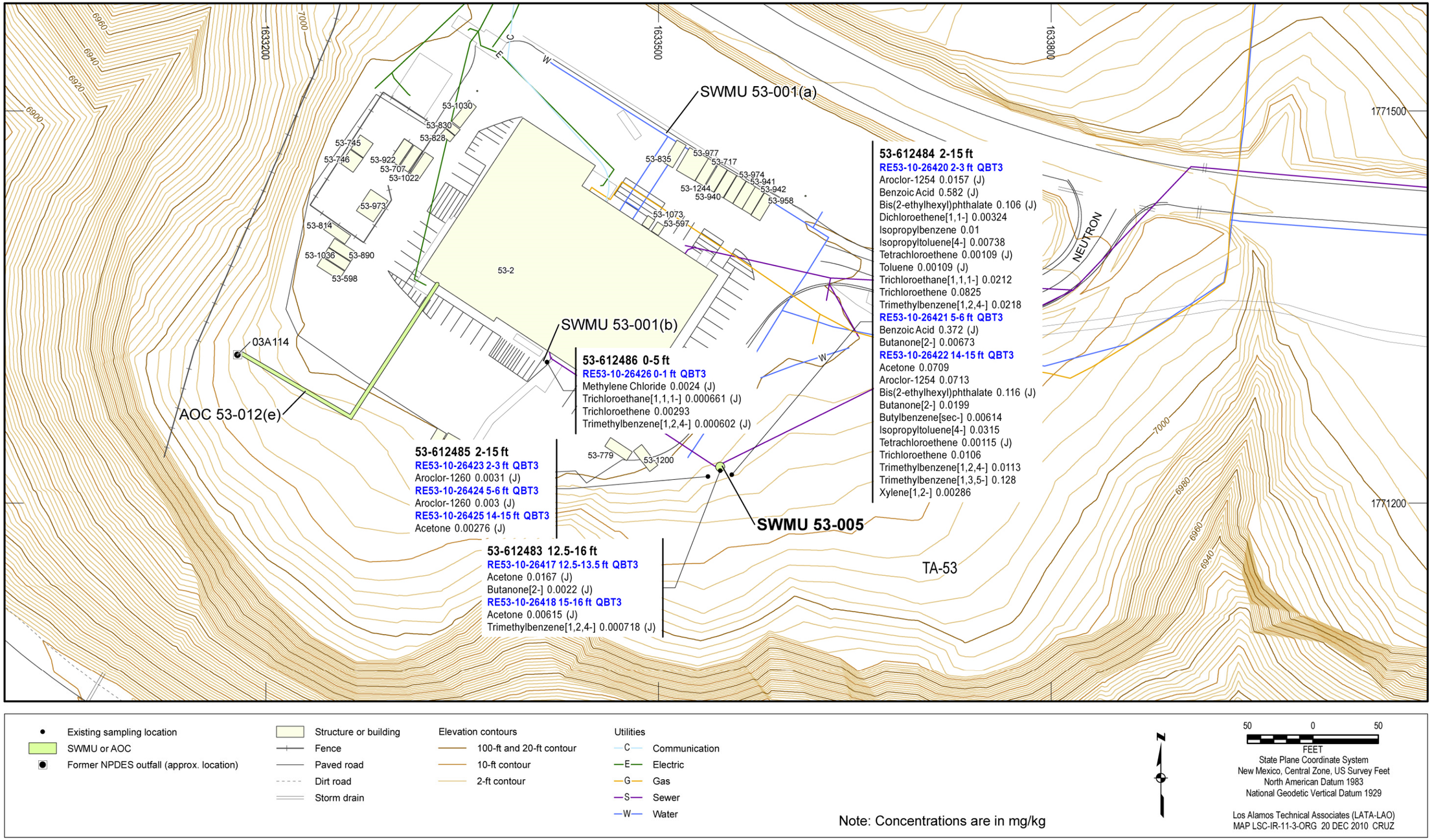


Figure 6 Organic chemicals detected at SWMU 53-005

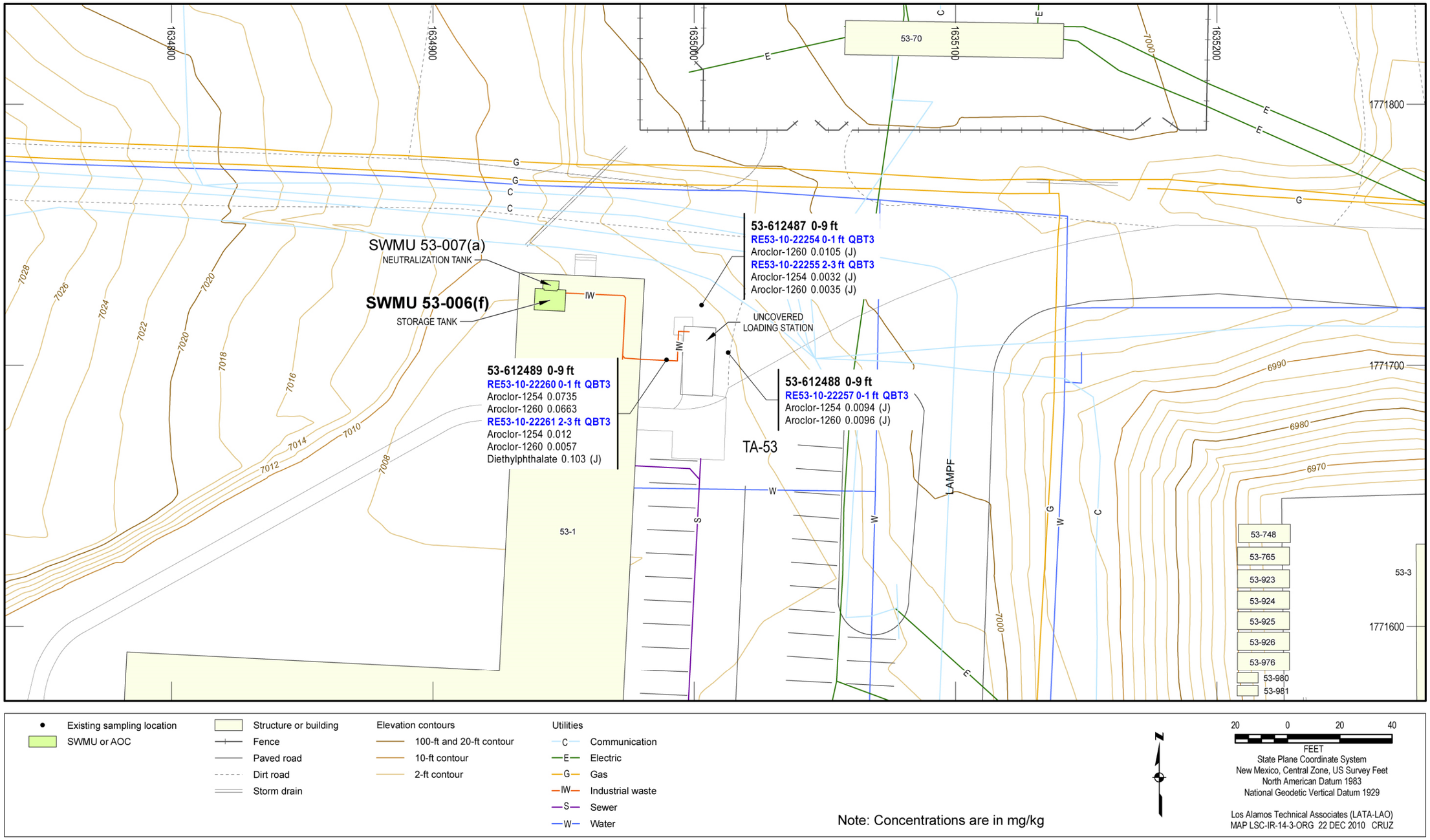


Figure 7 Organic chemicals detected at SWMU 53-006(f)

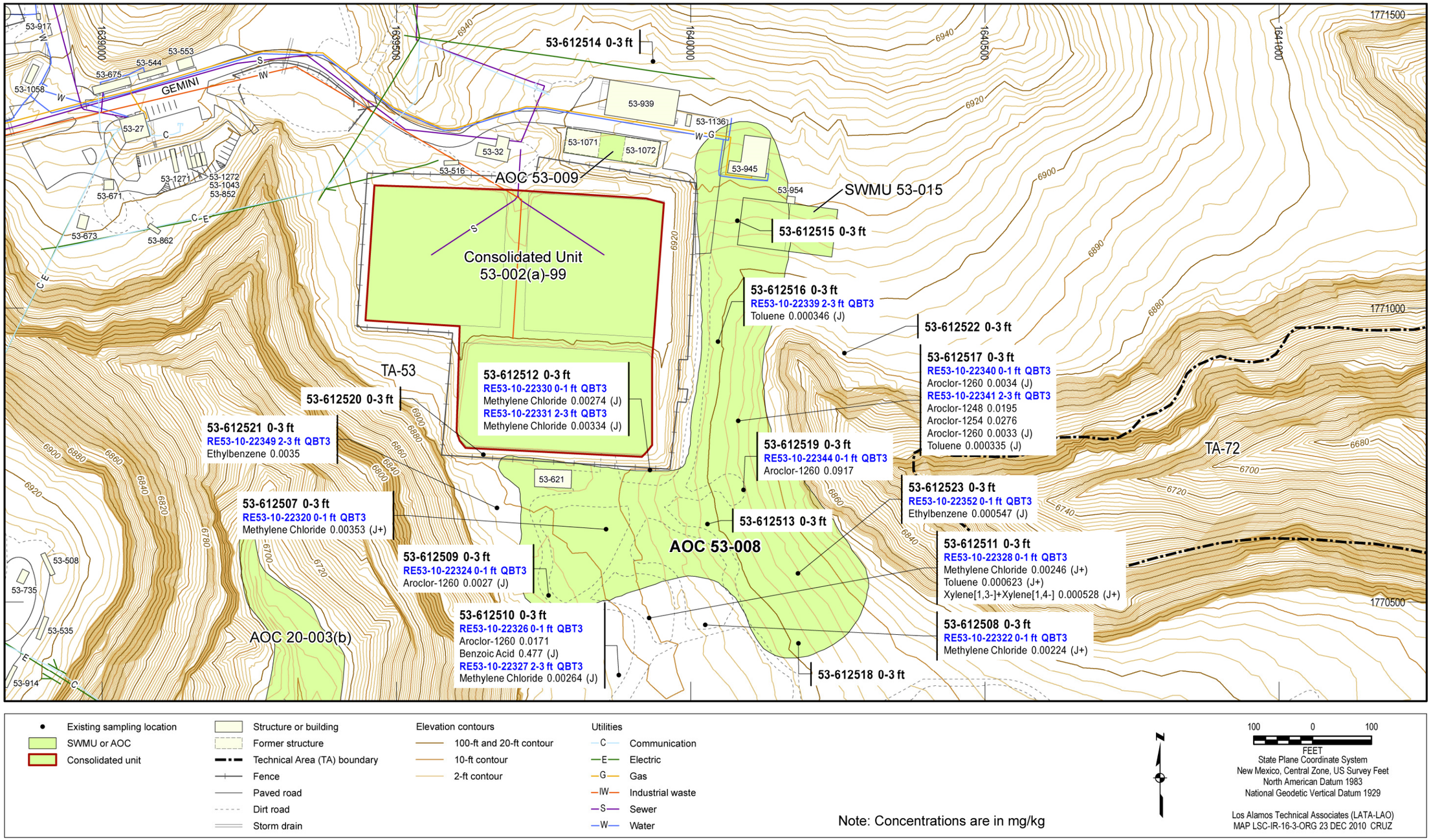


Figure 8 **Organic chemicals detected at AOC 53-008**

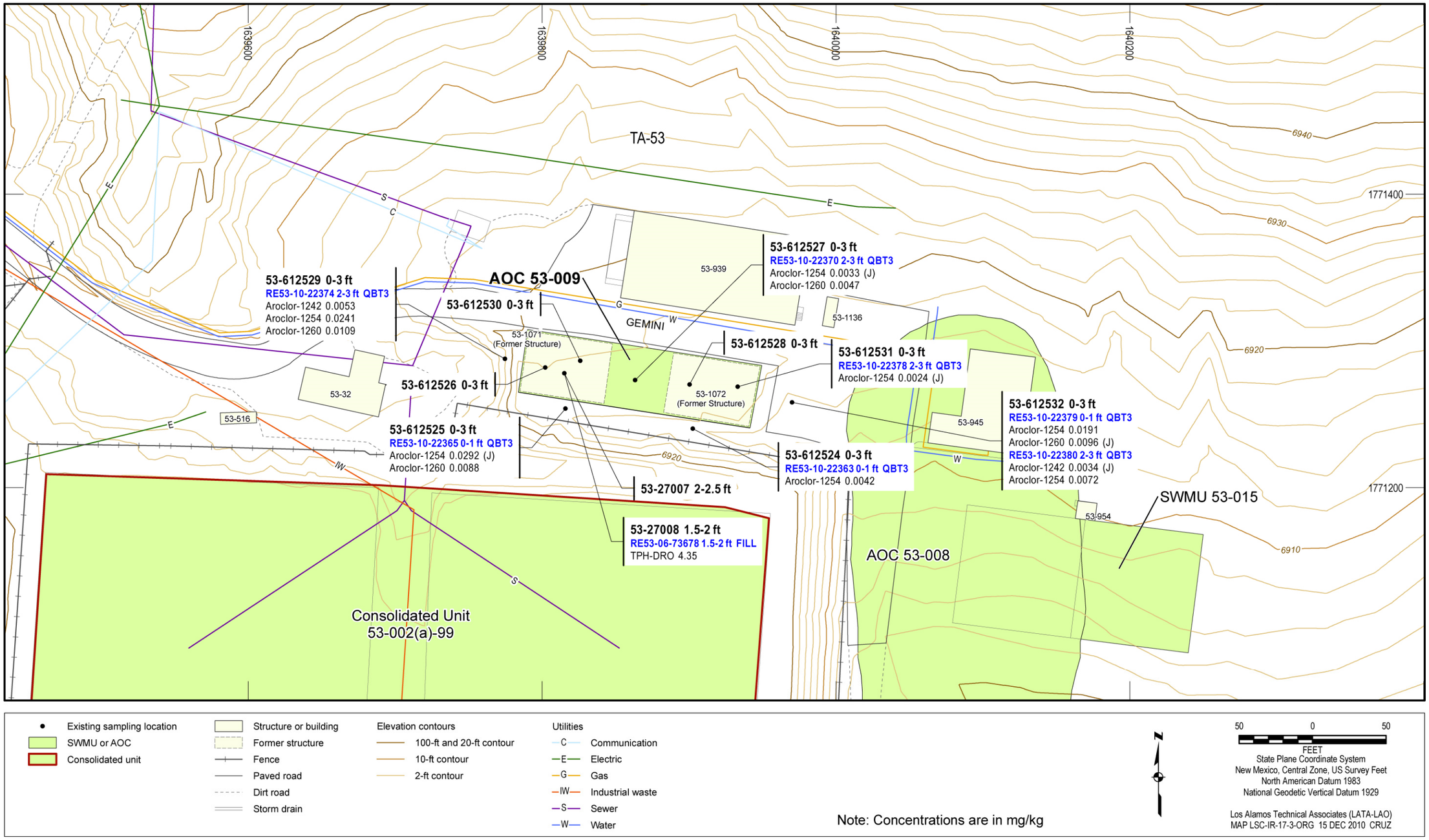


Figure 9 Organic chemicals detected at AOC 53-009

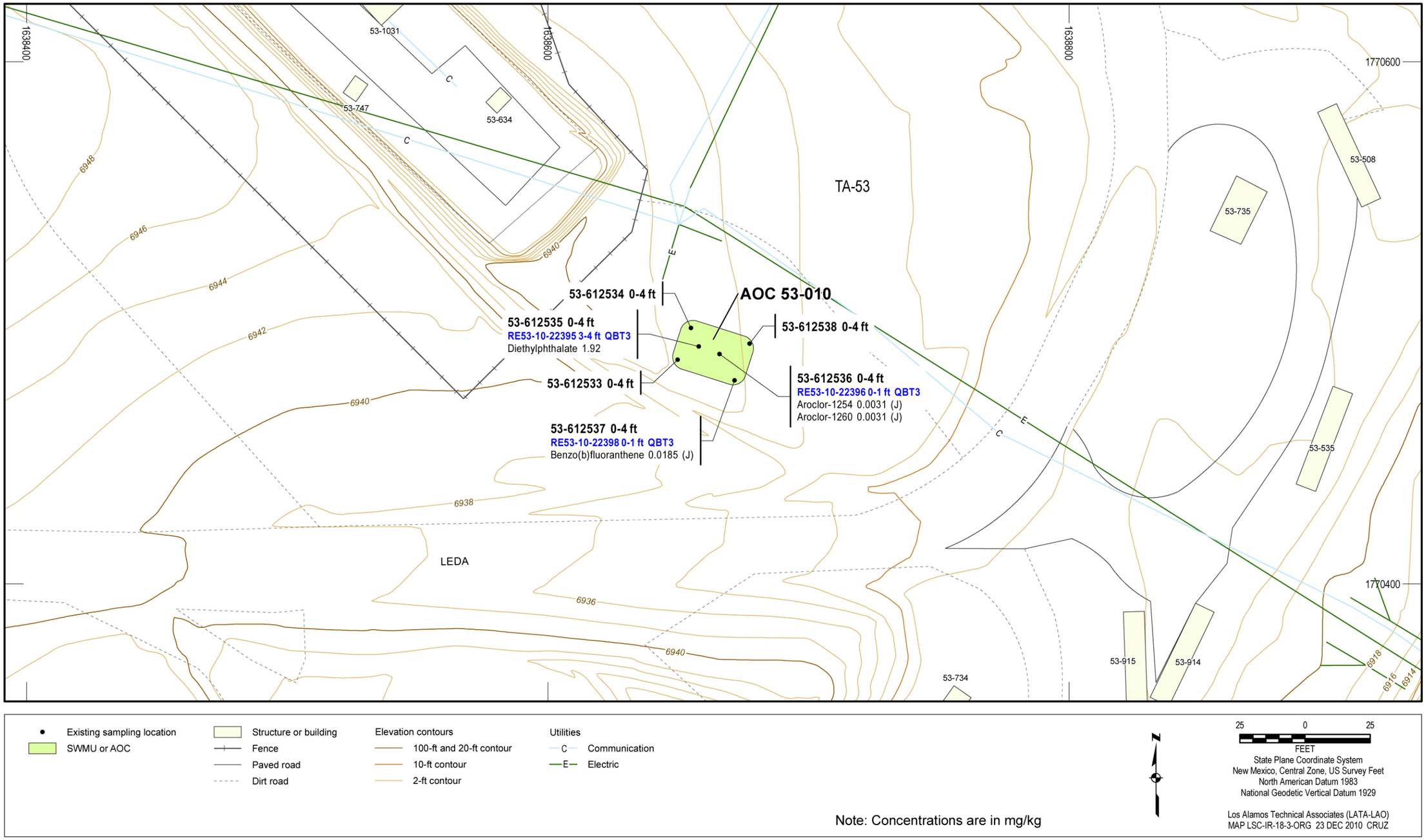


Figure 10 Organic chemicals detected at AOC 53-010

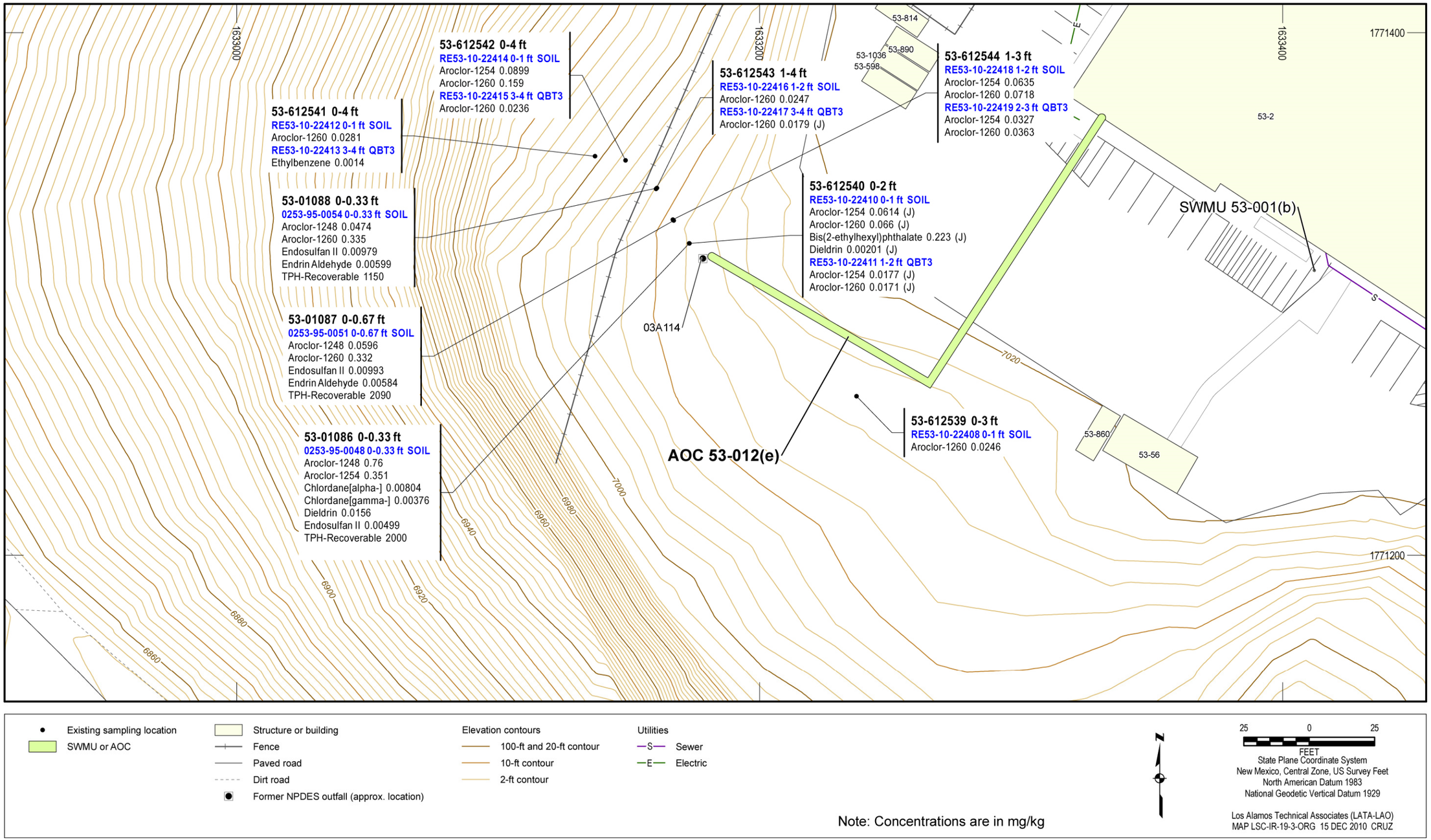


Figure 11 Organic chemicals detected at AOC 53-012(e)

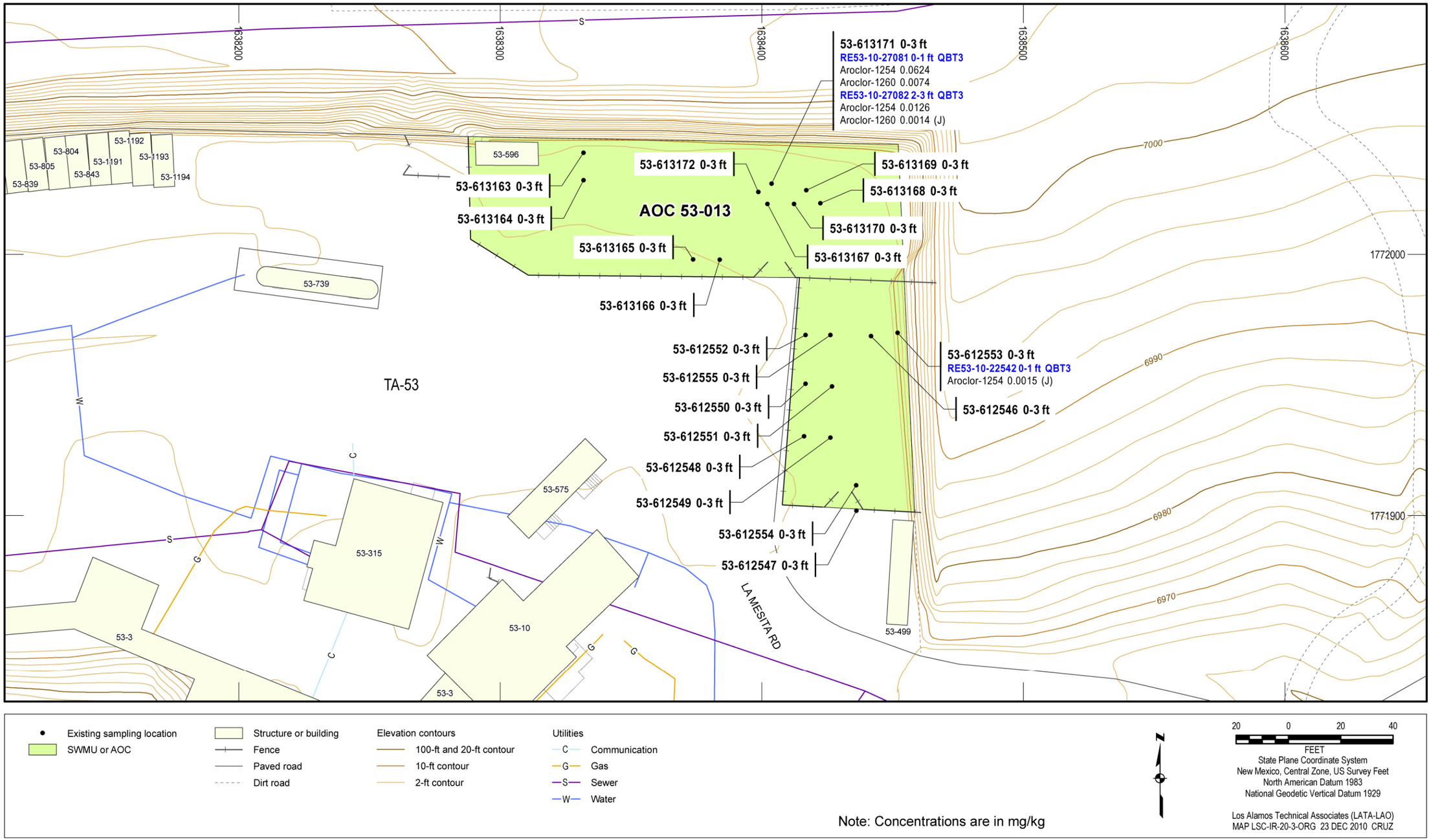


Figure 12 Organic chemicals detected at AOC 53-013

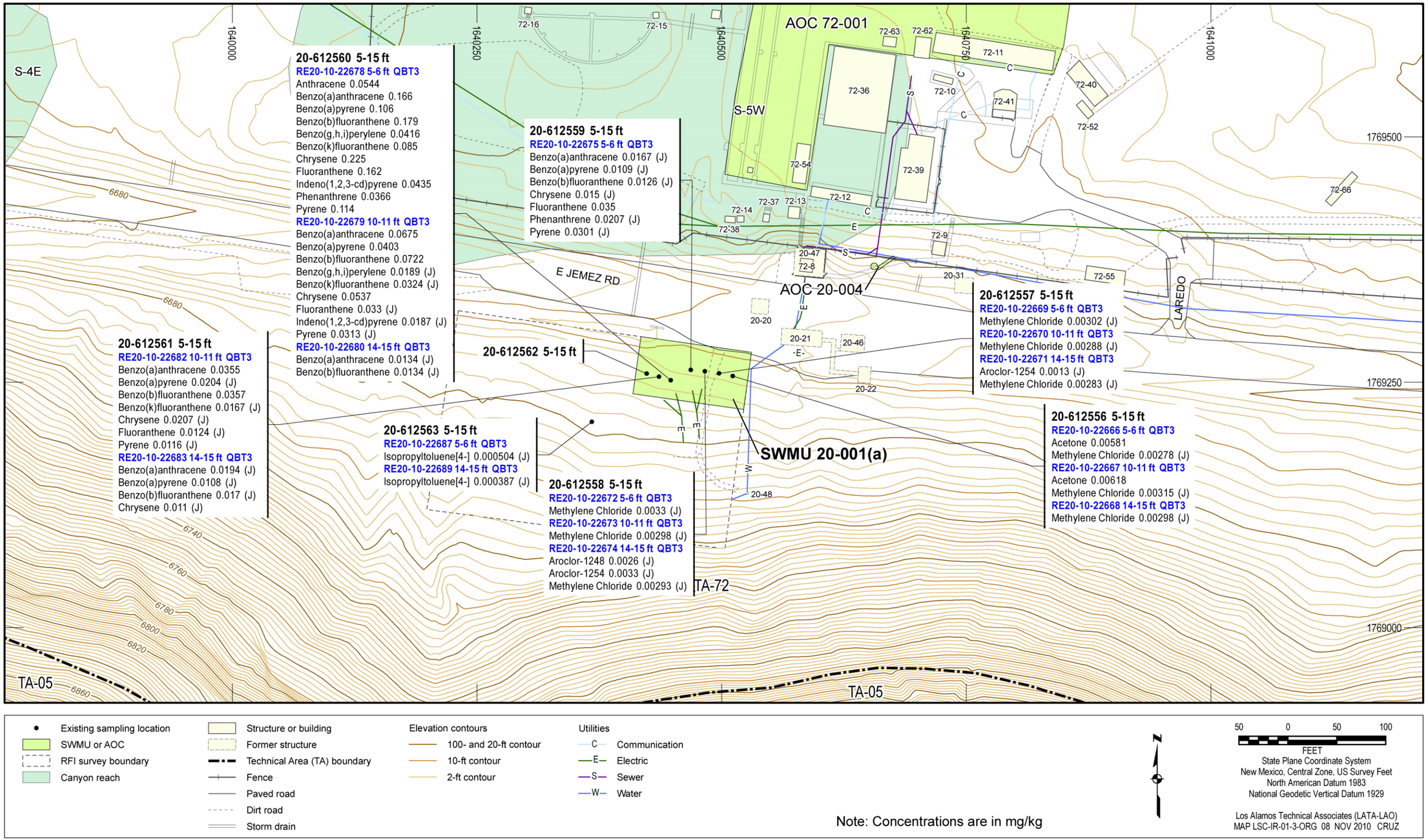


Figure 13 Organic chemicals detected at SWMU 20-001(a)

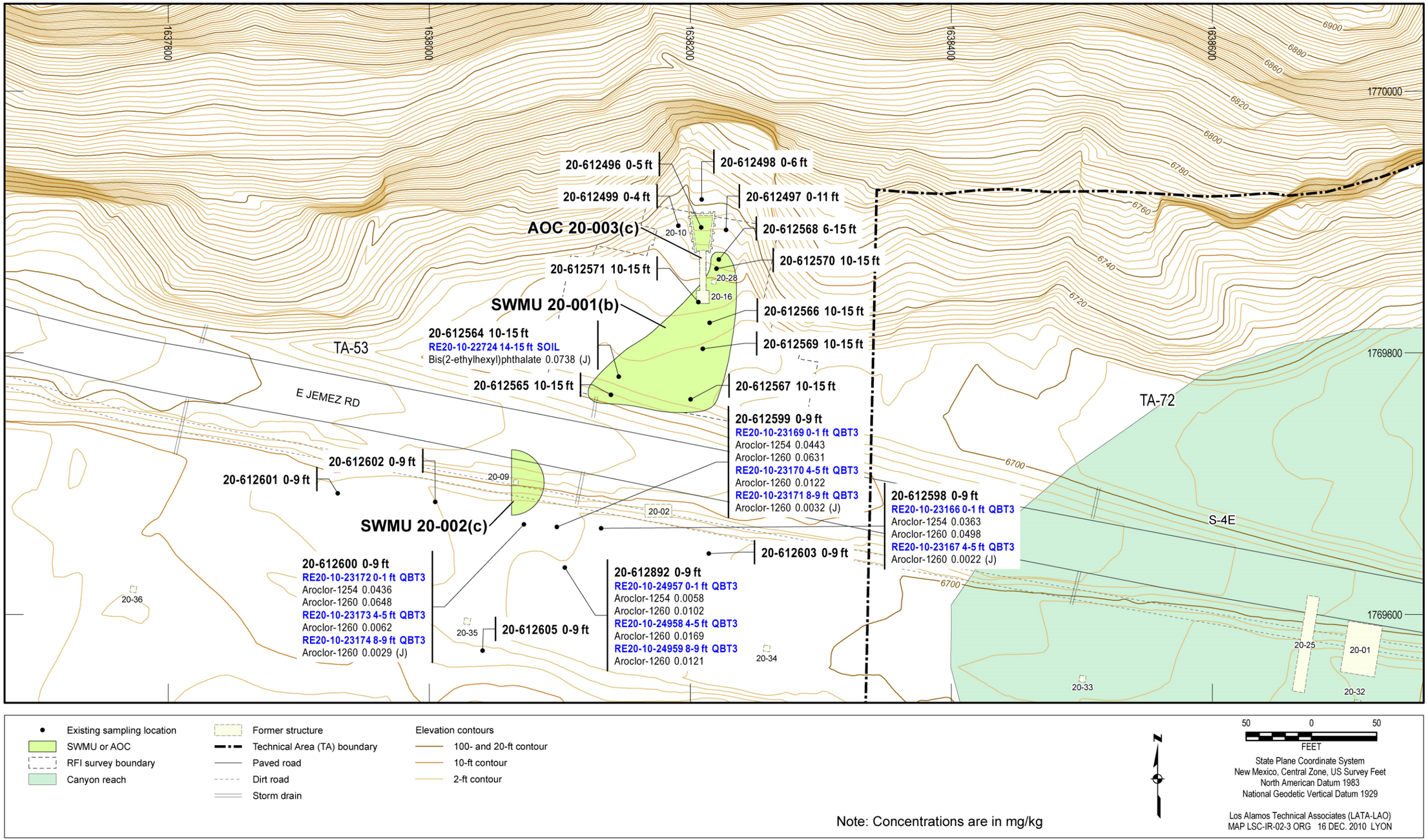
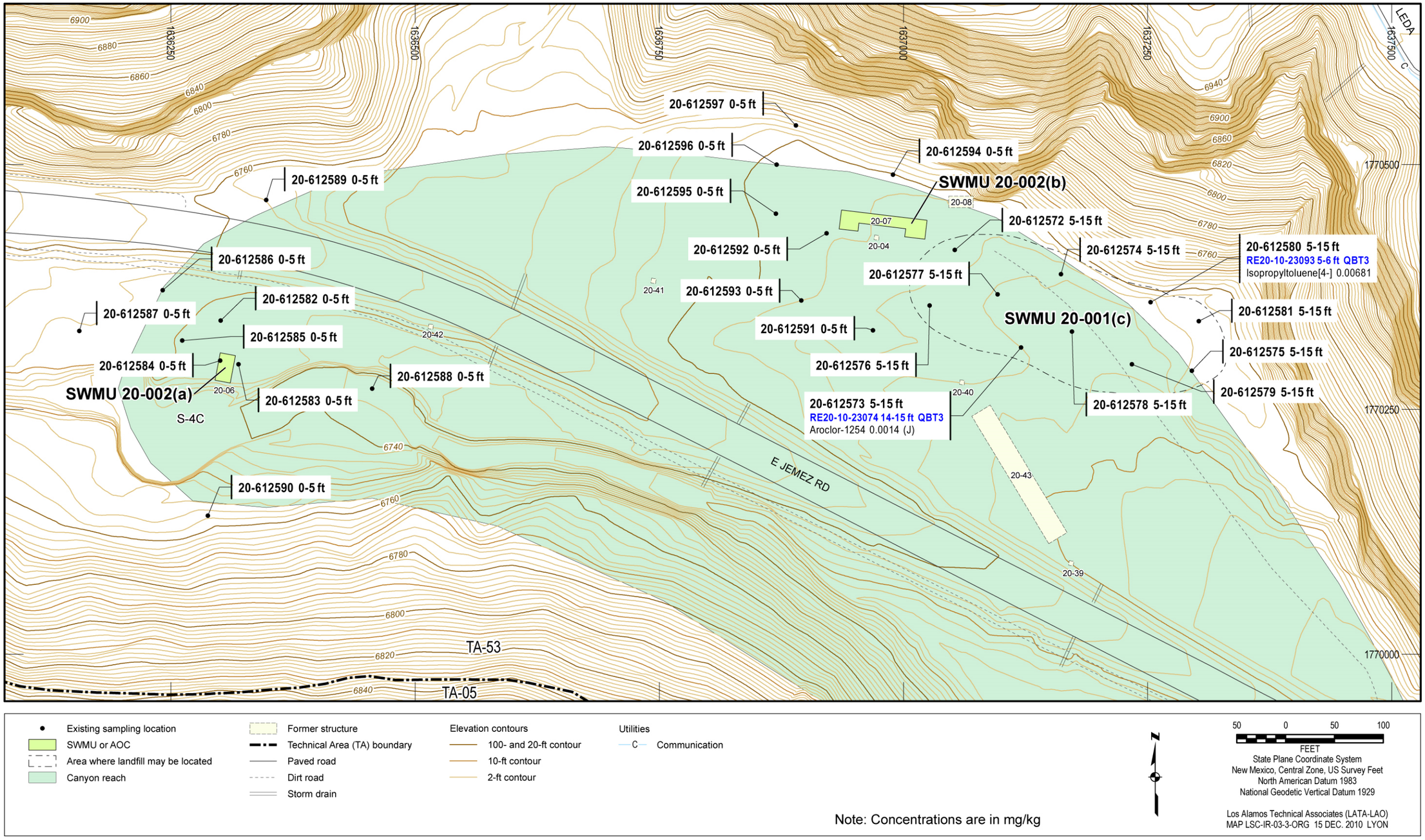


Figure 14 **Organic chemicals detected at SWMUs 20-001(b) and 20-002(c)**



Existing sampling location
SWMU or AOC
Area where landfill may be located
Canyon reach
Former structure
Technical Area (TA) boundary
Paved road
Dirt road
Storm drain
Elevation contours
100- and 20-ft contour
10-ft contour
2-ft contour
Utilities
C Communication

Note: Concentrations are in mg/kg

50 0 50 100
FEET
State Plane Coordinate System
New Mexico, Central Zone, US Survey Feet
North American Datum 1983
National Geodetic Vertical Datum 1929

Los Alamos Technical Associates (LATA-LAO)
MAP LSC-IR-03-3-ORG 15 DEC. 2010 LYON

Figure 15 Organic chemicals detected at SWMUs 20-001(c), 20-002(a), and 20-002(b)

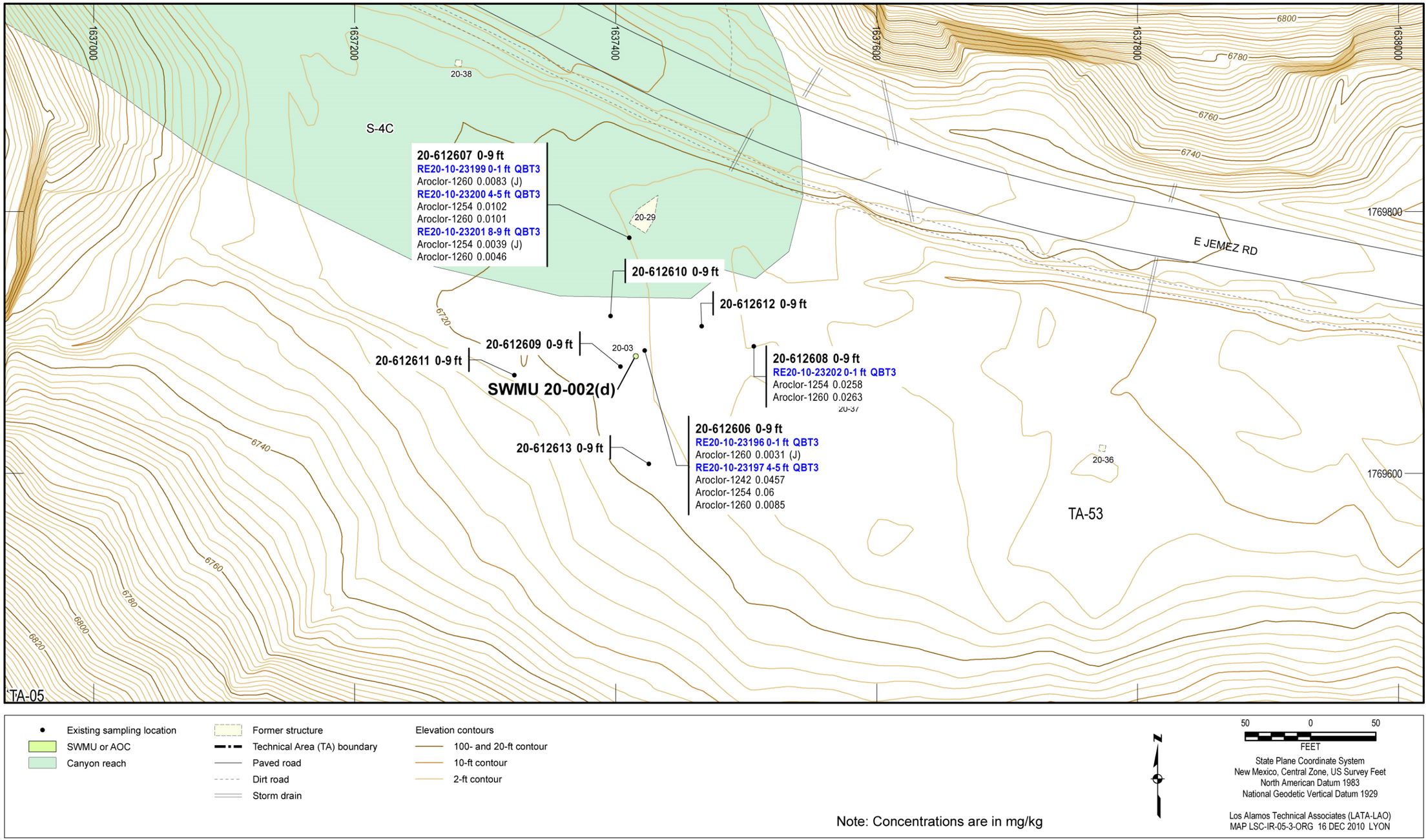


Figure 16 Organic chemicals detected at SWMU 20-002(d)

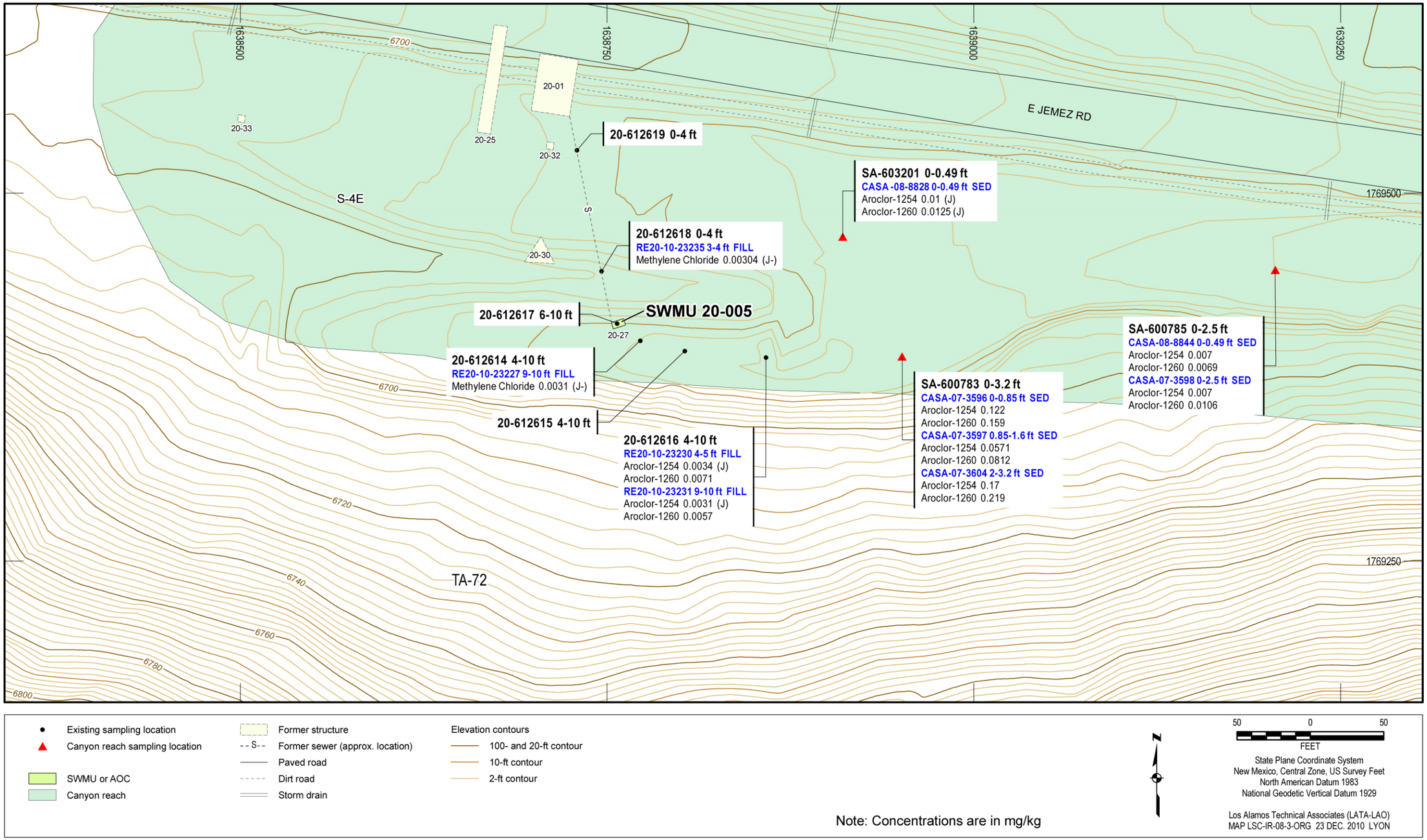


Figure 17 Organic chemicals detected at SWMU 20-005

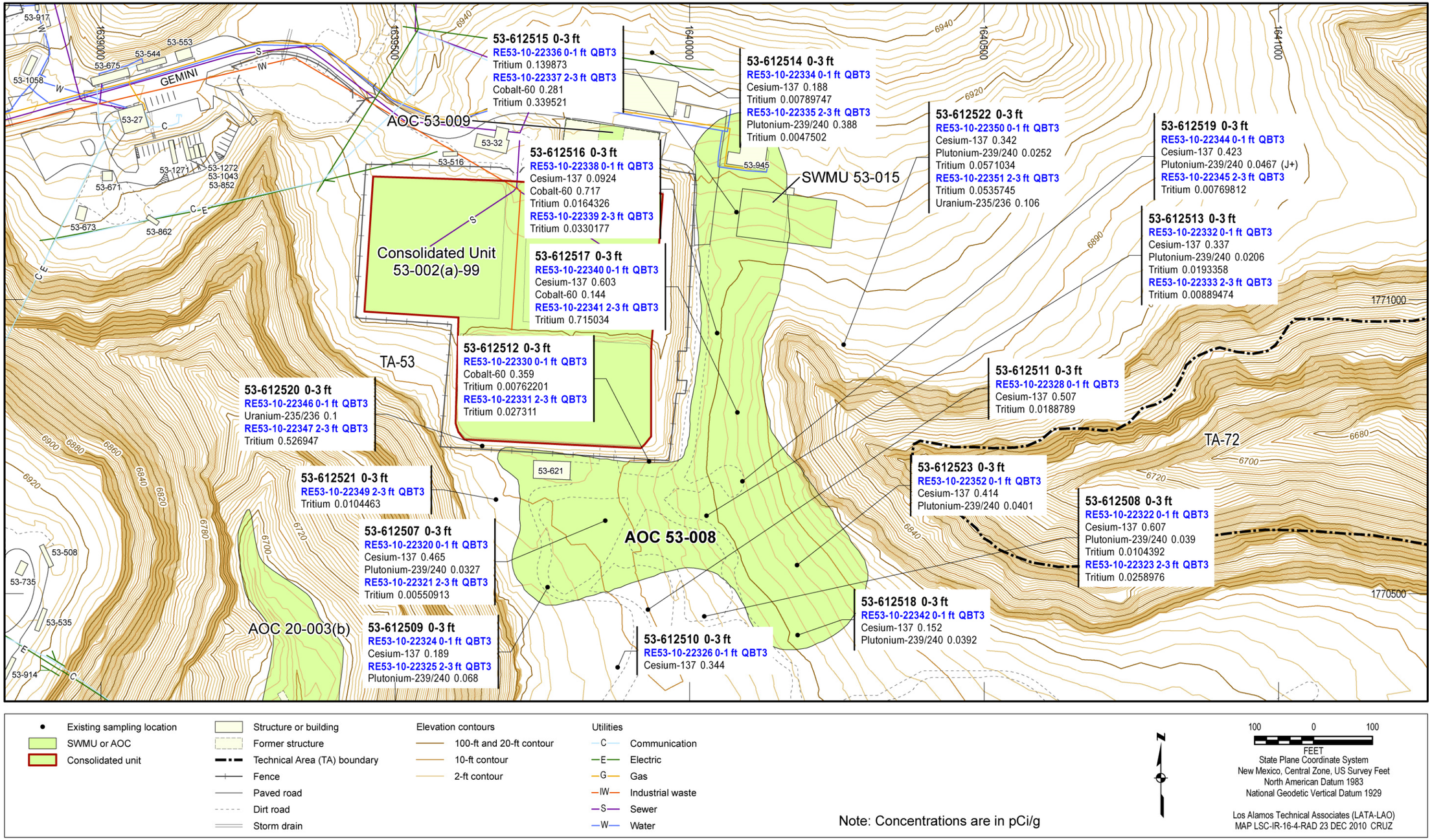


Figure 18 Radionuclides detected or detected above BVs/FVs at AOC 53-008

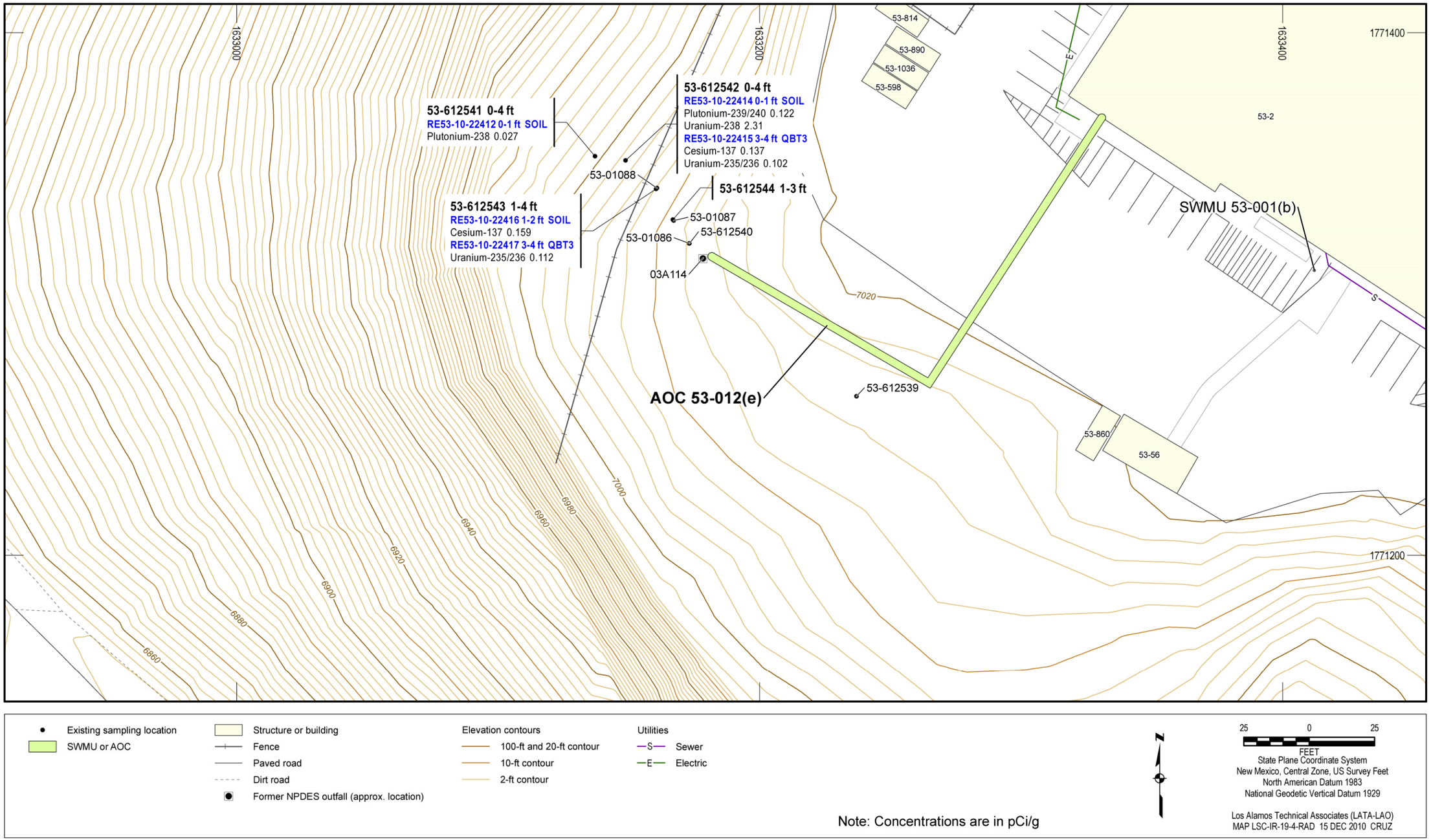


Figure 19 Radionuclides detected or detected above BVs/FVs at AOC 53-012(e)

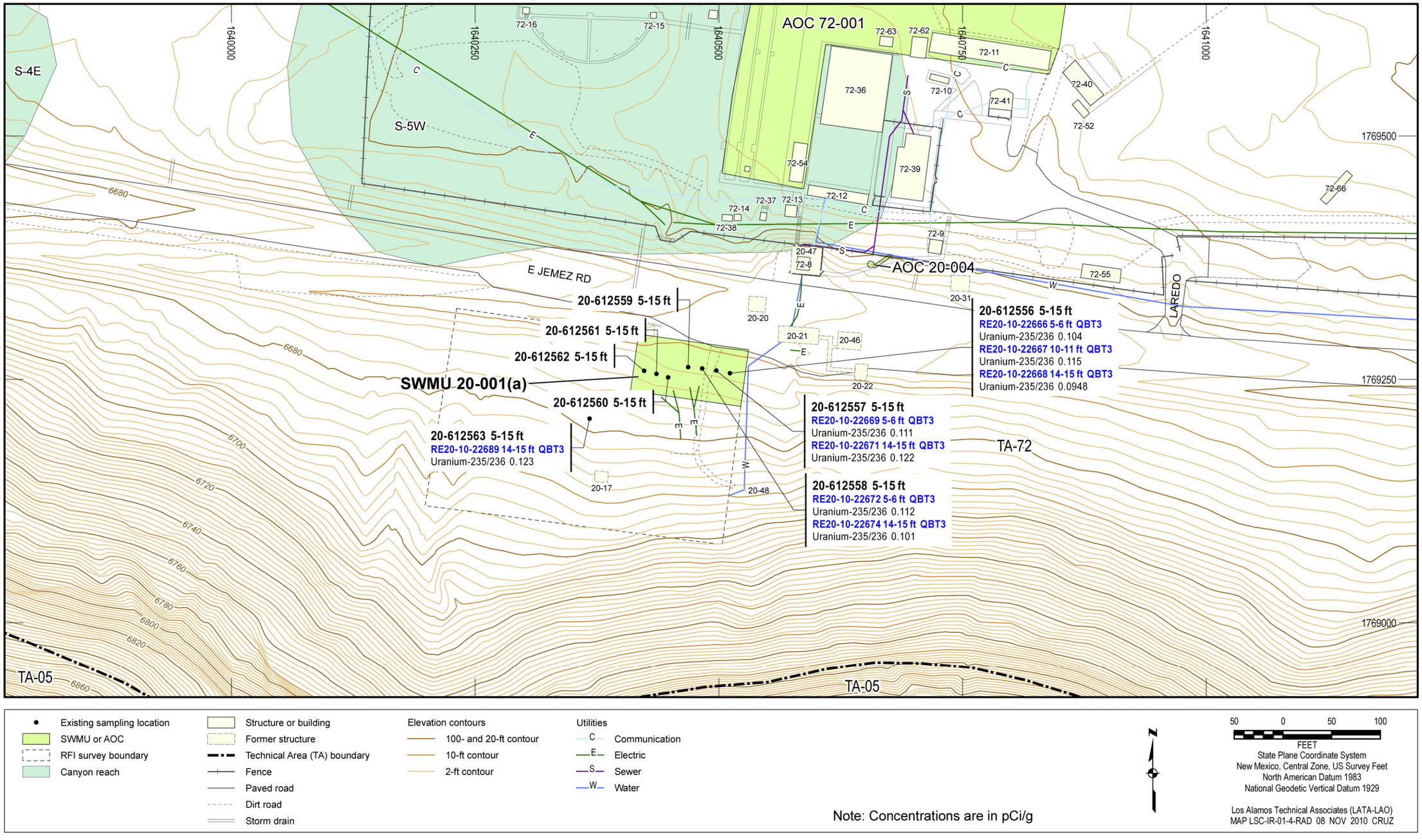


Figure 20 Radionuclides detected or detected above BVs/FVs at SWMU 20-001(a)

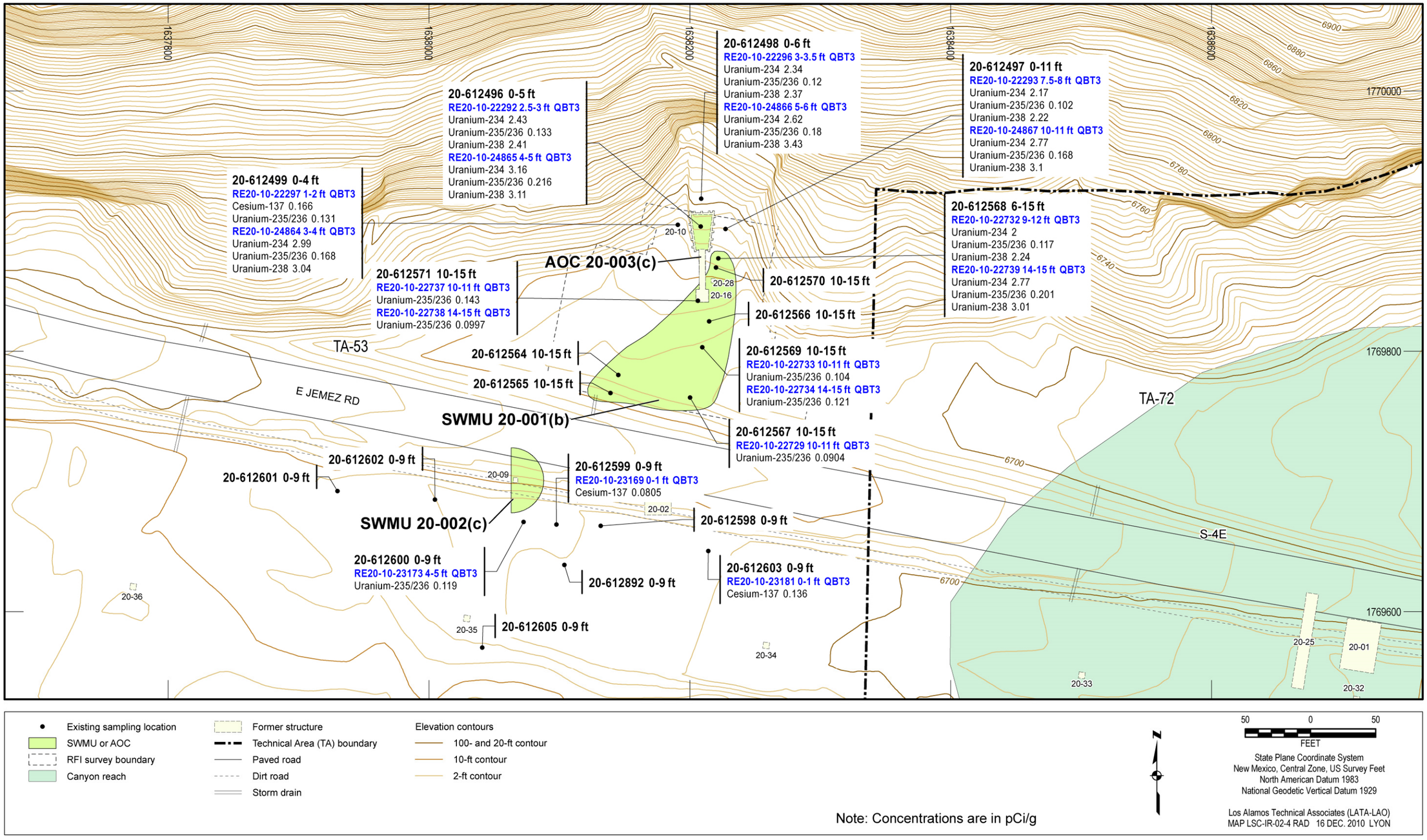


Figure 21 Radionuclides detected or detected above BVs/FVs at SWMUs 20-001(b) and 20-002(c) and AOC 20-003(c)

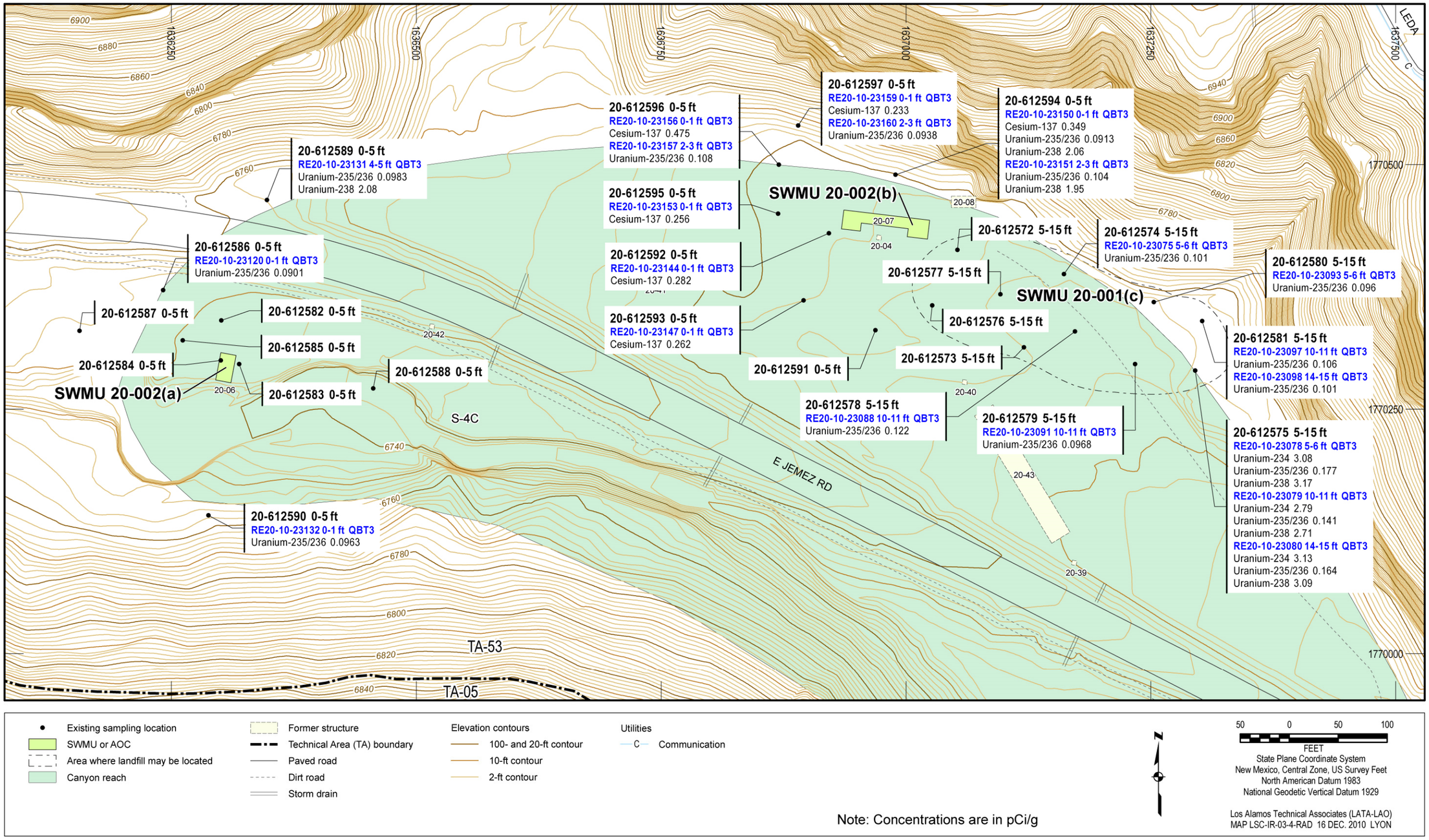


Figure 22 **Radionuclides detected or detected above BVs/FVs at SWMUs 20-001(c), 20-002(a), and 20-002(b)**

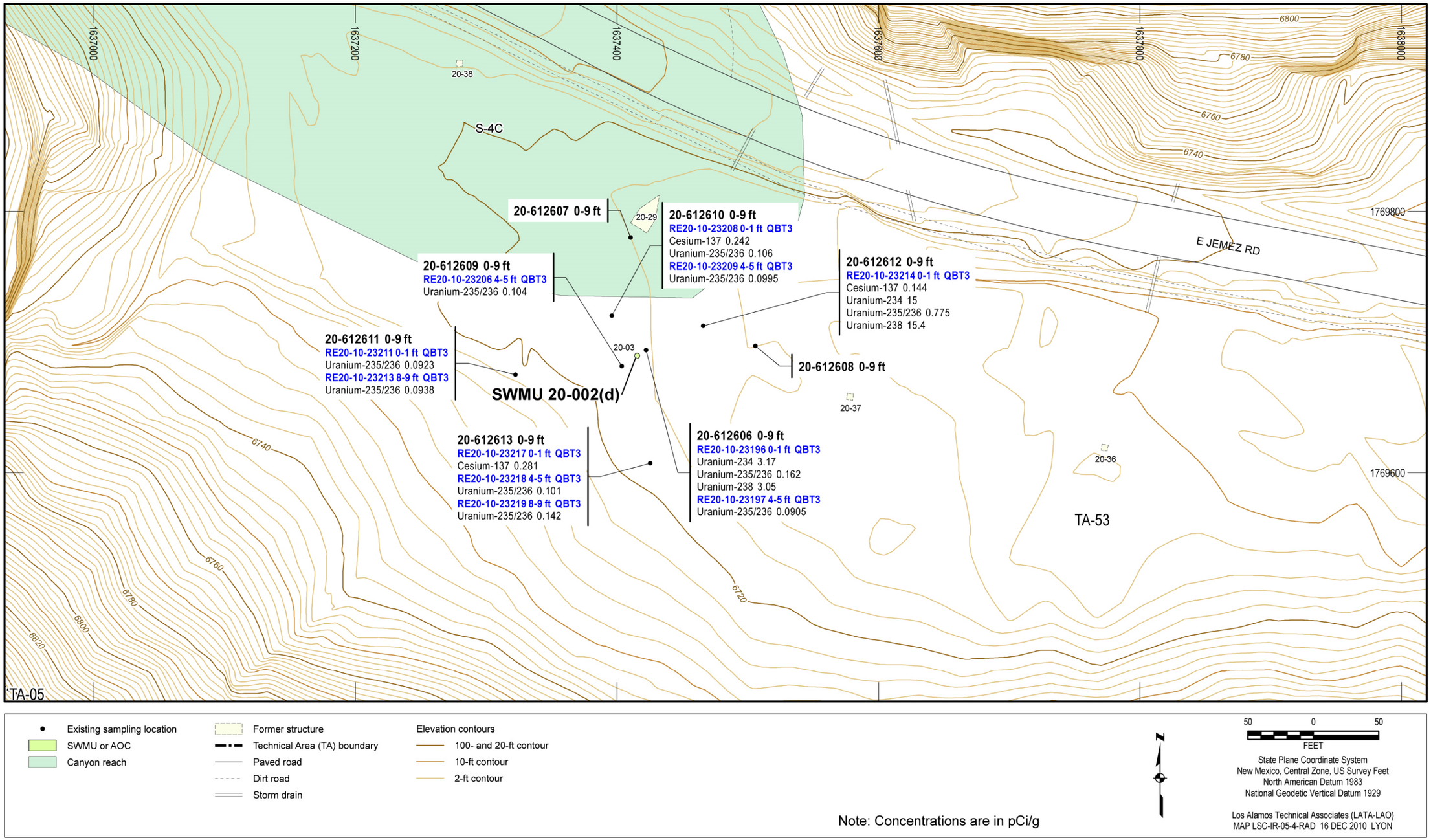


Figure 23 Radionuclides detected or detected above BVs/FVs at SWMU 20-002(d)

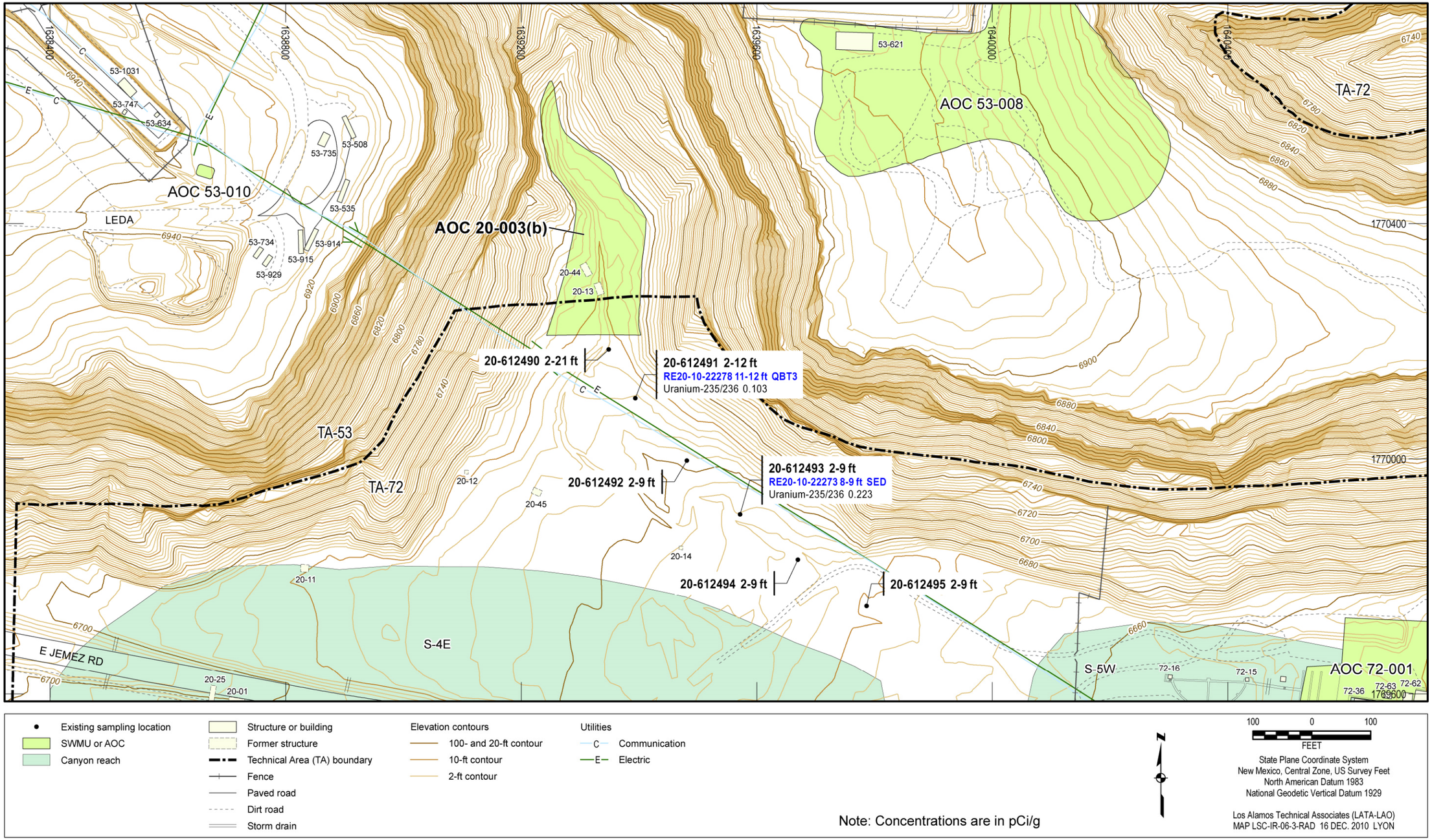


Figure 24 Radionuclides detected or detected above BVs/FVs at AOC 20-003(b)

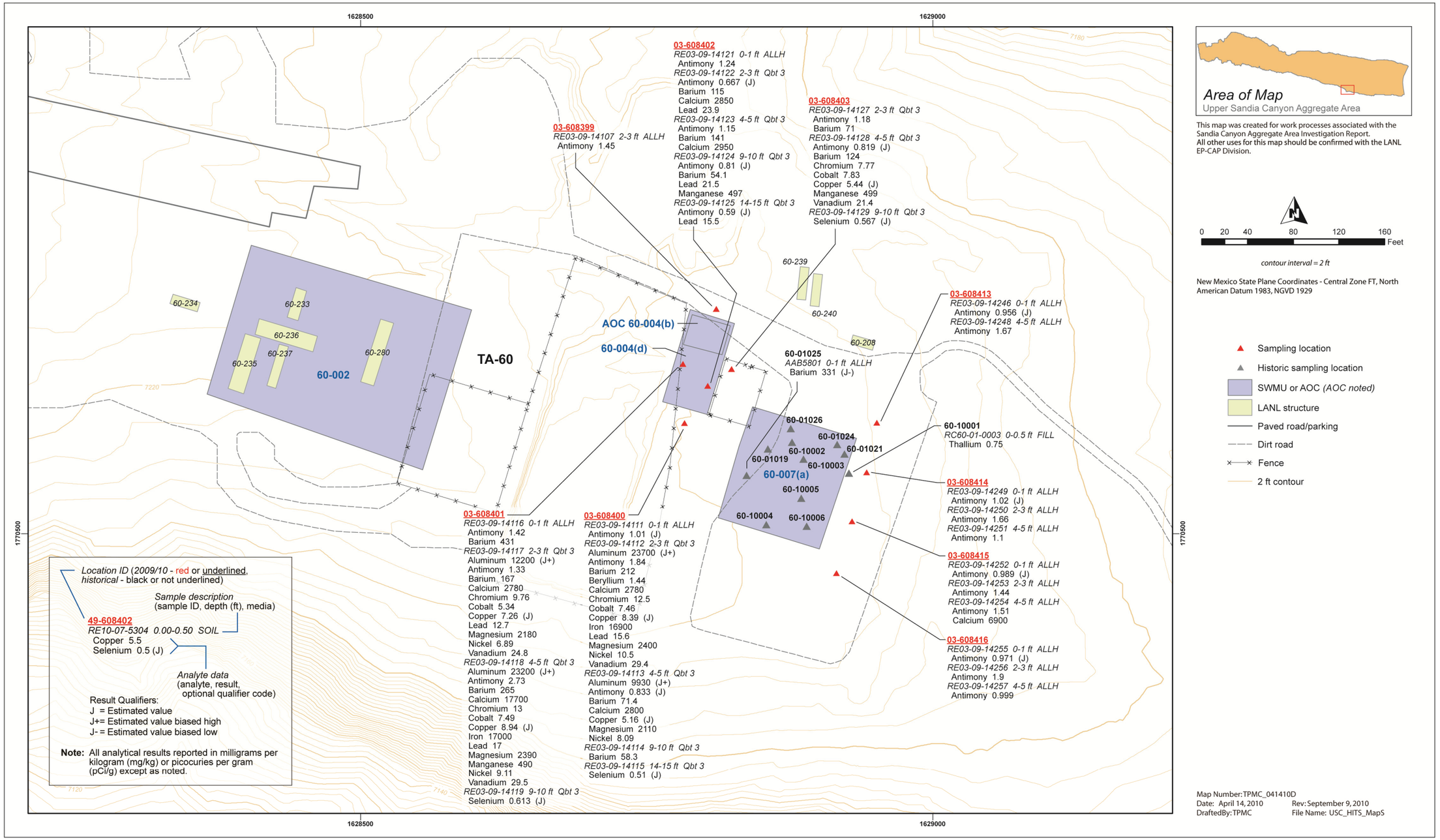


Figure 25 Inorganic chemical concentrations detected or detected above BVs at SWMU 60-007(a) and AOCs 60-004(b) and 60-004(d)

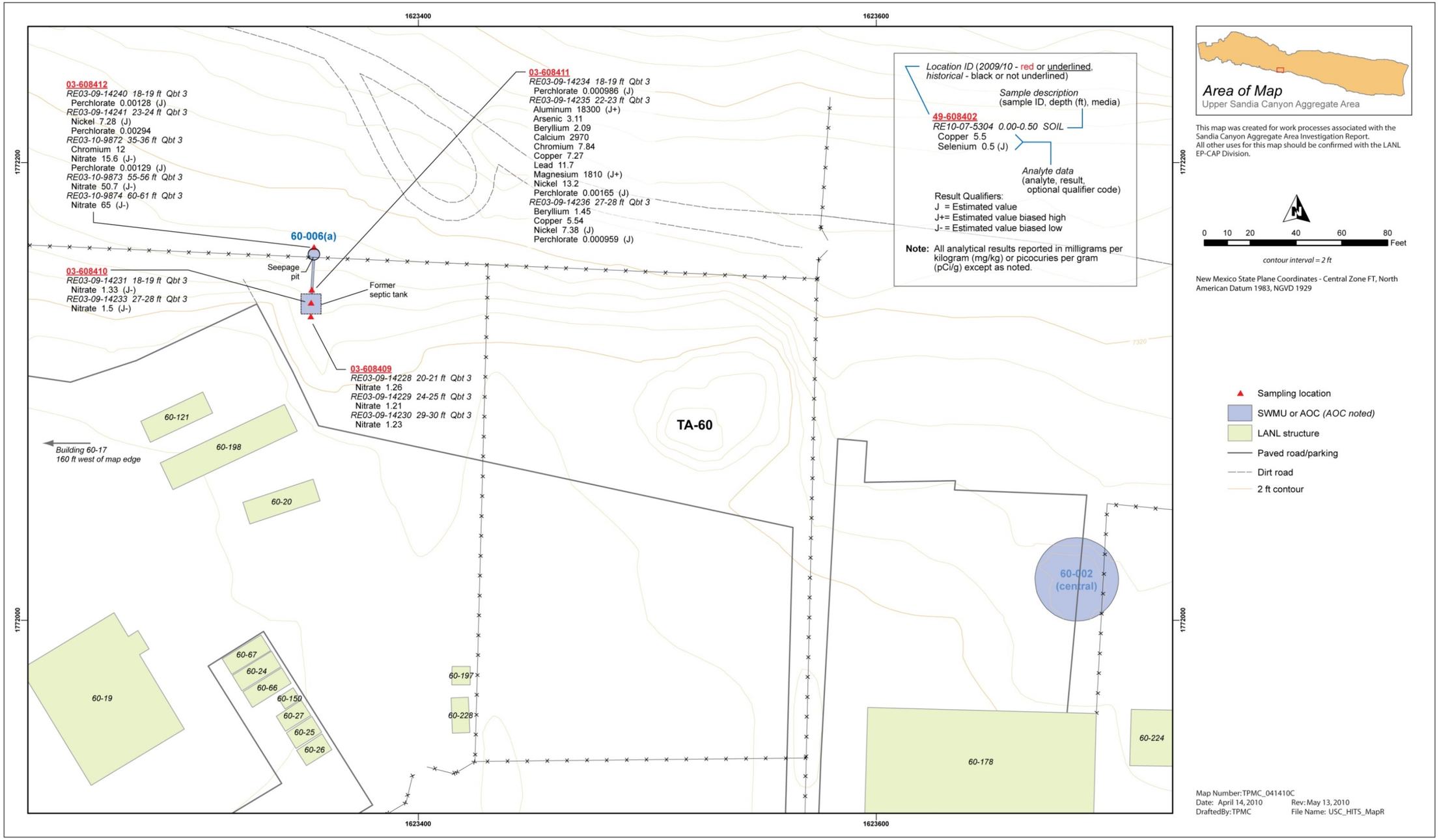


Figure 26 **Inorganic chemical concentrations detected or detected above BVs at SWMU 60-006(a)**

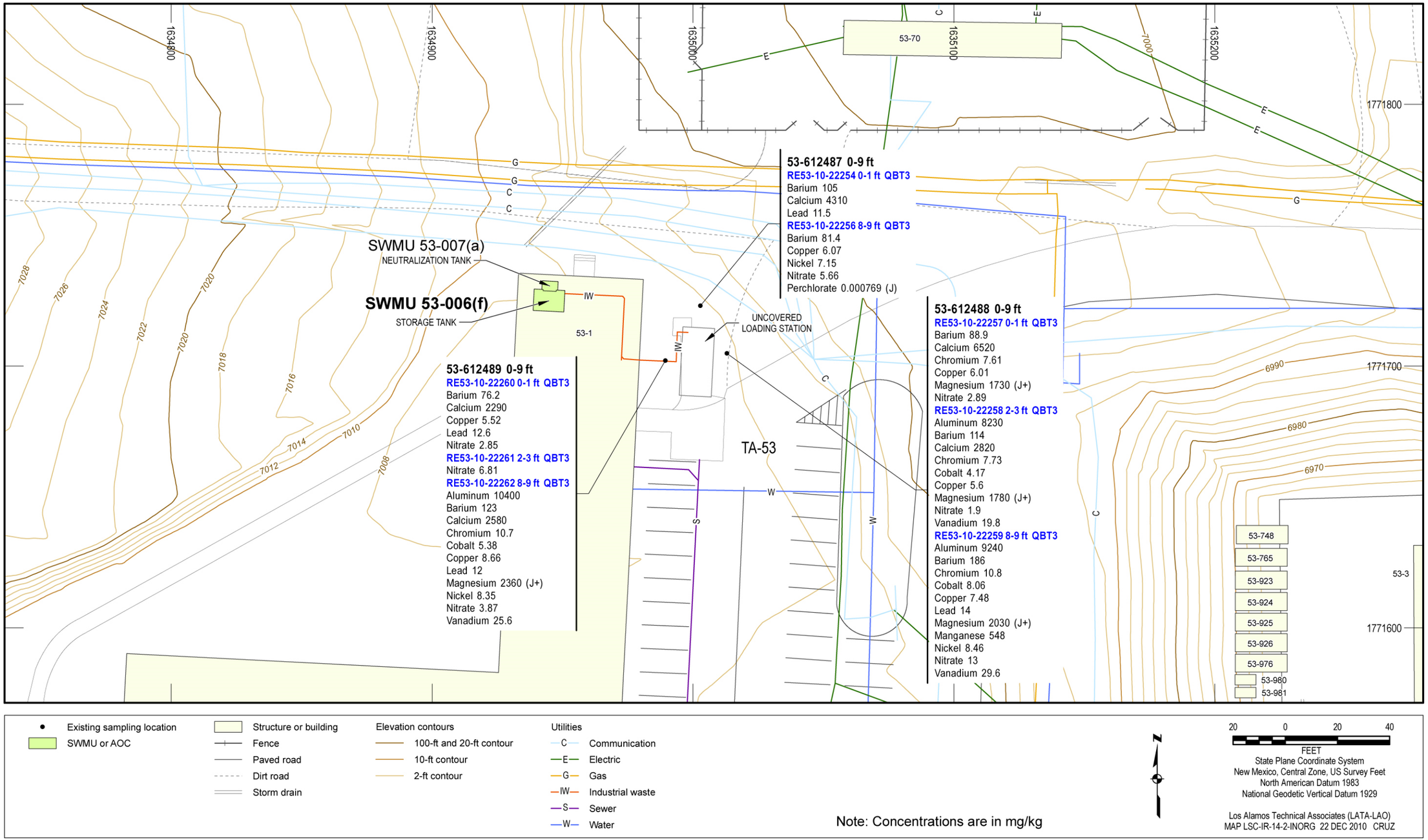
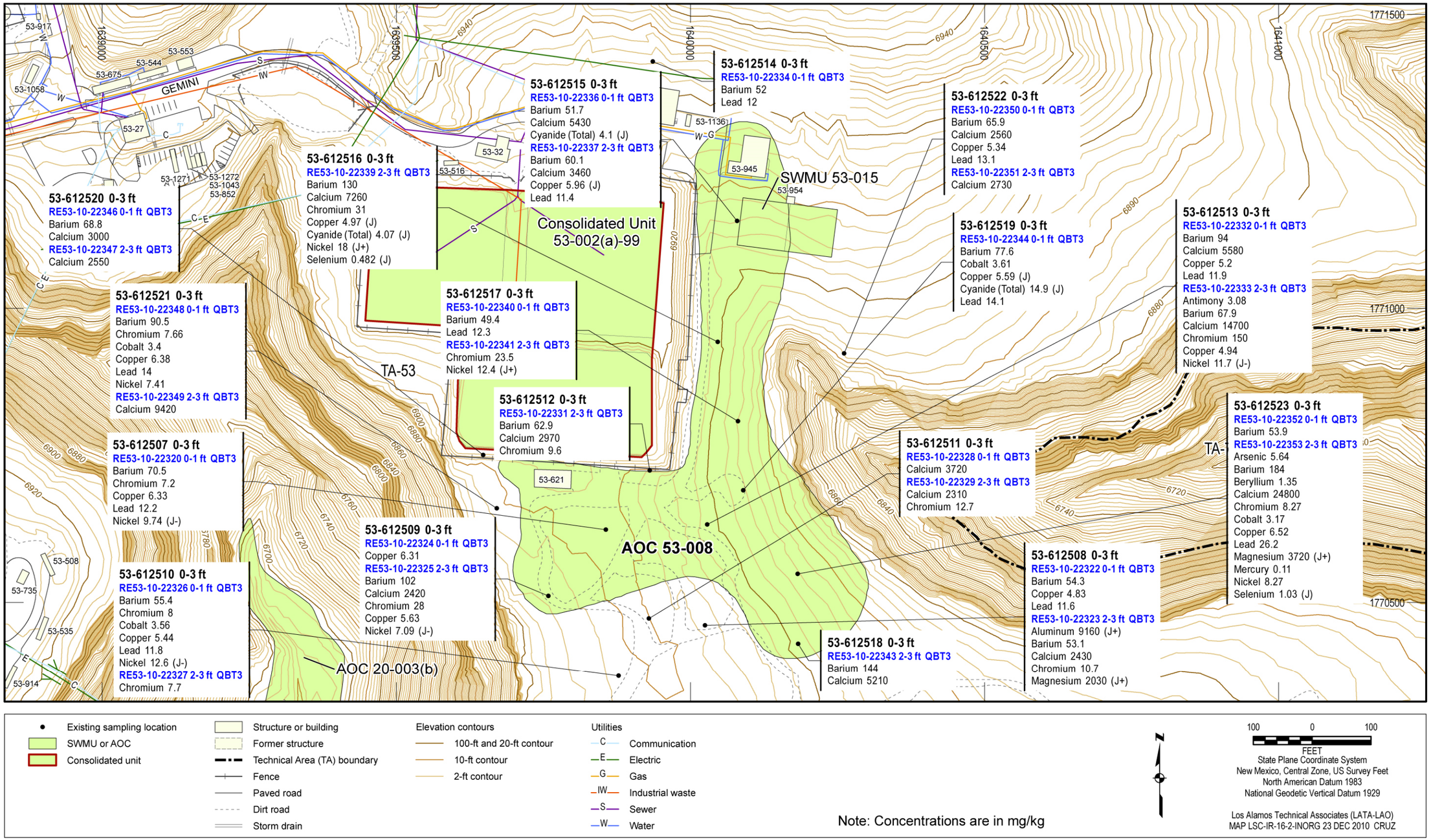


Figure 27 Inorganic chemicals detected or detected above BVs at SWMU 53-006(f)



Existing sampling location
SWMU or AOC
Consolidated unit

Structure or building
Former structure
Technical Area (TA) boundary
Fence
Paved road
Dirt road
Storm drain

Elevation contours
100-ft and 20-ft contour
10-ft contour
2-ft contour

Utilities
C Communication
E Electric
G Gas
IW Industrial waste
S Sewer
W Water

Note: Concentrations are in mg/kg

100 0 100
FEET
State Plane Coordinate System
New Mexico, Central Zone, US Survey Feet
North American Datum 1983
National Geodetic Vertical Datum 1929

Los Alamos Technical Associates (LATA-LAO)
MAP LSC-IR-16-2-INORG 23 DEC 2010 CRUZ

Figure 28 Inorganic chemicals detected or detected above BVs at AOC 53-008

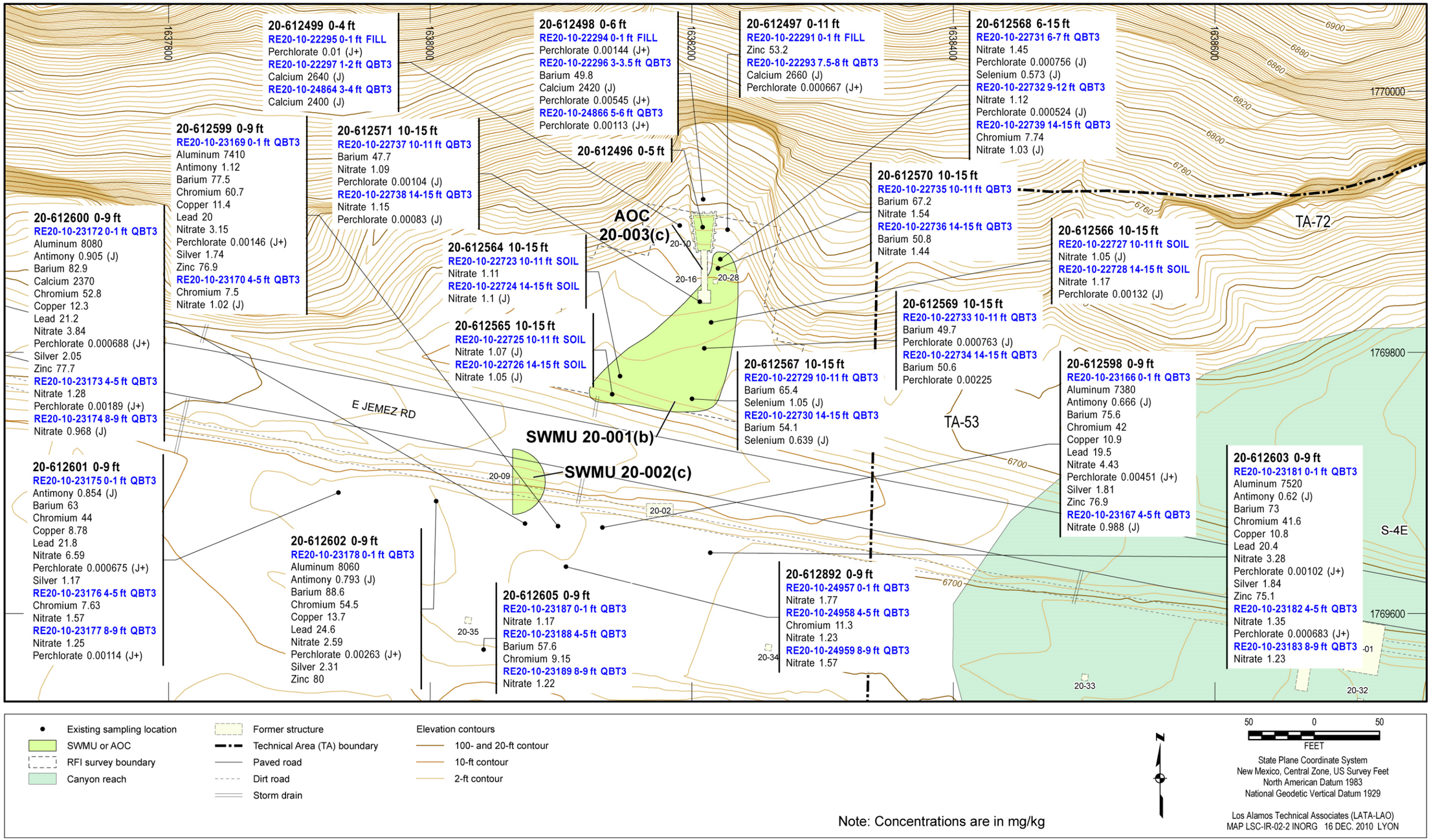


Figure 29 **Inorganic chemicals detected or detected above BVs at SWMUs 20-001(b) and 20-002(c) and AOC 20-003(c)**

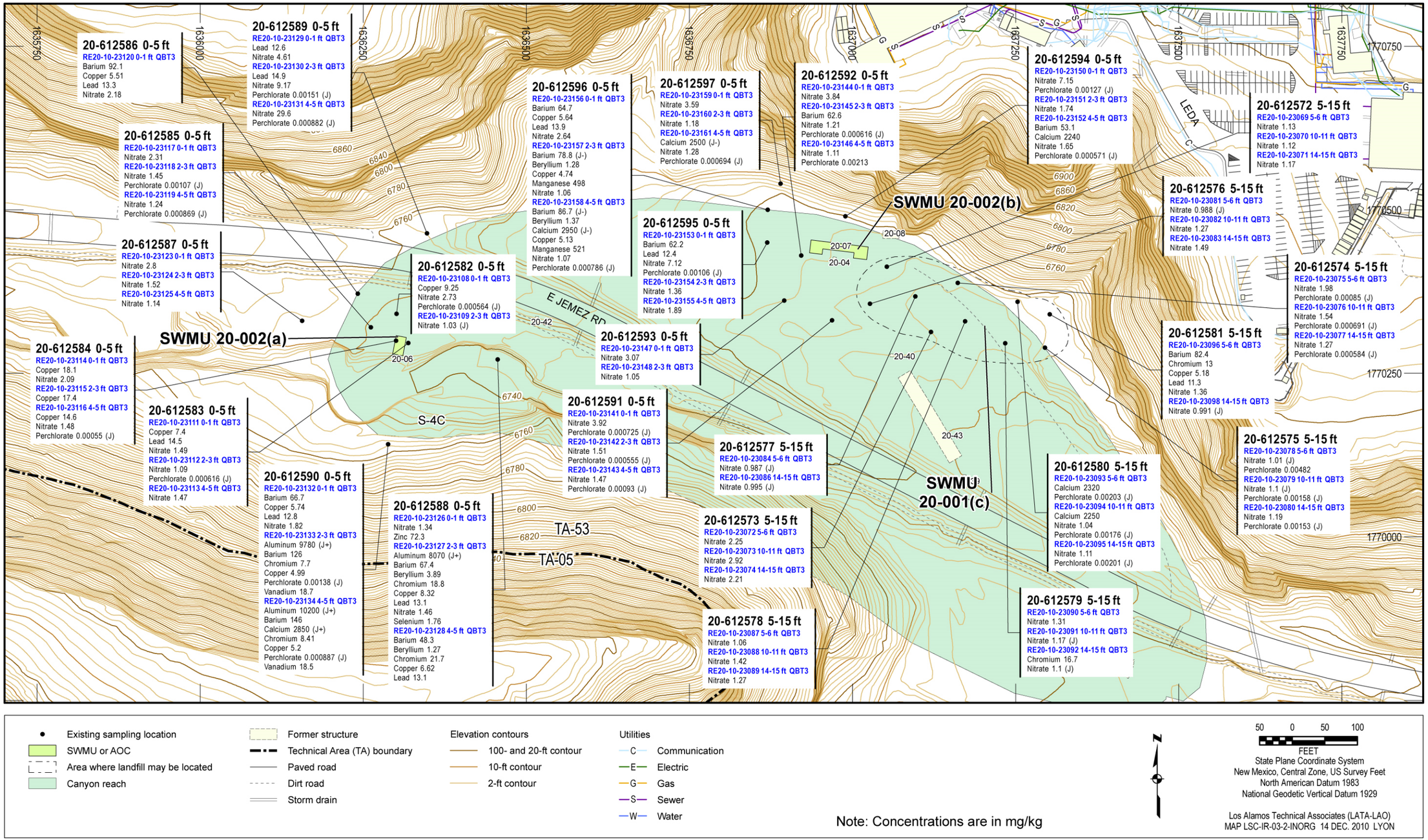


Figure 30 Inorganic chemicals detected or detected above BVs at SWMUs 20-001(c), 20-002(a), and 20-002(b)

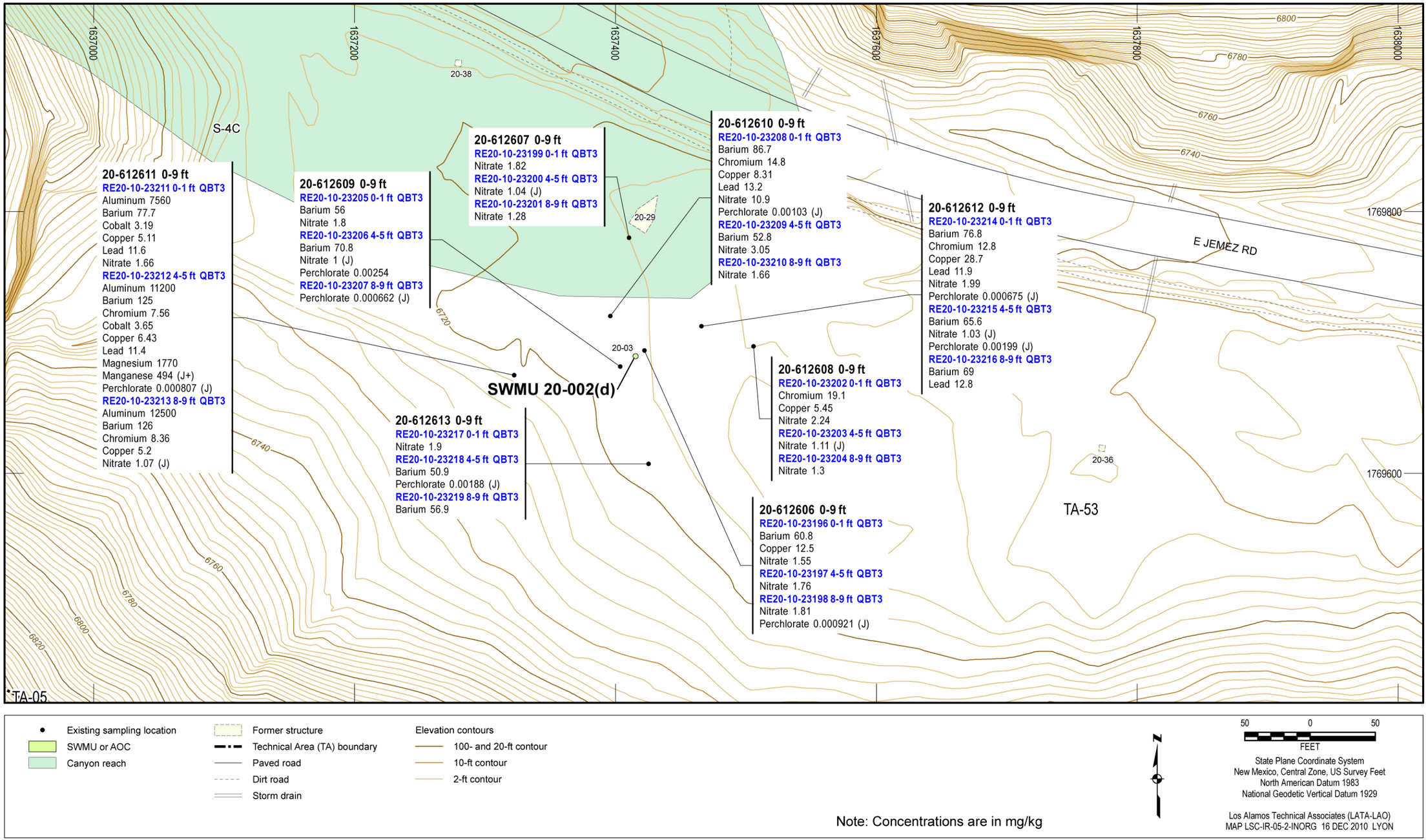


Figure 31 Inorganic chemicals detected or detected above BVs at SWMU 20-002(d)

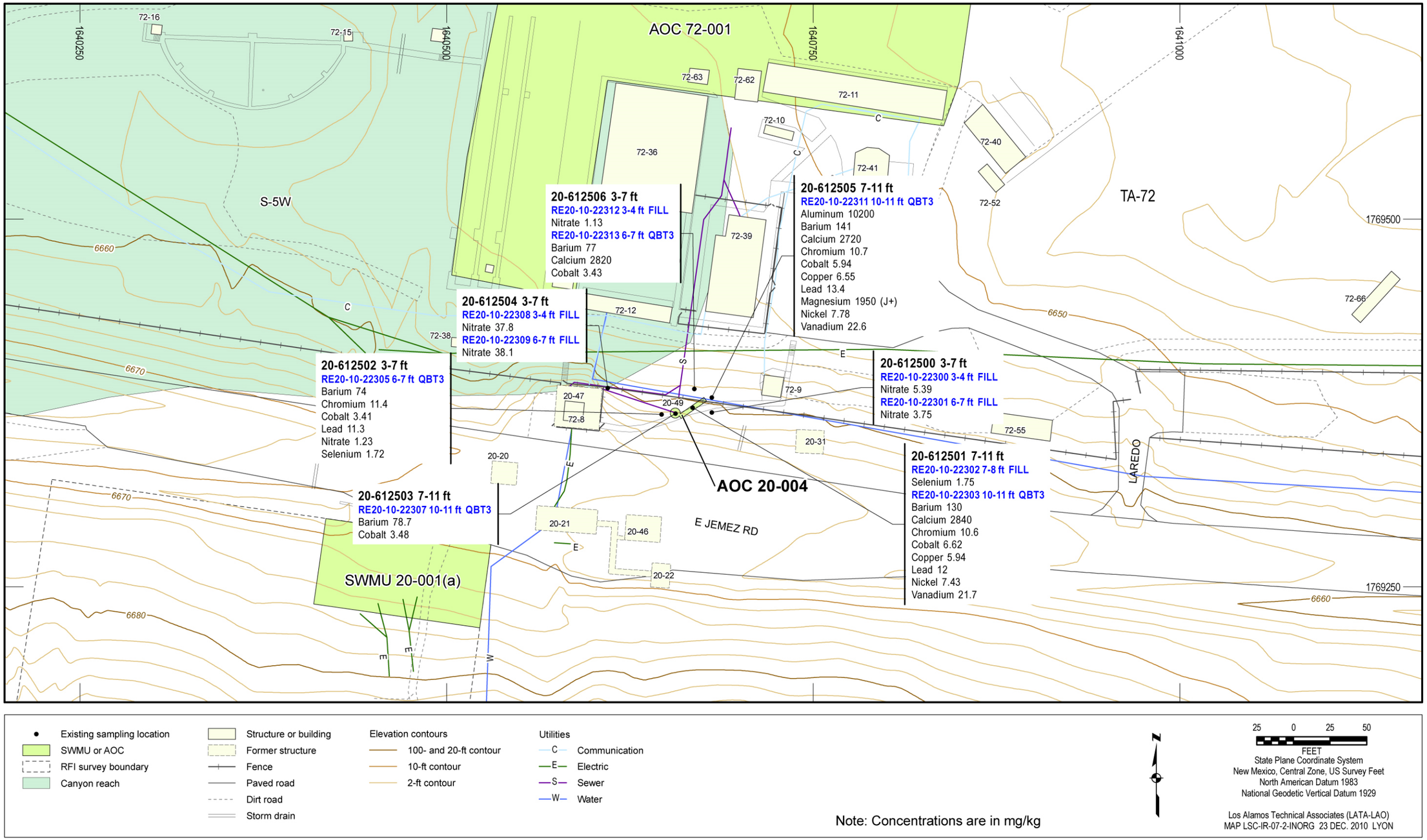
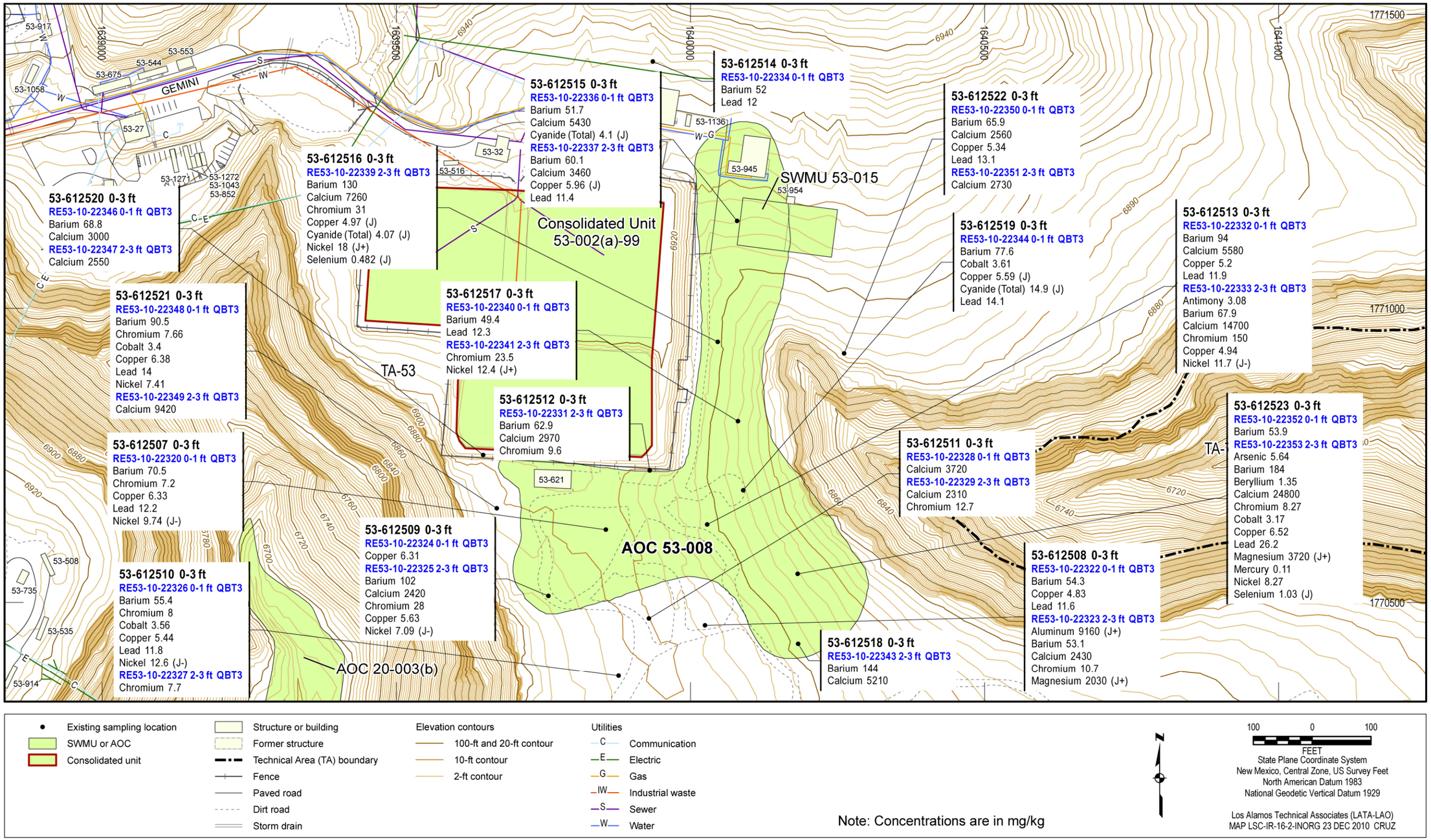


Figure 32 **Inorganic chemicals detected or detected above BVs at AOC 20-004**



Existing sampling location
SWMU or AOC
Consolidated unit

Structure or building
Former structure
Technical Area (TA) boundary
Fence
Paved road
Dirt road
Storm drain

Elevation contours
100-ft and 20-ft contour
10-ft contour
2-ft contour

Utilities
C Communication
E Electric
G Gas
IW Industrial waste
S Sewer
W Water

Note: Concentrations are in mg/kg

100 0 100
FEET
State Plane Coordinate System
New Mexico, Central Zone, US Survey Feet
North American Datum 1983
National Geodetic Vertical Datum 1929

Los Alamos Technical Associates (LATA-LAO)
MAP LSC-IR-16-2-INORG 23 DEC 2010 CRUZ

Figure 33 Inorganic chemicals detected or detected above BVs at AOC 53-008

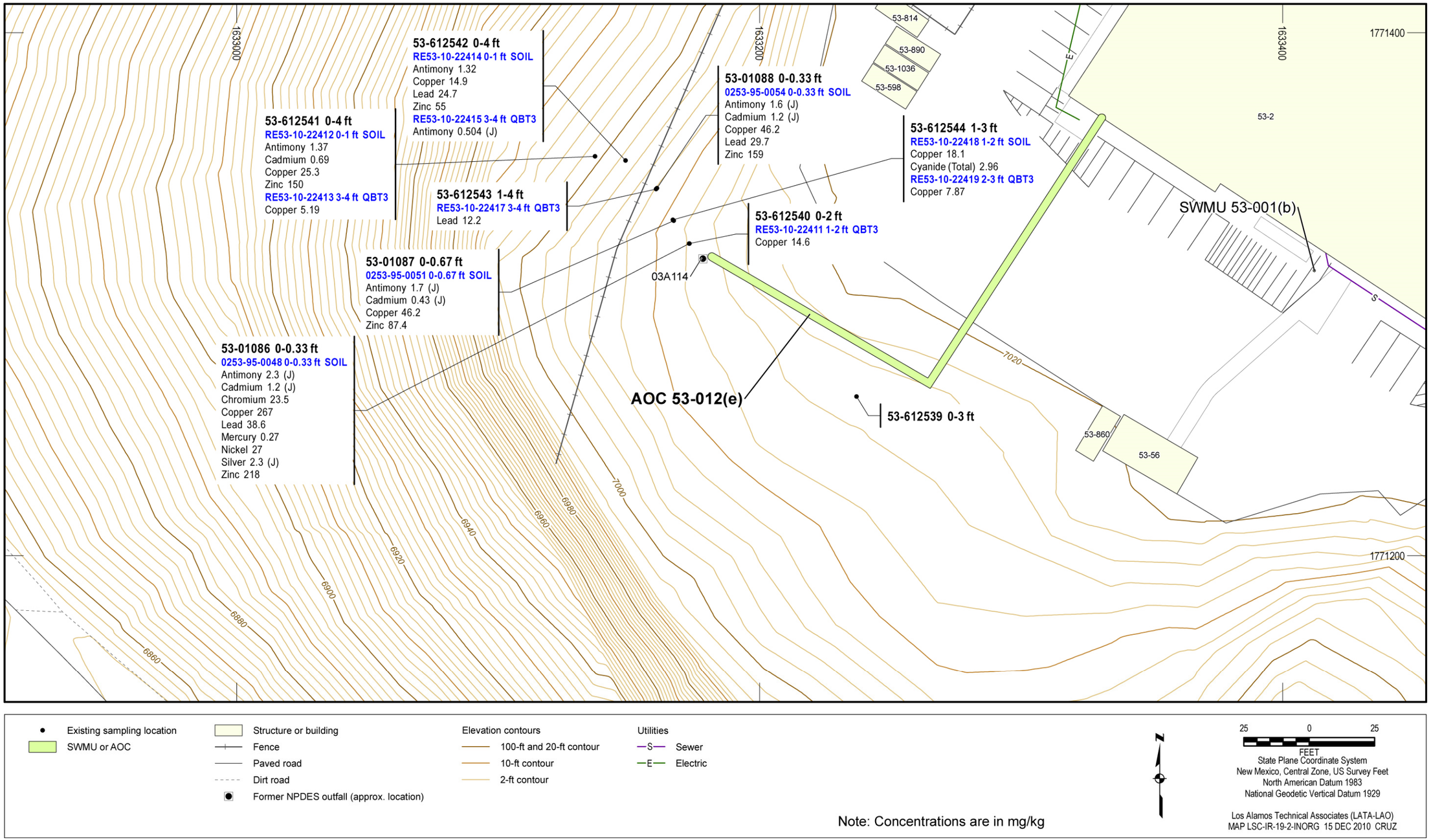


Figure 34 Inorganic chemicals detected or detected above BVs at AOC 53-012(e)

Attachment 3

Tables

Table 1
Sediment Investigation Reaches in Sandia Canyon

Investigation Reach	Reach Abbreviation	Approximate Distance From Rio Grande to Midpoint of Reach (km)	Reach Length (km)*	Year(s) of Sample Collection (Canyons Investigations)	Notes
S-1 North	S-1N	16.06	0.20	1998, 2008	North Fork of Sandia Canyon; below former asphalt batch plant
S-1 South	S-1S	16.06	0.20	1998, 2008	South Fork of Sandia Canyon; below power plant
S-2 West	S-2W	15.95	0.03	1998	Upcanyon from landfill bridge; below confluence of North and South Forks
S-2	S-2	15.44	0.68	1998, 2007, 2008	Downcanyon from landfill bridge; Sandia wetland and vicinity
S-3 West	S-3W	14.18	0.21	2007, 2008	Bouldery reach in narrow canyon bottom; below Royal Crest trailer park
S-3 East	S-3E	12.68	0.20	2000, 2007	Bouldery reach in narrow canyon bottom; below East Jemez Road
S-4 West	S-4W	11.31	0.23	2007	Downcanyon from western TA-53 SWMUs; incising reach
S-4 East	S-4E	9.89	0.31	2007	Upcanyon from eastern TA-53 drainage; aggrading reach
S-5 Central	S-5C	8.96	0.24	2000, 2007	Downcanyon from TA-53 and Protective Force firing range; near well R-35
S-5 East	S-5E	6.59	0.23	2007	Upcanyon from NM 4 and eastern Laboratory boundary
S-6 West	S-6W	3.32	0.20	2008	Pueblo de San Ildefonso land; above basalt knickpoint
S-6 East	S-6E	0.35	0.20	2008	Pueblo de San Ildefonso land; above Rio Grande

*Length refers to area mapped and characterized.

Table 2
PCBs Detected in Sandia Canyon Sediment Samples

Reach	Aroclor-1016	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
Minimum Soil ESL[a]	1	0.041	0.007	0.041	0.14
Residential SSL[b]	3.93	2.22	2.22	1.12	2.22
S-1N	—[c]	—	0.354	0.559	1.58
S-1S	—	—	—	0.648	11
S-2	0.02	0.366	0.076	2.53	2.08
S-3W	—	—	—	0.266	0.308
S-3E	—	—	—	0.06	0.3 (J-)
S-4W	—	—	—	0.112	0.12
S-4E	—	—	—	0.17	0.219
S-5C	—	0.043	—	0.098	0.157
S-5E	—	0.041	—	0.026	0.0527
S-6W	—	—	—	—	—
S-6E	—	—	—	—	—

Notes: Values are in mg/kg. Values are maximum detected values. Grey shading indicates the residential SSL was exceeded. All SSLs adjusted to a target risk of 10^{-5}. J- = The analyte was positively identified, and the result is likely to be biased low.

[a] Ecological screening levels (ESLs) are from the Ecorisk Database, Version 3.1 (LANL 2012c).

[b] SSLs are from NMED (2012) unless otherwise noted.

[c] — = Not a COPC in that reach (not detected or not analyzed).

Table 3
Inferred Primary Sources and Downcanyon Extent of PCB COPCs in Sediment in Sandia Canyon

Type of COPC	COPC	Inferred Primary Source(s) in the Sandia Canyon Watershed[a]	Inferred Downcanyon Extent from Laboratory Sources[b]
PCBs	Aroclor-1242	TA-03 and TA-53 and/or TA-72	Sandia Canyon between reaches S-5E and S-6W
	Aroclor-1248	TA-03	Sandia Canyon between reaches S-2 and S-3W
	Aroclor-1254	TA-03	Sandia Canyon between reaches S-5E and S-6W
	Aroclor-1260	TA-03	Sandia Canyon between reaches S-5E and S-6W

[a] Primary source(s) indicated by maximum concentrations and/or spatial distribution.

[b] Downcanyon extent indicates area where COPC remains detected and/or above background and can probably or possibly be traced to an upcanyon Laboratory source.

Table 4
PCB COPCs in Nonfiltered Nonstorm-related Surface Water Samples

Location	Aroclor-1254	Aroclor-1260	BHC[delta-]
ESL[a]	**0.014**	**0.014**	**na**[b]
Standard Level (Perennial Stream Classification)	**0.00064**	**0.00064**	**0.17**
Standard Type	**HHPU**[c]	**HHPU**	**HHPU**
NMED Tap Water[d]	**0.336**	**0.336**	**na**
Middle Sandia Canyon at terminus of persistent baseflow (WMSC)	—[e]	—	—
SA-00007	—	—	—
SA-10005	—	—	—
SA-603204	—	—	—
SA-603205	—	—	—
SCS-2 (W2CS)	—	—	—
Sandia Spring	—	—	—
Sandia below Wetlands (E123)	0.112	0.1	—
Sandia right fork at Power Plant (E121)	—	—	—
South Fork of Sandia Canyon at E122 (WSFS)	—	—	0.292

Notes: Values are in µg/L. Values are maximum detected value. Grey shading indicates a standard screening value was exceeded.
BHC = Benzene hexachloride.

[a] Water ESLs from Ecorisk Database Version 3.1 (LANL 2012c).

[b] na = Not available.

[c] HHPU = New Mexico Administrative Code (NMAC) 20.6.4, Human Health Perennial (Unfiltered).

[d] NMED tap water (2012).

[e] — = Not detected or not analyzed.

Table 5
Sandia Canyon Storm Water Screen–PCBs

Location Name	Field Preparation	Type of Analyte	Analyte	Total Number of Analyses	Count of Detected Analytes	Count of Nondetected Analytes	Average Detected Concentration	Minimum Detected Concentration	Maximum Detected Concentration	Count of Detected Analytes with Concentrations Greater than the Lowest Comparison Value	Lowest Comparison Value	Units
Sandia above Firing Range	Nonfiltered	Organic	Aroclor-1242	14	1	13	0.11	0.11	0.11	1	0.00064	µg/L
Sandia above Firing Range	Nonfiltered	Organic	Aroclor-1254	15	7	8	0.418143	0.076	1.7	7	0.00064	µg/L
Sandia above Firing Range	Nonfiltered	Organic	Aroclor-1260	15	10	5	0.514	0.046	3.2	10	0.00064	µg/L
Sandia above SR-4	Nonfiltered	Organic	Aroclor-1254	3	1	2	0.12	0.12	0.12	1	0.00064	µg/L
Sandia above SR-4	Nonfiltered	Organic	Aroclor-1260	3	2	1	0.175	0.13	0.22	2	0.00064	µg/L
Sandia below Wetlands	Nonfiltered	Organic	Aroclor-1254	24	15	9	0.309133	0.059	1.1	15	0.00064	µg/L
Sandia below Wetlands	Nonfiltered	Organic	Aroclor-1260	24	18	6	0.278778	0.059	0.9	18	0.00064	µg/L
Sandia left fork at Asphalt Plant	Nonfiltered	Organic	Aroclor-1254	14	2	12	0.1965	0.063	0.33	2	0.00064	µg/L
Sandia left fork at Asphalt Plant	Nonfiltered	Organic	Aroclor-1260	14	2	12	0.08	0.05	0.11	2	0.00064	µg/L
Sandia right fork at Power Plant	Nonfiltered	Organic	Aroclor-1254	14	7	7	0.442286	0.056	0.71	7	0.00064	µg/L
Sandia right fork at Power Plant	Nonfiltered	Organic	Aroclor-1260	15	10	5	0.5442	0.027	1.2	10	0.00064	µg/L

Table 6
Sandia Canyon Watershed COPC and Storm Water Summary—PCBs

Analyte	Sediment	Storm Water[a]	Nonstorm-Related Surface Water[b]	Alluvial\ Groundwater	Intermediate Groundwater	Regional Groundwater[b]
PCBs						
Aroclor-1016	X[c]	—[d]	—	—	—	X
Aroclor-1242	X	X	—	—	—	—
Aroclor-1248	X	—	—	—	—	—
Aroclor-1254	X	X	X	X	—	X
Aroclor-1260	X	X	X	X	—	X

Note: Grey shading indicates analyte exceeded SAL or SSL for sediment or a standard for water.

[a] For storm water, an analyte is marked with "X" if it was detected and is shaded gray if it exceeded an acute benchmark.

[b] Sandia Spring is screened both as surface water and regional groundwater.

[c] X = Analyte is a COPC for given medium.

[d] — = Analyte is not a COPC for a given medium or not detected in storm water.

Table 7
Inferred Primary Sources and Downcanyon Extent of PCB COPCs in Surface Water and Groundwater in Sandia Canyon

Analyte	Extent of COPC Distribution Related to Sandia Source(s)						Inferred Primary Source(s) in the Sandia Canyon Watershed	Inferred Downgradient Extent from Laboratory Sources
	Nonstorm-Related Surface Water	Alluvial Groundwater	Intermediate Groundwater (Sandia)	Intermediate Groundwater (Mortandad)	Regional Groundwater (Sandia)	Regional Groundwater (Mortandad)		
Organic COPCs								
Aroclor-1254	Above standard	—*	—	—	—	—	Suspended sediment from wetlands	Presence of Sandia COPC limited to surface water
Aroclor-1260	Above standard	Detected	—	—	—	—	Suspended sediment from wetlands	Presence of Sandia COPC limited to surface water and alluvial water

Notes: Explanation of column entries for "Extent of COPC Distribution Related to Sandia Source(s)":

– Above Standard. This analyte is detected more than once in this media, at a concentration exceeding a water-quality standard used for screening. (Table cell is highlighted in pink.)

– Detected. This analyte is detected more than once in this media, and detected concentrations are below any water quality standard, wESL, or BV used for screening. This entry is used of analytes for which wESLs or BVs are not available.

*— = This analyte is either not detected in the media, not detected above BV, not detected more than once, or detected <5% of the samples from this media.

Table 8
PCBs Detected at SWMU 53-001(a)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Construction Worker SSL[a]				**4.36**	**75.8**
Industrial SSL[a]				**8.26**	**8.26**
Residential SSL[a]				**1.12**	**2.22**
0253-95-0001	53-01051	0–0.5	SOIL	—[b]	—
0253-95-0002	53-01052	0–0.5	SOIL	—	—
0253-95-0003	53-01053	0–0.5	SOIL	—	0.0778
0253-97-0076	53-01522	0–0.5	SOIL	—	0.12
0253-97-0077	53-01523	0.6667–1.1667	SOIL	—	0.13
0253-97-0111	53-01526	2.5–3	QBT3	—	0.094
0253-97-0086	53-01531	0–0.5	QBT3	—	0.065 (J-)
0253-97-0092	53-01533	0.5–0.83	SOIL	—	0.018
0253-97-0112	53-01541	0–0.5	SOIL	—	0.15
RE53-10-22204	53-612469	2–3	QBT3	0.428	0.792
RE53-10-22205	53-612469	4–5	QBT3	0.201	0.443
RE53-10-22206	53-612470	2–3	QBT3	0.0066	0.0095
RE53-10-22207	53-612470	4–5	QBT3	0.0252	0.0574
RE53-10-22208	53-612471	1–2	QBT3	0.0065	0.003 (J)
RE53-10-22209	53-612471	3–4	QBT3	0.0031 (J)	0.0013 (J)
RE53-10-22210	53-612472	1–2	QBT3	3.47	3.84
RE53-10-22211	53-612472	3–4	QBT3	0.886	1.43
RE53-10-22212	53-612473	1–2	QBT3	0.0055	0.0178
RE53-10-22213	53-612473	3–4	QBT3	—	0.0055
RE53-10-22214	53-612474	1–2	QBT3	3.74	1.4
RE53-10-22215	53-612474	3–4	QBT3	0.57	0.256
RE53-10-22216	53-612475	1–2	QBT3	—	0.0317
RE53-10-22218	53-612476	1–2	QBT3	—	0.0101 (J)
RE53-10-22220	53-612477	1–2	QBT3	—	0.0642
RE53-10-22221	53-612477	3–4	QBT3	0.008	0.0139
RE53-10-22222	53-612478	0–1	SOIL	0.123	0.256
RE53-10-22223	53-612478	2–3	QBT3	0.0129	0.0303
RE53-10-22224	53-612479	0–1	SOIL	0.0372	0.0899
RE53-10-22225	53-612479	2–3	QBT3	—	0.0044
RE53-10-22226	53-612480	0–1	QBT3	—	0.0054
RE53-10-22227	53-612480	2–3	QBT3	—	—

Notes: Results are in mg/kg. 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 low.

[a] SSLs are from NMED (2012).

[b] — = Not detected.

Table 9
PCBs Detected at SWMU 53-001(b)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Construction Worker SSL[a]				**4.36**	**75.8**
Industrial SSL[a]				**8.26**	**8.26**
Residential SSL[a]				**1.12**	**2.22**
0253-95-0005	53-01055	0–1	SOIL	—[b]	—
0253-95-0007	53-01055	1–1.5	SOIL	—	—
0253-95-0008	53-01056	0–0.67	SOIL	—	—
RE53-10-22235	53-612481	0–1	QBT3	0.0989	0.188
RE53-10-22236	53-612481	2–3	QBT3	0.0073	0.0114
RE53-10-22237	53-612482	0–1	QBT3	0.95	1.06
RE53-10-22238	53-612482	2–3	QBT3	0.0145	0.0283

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

[a] SSLs are from NMED (2012).

[b] — = Not detected.

Table 10
PCBs Detected at SWMU 53-005

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Construction Worker SSL[a]				**4.36**	**75.8**
Industrial SSL[a]				**8.26**	**8.26**
Residential SSL[a]				**1.12**	**2.22**
RE53-10-26417	53-612483	12.5–13.5	QBT3	—[b]	—
RE53-10-26418	53-612483	15–16	QBT3	—	—
RE53-10-26420	53-612484	2–3	QBT3	0.0157 (J)	—
RE53-10-26421	53-612484	5–6	QBT3	—	—
RE53-10-26422	53-612484	14–15	QBT3	0.0713	—
RE53-10-26423	53-612485	2–3	QBT3	—	0.0031 (J)
RE53-10-26424	53-612485	5–6	QBT3	—	0.003 (J)
RE53-10-26425	53-612485	14–15	QBT3	—	—
RE53-10-26426	53-612486	0–1	QBT3	—	—

Notes: Results are in mg/kg. 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.

[a] SSLs are from NMED (2012).

[b] — = Not detected.

Table 11
PCBs Detected at SWMU 53-006(f)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Construction Worker SSL[a]				**4.36**	**75.8**
Industrial SSL[a]				**8.26**	**8.26**
Residential SSL[a]				**1.12**	**2.22**
RE53-10-22254	53-612487	0–1	QBT3	—[b]	0.0105 (J)
RE53-10-22255	53-612487	2–3	QBT3	0.0032 (J)	0.0035 (J)
RE53-10-22257	53-612488	0–1	QBT3	0.0094 (J)	0.0096 (J)
RE53-10-22260	53-612489	0–1	QBT3	0.0735	0.0663
RE53-10-22261	53-612489	2–3	QBT3	0.012	0.0057

Notes: Results are in mg/kg. 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.

[a] SSLs are from NMED (2012).

[b] — = Not detected.

Table 12
PCBs Detected at AOC 53-008

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1248	Aroclor-1254	Aroclor-1260
Construction Worker SSL[a]				**75.8**	**4.36**	**75.8**
Industrial SSL[a]				**8.26**	**8.26**	**8.26**
Residential SSL[a]				**2.22**	**1.12**	**2.22**
RE53-10-22320	53-612507	0–1	QBT3	—[b]	—	—
RE53-10-22322	53-612508	0–1	QBT3	—	—	—
RE53-10-22324	53-612509	0–1	QBT3	—	—	0.0027 (J)
RE53-10-22326	53-612510	0–1	QBT3	—	—	0.0171
RE53-10-22327	53-612510	2–3	QBT3	—	—	—
RE53-10-22328	53-612511	0–1	QBT3	—	—	—
RE53-10-22330	53-612512	0–1	QBT3	—	—	—
RE53-10-22331	53-612512	2–3	QBT3	—	—	—
RE53-10-22339	53-612516	2–3	QBT3	—	—	—
RE53-10-22340	53-612517	0–1	QBT3	—	—	0.0034 (J)
RE53-10-22341	53-612517	2–3	QBT3	0.0195	0.0276	0.0033 (J)
RE53-10-22344	53-612519	0–1	QBT3	—	—	0.0917
RE53-10-22349	53-612521	2–3	QBT3	—	—	—
RE53-10-22352	53-612523	0–1	QBT3	—	—	—

Notes: Results are in mg/kg. 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.

[a] SSLs are from NMED (2012).

[b] — = Not detected.

Table 13
PCBs Detected at AOC 53-009

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1242	Aroclor-1254	Aroclor-1260
Construction Worker SSL[a]				**75.8**	**4.36**	**75.8**
Industrial SSL[a]				**8.26**	**8.26**	**8.26**
Residential SSL[a]				**2.22**	**1.12**	**2.22**
RE53-06-73678	53-27008	1.5–2	FILL	NA[b]	NA	NA
RE53-10-22363	53-612524	0–1	QBT3	—[c]	0.0042	—
RE53-10-22365	53-612525	0–1	QBT3	—	0.0292 (J)	0.0088
RE53-10-22370	53-612527	2–3	QBT3	—	0.0033 (J)	0.0047
RE53-10-22374	53-612529	2–3	QBT3	0.0053	0.0241	0.0109
RE53-10-22378	53-612531	2–3	QBT3	—	0.0024 (J)	—
RE53-10-22379	53-612532	0–1	QBT3	—	0.0191	0.0096 (J)
RE53-10-22380	53-612532	2–3	QBT3	0.0034 (J)	0.0072	—

Notes: Results are in mg/kg. 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.

[a] SSLs are from NMED (2012).

[b] NA = Not analyzed

[c] — = Not detected.

Table 14
PCBs Detected at AOC 53-010

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Construction Worker SSL[a]				**4.36**	**75.8**
Industrial SSL[a]				**8.26**	**8.26**
Residential SSL[a]				**1.12**	**2.22**
RE53-10-22395	53-612535	3–4	QBT3	—[b]	—
RE53-10-22396	53-612536	0–1	QBT3	0.0031 (J)	0.0031 (J)
RE53-10-22398	53-612537	0–1	QBT3	—	—

Notes: Results are in mg/kg. 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.

[a] SSLs are from NMED (2012).

[b] — = Not detected

Table 15
PCBs Detected at AOC 53-012(e)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1248	Aroclor-1254	Aroclor-1260
Construction Worker SSL[a]				**75.8**	**4.36**	**75.8**
Industrial SSL[a]				**8.26**	**8.26**	**8.26**
Residential SSL[a]				**2.22**	**1.12**	**2.22**
0253-95-0048	53-01086	0–0.33	SOIL	0.76	0.351	—[b]
0253-95-0051	53-01087	0–0.67	SOIL	0.0596	—	0.332
0253-95-0054	53-01088	0–0.33	SOIL	0.0474	—	0.335
RE53-10-22408	53-612539	0–1	SOIL	—	—	0.0246
RE53-10-22410	53-612540	0–1	SOIL	—	0.0614 (J)	0.066 (J)
RE53-10-22411	53-612540	1–2	QBT3	—	0.0177 (J)	0.0171 (J)
RE53-10-22412	53-612541	0–1	SOIL	—	—	0.0281
RE53-10-22413	53-612541	3–4	QBT3	—	—	—
RE53-10-22414	53-612542	0–1	SOIL	—	0.0899	0.159
RE53-10-22415	53-612542	3–4	QBT3	—	—	0.0236
RE53-10-22416	53-612543	1–2	SOIL	—	—	0.0247
RE53-10-22417	53-612543	3–4	QBT3	—	—	0.0179 (J)
RE53-10-22418	53-612544	1–2	SOIL	—	0.0635	0.0718
RE53-10-22419	53-612544	2–3	QBT3	—	0.0327	0.0363

Notes: Results are in mg/kg. 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.

[a] SSLs are from NMED (2012) unless otherwise noted.

[b] — = Not detected.

Table 16
PCBs Detected at SWMU 20-001(a)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1248	Aroclor-1254
Construction Worker SSL[a]				**75.8**	**4.36**
Industrial SSL[a]				**8.26**	**8.26**
Residential SSL[a]				**2.22**	**1.12**
RE20-10-22666	20-612556	5–6	QBT3	—[b]	—
RE20-10-22667	20-612556	10–11	QBT3	—	—
RE20-10-22668	20-612556	14–15	QBT3	—	—
RE20-10-22669	20-612557	5–6	QBT3	—	—
RE20-10-22670	20-612557	10–11	QBT3	—	—
RE20-10-22671	20-612557	14–15	QBT3	—	0.0013 (J)
RE20-10-22672	20-612558	5–6	QBT3	—	—
RE20-10-22673	20-612558	10–11	QBT3	—	—
RE20-10-22674	20-612558	14–15	QBT3	0.0026 (J)	0.0033 (J)
RE20-10-22675	20-612559	5–6	QBT3	NA[c]	NA
RE20-10-22678	20-612560	5–6	QBT3	NA	NA
RE20-10-22679	20-612560	10–11	QBT3	NA	NA
RE20-10-22680	20-612560	14–15	QBT3	NA	NA
RE20-10-22682	20-612561	10–11	QBT3	NA	NA
RE20-10-22683	20-612561	14–15	QBT3	NA	NA
RE20-10-22687	20-612563	5–6	QBT3	NA	NA
RE20-10-22689	20-612563	14–15	QBT3	NA	NA

Notes: Results are in mg/kg. 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.

[a] SSLs are from NMED (2012).

[b] — = Not detected.

[c] NA = Not analyzed.

Table 17
PCBs Detected at SWMU 20-001(c)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254
Construction Worker SSL[a]				**4.36**
Industrial SSL[a]				**8.26**
Residential SSL[a]				**1.12**
RE20-10-23074	20-612573	14–15	QBT3	0.0014 (J)
RE20-10-23093	20-612580	5–6	QBT3	NA[b]

Notes: Results are in mg/kg. 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.

[a] SSLs are from NMED (2012).

[b] NA = Not detected.

Table 18
PCBs Detected at SWMU 20-002(c)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Construction Worker SSL[a]				**4.36**	**75.8**
Industrial SSL[a]				**8.26**	**8.26**
Residential SSL[a]				**1.12**	**2.22**
RE20-10-23166	20-612598	0–1	QBT3	0.0363	0.0498
RE20-10-23167	20-612598	4–5	QBT3	—[b]	0.0022 (J)
RE20-10-23169	20-612599	0–1	QBT3	0.0443	0.0631
RE20-10-23170	20-612599	4–5	QBT3	—	0.0122
RE20-10-23171	20-612599	8–9	QBT3	—	0.0032 (J)
RE20-10-23172	20-612600	0–1	QBT3	0.0436	0.0648
RE20-10-23173	20-612600	4–5	QBT3	—	0.0062
RE20-10-23174	20-612600	8–9	QBT3	—	0.0029 (J)
RE20-10-24957	20-612892	0–1	QBT3	0.0058	0.0102
RE20-10-24958	20-612892	4–5	QBT3	—	0.0169
RE20-10-24959	20-612892	8–9	QBT3	—	0.0121

Notes: Results are in mg/kg.

[a] SSLs are from NMED (2012).

[b] — = Not analyzed.

Table 19
PCBs Detected at SWMU 20-002(d)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1242	Aroclor-1254	Aroclor-1260
Construction Worker SSL[a]				**75.8**	**4.36**	**75.8**
Industrial SSL[a]				**8.26**	**8.26**	**8.26**
Residential SSL[a]				**2.22**	**1.12**	**2.22**
RE20-10-23196	20-612606	0–1	QBT3	—[b]	—	0.0031 (J)
RE20-10-23197	20-612606	4–5	QBT3	0.0457	0.06	0.0085
RE20-10-23199	20-612607	0–1	QBT3	—	—	0.0083 (J)
RE20-10-23200	20-612607	4–5	QBT3	—	0.0102	0.0101
RE20-10-23201	20-612607	8–9	QBT3	—	0.0039 (J)	0.0046
RE20-10-23202	20-612608	0–1	QBT3	—	0.0258	0.0263

Notes: Results are in mg/kg. 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.

[a] SSLs are from NMED (2012).

[b] — = Not detected.

Table 20
PCBs Detected at SWMU 20-005

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254	Aroclor-1260
Construction Worker SSL[a]				**4.36**	**75.8**
Industrial SSL[a]				**8.26**	**8.26**
Residential SSL[a]				**1.12**	**2.22**
RE20-10-23227	20-612614	9–10	FILL	—[b]	—
RE20-10-23230	20-612616	4–5	FILL	0.0034 (J)	0.0071
RE20-10-23231	20-612616	9–10	FILL	0.0031 (J)	0.0057
RE20-10-23235	20-612618	3–4	FILL	NA[c]	NA

Notes: Results are in mg/kg. 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.

[a] SSLs are from NMED (2012).

[b] — = Not detected.

[c] NA = Not analyzed

Table 21
Sediment Investigation Reaches in Sandia Canyon

Investigation Reach	Reach Abbreviation	Approximate Distance From Rio Grande to Midpoint of Reach (km)	Reach Length (km)*	Year(s) of Sample Collection (Canyons Investigations)	Notes
S-1 North	S-1N	16.06	0.20	1998, 2008	North Fork of Sandia Canyon; below former asphalt batch plant
S-1 South	S-1S	16.06	0.20	1998, 2008	South Fork of Sandia Canyon; below power plant
S-2 West	S-2W	15.95	0.03	1998	Upcanyon from landfill bridge; below confluence of North and South Forks
S-2	S-2	15.44	0.68	1998, 2007, 2008	Downcanyon from landfill bridge; Sandia wetland and vicinity
S-3 West	S-3W	14.18	0.21	2007, 2008	Bouldery reach in narrow canyon bottom; below Royal Crest trailer park
S-3 East	S-3E	12.68	0.20	2000, 2007	Bouldery reach in narrow canyon bottom; below East Jemez Road
S-4 West	S-4W	11.31	0.23	2007	Downcanyon from western TA-53 SWMUs; incising reach
S-4 East	S-4E	9.89	0.31	2007	Upcanyon from eastern TA-53 drainage; aggrading reach
S-5 Central	S-5C	8.96	0.24	2000, 2007	Downcanyon from TA-53 and Protective Force firing range; near well R-35
S-5 East	S-5E	6.59	0.23	2007	Upcanyon from NM 4 and eastern Laboratory boundary
S-6 West	S-6W	3.32	0.20	2008	Pueblo de San Ildefonso land; above basalt knickpoint
S-6 East	S-6E	0.35	0.20	2008	Pueblo de San Ildefonso land; above Rio Grande

*Length refers to area mapped and characterized.

Table 22
Alpha-Emitting Radionuclide COPCs in Sandia Canyon Sediment Samples

Reach	Americium-241	Plutonium-238	Plutonium-239/240	Thorium-228	Thorium-232	Uranium-234	Uranium-235/236	Uranium-238
BV (pCi/g)[a]	0.04	0.006	0.068	2.28	2.33	2.59	0.2	2.29
Minimum Soil ESL[b]	44	44	47	43	6.2	51	55	55
Residential SAL[c]	82	84	79	4.1	5	270	39	150
S-1N	—[d]	0.0195	—	—	—	—	—	—
S-1S	—	—	0.113	—	—	—	—	—
S-2	0.05	0.125	0.391	—	—	4.29	0.228	4.04
S-4W	—	0.0251	—	2.47	2.37	—	—	—
S-4E	—	—	1.72	—	—	—	—	—
S-5C	—	—	—	—	—	—	—	—
S-5E	0.0431	—	—	2.35	—	—	—	—

Notes: Values are in pCi/g. Values are maximum detected values greater than the sediment BV. Grey shading indicates the residential SAL was exceeded.

[a] BVs are from LANL (1998).

[b] ESLs are from the Ecorisk Database, Version 3.1 (LANL 2012c).

[c] SALs are from LANL (2012b) unless otherwise noted.

[d] — = Not a COPC in that reach (not detected, not detected > BV, or not analyzed).

Table 23
Inferred Primary Sources and Downcanyon
Extent of Select COPCs in Sediment in Sandia Canyon

Type of COPC	COPC	Inferred Primary Source(s) in the Sandia Canyon Watershed[a]	Inferred Downcanyon Extent from Laboratory Sources[b]
Radionuclide	Thorium-228	Natural background	n/a[c]
	Thorium-232	Natural background	n/a

[a] Primary source(s) indicated by maximum concentrations and/or spatial distribution.

[b] Downcanyon extent indicates area where COPC remains detected and/or above background and can probably or possibly be traced to an upcanyon Laboratory source.

[c] n/a = Not applicable (inferred source is natural background).

Table 24
Sandia Canyon Surface and Water Sampling Locations and Rationale

Location Name	Location and Rationale
Base Flow (West to East)	
Surface Water Gaging Station E121	South Fork of Sandia Canyon, near power plant. Located west of wetland. Provides information about potential contaminant releases from TA-03 facilities to the west and baseline data about surface water entering the wetland.
Surface Water Gaging Station E122 (equivalent WSFS)	North Fork of Sandia Canyon, near power plant. Located west of wetland. Downgradient of main contaminant release sites in Sandia Canyon. Provides baseline data about surface water entering the wetland.
Surface Water Sampling Station SCS-1	Surface water sampling station at west end of wetland. Provides baseline data about surface water entering the wetland.
Surface Water Gaging Station E123	Sandia Canyon just east of wetland. Location selected to monitor persistent surface water exiting the wetland.
Surface Water Gaging Station E123.6	Surface water base flow collected at gage station E123.6. Location selected to monitor persistent surface water in narrow, bedrock-dominated portion of middle Sandia Canyon.
Surface Water Sampling Station SCS-2 (equivalent WMSC)	Middle Sandia Canyon. Location selected to monitor surface water near the eastern terminus of persistent base flow.
Surface Water Sampling Station SCS-3	Near eastern end of middle Sandia Canyon. Provides baseline data about surface water upgradient of TA-53 facilities. Area of ephemeral surface water flow.
Surface Water Gaging Station E124	Surface water base flow collected at gage station E124. Location selected to monitor surface water in area where Sandia Canyon widens and ephemeral surface water flows.
Surface Water Gaging Station E125	Surface water base flow collected at gage station E125. Location selected to monitor surface water near eastern Laboratory boundary. Area of ephemeral surface water flow.

Table 25
Water Screening Location, Synonym, and Reach

Location Name[a]	Location Synonym	Reach[b]
Surface Water		
North Fork of Sandia Canyon at E122	WSFS	S-1N
Sandia left fork at Asphalt Plant	E122	S-1N
Sandia right fork at Power Plant	E121	S-1S
SA-00007	—[c]	S-2
SA-603204	—	S-2
Sandia below Wetlands	E123	S-2
SA-10005	—	S-3E
Middle Sandia Canyon at terminus of persistent base flow	WMSC	S-3E and S-4W
SCS-2	—	S-3E and S-4W
SA-603205	—	S-3E and S-4W
Sandia Spring[d]	—	S-6E
Sandia above Firing Range	E124	S-4W and S-4E
Sandia above SR-4	E125	S-5E

[a] Locations are listed from west to east.

[b] The listed location is either within the reach, or else the nearest reach is listed; for locations midway between reaches, both reaches are listed.

[c] — = Not applicable.

[d] Sandia Spring is screened as part of the surface water dataset as well as part of the regional aquifer dataset.

Table 26
Alpha-Emitting Radionuclide COPCs in Nonfiltered Nonstorm-Related Surface Water Samples

Location	Gross Alpha	Radium-226	Uranium-234	Uranium-235/236	Uranium-238
ESL[a]	na[b]	0.1	22	24	24
Standard Level (Perennial Stream Classification)	na	60	200	300	200
Standard Type	na	NMRPS[c]	BCG[d]	NMRPS	BCG
Middle Sandia Canyon at terminus of persistent baseflow (WMSC)	4.13	—[e]	0.55	—	0.528
SCS-2 (W2CS)	—	—	0.193	—	0.153
Sandia Spring	2.47	—	0.784	0.0589	0.414
Sandia below Wetlands (E123)	1.86	0.347	0.528	0.0448	0.317
Sandia right fork at Power Plant (E121)	—	0.321	0.253	—	0.138
South Fork of Sandia Canyon at E122 (WSFS)	—	—	0.888	—	0.435

Notes: Values are in pCi/L. Values are maximum detected value.

[a] Water ESLs from Ecorisk Database Version 3.1 (LANL 2012c).

[b] na = Not available.

[c] NMRPS = New Mexico Environmental Improvement Board Radiation Protection Standards http://www.nmcpr.state.nm.us/nmac/_title20/T20C003.htm.

[d] BCG = DOE Biota Concentration Guidelines (BCG) for radionuclides (DOE 2002).

[e] — = Not detected or not analyzed.

Table 27
Sandia Canyon Storm Water Screen—Gross Alpha

Location Name	Field Preparation	Type of Analyte	Analyte	Total Number of Analyses	Count of Detected Analytes	Count of Nondetected Analytes	Average Detected Concentration	Minimum Detected Concentration	Maximum Detected Concentration	Count of Detected Analytes with Concentrations Greater than the Lowest Comparison Value	Lowest Comparison Value	Units
Sandia above Firing Range	Nonfiltered	RAD	Gross alpha	18	18	0	170.5389	2.12	877	15	15	pCi/L
Sandia above SR-4	Nonfiltered	RAD	Gross alpha	2	2	0	112.15	47.3	177	2	15	pCi/L
Sandia below Wetlands	Nonfiltered	RAD	Gross alpha	12	12	0	30.81667	11	66.9	10	15	pCi/L
Sandia left fork at Asphalt Plant	Nonfiltered	RAD	Gross alpha	7	6	1	15.34	3.81	32.2	3	15	pCi/L
Sandia right fork at Power Plant	Nonfiltered	RAD	Gross alpha	14	14	0	20.13071	5.32	45.1	9	15	pCi/L

Table 28
Summary of Storm Water Analytes with Gross-Alpha Concentrations Greater Than Comparison Values

Analyte	Field Preparation	Number of Detected Results > Lowest Comparison Value	Maximum Detected Concentration	Comparison Value	Units	Lowest Comparison Value Basis[a]	Locations with Results > Lowest Comparison Value
Gross alpha	Nonfiltered	39	877	15	pCi/L	NM WQCC Wildlife Habitat[b]	Sandia above SR-4, Sandia above Firing Range, Sandia below Wetlands, Sandia left fork at Asphalt Plant, Sandia right fork at Power Plant

[a] Basis from State of New Mexico Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC).

[b] Basis is inconsistent with existing, designated, or reasonably anticipated attainable uses of storm water in Sandia Canyon.

Table 29
Sandia Canyon Watershed Alpha-Emitting COPC and Storm Water Summary

Analyte	Sediment	Storm Water[a]	Nonstorm-Related Surface Water[b]	Alluvial Groundwater	Intermediate Groundwater	Regional Groundwater[b]
Radionuclides						
Americium-241	X[c]	X	X	—[d]	—	X
Gross alpha	—	X	X	X	X	X
Plutonium-238	X	X	X	—	—	X
Plutonium-239/240	X	X	X	—	—	—
Radium-226	—	X	X	X	X	X
Radium-228	—	X	—	X	X	X
Thorium-228	X	X	—	—	—	—
Thorium-230	—	X	—	—	—	X
Thorium-232	X	X	—	—	—	—
Uranium-234	X	X	X	X	X	X
Uranium-235/236	X	X	X	X	X	X
Uranium-238	X	X	X	X	X	X

Note: Grey shading indicates analyte exceeded SAL or SSL for sediment or a standard for water.

[a] For storm water, an analyte is marked with "X" if it was detected and is shaded gray if it exceeded an acute benchmark.

[b] Sandia spring is screened both as surface water and regional groundwater.

[c] X = Analyte is a COPC for given medium.

[d] — = Analyte is not a COPC for a given medium or not detected in storm water.

Table 30
Inferred Primary Sources and Downgradient Extent of Select COPCs in Surface Water and Groundwater

Analyte	Extent of COPC Distribution Related to Sandia Source(s)						Inferred Primary Source(s) in the Sandia Canyon Watershed[c]	Inferred Downgradient Extent from Laboratory Sources
	Nonstorm-Related Surface Water	Alluvial Groundwater	Intermediate Groundwater (Sandia)	Intermediate Groundwater (Mortandad)	Regional Groundwater (Sandia)	Regional Groundwater (Mortandad)		
Radionuclide COPCs								
Radium-226	Above wESL	Detected	n/a*	n/a	n/a	n/a	Natural	
Uranium-234	Detected	n/a	n/a	n/a	n/a	n/a	Natural	
Uranium-238	Detected	n/a	n/a	n/a	n/a	n/a	Natural	

Notes: Explanation of column entries for "Extent of COPC Distribution related to Sandia Source(s)":

- Above wESL: This analyte is detected more than once in a surface-water sample, at a concentration exceeding the water ESL. (Table cell is highlighted in yellow.)
- Detected: This analyte is detected more than once in this media, and detected concentrations are below any water-quality standard, wESL, or BV used for screening. This entry is used for analytes for which wESLs or BVs are not available.

*n/a = This analyte is detected more than once in this media, and maximum detected concentrations are above a water-quality standard, wESL, or BV used for screening. However, exceedances are not representative of groundwater concentrations for reasons discussed in text. However, concentrations exceed a screening value either as a residual effect of well drilling, constructtion, rehabilitation, or conversion or from a source located in a watershed other than Sandia.

Table 31
Radionuclides Detected or
Detected above BVs/FVs at SWMU 53-005

Sample ID	Location ID	Depth (ft)	Media	Cesium-137
Qbt 2, 3, 4 BV[a]				**na[b]**
Construction Worker SAL[c]				**31**
Industrial SAL[c]				**39**
Residential SAL[c]				**4.7**
RE53-10-26418	53-612483	15–16	QBT3	0.114
RE53-10-26420	53-612484	2–3	QBT3	0.0885

Note: Results are in pCi/g.

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

[b] na = Not available.

[c] SALs are from LANL (2012b).

Table 32
Radionuclides Detected or Detected above BVs/FVs at SWMU 53-006(f)

Sample ID	Location ID	Depth (ft)	Media	Tritium
Qbt 2, 3, 4 BV[a]				**na[b]**
Construction Worker SAL[c]				**62000**
Industrial SAL[c]				**200000**
Residential SAL[c]				**850**
RE53-10-22256	53-612487	8–9	QBT3	0.0358453
RE53-10-22257	53-612488	0–1	QBT3	0.0257297
RE53-10-22258	53-612488	2–3	QBT3	0.0284914
RE53-10-22259	53-612488	8–9	QBT3	0.0581442
RE53-10-22262	53-612489	8–9	QBT3	0.0463953

Note: Results are in pCi/g.
[a] BVs/FVs are from LANL (1998).
[b] na = Not available.
[c] SALs from LANL (2012b).

Table 33
Radionuclides Detected or Detected above BVs/FVs at AOC 53-008

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Cobalt-60	Plutonium-239/240	Tritium	Uranium-235/236
Qbt 2, 3, 4 BV[a]				**na[b]**	**na**	**na**	**na**	**0.09**
Construction Worker SAL[c]				**31**	**6.8**	**120**	**62000**	**100**
Industrial SAL[c]				**39**	**8.5**	**1200**	**200000**	**150**
Residential SAL[c]				**4.7**	**11**	**79**	**850**	**39**
RE53-10-22320	53-612507	0–1	QBT3	0.465	—[d]	0.0327	—	—
RE53-10-22321	53-612507	2–3	QBT3	—	—	—	0.00550913	—
RE53-10-22322	53-612508	0–1	QBT3	0.607	—	0.039	0.0104392	—
RE53-10-22323	53-612508	2–3	QBT3	—	—	—	0.0258976	—
RE53-10-22324	53-612509	0–1	QBT3	0.189	—	—	—	—
RE53-10-22325	53-612509	2–3	QBT3	—	—	0.068	—	—
RE53-10-22326	53-612510	0–1	QBT3	0.344	—	—	—	—
RE53-10-22328	53-612511	0–1	QBT3	0.507	—	—	0.0188789	—
RE53-10-22330	53-612512	0–1	QBT3	—	0.359	—	0.00762201	—
RE53-10-22331	53-612512	2–3	QBT3	—	—	—	0.027311	—
RE53-10-22332	53-612513	0–1	QBT3	0.337	—	0.0206	0.0193358	—
RE53-10-22333	53-612513	2–3	QBT3	—	—	—	0.00889474	—
RE53-10-22334	53-612514	0–1	QBT3	0.188	—	—	0.00789747	—
RE53-10-22335	53-612514	2–3	QBT3	—	—	0.388	0.0047502	—
RE53-10-22336	53-612515	0–1	QBT3	—	—	—	0.139873	—
RE53-10-22337	53-612515	2–3	QBT3	—	0.281	—	0.339521	—

Table 33 (continued)

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Cobalt-60	Plutonium-239/240	Tritium	Uranium-235/236
Qbt 2, 3, 4 BV[a]				**na[b]**	**na**	**na**	**na**	**0.09**
Construction Worker SAL[c]				**31**	**6.8**	**120**	**62000**	**100**
Industrial SAL[c]				**39**	**8.5**	**1200**	**200000**	**150**
Residential SAL[c]				**4.7**	**11**	**79**	**850**	**39**
RE53-10-22338	53-612516	0–1	QBT3	0.0924	0.717	—	0.0164326	—
RE53-10-22339	53-612516	2–3	QBT3	—	—	—	0.0330177	—
RE53-10-22340	53-612517	0–1	QBT3	0.603	0.144	—	—	—
RE53-10-22341	53-612517	2–3	QBT3	—	—	—	0.715034	—
RE53-10-22342	53-612518	0–1	QBT3	0.152	—	0.0392	—	—
RE53-10-22344	53-612519	0–1	QBT3	0.423	—	0.0467 (J+)	—	—
RE53-10-22345	53-612519	2–3	QBT3	—	—	—	0.00769812	—
RE53-10-22346	53-612520	0–1	QBT3	—	—	—	—	0.1
RE53-10-22347	53-612520	2–3	QBT3	—	—	—	0.526947	—
RE53-10-22349	53-612521	2–3	QBT3	—	—	—	0.0104463	—
RE53-10-22350	53-612522	0–1	QBT3	0.342	—	0.0252	0.0571034	—
RE53-10-22351	53-612522	2–3	QBT3	—	—	—	0.0535745	0.106
RE53-10-22352	53-612523	0–1	QBT3	0.414	—	0.0401	—	—

Note: Results are in pCi/g.

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

[b] na = Not available.

[c] SALs are from LANL (2012b).

[d] — = Not detected.

Table 34
Radionuclides Detected or Detected above BVs/FVs at SWMU 20-001(a)

Sample ID	Location ID	Depth (ft)	Media	Uranium-235/236
Qbt 2, 3, 4 BV[a]				**0.09**
Construction Worker SAL[b]				**100**
Industrial SAL[b]				**150**
Residential SAL[b]				**39**
RE20-10-22666	20-612556	5–6	QBT3	0.104
RE20-10-22667	20-612556	10–11	QBT3	0.115
RE20-10-22668	20-612556	14–15	QBT3	0.0948
RE20-10-22669	20-612557	5–6	QBT3	0.111
RE20-10-22671	20-612557	14–15	QBT3	0.122
RE20-10-22672	20-612558	5–6	QBT3	0.112
RE20-10-22674	20-612558	14–15	QBT3	0.101
RE20-10-22689	20-612563	14–15	QBT3	0.123

Note: Results are in pCi/g.

[a] BVs are from LANL (1998).

[b] SALs are from LANL (2012b).

Table 35
Radionuclides Detected or Detected above BVs/FVs at SWMU 20-001(b)

Sample ID	Location ID	Depth (ft)	Media	Uranium-234	Uranium-235/236	Uranium-238
Qbt 2, 3, 4 BV[a]				**1.98**	**0.09**	**1.93**
Construction Worker SAL[b]				**770**	**100**	**410**
Industrial SAL[b]				**3000**	**150**	**750**
Residential SAL[b]				**270**	**39**	**150**
RE20-10-22729	20-612567	10–11	QBT3	—[c]	0.0904	—
RE20-10-22732	20-612568	9–12	QBT3	2	0.117	2.24
RE20-10-22739	20-612568	14–15	QBT3	2.77	0.201	3.01
RE20-10-22733	20-612569	10–11	QBT3	—	0.104	—
RE20-10-22734	20-612569	14–15	QBT3	—	0.121	—
RE20-10-22737	20-612571	10–11	QBT3	—	0.143	—
RE20-10-22738	20-612571	14–15	QBT3	—	0.0997	—

Note: Results are in pCi/g.
[a] BVs are from LANL (1998).
[b] SALs are from LANL (2012b).
[c] — = Not detected or not detected above BV.

Table 36
Radionuclides Detected or Detected above BVs/FVs at SWMU 20-002(c)

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Uranium-235/236
Qbt 2, 3, 4 BV[a]				**na[b]**	**0.09**
Construction Worker SAL[c]				**31**	**100**
Industrial SAL[c]				**39**	**150**
Residential SAL[c]				**4.7**	**39**
RE20-10-23169	20-612599	0–1	QBT3	0.0805	—[d]
RE20-10-23173	20-612600	4–5	QBT3	—	0.119
RE20-10-23181	20-612603	0–1	QBT3	0.136	—

Note: Results are in pCi/g.
[a] BVs/FVs are from LANL (1998).
[b] na = Not available.
[c] SALs are from LANL (2012b).
[d] — = Not detected or not detected above BV/FV.

Table 37
Radionuclides Detected or Detected above BVs/FVs at AOC 20-003(c)

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Uranium-234	Uranium-235/236	Uranium-238
Qbt 2, 3, 4 BV[a]				**na[b]**	**1.98**	**0.09**	**1.93**
Construction Worker SAL[c]				**31**	**770**	**100**	**410**
Industrial SAL[c]				**39**	**3000**	**150**	**750**
Residential SAL[c]				**4.7**	**270**	**39**	**150**
RE20-10-22292	20-612496	2.5–3	QBT3	—[d]	2.43	0.133	2.41
RE20-10-24865	20-612496	4–5	QBT3	—	3.16	0.216	3.11
RE20-10-22293	20-612497	7.5–8	QBT3	—	2.17	0.102	2.22
RE20-10-24867	20-612497	10–11	QBT3	—	2.77	0.168	3.1
RE20-10-22296	20-612498	3–3.5	QBT3	—	2.34	0.12	2.37
RE20-10-24866	20-612498	5–6	QBT3	—	2.62	0.18	3.43
RE20-10-22297	20-612499	1–2	QBT3	0.166	—	0.131	—
RE20-10-24864	20-612499	3–4	QBT3	—	2.99	0.168	3.04

Note: Results are in pCi/g.
[a] BVs/FVs are from LANL (1998).
[b] na = Not available.
[c] SALs are from LANL (2012b).
[d] — = Not detected or not detected above BV/FV.

Table 38
Radionuclides Detected or Detected above BVs/FVs at SWMU 20-001(c)

Sample ID	Location ID	Depth (ft)	Media	Uranium-234	Uranium-235/236	Uranium-238
Qbt 2, 3, 4 BV[a]				**1.98**	**0.09**	**1.93**
Construction Worker SAL[b]				**770**	**100**	**410**
Industrial SAL[b]				**3000**	**150**	**750**
Residential SAL[b]				**270**	**39**	**150**
RE20-10-23075	20-612574	5–6	QBT3	—[c]	0.101	—
RE20-10-23078	20-612575	5–6	QBT3	3.08	0.177	3.17
RE20-10-23079	20-612575	10–11	QBT3	2.79	0.141	2.71
RE20-10-23080	20-612575	14–15	QBT3	3.13	0.164	3.09
RE20-10-23088	20-612578	10–11	QBT3	—	0.122	—
RE20-10-23091	20-612579	10–11	QBT3	—	0.0968	—
RE20-10-23093	20-612580	5–6	QBT3	—	0.096	—
RE20-10-23097	20-612581	10–11	QBT3	—	0.106	—
RE20-10-23098	20-612581	14–15	QBT3	—	0.101	—

Note: Results are in pCi/g.
[a] BVs are from LANL (1998).
[b] SALs are from LANL (2012b).
[c] — = Not detected or not detected above BV/FV.

Table 39
Radionuclides Detected or Detected above BVs/FVs at SWMU 20-002(a)

Sample ID	Location ID	Depth (ft)	Media	Uranium-235/236	Uranium-238
Qbt 2, 3, 4 BV[a]				**0.09**	**1.93**
Construction Worker SAL[b]				**100**	**410**
Industrial SAL[b]				**150**	**750**
Residential SAL[b]				**39**	**150**
RE20-10-23120	20-612586	0–1	QBT3	0.0901	—[c]
RE20-10-23131	20-612589	4–5	QBT3	0.0983	2.08
RE20-10-23132	20-612590	0–1	QBT3	0.0963	—

Note: Results are in pCi/g.
[a] BVs/FVs are from LANL (1998).
[b] SALs are from LANL (2012b).
[c] — = Not detected or not detected above BV/FV.

Table 40
Radionuclides Detected or Detected above BVs/FVs at SWMU 20-002(b)

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Uranium-235/236	Uranium-238
Qbt 2, 3, 4 BV[a]				**na[b]**	**0.09**	**1.93**
Construction Worker SAL[c]				**31**	**100**	**410**
Industrial SAL[c]				**39**	**150**	**750**
Residential SAL[c]				**4.7**	**39**	**150**
RE20-10-23144	20-612592	0–1	QBT3	0.282	—[d]	—
RE20-10-23147	20-612593	0–1	QBT3	0.262	—	—
RE20-10-23150	20-612594	0–1	QBT3	0.349	0.0913	2.06
RE20-10-23151	20-612594	2–3	QBT3	—	0.104	1.95
RE20-10-23153	20-612595	0–1	QBT3	0.256	—	—
RE20-10-23156	20-612596	0–1	QBT3	0.475	—	—
RE20-10-23157	20-612596	2–3	QBT3	—	0.108	—
RE20-10-23159	20-612597	0–1	QBT3	0.233	—	—
RE20-10-23160	20-612597	2–3	QBT3	—	0.0938	—

Note: Results are in pCi/g.
[a] BVs/FVs are from LANL (1998).
[b] na = Not available.
[c] SALs are from LANL (2012b).
[d] — = Not detected or not detected above BV/FV.

Table 41
Radionuclides Detected or Detected above BVs/FVs at SWMU 20-002(d)

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Uranium-234	Uranium-235/236	Uranium-238
Qbt 2, 3, 4 BV[a]				**na[b]**	**1.98**	**0.09**	**1.93**
Construction Worker SAL[c]				**31**	**770**	**100**	**410**
Industrial SAL[c]				**39**	**3000**	**150**	**750**
Residential SAL[c]				**4.7**	**270**	**39**	**150**
RE20-10-23196	20-612606	0–1	QBT3	—[d]	3.17	0.162	3.05
RE20-10-23197	20-612606	4–5	QBT3	—	—	0.0905	—
RE20-10-23206	20-612609	4–5	QBT3	—	—	0.104	—
RE20-10-23208	20-612610	0–1	QBT3	0.242	—	0.106	—
RE20-10-23209	20-612610	4–5	QBT3	—	—	0.0995	—
RE20-10-23211	20-612611	0–1	QBT3	—	—	0.0923	—
RE20-10-23213	20-612611	8–9	QBT3	—	—	0.0938	—
RE20-10-23214	20-612612	0–1	QBT3	0.144	15	0.775	15.4
RE20-10-23217	20-612613	0–1	QBT3	0.281	—	—	—
RE20-10-23218	20-612613	4–5	QBT3	—	—	0.101	—
RE20-10-23219	20-612613	8–9	QBT3	—	—	0.142	—

Note: Results are in pCi/g.
[a] BVs/FVs are from LANL (1998).
[b] na = Not available.
[c] SALs are from LANL (2012b).
[d] — = Not detected or not detected above BV/FV.

Table 42
Radionuclides Detected or Detected above BVs/FVs at AOC 20-003(b)

Sample ID	Location ID	Depth (ft)	Media	Uranium-235/236
Qbt 2, 3, 4 BV[a]				**0.09**
Sediment BV[a]				**0.2**
Construction Worker SAL[b]				**100**
Industrial SAL[b]				**150**
Residential SAL[b]				**39**
RE20-10-22278	20-612491	11–12	QBT3	0.103
RE20-10-22273	20-612493	8–9	SED	0.223

Note: Results are in pCi/g.
[a] BVs/FVs are from LANL (1998).
[b] SALs are from LANL (2012b).

Table 43
Sediment Investigation Reaches in Sandia Canyon

Investigation Reach	Reach Abbreviation	Approximate Distance From Rio Grande to Midpoint of Reach (km)	Reach Length (km)*	Year(s) of Sample Collection (Canyons Investigations)	Notes
S-1 North	S-1N	16.06	0.20	1998, 2008	North Fork of Sandia Canyon; below former asphalt batch plant
S-1 South	S-1S	16.06	0.20	1998, 2008	South Fork of Sandia Canyon; below power plant
S-2 West	S-2W	15.95	0.03	1998	Upcanyon from landfill bridge; below confluence of north and south forks
S-2	S-2	15.44	0.68	1998, 2007, 2008	Downcanyon from landfill bridge; Sandia wetland and vicinity
S-3 West	S-3W	14.18	0.21	2007, 2008	Bouldery reach in narrow canyon bottom; below Royal Crest trailer park
S-3 East	S-3E	12.68	0.20	2000, 2007	Bouldery reach in narrow canyon bottom; below East Jemez Road
S-4 West	S-4W	11.31	0.23	2007	Downcanyon from western TA-53 SWMUs; incising reach
S-4 East	S-4E	9.89	0.31	2007	Upcanyon from eastern TA-53 drainage; aggrading reach
S-5 Central	S-5C	8.96	0.24	2000, 2007	Downcanyon from TA-53 and Protective Force firing range; near well R-35
S-5 East	S-5E	6.59	0.23	2007	Upcanyon from NM 4 and eastern Laboratory boundary
S-6 West	S-6W	3.32	0.20	2008	Pueblo de San Ildefonso land; above basalt knickpoint
S-6 East	S-6E	0.35	0.20	2008	Pueblo de San Ildefonso land; above Rio Grande

*Length refers to area mapped and characterized.

Table 44
Aluminum in Sandia Canyon Sediment Samples

Reach	Aluminum
BV (mg/kg)[a]	**15400**
Minimum Soil ESL[b]	**pH-dependent**
Residential SSL[c]	**78000**
S-1N	—[d]
S-1S	—
S-2	20,000
S-3W	—
S-3E	—
S-4W	—
S-4E	—
S-5C	—
S-5E	—
S-6W	—
S-6E	—

Notes: Values are in mg/kg. Values are maximum values greater than the sediment BVs for analytes with BVs, and the maximum detected value for analytes without BVs.

[a] BVs are from LANL (1998).

[b] ESLs are from the Ecorisk Database, Version 3.1 (LANL 2012c).

[c] SSLs are from NMED (2012) unless otherwise noted.

[d] — = Not a COPC in that reach (not detected, not detected > BV, or not analyzed).

Table 45
Inferred Primary Sources and Downcanyon Extent of Aluminum in Sediment in Sandia Canyon

Type of COPC	COPC	Inferred Primary Source(s) in the Sandia Canyon Watershed[a]	Inferred Downcanyon Extent from Laboratory Sources[b]
Inorganic Chemical	Aluminum	Natural background	n/a[c]

[a] Primary source(s) indicated by maximum concentrations and/or spatial distribution.

[b] Downcanyon extent indicates area where COPC remains detected and/or above background and can probably or possibly be traced to an upcanyon Laboratory source.

[c] n/a = Not applicable (inferred source is natural background).

Table 46
Sandia Canyon Surface Water Sampling Locations and Rationale

Location Name	Location and Rationale
Base Flow (west to east)	
Surface Water Gaging Station E121	South Fork of Sandia Canyon, near power plant. Located west of wetland. Provides information about potential contaminant releases from TA-03 facilities to the west and baseline data about surface water entering the wetland.
Surface Water Gaging Station E122 (equivalent WSFS)	North Fork of Sandia Canyon, near power plant. Located west of wetland. Downgradient of main contaminant release sites in Sandia Canyon. Provides baseline data about surface water entering the wetland.
Surface Water Sampling Station SCS-1	Surface water sampling station at west end of wetland. Provides baseline data about surface water entering the wetland.
Surface Water Gaging Station E123	Sandia Canyon just east of wetland. Location selected to monitor persistent surface water exiting the wetland.
Surface Water Gaging Station E123.6	Surface water base flow collected at gage station E123.6. Location selected to monitor persistent surface water in narrow, bedrock-dominated portion of middle Sandia Canyon.
Surface Water Sampling Station SCS-2 (equivalent WMSC)	Middle Sandia Canyon. Location selected to monitor surface water near the eastern terminus of persistent base flow.
Surface Water Sampling Station SCS-3	Near eastern end of middle Sandia Canyon. Provides baseline data about surface water up gradient of TA-53 facilities. Area of ephemeral surface water flow.
Surface Water Gaging Station E124	Surface water base flow collected at gage station E124. Location selected to monitor surface water in area where Sandia Canyon widens and ephemeral surface water flows.
Surface Water Gaging Station E125	Surface water base flow collected at gage station E125. Location selected to monitor surface water near eastern Laboratory boundary. Area of ephemeral surface water flow.

Table 47
Water Screening Location, Synonym, and Reach

Location Name[a]	Location Synonym	Reach[b]
Surface Water		
North Fork of Sandia Canyon at E122	WSFS	S-1N
Sandia left fork at Asphalt Plant	E122	S-1N
Sandia right fork at Power Plant	E121	S-1S
SA-00007	—[c]	S-2
SA-603204	—	S-2
Sandia below Wetlands	E123	S-2
SA-10005	—	S-3E
Middle Sandia Canyon at terminus of persistent base flow	WMSC	S-3E and S-4W
SCS-2	—	S-3E and S-4W
SA-603205	—	S-3E and S-4W
Sandia Spring[d]	—	S-6E
Sandia above Firing Range	E124	S-4W and S-4E
Sandia above SR-4	E125	S-5E

[a] Locations are listed from west to east.

[b] The listed location is either within the reach, or else the nearest reach is listed; for locations midway between reaches, both reaches are listed.

[c] — = Not applicable.

[d] Sandia Spring is screened as part of the surface water dataset as well as part of the regional aquifer dataset.

Table 48
Aluminum in Filtered Nonstorm-Related Surface Water Samples

Location	Aluminum
ESL[a]	87
Standard Level (Perennial Stream Classification)	87
Standard Type	AqChrF[b]
NMED Tap Water[c]	36500
Middle Sandia Canyon at terminus of persistent baseflow (WMSC)	250
SCS-2 (W2CS)	139
Sandia Spring	—[d]
Sandia below Wetlands (E123)	100
Sandia right fork at Power Plant (E121)	55
South Fork of Sandia Canyon at E122 (WSFS)	552

Notes: Values are in µg/L. Values are maximum detected value. Grey shading indicates a standard screening value was exceeded.

[a] Water ESLs from Ecorisk Database Version 3.1 (LANL 2012c).

[b] na = Not available.

[c] NMED Tap Water (2012).

[d] — = Not detected or not analyzed.

Table 49
Aluminum in Nonfiltered Nonstorm-Related Surface Water Samples

Location	Aluminum
ESL[a]	530
Standard Level (Perennial Stream Classification)	na[b]
Standard Type	na
NMED Tap Water[c]	36500
Middle Sandia Canyon at terminus of persistent base flow (WMSC)	1010
SA-00007	77.4
SA-10005	72
SA-603204	110
SA-603205	—[d]
SCS-2 (W2CS)	354
Sandia Spring	610
Sandia below Wetlands (E123)	1290
Sandia left fork at Asphalt Plant (E122)	1010
Sandia right fork at Power Plant (E121)	171
South Fork of Sandia Canyon at E122 (WSFS)	2420

Notes: Values are in µg/L. Values are maximum detected value.

[a] Water ESLs from Ecorisk Database Version 3.1 (LANL 2012c).

[b] na = Not available.

[c] NMED Tap Water (2012).

[d] — = Not detected or not analyzed.

Table 50
Aluminum in Phase II Filtered Nonstorm-Related Surface Water Samples from Sandia Canyon

Location	Aluminum µg/L
Comparison Value	1370
Middle Sandia at WP terminus	—*
Sandia below Wetlands	121 (J)
Sandia right fork at Power Plant	75.5 (J)
South Fork of Sandia at E122	137 (J)
Comparison Value	—
Sandia Spring	—

Note: Highlighted values are greater than the comparison value.
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.

* — = Not a COPC at that location (not above comparison value, not detected, or not analyzed).

Table 51
Sandia Canyon Watershed COPC Summary

Analyte	Sediment		Storm Water[a]		Nonstorm-Related Surface Water[b]		Alluvial Groundwater		Intermediate Groundwater		Regional Groundwater[b]	
	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2
Metals												
Aluminum	X[c]	—[d]	X	X	X	X	X	X	—	X	X	X

Note: Grey shading indicates analyte was not a Phase I sediment COPC.

[a] For storm water, an analyte is marked with "X" if it was detected and is shaded gray if it exceeded a comparison value.

[b] Sandia Spring is screened both as surface water and regional groundwater.

[c] X = Analyte is a COPC for given medium.

[d] — = Analyte is not a COPC for a given medium or not detected in storm water.

Table 52
Inferred Primary Sources and Downgradient Extent of Aluminum in Surface Water and Groundwater

Analyte	Extent of COPC Distribution Related to Sandia Source(s)						Inferred Primary Source(s) in the Sandia Canyon Watershed	Inferred Downgradient Extent from Laboratory Sources
	Nonstorm-Related Surface Water	Alluvial Groundwater	Intermediate Groundwater (Sandia)	Intermediate Groundwater (Mortandad)	Regional Groundwater (Sandia)	Regional Groundwater (Mortandad)		
Trace Metal COPCs								
Aluminum	Above standard	Above BV	—[a]	n/a[b]	n/a	n/a	Natural sources	Presence of Sandia COPC limited to surface water and alluvial water

Notes: Explanation of column entries for "Extent of COPC Distribution related to Sandia Source(s)":

- Above Standard: This analyte is detected more than once in this media, at a concentration exceeding a water-quality standard used for screening. (Table cell is highlighted in pink.)
- Above BV: This analyte is detected more than once in groundwater from this media, at a concentration exceeding the background value (BV). (Table cell is highlighted yellow).

[a] — = This analyte is either not detected in this media, not detected above the BV, not detected more than once, or detected in < 5% of the samples from this media.

[b] n/a = This analyte is detected more than once in this media, and maximum detected concentrations are above a water-quality standard, wESL, or BV used for screening. However, exceedances are not representative of groundwater concentrations. However, concentrations exceed a screening value either as a residual effect of well drilling, construction, rehabilitation, or conversion, or from a source located in a watershed other than Sandia.

Table 53
Aluminum above BVs at SWMU 60-002 (West)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2,3,4 BV[a]				**7340**
Soil BV[a]				**29,200**
Residential SSL[b]				**7.80E+04**
Industrial SSL[b]				**1.13E+06**
Construction Worker SSL[b]				**4.07E+04**
RE03-09-14094	03-608393	1–2	Soil	—[c]
RE03-09-14095	03-608393	4–5	Qbt3	10,500 (J)
RE03-09-14096	03-608394	1–2	Qbt3	10,500 (J)
RE03-09-14097	03-608394	4–5	Qbt3	16,000 (J)
RE03-09-14098	03-608395	1–2	Soil	—
RE03-09-14099	03-608395	4–5	Soil	—
RE03-09-14100	03-608396	1–2	Soil	—
RE03-09-14101	03-608396	4–5	Soil	—
RE03-09-14102	03-608397	1–2	Soil	—
RE03-09-14103	03-608397	4–5	Qbt3	8790 (J)
RE03-09-14104	03-608398	1–2	Soil	—
RE03-09-14105	03-608398	4–5	Qbt3	10,500 (J)

Notes: Results are in mg/kg. 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.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012).

[c] — = Not above BV.

Table 54
Aluminum above BVs at SWMU 60-002 (Central and East)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2,3,4 BV[a]				**7340**
Soil BV[a]				**29,200**
Residential SSL[b]				**7.80E+04**
Industrial SSL[b]				**1.13E+06**
Construction Worker SSL[b]				**4.07E+04**
RE60-03-52308	60-22517	4–4.5	Qbt4	15,350
RE60-03-52307	60-22517	8.5–9	Qbt4	—[c]
RE60-03-52309	60-22517	14.5–15	Qbt4	—
RE60-03-52312	60-22518	4.5–5	Soil	—
RE60-03-52314	60-22518	14.5–15	Qbt4	—
RE60-03-52317	60-22519	4.5–5	Soil	—

Table 54 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2,3,4 BV[a]				**7340**
Soil BV[a]				**29,200**
Residential SSL[b]				**7.80E+04**
Industrial SSL[b]				**1.13E+06**
Construction Worker SSL[b]				**4.07E+04**
RE60-03-52320	60-22519	13.5–14	Qbt4	23,720
RE60-03-52322	60-22520	3–3.5	Soil	—
RE60-03-52324	60-22520	14.5–15	Qbt4	—
RE60-03-52327	60-22521	4–4.5	Soil	—
RE60-03-52332	60-22522	5.5–6	Qbt4	15,520
RE60-03-52334	60-22522	16–17	Qbt4	9900
RE60-04-53096	60-22680	1.5–2	Soil	—

Note: Results are in mg/kg.
[a] BVs are from LANL (1998).
[b] SSLs are from NMED (2012).
[c] — = Not above BV.

Table 55
Aluminum above BVs at AOCs 60-004(b) and 60-004(d)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2,3,4 BV[a]				**7340**
Soil BV[a]				**29,200**
Residential SSL[b]				**7.80E+04**
Industrial SSL[b]				**1.13E+06**
Construction Worker SSL[b]				**4.07E+04**
RE03-09-14106	03-608399	0.0–1.0	Soil	—[c]
RE03-09-14107	03-608399	2.0–3.0	Soil	—
RE03-09-14108	03-608399	4.0–5.0	Soil	—
RE03-09-14109	03-608399	9.0–10.0	Qbt3	—
RE03-09-14110	03-608399	14.0–15.0	Qbt3	—
RE03-09-14111	03-608400	0.0–1.0	Soil	—
RE03-09-14112	03-608400	2.0–3.0	Qbt3	23,700 (J+)
RE03-09-14113	03-608400	4.0–5.0	Qbt3	9930 (J+)
RE03-09-14114	03-608400	9.0–10.0	Qbt3	—
RE03-09-14115	03-608400	14.0–15.0	Qbt3	—
RE03-09-14116	03-608401	0.0–1.0	Soil	—
RE03-09-14117	03-608401	2.0–3.0	Qbt3	12,200 (J+)
RE03-09-14118	03-608401	4.0–5.0	Qbt3	23,200 (J+)

Table 55 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2,3,4 BV[a]				**7340**
Soil BV[a]				**29,200**
Residential SSL[b]				**7.80E+04**
Industrial SSL[b]				**1.13E+06**
Construction Worker SSL[b]				**4.07E+04**
RE03-09-14119	03-608401	9.0–10.0	Qbt3	—
RE03-09-14120	03-608401	14.0–15.0	Qbt3	—
RE03-09-14121	03-608402	0.0–1.0	Soil	—
RE03-09-14122	03-608402	2.0–3.0	Qbt3	—
RE03-09-14123	03-608402	4.0–5.0	Qbt3	—
RE03-09-14124	03-608402	9.0–10.0	Qbt3	—
RE03-09-14125	03-608402	14.0–15.0	Qbt3	—
RE03-09-14126	03-608403	0.0–1.0	Soil	—
RE03-09-14127	03-608403	2.0–3.0	Qbt3	—
RE03-09-14128	03-608403	4.0–5.0	Qbt3	—
RE03-09-14129	03-608403	9.0–10.0	Qbt3	—
RE03-09-14130	03-608403	14.0–15.0	Qbt3	—

Note: Results are in mg/kg.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012).

[c] — = Not above BV.

Table 56
Aluminum above BVs at AOC 60-004(f)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2,3,4 BV[a]				**7340**
Soil BV[a]				**29,200**
Residential SSL[b]				**7.80E+04**
Industrial SSL[b]				**1.13E+06**
Construction Worker SSL[b]				**4.07E+04**
RE03-09-14208	03-608404	1.0–2.0	Soil	—[c]
RE03-09-14209	03-608404	2.0–3.0	Qbt3	13,500
RE03-09-14210	03-608404	4.0–5.0	Qbt3	10,200
RE03-09-14211	03-608404	9.0–10.0	Qbt3	—
RE03-09-14212	03-608405	1.0–2.0	Soil	—
RE03-09-14213	03-608405	2.0–3.0	Soil	—
RE03-09-14214	03-608405	4.0–5.0	Qbt3	—
RE03-09-14215	03-608405	9.0–10.0	Qbt3	—
RE03-09-14216	03-608406	1.0–2.0	Soil	—

Table 56 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2,3,4 BV[a]				**7340**
Soil BV[a]				**29,200**
Residential SSL[b]				**7.80E+04**
Industrial SSL[b]				**1.13E+06**
Construction Worker SSL[b]				**4.07E+04**
RE03-09-14208	03-608404	1.0–2.0	Soil	—[c]
RE03-09-14209	03-608404	2.0–3.0	Qbt3	13,500
RE03-09-14210	03-608404	4.0–5.0	Qbt3	10,200
RE03-09-14211	03-608404	9.0–10.0	Qbt3	—
RE03-09-14212	03-608405	1.0–2.0	Soil	—
RE03-09-14213	03-608405	2.0–3.0	Soil	—
RE03-09-14214	03-608405	4.0–5.0	Qbt3	—
RE03-09-14215	03-608405	9.0–10.0	Qbt3	—
RE03-09-14216	03-608406	1.0–2.0	Soil	—
RE03-09-14217	03-608406	2.0–3.0	Soil	—
RE03-09-14218	03-608406	4.0–5.0	Soil	—
RE03-09-14219	03-608406	9.0–10.0	Soil	—
RE03-09-14220	03-608407	1.0–2.0	Soil	—
RE03-09-14221	03-608407	2.0–3.0	Soil	—
RE03-09-14222	03-608407	4.0–5.0	Soil	—
RE03-09-14223	03-608407	9.0–10.0	Qbt3	—
RE03-09-14224	03-608408	1.0–2.0	Soil	—
RE03-09-14225	03-608408	2.0–3.0	Soil	—
RE03-09-14226	03-608408	4.0–5.0	Soil	—
RE03-09-14227	03-608408	9.0–10.0	Soil	—

Note: Results are in mg/kg.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012).

[c] — = Not above BV.

Table 57
Aluminum above BVs at SWMU 60-006(a)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2,3,4 BV[a]				**7340**
Soil BV[a]				**29,200**
Residential SSL[b]				**7.80E+04**
Industrial SSL[b]				**1.13E+06**
Construction Worker SSL[b]				**4.07E+04**
RE03-09-14228	03-608409	20.0–21.0	Qbt3	—[c]
RE03-09-14229	03-608409	24.0–25.0	Qbt3	—
RE03-09-14230	03-608409	29.0–30.0	Qbt3	—
RE03-09-14231	03-608410	18.0–19.0	Qbt3	—
RE03-09-14232	03-608410	22.0–23.0	Qbt3	—
RE03-09-14233	03-608410	27.0–28.0	Qbt3	—
RE03-09-14234	03-608411	18.0–19.0	Qbt3	—
RE03-09-14235	03-608411	22.0–23.0	Qbt3	18,300 (J+)
RE03-09-14236	03-608411	27.0–28.0	Qbt3	—
RE03-09-14238	03-608412	10.0–11.0	Qbt3	—
RE03-09-14239	03-608412	14.0–15.0	Qbt3	—
RE03-09-14240	03-608412	18.0–19.0	Qbt3	—
RE03-09-14241	03-608412	23.0–24.0	Qbt3	—
RE03-10-9872	03-608412	35.0–36.0	Qbt3	—
RE03-10-9873	03-608412	55.0–56.0	Qbt3	—
RE03-10-9874	03-608412	60.0–61.0	Qbt3	—

Notes: Results are in mg/kg. J+ = The analyte was positively identified, and the result is likely to be biased high.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012).

[c] — = Not above BV.

Table 58
Aluminum above BVs at SWMU 60-007(b)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2,3,4 BV[a]				**7340**
Soil BV[a]				**29,200**
Residential SSL[b]				**7.80E+04**
Industrial SSL[b]				**1.13E+06**
Construction Worker SSL[b]				**4.07E+04**
RE03-09-14265	03-608417	0–1	Soil	—[c]
RE03-09-14267	03-608418	0–0.5	Soil	—
RE03-09-14269	03-608419	0–0.4	Soil	—
RE03-09-14271	03-608420	0–0.5	Soil	—
RE03-09-14273	03-608421	0–1	Soil	—
RE03-09-14274	03-608421	1–2	Soil	—
RE03-09-14275	03-608422	0–1	Soil	—
RE03-09-14276	03-608422	1–2	Soil	—
RE03-09-14277	03-608423	0–1	Soil	—
RE03-09-14278	03-608423	1–2	Soil	—
RE03-09-14279	03-608424	0–1	Soil	—
RE03-09-14280	03-608424	1–2	Qbt3	8660 (J)
RE03-09-14281	03-608425	0–1	Qbt3	—
RE03-09-14282	03-608425	1–2	Qbt3	—
RE03-09-14283	03-608426	0–1	Qbt3	—
RE03-09-14284	03-608426	1–2	Qbt3	—
RE03-09-14285	03-608427	0–1	Qbt3	—
RE03-09-14286	03-608427	1–2	Qbt3	—
RE03-09-14287	03-608428	0–1	Soil	—
RE03-09-14288	03-608428	1–2	Soil	—

Notes: Results are in mg/kg. 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.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012).

[c] — = Not above BV.

Table 59
Aluminum above BVs at AOC C-61-002

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2,3,4 BV[a]				**7340**
Soil BV[a]				**29,200**
Residential SSL[b]				**7.80E+04**
Industrial SSL[b]				**1.13E+06**
Construction Worker SSL[b]				**4.07E+04**
RE03-09-14300	03-608429	3.0–4.0	Soil	—[c]
RE03-09-14301	03-608429	5.0–6.0	Soil	—
RE03-09-14302	03-608429	7.0–8.0	Soil	—
RE03-09-14303	03-608429	9.0–10.0	Soil	—
RE03-09-14304	03-608429	11.0–12.0	Soil	—
RE03-09-14305	03-608429	14.0–15.0	Soil	—
RE03-09-14306	03-608430	3.0–4.0	Soil	—
RE03-09-14307	03-608430	5.0–6.0	Soil	—
RE03-09-14308	03-608430	7.0–8.0	Soil	—
RE03-09-14309	03-608430	9.0–10.0	Soil	—
RE03-09-14310	03-608430	11.0–12.0	Soil	—
RE03-09-14311	03-608430	14.0–15.0	Soil	—
RE03-09-14312	03-608431	3.0–4.0	Soil	—
RE03-09-14313	03-608431	5.0–6.0	Soil	—
RE03-09-14314	03-608431	7.0–8.0	Soil	—
RE03-09-14315	03-608431	9.0–10.0	Soil	—
RE03-09-14316	03-608431	11.0–12.0	Qbt3	11,200
RE03-09-14317	03-608431	14.0–15.0	Qbt3	10,300
RE03-09-14318	03-608432	3.0–4.0	Soil	—
RE03-09-14319	03-608432	5.0–6.0	Qbt3	—
RE03-09-14320	03-608432	7.0–8.0	Qbt3	—
RE03-09-14321	03-608432	9.0–10.0	Qbt3	—
RE03-09-14322	03-608432	11.0–12.0	Qbt3	—
RE03-09-14323	03-608432	14.0–15.0	Qbt3	—
RE03-09-14324	03-608433	3.0–4.0	Soil	—
RE03-09-14325	03-608433	5.0–6.0	Soil	—
RE03-09-14326	03-608433	7.0–8.0	Qbt3	19,900
RE03-09-14327	03-608433	9.0–10.0	Qbt3	—
RE03-09-14328	03-608433	11.0–12.0	Qbt3	—
RE03-09-14329	03-608433	14.0–15.0	Qbt3	—

Notes: Results are in mg/kg.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012).

[c] — = Not detected above BV.

Table 60
Aluminum above BVs at SWMU 53-006(f)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2, 3, 4 BV[a]				**7340**
Construction Worker SSL[b]				**40,700**
Industrial SSL[b]				**1,130,000**
Residential SSL[b]				**78,000**
RE53-10-22254	53-612487	0–1	QBT3	—[c]
RE53-10-22255	53-612487	2–3	QBT3	—
RE53-10-22256	53-612487	8–9	QBT3	—
RE53-10-22257	53-612488	0–1	QBT3	—
RE53-10-22258	53-612488	2–3	QBT3	8230
RE53-10-22259	53-612488	8–9	QBT3	9240
RE53-10-22260	53-612489	0–1	QBT3	—
RE53-10-22261	53-612489	2–3	QBT3	—
RE53-10-22262	53-612489	8–9	QBT3	10,400

Notes: Results are in mg/kg.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012), unless otherwise noted.

[c] — = Not detected above BV.

Table 61
Inorganic Chemicals above BVs at AOC 53-008

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2, 3, 4 BV[a]				**7340**
Construction Worker SSL[b]				**40,700**
Industrial SSL[b]				**1,130,000**
Residential SSL[b]				**78,000**
RE53-10-22320	53-612507	0–1	QBT3	—[c]
RE53-10-22321	53-612507	2–3	QBT3	—
RE53-10-22322	53-612508	0–1	QBT3	—
RE53-10-22323	53-612508	2–3	QBT3	9160 (J+)
RE53-10-22324	53-612509	0–1	QBT3	—
RE53-10-22325	53-612509	2–3	QBT3	—
RE53-10-22326	53-612510	0–1	QBT3	—
RE53-10-22327	53-612510	2–3	QBT3	—
RE53-10-22328	53-612511	0–1	QBT3	—
RE53-10-22329	53-612511	2–3	QBT3	—
RE53-10-22330	53-612512	0–1	QBT3	—
RE53-10-22331	53-612512	2–3	QBT3	—
RE53-10-22332	53-612513	0–1	QBT3	—

Table 61 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2, 3, 4 BV[a]				**7340**
Construction Worker SSL[b]				**40,700**
Industrial SSL[b]				**113,0000**
Residential SSL[b]				**78,100**
RE53-10-22333	53-612513	2–3	QBT3	—
RE53-10-22333	53-612513	2–3	QBT3	—
RE53-10-22334	53-612514	0–1	QBT3	—
RE53-10-22335	53-612514	2–3	QBT3	—
RE53-10-22336	53-612515	0–1	QBT3	—
RE53-10-22337	53-612515	2–3	QBT3	—
RE53-10-22338	53-612516	0–1	QBT3	—
RE53-10-22339	53-612516	2–3	QBT3	—
RE53-10-22340	53-612517	0–1	QBT3	—
RE53-10-22341	53-612517	2–3	QBT3	—
RE53-10-22342	53-612518	0–1	QBT3	—
RE53-10-22343	53-612518	2–3	QBT3	—
RE53-10-22344	53-612519	0–1	QBT3	—
RE53-10-22345	53-612519	2–3	QBT3	—
RE53-10-22346	53-612520	0–1	QBT3	—
RE53-10-22347	53-612520	2–3	QBT3	—
RE53-10-22348	53-612521	0–1	QBT3	—
RE53-10-22349	53-612521	2–3	QBT3	—
RE53-10-22350	53-612522	0–1	QBT3	—
RE53-10-22351	53-612522	2–3	QBT3	—
RE53-10-22352	53-612523	0–1	QBT3	—
RE53-10-22353	53-612523	2–3	QBT3	—

Notes: Results are in mg/kg. J+ = The analyte was positively identified, and the result is likely to be biased high.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012), unless otherwise noted.

[c] — = Not detected above BV.

Table 62
Aluminum above BVs at SWMU 20-002(c)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2, 3, 4 BV[a]				**7340**
Construction Worker SSL[b]				**40,700**
Industrial SSL[b]				**1,130,000**
Residential SSL[b]				**78,000**
RE20-10-23166	20-612598	0–1	QBT3	7380
RE20-10-23167	20-612598	4–5	QBT3	—[c]
RE20-10-23168	20-612598	8–9	QBT3	—
RE20-10-23169	20-612599	0–1	QBT3	7410
RE20-10-23170	20-612599	4–5	QBT3	—
RE20-10-23171	20-612599	8–9	QBT3	—
RE20-10-23172	20-612600	0–1	QBT3	8080
RE20-10-23173	20-612600	4–5	QBT3	—
RE20-10-23174	20-612600	8–9	QBT3	—
RE20-10-23175	20-612601	0–1	QBT3	—
RE20-10-23176	20-612601	4–5	QBT3	—
RE20-10-23177	20-612601	8–9	QBT3	—
RE20-10-23178	20-612602	0–1	QBT3	8060
RE20-10-23179	20-612602	4–5	QBT3	—
RE20-10-23180	20-612602	8–9	QBT3	—
RE20-10-23181	20-612603	0–1	QBT3	7520
RE20-10-23182	20-612603	4–5	QBT3	—
RE20-10-23183	20-612603	8–9	QBT3	—
RE20-10-23187	20-612605	0–1	QBT3	—
RE20-10-23188	20-612605	4–5	QBT3	—
RE20-10-23189	20-612605	8–9	QBT3	—
RE20-10-24957	20-612892	0–1	QBT3	—
RE20-10-24958	20-612892	4–5	QBT3	—
RE20-10-24959	20-612892	8–9	QBT3	—

Notes: Results are in mg/kg.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012).

[c] — = Not detected above BV.

Table 63
Aluminum above BVs at SWMU 20-002(a)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2, 3, 4 BV[a]				**7340**
Construction Worker SSL[b]				**40,700**
Industrial SSL[b]				**1,130,000**
Residential SSL[b]				**78,100**
RE20-10-23108	20-612582	0–1	QBT3	—[c]
RE20-10-23109	20-612582	2–3	QBT3	—
RE20-10-23110	20-612582	4–5	QBT3	—
RE20-10-23111	20-612583	0–1	QBT3	—
RE20-10-23112	20-612583	2–3	QBT3	—
RE20-10-23113	20-612583	4–5	QBT3	—
RE20-10-23114	20-612584	0–1	QBT3	—
RE20-10-23115	20-612584	2–3	QBT3	—
RE20-10-23116	20-612584	4–5	QBT3	—
RE20-10-23117	20-612585	0–1	QBT3	—
RE20-10-23118	20-612585	2–3	QBT3	—
RE20-10-23119	20-612585	4–5	QBT3	—
RE20-10-23120	20-612586	0–1	QBT3	—
RE20-10-23121	20-612586	2–3	QBT3	—
RE20-10-23122	20-612586	4–5	QBT3	—
RE20-10-23123	20-612587	0–1	QBT3	—
RE20-10-23124	20-612587	2–3	QBT3	—
RE20-10-23125	20-612587	4–5	QBT3	—
RE20-10-23126	20-612588	0–1	QBT3	—
RE20-10-23127	20-612588	2–3	QBT3	8070 (J+)
RE20-10-23128	20-612588	4–5	QBT3	—
RE20-10-23129	20-612589	0–1	QBT3	—
RE20-10-23130	20-612589	2–3	QBT3	—
RE20-10-23131	20-612589	4–5	QBT3	—
RE20-10-23132	20-612590	0–1	QBT3	—
RE20-10-23133	20-612590	2–3	QBT3	9780 (J+)
RE20-10-23134	20-612590	4–5	QBT3	10200 (J+)

Notes: Results are in mg/kg. J+ = The analyte was positively identified, and the result is likely to be biased high.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012).

[c] — = Not detected above BV.

Table 64
Aluminum above BVs at SWMU 20-002(d)

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2, 3, 4 BV[a]				**7340**
Construction Worker SSL[b]				**40,700**
Industrial SSL[b]				**1,130,000**
Residential SSL[b]				**78,000**
RE20-10-23196	20-612606	0–1	QBT3	—[c]
RE20-10-23197	20-612606	4–5	QBT3	—
RE20-10-23198	20-612606	8–9	QBT3	—
RE20-10-23199	20-612607	0–1	QBT3	—
RE20-10-23200	20-612607	4–5	QBT3	—
RE20-10-23201	20-612607	8–9	QBT3	—
RE20-10-23202	20-612608	0–1	QBT3	—
RE20-10-23203	20-612608	4–5	QBT3	—
RE20-10-23204	20-612608	8–9	QBT3	—
RE20-10-23205	20-612609	0–1	QBT3	—
RE20-10-23206	20-612609	4–5	QBT3	—
RE20-10-23207	20-612609	8–9	QBT3	—
RE20-10-23208	20-612610	0–1	QBT3	—
RE20-10-23209	20-612610	4–5	QBT3	—
RE20-10-23210	20-612610	8–9	QBT3	—
RE20-10-23211	20-612611	0–1	QBT3	7560
RE20-10-23212	20-612611	4–5	QBT3	11,200
RE20-10-23214	20-612612	0–1	QBT3	—
RE20-10-23215	20-612612	4–5	QBT3	—
RE20-10-23216	20-612612	8–9	QBT3	—
RE20-10-23217	20-612613	0–1	QBT3	—
RE20-10-23218	20-612613	4–5	QBT3	—
RE20-10-23219	20-612613	8–9	QBT3	—

Notes: Results are in mg/kg.
[a] BVs are from LANL (1998).
[b] SSLs are from NMED (2012) unless otherwise noted.
[c] — = Not detected above BV.

Table 65
Aluminum above BVs at AOC 20-004

Sample ID	Location ID	Depth (ft)	Media	Aluminum
Qbt 2, 3, 4 BV[a]				**7340**
Soil BV[a]				**29200**
Construction Worker SSL[c]				**40,700**
Industrial SSL[c]				**1,130,000**
Residential SSL[c]				**78,000**
RE20-10-22300	20-612500	3–4	FILL	—[c]
RE20-10-22301	20-612500	6–7	FILL	—
RE20-10-22302	20-612501	7–8	FILL	—
RE20-10-22303	20-612501	10–11	QBT3	—
RE20-10-22304	20-612502	3–4	FILL	—
RE20-10-22305	20-612502	6–7	QBT3	—
RE20-10-22306	20-612503	7–8	FILL	—
RE20-10-22307	20-612503	10–11	QBT3	—
RE20-10-22308	20-612504	3–4	FILL	—
RE20-10-22309	20-612504	6–7	FILL	—
RE20-10-22310	20-612505	7–8	FILL	—
RE20-10-22311	20-612505	10–11	QBT3	10,200
RE20-10-22312	20-612506	3–4	FILL	—
RE20-10-22313	20-612506	6–7	QBT3	—

Notes: Results are in mg/kg.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012) unless otherwise noted.

[c] — = Not detected above BV.

Table 66
Sediment Investigation Reaches in Sandia Canyon

Investigation Reach	Reach Abbreviation	Approximate Distance from Rio Grande to Midpoint of Reach (km)	Reach Length (km)*	Year(s) of Sample Collection (Canyons Investigations)	Notes
S-1 North	S-1N	16.06	0.20	1998, 2008	North Fork of Sandia Canyon; below former asphalt batch plant
S-1 South	S-1S	16.06	0.20	1998, 2008	South Fork of Sandia Canyon; below power plant
S-2 West	S-2W	15.95	0.03	1998	Upcanyon from landfill bridge; below confluence of north and south forks
S-2	S-2	15.44	0.68	1998, 2007, 2008	Downcanyon from landfill bridge; Sandia wetland and vicinity
S-3 West	S-3W	14.18	0.21	2007, 2008	Bouldery reach in narrow canyon bottom; below Royal Crest trailer park
S-3 East	S-3E	12.68	0.20	2000, 2007	Bouldery reach in narrow canyon bottom; below East Jemez Road
S-4 West	S-4W	11.31	0.23	2007	Downcanyon from western TA-53 SWMUs; incising reach
S-4 East	S-4E	9.89	0.31	2007	Upcanyon from eastern TA-53 drainage; aggrading reach
S-5 Central	S-5C	8.96	0.24	2000, 2007	Downcanyon from TA-53 and Protective Force firing range; near well R-35
S-5 East	S-5E	6.59	0.23	2007	Upcanyon from NM 4 and eastern Laboratory boundary
S-6 West	S-6W	3.32	0.20	2008	Pueblo de San Ildefonso land; above basalt knickpoint
S-6 East	S-6E	0.35	0.20	2008	Pueblo de San Ildefonso land; above Rio Grande

*Length refers to area mapped and characterized.

Table 67
Cyanide in Sandia Canyon Sediment Samples

Reach	Cyanide [Total]
BV (mg/kg)[a]	**0.82**
Minimum Soil ESL[b]	**0.1**
Residential SSL[c]	**46.9**
S-1N	1.27 (J)
S-1S	8.35
S-2	11.6
S-3W	—[d]
S-3E	0.86 (U)
S-4W	—
S-4E	—
S-5C	—
S-5E	—
S-6W	—
S-6E	—

Notes: Values are in mg/kg. Values are maximum values greater than the sediment BVs for analytes with BVs, and the maximum detected value for analytes without BVs. 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. U = The analyte was analyzed for but not detected.

[a] BVs are from LANL (1998).

[b] ESLs are from Ecorisk Database Version 3.1 (LANL 2012c).

[c] SSLs are from NMED (2012) unless otherwise noted.

[d] — = Not a COPC in that reach (not detected, not detected > BV, or not analyzed).

Table 68
Inferred Primary Sources and Downcanyon Extent of Cyanide in Sediment in Sandia Canyon

Type of COPC	COPC	Inferred Primary Source(s) in the Sandia Canyon Watershed[a]	Inferred Downcanyon Extent from Laboratory Sources[b]
Inorganic Chemical	Cyanide (Total)	TA-03	Sandia Canyon between reaches S-3E and S-4W

[a] Primary source(s) indicated by maximum concentrations and/or spatial distribution.

[b] Downcanyon extent indicates area where COPC remains detected and/or above background and can probably or possibly be traced to an upcanyon Laboratory source.

Table 69
Sandia Canyon Surface Water Sampling Locations and Rationale

Location Name	Location and Rationale
Base Flow (West to East)	
Surface Water Gaging Station E121	South Fork of Sandia Canyon, near power plant. Located west of wetland. Provides information about potential contaminant releases from TA-03 facilities to the west and baseline data about surface water entering the wetland.
Surface Water Gaging Station E122 (equivalent WSFS)	North Fork of Sandia Canyon, near power plant. Located west of wetland. Downgradient of main contaminant release sites in Sandia Canyon. Provides baseline data about surface water entering the wetland.
Surface Water Sampling Station SCS-1	Surface water sampling station at west end of wetland. Provides baseline data about surface water entering the wetland.
Surface Water Gaging Station E123	Sandia Canyon just east of wetland. Location selected to monitor persistent surface water exiting the wetland.
Surface Water Gaging Station E123.6	Surface water base flow collected at gage station E123.6. Location selected to monitor persistent surface water in narrow, bedrock-dominated portion of middle Sandia Canyon.
Surface Water Sampling Station SCS-2 (equivalent WMSC)	Middle Sandia Canyon. Location selected to monitor surface water near the eastern terminus of persistent base flow.
Surface Water Sampling Station SCS-3	Near eastern end of middle Sandia Canyon. Provides baseline data about surface water up gradient of TA-53 facilities. Area of ephemeral surface water flow.
Surface Water Gaging Station E124	Surface water base flow collected at gage station E124. Location selected to monitor surface water in area where Sandia Canyon widens and ephemeral surface water flows.
Surface Water Gaging Station E125	Surface water base flow collected at gage station E125. Location selected to monitor surface water near eastern Laboratory boundary. Area of ephemeral surface water flow.

Table 70
Water Screening Location, Synonym, and Reach

Location Name[a]	Location Synonym	Reach[b]
Surface Water		
North Fork of Sandia Canyon at E122	WSFS	S-1N
Sandia left fork at Asphalt Plant	E122	S-1N
Sandia right fork at Power Plant	E121	S-1S
SA-00007	—[c]	S-2
SA-603204	—	S-2
Sandia below Wetlands	E123	S-2
SA-10005	—	S-3E
Middle Sandia Canyon at terminus of persistent baseflow	WMSC	S-3E and S-4W
SCS-2	—	S-3E and S-4W
SA-603205	—	S-3E and S-4W
Sandia Spring[d]	—	S-6E
Sandia above Firing Range	E124	S-4W and S-4E
Sandia above SR-4	E125	S-5E

[a] Locations are listed from west to east.

[b] The listed location is either within the reach, or else the nearest reach is listed; for locations midway between reaches, both reaches are listed.

[c] — = Not applicable.

[d] Sandia Spring is screened as part of the surface water dataset as well as part of the regional aquifer dataset.

Table 71
Cyanide in Filtered Nonstorm-Related Surface Water Samples

Location	Cyanide (Total)
ESL[a]	5.2
NMED Tap Water[b]	21.9
Middle Sandia Canyon at terminus of persistent baseflow (WMSC)	—[c]
Sandia below Wetlands (E123)	3.22
Sandia right fork at Power Plant (E121)	2.75
South Fork of Sandia Canyon at E122	13.3

Notes: Values are in µg/L. Values are maximum detected value.

[a] Water ESLs from Ecorisk Database Version 3.1 (LANL 2012c).

[b] NMED Tap Water (2012).

[c] — = Not detected or not analyzed.

Table 72
Cyanide in Nonfiltered Nonstorm-related Surface Water Samples

Location	Cyanide (Total)
ESL[a]	**5.2**
Standard Level (Perennial Stream Classification)	**na[b]**
Standard Type	**na**
NMED Tap Water[c]	**21.9**
Sandia below Wetlands (E123)	9.07
Sandia left fork at Asphalt Plant (E122)	—[d]
Sandia right fork at Power Plant (E121)	5.41
South Fork of Sandia Canyon at E122	11.1

Notes: Values are in µg/L. Values are maximum detected value.

[a] Water ESLs from Ecorisk Database Version 3.1 (LANL 2012).

[b] na = Not available.

[c] NMED Tap Water (2012).

[d] — = Not detected or not analyzed.

Table 73
Sandia Canyon Watershed COPC Summary - Cyanide

Analyte	Sediment		Stormwater[a]		Nonstorm-Related Surface Water[b]		Alluvial Groundwater		Intermediate Groundwater		Regional Groundwaterb	
	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2
Cyanide [Total]	X[a]	—[b]	X	X	X	X	X	—	X	X[c]	X	X

Note: Grey shading indicates analyte was not a Phase I sediment COPC.

[a] X = Analyte is a COPC for given medium.

[b] — = Analyte is not a COPC for a given medium or not detected in storm water.

[c] For storm water, an analyte is marked with "X" if it was detected and is shaded gray if it exceeded a comparison value.

Table 74
Cyanide above BVs at AOC 53-008

Sample ID	Location ID	Depth (ft)	Media	Cyanide (Total)
Qbt 2, 3, 4 BV[a]				**0.5**
Construction Worker SSL[b]				**186**
Industrial SSL[b]				**681**
Residential SSL[b]				**46.9**
RE53-10-22320	53-612507	0–1	QBT3	—[c]
RE53-10-22321	53-612507	2–3	QBT3	—
RE53-10-22322	53-612508	0–1	QBT3	—
RE53-10-22323	53-612508	2–3	QBT3	—
RE53-10-22324	53-612509	0–1	QBT3	—
RE53-10-22325	53-612509	2–3	QBT3	—
RE53-10-22326	53-612510	0–1	QBT3	—
RE53-10-22327	53-612510	2–3	QBT3	—
RE53-10-22328	53-612511	0–1	QBT3	—
RE53-10-22329	53-612511	2–3	QBT3	—
RE53-10-22330	53-612512	0–1	QBT3	—
RE53-10-22331	53-612512	2–3	QBT3	—
RE53-10-22332	53-612513	0–1	QBT3	—
RE53-10-22333	53-612513	2–3	QBT3	—
RE53-10-22334	53-612514	0–1	QBT3	—
RE53-10-22335	53-612514	2–3	QBT3	—
RE53-10-22336	53-612515	0–1	QBT3	4.1 (J)
RE53-10-22337	53-612515	2–3	QBT3	—
RE53-10-22338	53-612516	0–1	QBT3	—
RE53-10-22339	53-612516	2–3	QBT3	4.07 (J)
RE53-10-22340	53-612517	0–1	QBT3	—
RE53-10-22341	53-612517	2–3	QBT3	—
RE53-10-22342	53-612518	0–1	QBT3	—
RE53-10-22343	53-612518	2–3	QBT3	—
RE53-10-22344	53-612519	0–1	QBT3	14.9 (J)
RE53-10-22345	53-612519	2–3	QBT3	—
RE53-10-22346	53-612520	0–1	QBT3	—
RE53-10-22347	53-612520	2–3	QBT3	—
RE53-10-22348	53-612521	0–1	QBT3	—
RE53-10-22349	53-612521	2–3	QBT3	—
RE53-10-22350	53-612522	0–1	QBT3	—
RE53-10-22351	53-612522	2–3	QBT3	—
RE53-10-22352	53-612523	0–1	QBT3	—
RE53-10-22353	53-612523	2–3	QBT3	—

Notes: Results are in mg/kg. 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.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012) unless otherwise noted.

[c] — = Not detected or not detected above BV.

Table 75
Inorganic Chemicals above BVs at AOC 53-012(e)

Sample ID	Location ID	Depth (ft)	Media	Cyanide (Total)
Qbt 2, 3, 4 BV[a]				**0.5**
Soil BV[a]				**0.5**
Construction Worker SSL[b]				**186**
Industrial SSL[b]				**681**
Residential SSL[b]				**46.9**
0253-95-0048	53-01086	0–0.33	SOIL	NA[c]
0253-95-0051	53-01087	0–0.67	SOIL	NA
0253-95-0054	53-01088	0–0.33	SOIL	NA
RE53-10-22408	53-612539	0–1	SOIL	—[d]
RE53-10-22409	53-612539	2–3	QBT3	—
RE53-10-22410	53-612540	0–1	SOIL	—
RE53-10-22411	53-612540	1–2	QBT3	—
RE53-10-22412	53-612541	0–1	SOIL	—
RE53-10-22413	53-612541	3–4	QBT3	—
RE53-10-22414	53-612542	0–1	SOIL	—
RE53-10-22415	53-612542	3–4	QBT3	—
RE53-10-22416	53-612543	1–2	SOIL	—
RE53-10-22417	53-612543	3–4	QBT3	—
RE53-10-22418	53-612544	1–2	SOIL	2.96
RE53-10-22419	53-612544	2–3	QBT3	—

Notes: Results are in mg/kg.

[a] BVs are from LANL (1998).

[b] SSLs are from NMED (2012) unless otherwise noted.

[c] NA = Not analyzed.

[d] — = Not detected or not detected above BV.