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National Nuclear Security Administration
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Date: November 30, 2004
Refer To: ER2004-0679

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

SUBJECT: SUBMITTAL OF THE INVESTIGATION WORK PLAN AND THE HISTORICAL INVESTIGATION REPORT FOR MATERIAL DISPOSAL AREA U, SOLID WASTE MANAGEMENT UNIT 21-017(a)-99, AT TECHNICAL AREA 21

Dear Mr. Young:

Enclosed please find the certification and two copies each of the "Investigation Work Plan for Material Disposal Area U, Solid Waste Management Unit 21-017(a)-99, at Technical Area 21" and the "Historical Investigation Report for Material Disposal Area U, Solid Waste Management Unit 21-017(a)-99, at Technical Area 21." Additional copies of the two documents are available upon request.

If you have any questions, please contact Becky Coel-Roback at (505) 665-5011 or Woody Woodworth at (505) 665-5820.

Sincerely,

David McInroy, Deputy Project Director
Remediation Services
Los Alamos National Laboratory

Sincerely,

for David Gregory, Federal Project Director
Department of Energy
Los Alamos Site Office

DM/DG/RCR/jr

Enclosures: 1) Investigation Work Plan for Material Disposal Area U, ER2004-0569
2) Historical Investigation Report for Material Disposal Area U, ER2004-0570
3) Certification

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CERTIFICATION

CERTIFICATION BY THE ENVIRONMENTAL STEWARDSHIP–REMEDIATION SERVICES (ENV-RS) PROJECT TECHNICAL REPRESENTATIVES

Document Titles: **INVESTIGATION WORK PLAN FOR MATERIAL DISPOSAL AREA U, SOLID WASTE MANAGEMENT UNIT 21-017-(a)-99, AT TECHNICAL AREA 12**

HISTORICAL INVESTIGATION REPORT FOR MATERIAL DISPOSAL AREA U, SOLID WASTE MANAGEMENT UNIT 21-017 (a)99, AT TECHNICAL AREA 21

I certify under penalty of law that these documents and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violation.

Name: ______________________ Date: 11/29/04

David McInroy, Deputy Project Director
Remediation Services
Los Alamos National Laboratory

or

______________________ Date: ____________

Ken Hargis, Division Leader
Environmental Stewardship Division
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______________________ Date: 11/30/04

David Gregory, Federal Project Director
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Department of Energy/Los Alamos Site Office

or

______________________ Date: ____________

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Department of Energy/Los Alamos Site Office

LA-UR-04-7268
November 2004
ER2004-0569

Investigation Work Plan for Material Disposal Area U, Solid Waste Management Unit 21-017(a)-99, at Technical Area 21

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Disclaimer

This document contains data on radioactive materials, including source, special nuclear, and by-product material. The management of these materials is regulated under the Atomic Energy Act and is specifically excluded from regulation under the Resource Conservation and Recovery Act and the New Mexico Hazardous Waste Act. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to the New Mexico Environment Department in accordance with U.S. Department of Energy policy.

Prepared by
Environmental Stewardship Division–Remediation Services

LA-UR-04-7268
ER2004-0569

Investigation Work Plan for Material Disposal Area U, Solid Waste Management Unit 21-017(a)-99, at Technical Area 21

November 2004

Responsible project leader:

Printed Name	Signature	Title	Organization	Date
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Responsible UC representative:

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Printed Name	Signature	Title	Organization	Date
David Gregory		Federal Project Director	DOE-LASO	11/30/04

EXECUTIVE SUMMARY

This investigation work plan proposes characterization activities for Material Disposal Area (MDA) U at Los Alamos National Laboratory (the Laboratory). MDA U is located on Delta Prime Mesa in Technical Area (TA-) 21. It is the easternmost MDA on the mesa. MDA U is also designated as Solid Waste Management Unit (SWMU) 21-017(a)-99, a consolidation of the following individual SWMUs:

- SWMU 21-017(a) is an absorption bed on the west side of the site;
- SWMU 21-017(b) is an absorption bed on the east side of the site;
- SWMU 21-017(c) is the location of a former distribution box located between the two absorption beds; and
- SWMU 21-022(f) is a sump located southwest of MDA U, which was historically connected to the distribution box.

MDA U, which is inactive, is located on land owned by the Department of Energy. The current land use is industrial, and the future land use is expected to remain industrial.

The objectives of the work proposed in this investigation work plan are to finalize characterization of MDA U and fulfill the requirements of the New Mexico Environment Department September 1, 2004, proposed Consent Order. To achieve these investigation objectives, this work plan (1) provides an overview of the site history and operations; (2) presents the current knowledge of the nature and extent of contamination based on a review of existing data; (3) establishes the rationale for additional data collection and analysis; (4) describes the scope of activities necessary to complete the characterization of MDA U; and (5) presents the methods for accomplishing the proposed work. SWMU 21-022(f) is not addressed in this work plan; rather, it is included in an August 2004 Laboratory report entitled "Investigation Work Plan for Delta Prime Site Aggregate Area at Technical Area 21."

Based on historical sampling results, radionuclides, inorganic chemicals, and organic chemicals are present at MDA U at relatively low concentrations (i.e., below screening action levels for radionuclides and soil screening levels for inorganic and organic chemicals). However, additional information is needed to define fully the extent of some site contaminants and verify site conditions.

- Tritium is pervasive across the site and was detected at the total depth (75 ft) of two boreholes; the existing site data do not adequately define the extent of tritium, particularly vertically.
- Uranium-234 exists at concentrations above background values on the western side of the site, both within and below the absorption beds. Additional data are needed to define the extent of elevated uranium levels to the west and at depth.
- Actinium-227 progeny are present in the eastern absorption bed and at depth within the clay interbed zone. Additional site data are needed to define the extent of the subsurface release, particularly within the clay interbed zone. Previous analytical methods used gamma spectroscopy rather than alpha spectroscopy, which is a more effective method to target actinium-227 progeny. Using the appropriate analytical methods may quantify more accurately the levels of actinium-227 at the site.
- Vapor-phase volatile organic compounds (VOCs) in subsurface samples may indicate a potential release from the absorption beds; additional site data are needed to define the nature and extent of vapor-phase VOC contamination in the subsurface.

- No samples in any media were analyzed for cyanide, nitrates, or perchlorates during previous sampling campaigns. All samples proposed in this work plan will be analyzed for these chemicals.
- No information is available to document whether a perched water horizon exists in the immediate vicinity of MDA U.

To address these data needs, four boreholes are proposed for drilling at MDA U. Surface and subsurface samples will be collected to finalize the characterization of MDA U. One of the four boreholes will be drilled to the Cerro Toledo interval to determine if perched groundwater exists beneath MDA U.

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1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility operated by the Department of Energy (DOE) and managed by the University of California (UC). The Laboratory is located in north-central New Mexico approximately 60 miles north of Albuquerque and 20 miles northwest of Santa Fe. The Laboratory covers 40 square miles of the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation between 6200 ft and 7800 ft above sea level (asl).

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

1.1 General Site Information

MDA U is located on Delta Prime (DP) Mesa within the Laboratory's Technical Area (TA-) 21 (Figure 1.1-1). From 1945 to 1978, TA-21 was primarily used for plutonium research, metal production, and related activities. Since 1978, various administrative and chemical research activities have been conducted at TA-21.

MDA U, or SWMU 21-017(a)-99, consists of four individual SWMUs consolidated according to their related operational history. These SWMUs are shown on Figure 1.1-2 and are described as follows:

- SWMU 21-017(a) was an absorption bed on the west side of the MDA that received effluent from 1945 to 1976.
- SWMU 21-017(b) was an absorption bed on the east side of the MDA that received effluent from 1945 to 1968.
- SWMU 21-017(c) was a former distribution box located between the two absorption beds and was removed in 1985.
- SWMU 21-022(f) was a sump located southwest of and historically connected to the distribution box that received effluent from Buildings 21-152 and 21-370.

These SWMUs are inactive, and MDA U is currently in the corrective action process. The operational history of MDA U is described briefly in section 2.1 of this report and in more detail in the historical investigation report (HIR) for MDA U (LANL 2004, 87454).

1.2 Investigation Objectives

The objectives of the work proposed in this investigation work plan are to finalize the characterization of MDA U and fulfill the requirements of the New Mexico Environment Department's (NMED's) September 1, 2004, proposed Consent Order. To achieve these investigation objectives, this work plan (1) provides an overview of the site history and operations; (2) presents the current knowledge of the nature and extent of contamination based on a review of existing data; (3) establishes the rationale for additional data collection and analysis; (4) describes the scope of activities necessary to complete the characterization of MDA U; and (5) presents the methods for conducting the proposed work.

2.0 BACKGROUND

2.1 Operational History

The DP East area began operation in 1945 at Buildings 21-152, 21-153, 21-155. These facilities were used to process polonium and actinium and to produce weapon components. Process waste resulting from various research and production activities consisted of both solids and liquids. In the 1940s, it was determined the natural soils and clays at TA-21 were effective in separating radioactive contaminants from liquid wastes (Merrill 1990, 11721). Absorption beds consisting of excavated trenches filled with cobbles, gravel, and fine sand were constructed at several locations within TA-21 to use the natural soil and clay characteristics for treating process effluents (LASL 1945, 01093). MDA U is one of the areas where absorption beds were used to dispose of liquid wastes at TA-21.

The TA-21 work plan (LANL 1991, 07529) refers to a 1945 memorandum (Veltman 1945, 01305) that described in some detail the presumed design requirements for the TA-21 absorption beds. The memorandum stated the requirements as follows:

> A pit will be dug on the north side of the mesa approximately 6 ft deep and 10 x 50 ft in area for Building 52 [DP East, Building 21-152]. A graded gravel absorption bed will fill this pit with relatively large stones in the bottom and ordinary soil on top. This arrangement will allow satisfactory draining of process sewage.

A portion of a Laboratory engineering drawing (LASL 1945, 01093) illustrating the design of the MDA U absorption beds is shown in Figure 2.1-1.

Liquid effluent from Buildings 21-152, 21-153, and 21-155, which later became the Tritium Systems Test Assembly (TSTA) facility, was discharged to the MDA U absorption beds. In addition, oil from precipitrons was disposed of at MDA U (Drager 1946, 01562). Precipitrons were air filters used to remove dust, dirt, smoke, soot, and other solids from ventilating air (Francis 1996, 76137). Dirt particles in the airstream were given electrical charges as they passed through an ionizer and were trapped in dust-collector cells by attraction of these charged particles to plate surfaces of opposite polarity. The oil may have been used in the filtration process or may have been a component of the precipitrons.

During their operational lifetime, the absorption beds may not always have performed as designed. The TA-21 Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan (LANL 1991, 07529, p. 16-198) states, "There were early problems with the pits [absorption beds]; they did not function properly, and it was reported that the oil washing from the precipitron is lying on top of the ground (Drager 1946, 01562)." In addition, a memorandum dated December 18, 1975, stated, "water from a cooling process was being released into the west pit from a nearby building. At that time, there appeared to be permanent water in the west pit, although no overflow into the adjacent drainage was observed" (Purtymun 1976, 01107).

Disposal of liquid effluent at MDA U from Buildings 21-152 and 21-153 ceased in 1968 (Hakonson 1987, 07422). The western absorption bed continued to receive water from the cooling tower associated with Building 21-155 until approximately 1976 (Purtymun 1976, 01107), but the site has been inactive since.

In 1985, site stabilization efforts began. Excavation of material from a trench 20 ft wide, 100 ft long, and 4 to 13 ft deep was reported (Merrill 1990, 11721), a minimum of 8000 ft^3. Material above the pipelines was excavated, stockpiled, and used to backfill the pipeline trench. The distribution box and pipelines within the absorption beds, portions of the two absorption beds, and a portion of the drainline from the cooling tower were excavated and taken to MDA G within Area G at TA-54 (LANL 1991, 07529, p. 16-199) (Figure 2.1-2). Records from TA-54 indicate approximately 3000 ft^3 of material from MDA U was taken to MDA G following this excavation, indicating a significant volume of material was returned to the site (Benson 2004, 87383). At this time, the line from the cooling tower was found in the west absorption bed, indicating cooling tower effluent had discharged directly into the west bed and not through the sump and distribution box (Mayfield 1985, 01172). The absorption bed excavation (walls and bottom) was marked with plastic sheeting and covered with fill. The area between the top of the absorption beds and the embankments surrounding them was backfilled with uncontaminated tuff, covered with 6 in. of topsoil, regraded to address drainage problems, and revegetated.

In 1987, the site-stabilization activities were completed. Additional work included (1) constructing a ditch along the south fence of MDA U to prevent run-on and (2) implementing best management practices inside the fence, including placing mulch and topsoil and reseeding the area. Four brass markers were placed at the corners of the MDA. In 1990, additional controls were constructed to prevent runoff from the surrounding area from flowing across MDA U.

2.2 Relationship to Other SWMUs and AOCs

With the exception of SWMU 21-021-99, which covers all of TA-21, other SWMUs/AOCs in the vicinity of MDA U are shown in Figure 1.1-2. These include the following:

- SWMU 21-013(c), an inactive surface disposal area located southeast of MDA U and east of former Building 21-153, consisted of mounds of earth, an excavated trench, and an earthen berm containing scattered concrete, asphalt, and metal debris. The SWMU was investigated and appeared to contain only building materials (LANL 1995, 54320).
- AOC 21-020(b), the location of a removed filter house (Building TA-21-153), is the closest upgradient SWMU to MDA U. This building was located immediately south of MDA U and was used for DP East Operations, which involved the production of weapons components. Actinium-227 and polonium-210 were major process radionuclides at this building, and process effluent from this building was released to the MDA U absorption beds. When decommissioned and removed in 1978, soil under and around the filter house was removed. Activity levels in the remaining soils were less than 30 pCi gross alpha activity/gram soil, which was the detection limit of the Laboratory's alpha screening instrument used at the time (Harper and Garde 1981, 06281). This AOC is now part of consolidated SWMU 21-021-99.
- Consolidated SWMU 21-021-99 consists of SWMU 21-021 and AOCs 21-019(a, b, c, d, e, f, g, h, i, j, k, l, m), 21-020(a), and 21-020(b). It was investigated as part of a larger group of sites that represent potential surface soil contamination from historical airborne releases from TA-21 operations. This SWMU encompasses the entire surface of TA-21 (DP Mesa), which received air emissions from incinerators, filter houses, buildings, and exhaust stacks since the beginning of technical operations in the mid-1940s. Radionuclides were the predominant contaminant in historical air emissions.
- SWMU 21-024(n), an active drainline that exits Building 21-155 and discharges into DP Canyon, consists of a corrugated metal pipe that exits a concrete bulkhead and discharges onto a gravel road adjacent to MDA U (LANL 1994, 31591). The effluent flows north to the ditch paralleling the

north perimeter road. From there, it flows east to a culvert that passes under the north perimeter road and into DP Canyon.

Any of these SWMUs/AOCs may have contributed to contamination at MDA U. However, given the similarity of contaminants encountered at TA-21, it would be difficult to distinguish between potential sources of contamination at MDA U.

2.3 Contaminant Transport Mechanisms and Potential Receptors

The limited information on liquid wastes discharged to MDA U indicates radionuclides in water and possibly oil were released to the absorption beds. Given the nature of processes in buildings that released effluents to MDA U, it is likely other hazardous constituents were released as well; however, there is no information to verify the nature or amounts of hazardous constituents released to MDA U. The relevant release and transport processes associated with these wastes are a function of chemical-specific properties, the physical form of the waste, and the nature of the transport processes. Water-soluble contaminants are primarily released and transported through infiltration into the absorption beds and surrounding soil/tuff, whereas insoluble contaminants may adsorb relatively quickly to near-surface soils. The transport of volatile components following initial discharge occurs primarily in the gas phase by diffusion or advection in formation or atmospheric air. The primary potential release and transport mechanisms for contaminants on the surface of MDA U or released from the absorption beds include the following:

Volatilization, diffusion, and dispersion in air or pore gas. Gases and suspended particulates in air may be transported to downwind locations. Vapor-phase tritium or volatile organic compounds (VOCs) in pore gas may be transported through subsurface geological strata toward the regional aquifer.

Dissolution and advective transport in water (leachate or surface water). Contaminants deposited on the mesa top may be transported across the surface and away from the absorption beds in surface water runoff or those deposited in the absorption beds may be transported to deeper geological strata in infiltrating water.

Biotic perturbation and translocation of contaminants from the mesa top. Based on the volumes of material excavated from MDA U (a minimum of 8000 ft^3) and disposed of at Area G (3000 ft^3), it is likely that a significant volume of absorption bed material remains onsite. Plants have grown into the remaining absorption bed material and may have incorporated contaminants into their biomass. As these plants mature and decay, contaminants may be deposited onto the soil surface. Burrowing animals may also excavate contaminated wastes and release them onto the soil surface as borrow spoils. Contaminants deposited on the surface through these mechanisms may be transported away from the site by suspension in air or surface water runoff.

Following the stabilization and partial excavation efforts in 1985 and 1987, RFI data have been collected over the past 12 years at MDA U. Site conditions have been stable over this sampling period and the redistribution of contaminants and changes in contaminant concentrations as a result of surficial processes is unlikely; however, temporal changes in contaminant concentrations may have occurred as a result of radioactive decay and chemical degradation.

Although potential surface contamination at MDA U and contaminant releases from the absorption beds may result in exposures to on-site human and ecological receptors through a variety of pathways, present-day exposures to humans are limited because access to the site is restricted, and the majority of the waste was disposed of in the subsurface. The abundance of burrows and anthills indicates ecological receptors are present and may be bringing some contamination derived from the remaining absorption bed material to the surface.

MDA U is an industrial area under Laboratory control and is expected to remain industrial in the foreseeable future (LANL 2001, 71536). MDA U is located in the eastern portion of TA-21 behind the TA-21 fence. Access to the area is controlled by a fence and a locked gate. This security measure effectively eliminates the possibility of inadvertent site intrusion by humans. Potentially, site workers may be exposed to contaminants as a result of inadvertent soil ingestion; inhalation of suspended soil, dust, or gas-phase contaminants such as tritium and VOCs; dermal absorption from soil on the skin; and external irradiation (Figure 2.3-1). No perched water has been encountered to a depth of 75 ft below MDA U (LANL 2004, 87454), and current unsaturated conditions limit vertical migration of contamination to regional groundwater. If subsurface materials are excavated and brought to the surface, potential exposure pathways will be the same as those listed for surface contamination. Ecological receptors may be exposed through these pathways as well as through root uptake and the food web.

2.4 MDA U Waste Inventory

Although little information exists about waste disposal at MDA U, it is estimated that the absorption beds received approximately 135,000 gal. of liquid waste between 1945 and 1968 (Walker et al. 1981, 06277), when effluent disposal from Buildings 21-152 and 21-153 ceased. The volume of cooling water received by the western absorption bed from the cooling tower between 1968 and 1976 is not known. The TA-21 RFI work plan (LANL 1991, 07529, p. 16-99) states

> Existing information on waste discharge is scant. It is known that the primary contaminant of waste discharged to the two absorption beds was ^{210}Po (Christenson 1973, 0440.1). Although the amount of ^{210}Po discharged is unknown, its half-life is 138.4 days so it must have decayed [to stable lead] to undetectable levels [of polonium-210, although there may be elevated concentrations of lead]. Christenson (1973, 0440.1) also stated the absorption beds received 2.5 Ci of actinium-227 in 1953. Actinium-227 came principally from the effluents of filter building [21-] 153, which scrubbed actinium-227 out of the air in several process buildings at TA-21 (DOE 1979, 08610.1). Identification of other wastes at MDA U must come from sampling data."

Actinium-227 has a half-life of about 21.8 years and decays to francium, thorium, radium, and radon (Figure 2.4-1).

In addition, a 1946 memorandum (Tribby 1946, 01540) indicates plutonium, as well as polonium, was measured in effluent discharged to MDA U. Tritium was probably present in the cooling tower water and may also have reached the beds from TA-21 air-emission sources, such as stacks and filter houses. Historical information also indicates uranium-235 and sources of gamma radiation were discharged to the beds.

Known documentation does not provide any information on the constituents, types, or volumes of nonradioactive waste discharged to MDA U. Although the precipitron oil discharged to the beds was described as contaminated, the specific contaminants are not known. The TA-21 RFI work plan (LANL 1991, 07529, p. 16-198) states, "This (oil) is very definitely contaminated to a high degree (Drager, 1946)." Although the oil itself was either removed during site-stabilization activities or has already degraded, other contaminants associated with the oil may remain at MDA U.

Information on releases from the absorption beds is limited. Although the intent of the absorption bed design was to promote infiltration, early reports that the beds were not functioning properly suggest that historic overflows from the beds, although not observed, may have occurred. It is possible that contamination observed on the surface of the absorption beds, specifically the precipitron oil, could have been transported along the surface by rain, wind, or other processes. Infiltrating water also carried contamination into the subsurface beneath the absorption beds.

2.5 Summary of Historical Investigations

This section discusses pre-RFI and RFI sampling conducted at MDA U beginning with the first field investigation in 1946 to the most recent investigation in 2001. The results of these investigations are used to (1) identify radionuclides, organic chemicals, and inorganic chemicals at the site, (2) evaluate trends in site contaminant data, and (3) identify data needed to finalize the characterization of MDA U. The HIR for MDA U (LANL 2004, 87454) is a companion document to this work plan and provides a more complete description of the previous investigations at the site.

2.5.1 Pre-RFI Sampling

2.5.1.1 Pre-RFI Soil/Surface Sampling

Pre-RFI surface sampling included soil, tar, and vegetation on the surface of absorption beds and effluent from active process buildings.

1946 Effluent Sampling

Effluent from Buildings 21-152 and 21-153 was sampled in 1946, and results for plutonium and polonium were reported in a memorandum by Tribby (1946, 01540). Levels of plutonium in the effluent from these buildings (and discharged into MDA U) were up to 650 pCi/L; polonium levels were as high as 21,000 pCi/L.

1976 Soil and Water Sampling

In 1976, soil samples were taken outside of and from the absorption beds. A sample of standing water was also taken from the western absorption bed. At this time, the absorption beds were still uncovered, the eastern absorption bed was inactive, and the western absorption bed was receiving water only from the cooling tower associated with Building 21-155. The maximum gross alpha level measured in soil was 3345 pCi/g, encountered in the 0 to 2 in. interval from the east absorption bed (LANL 1991, 07529, p. 16-219). The water sample from the western absorption bed was reported as having 18 pCi/g gross alpha. All values are presented in Table 3.1-1 of the MDA U HIR (LANL 2004, 87454).

1980 Soil, Vegetation, and Tar Sampling

In 1980, soil and vegetation samples were collected from each absorption bed and immediately outside the fenced area (LANL 1991, 07529, p. 16-200). Both soil and vegetation were reported to have elevated levels of tritium (30,000 pCi/g and 7000 pCi/L, respectively). Total uranium was elevated compared to background levels (Purtymun 1987, 06687) cited in the TA-21 work plan (LANL 1991, 07529, p. 16-220). The data are presented in Tables 3.1-2 and 3.1-3 of the MDA U HIR (LANL 2004, 87454).

Tar samples, thought to be the precipitron oil that migrated from floor drains in Building 21-153, were also collected in 1980. Although quantitative tar data were not given, a 1985 memorandum stated that actinium-227 progeny were detected in the tar sample collected in the east absorption bed (Mayfield 1985, 01172).

1984 Soil and Vegetation Sampling

In 1984, twelve soil samples were taken around MDA U: three samples were taken on the fence line, one sample was taken inside the fence line, and the remaining eight samples were taken outside the fence line. The samples were analyzed for tritium, uranium, and plutonium-239/240. Samples were collected from three depth intervals, but the most complete dataset is for the 0–1 cm horizon. Data from this interval were used to produce activity contour plots illustrating that the highest tritium concentrations were at the southeast end outside MDA U and total uranium was highest in the west absorption bed (LANL 1991, 07529, p. 16-200). Plutonium-239/240 was highest north of the site. Vegetation samples taken from the same locations contained tritium at concentrations 4 to 10 times higher than the vegetation background levels reported by the Laboratory's Environmental Surveillance Group (LANL 1991, 07529, p. 16-214).

2.5.1.2 Pre-RFI Subsurface Sampling

1983 Subsurface Sampling Data

In 1983, subsurface samples were collected from two boreholes north of MDA U (U-E and U-W). At each location, samples were collected at 12 depths ranging from 0 to 58 ft. The samples were analyzed for tritium, total uranium, and cesium-137. Tritium data are shown in Figure 3.1-2 of the MDA U HIR (LANL 2004, 87454). Tritium values in both boreholes at all depths exceeded the maximum soil background level (Purtymun 1987, 06687; LANL 1991, 07529, p. 16-214). In the east hole (U-E), tritium levels increased with depth and ranged from 19,000 pCi/L to 78,000 pCi/L. In both boreholes, total uranium values exceeded the maximum background level in over 80% of the samples and did not decrease with depth. All cesium-137 values were below the maximum background level.

2.5.1.3 Summary of Pre-RFI Results

Historical data indicate that tritium, plutonium-239/240, and uranium surface contamination extends north of the MDA U fence. Tritium and uranium were found at a depth of 58 ft bgs in two holes immediately north of the MDA U fence. Actinium progeny were detected in soil from the eastern absorption bed. Vegetation samples collected from within and around MDA U during pre-RFI sampling were found to contain tritium and plutonium-239/240 at levels elevated relative to background.

2.5.2 RFI Sampling

Tables 2.5-1 through 2.5-4 summarize the RFI data for MDA U. Where applicable, these tables also provide screening action levels (SALs) for radionuclides (LANL 2002, 73705) and soil screening levels (SSLs) for inorganic and organic chemicals (NMED 2004, 85615).

2.5.2.1 Surface Soil and Sediment Sampling

RFI surface soil and sediment sampling campaigns were conducted at MDA U in 1992, 1994, 1998, and 2001. The RFI surface soil and sediment data are summarized in Tables 3.4-2, 3.4-4, and 3.4-6 and presented in Appendix D of the MDA U HIR (LANL 2004, 87454).

In 1992, samples were collected at seven locations bordering and downslope of MDA U and analyzed for inorganic chemicals, organic chemicals, and radionuclides. Several inorganic chemicals were detected above Laboratory background values (LANL 1998, 59730), particularly north of DP Road (Figure 2.5-1). Samples collected lower downslope from MDA U contained only lead and uranium at concentrations above Laboratory background values, and strontium, which has no background value. Organic chemicals were not detected in any of the 1992 surface samples. The 1992 radionuclide results indicated the presence of americium-241, plutonium-238, plutonium-239, and tritium above fallout values at MDA U (Figure 2.5-2).

In 1994, samples collected from an extensive grid (54 locations) covering MDA U and including areas outside of the MDA U fence were analyzed for inorganic chemicals, organic chemicals, and radionuclides. Inorganic chemicals, such as chromium, copper, lead, mercury, nickel, uranium, and zinc, were detected at concentrations above Laboratory background values in most 1994 samples (Figure 2.5-3). Organic chemicals, primarily polycyclic aromatic hydrocarbons (PAHs), were detected infrequently and at low concentrations (typically less than 1 mg/kg) (Figure 2.5-4). Radionuclide results showed plutonium-239, plutonium-238, tritium, strontium-90, americium-241, cesium-137, and uranium-235 activities above background/fallout values (Figure 2.5-5). The highest plutonium-239 value (4.14 pCi/g) was in sediments on the north slope of DP Mesa below MDA U. The majority of tritium levels were below 1 pCi/g.

In 1998, eighteen locations outside of the MDA U fence were sampled and analyzed for radionuclides and polychlorinated biphenyls (PCBs). Samples from three of these locations contained radionuclides at levels above Laboratory background/ fallout values (Figure 2.5-6). The sample from location 21-10858 had the highest radionuclide result with a uranium-234 concentration of 6.87 pCi/g. No PCBs were detected in any of these samples.

In 2001, an investigation was conducted to assess possible mercury contamination identified during the 1994 campaign. The 1994 grid locations were resampled and analyzed for mercury; five of these samples were also analyzed for tritium. None of the samples contained mercury at concentrations above Laboratory background values (LANL 1998, 59730), but all the samples contained low levels of tritium (maximum of 7.08 pCi/g) (Figure 2.5-7).

2.5.2.2 Absorption Bed Sampling

The absorption beds were sampled in 1998 and 2001. In 1998, elevated activities of uranium-234 (22.5 pCi/g and 6.68 pCi/g) and low activities of uranium-235 (<1.3 pCi/g) were detected in samples collected in the western bed. Low activities of plutonium-239 (<0.25 pCi/g) and tritium (<1 pCi/g) were detected in both beds (Figure 2.5-6). The 2001 sampling confirmed low tritium activities and elevated uranium-234 activities (17.9 pCi/g). In addition, actinium-227 progeny (thorium-227, radon-219, and radium-223) was detected primarily in the eastern absorption bed (Figure 2.5-7). Cesium-137 was detected at low concentrations (<0.7 pCi/g). All RFI absorption bed data are presented in Tables 3.4-2, 3.4-4, and 3.4-6 in the MDA U HIR (LANL 2004, 87454).

2.5.2.3 Subsurface Sampling

In 1998, eight boreholes were drilled to sample the MDA U subsurface. During this investigation, a fractured/clay-interbed zone was observed at depths between 50–75 ft below ground surface (bgs). Samples collected from this zone contained inorganic chemicals, including aluminum, arsenic, barium, beryllium, copper, lead, and mercury, at concentrations above Laboratory background values (LANL 1998, 59730) (Figure 2.5-8). Samples from this zone also contained uranium-234, uranium-235, actinium-227 progeny (radium and thorium), as well as americium-241 and tritium (Figure 2.5-6). Moisture contents were also slightly elevated (approximately 10% in this zone versus approximately 5% above and below this interval [Figure 2.5-9]).

Americium-241, plutonium-238, plutonium-239, tritium, uranium-234, and uranium-235 were elevated (Figure 2.5-6) at several other depths outside of the interbed zone as were several inorganic chemicals, including aluminum, arsenic, barium, chromium, copper, lead, manganese, mercury, and zinc (Figure 2.5-8). Tritium was detected at multiple depths in all eight boreholes, although all levels were less than 2.4 pCi/g. At locations 21-10841 and 21-10844, tritium was detected at the total depth (TD) of the boreholes (75 ft bgs) (Figure 2.5-6).

Di-n-butylphthalate was the only organic chemical detected in samples from only one borehole (location 21-10842); all levels were less than 0.5 mg/kg (Figure 2.5-10).

Pore-gas samples were also collected during the 1998 investigation (Figure 2.5-11). Samples from borehole location 21-10845 contained toluene at concentrations ranging from 480 parts per billion by volume (ppbv) at 50 ft to 220 ppbv at TD. Toluene was also detected in pore-gas samples from all other boreholes at lower levels. Several other VOCs were detected in pore-gas samples from multiple boreholes and depths but at relatively low concentrations (typically less than 10 ppbv) (Figure 2.5-11).

All subsurface RFI data are presented in Tables 3.4-2, 3.4-4, and 3.4-6 in the MDA U HIR (LANL 2004, 87454).

2.6 Summary of Data Interpretation and Identification of Data Needs

A brief analysis of RFI results is presented in this section to provide the current understanding of the nature and extent of contamination at MDA U. Data needs are identified based on the conclusions derived from the RFI results and regulatory requirements.

Radionuclides and inorganic and organic chemicals are present at MDA U; however, concentrations in site samples are generally low (i.e., below SALs/SSLs). To completely define nature and extent, the following data are required:

- Tritium is pervasive at low levels across the site and was detected at the TD of two boreholes at 75 ft. The existing site data do not adequately establish trends in the tritium distribution as needed to define the extent of tritium, particularly vertically.
- Elevated uranium-234 concentrations occur on the western side of the site in the absorption beds and in the subsurface. The existing data effectively bound the extent of elevated uranium levels to the east; however, additional data are needed to define the extent of elevated uranium levels to the west and at depth.
- Levels of actinium-227 progeny are elevated in the eastern absorption bed and at depth within the clay interbed zone. This finding is consistent with site history information, which indicates actinium-227 was discharged directly to MDA U. Additional site data are needed to define the extent of the subsurface release, particularly within the clay-interbed zone.
- Vapor-phase toluene in subsurface samples may indicate a release; one detection was found at the maximum depth of borehole 21-10845 at a concentration of less than 1 part per million by volume. Additional site data are needed to define the nature and extent of toluene and other possible vapor-phase VOC contamination.
- A borehole upgradient (south) of MDA U is needed to define the lateral extent of inorganic chemical contamination, particularly the mercury detected in borehole 21-10841 (Figure 2.5-8).

- No samples in any media were analyzed for cyanide, nitrates, or perchlorates. All samples proposed in this work plan will be analyzed for these chemicals.
- No information is available to document whether a perched water horizon occurs within or near the Cerro Toledo interval directly beneath MDA U. Drilling is necessary to determine whether it is present.

3.0 SITE CONDITIONS

The following sections present the current surface features and the existing subsurface geologic characteristics beneath TA-21, in general, and MDA U, in particular. Known surface and subsurface traits and their potential effects on the occurrence and concentration of contaminants include

- canyon-mesa terrain, which affects meteorological conditions and ecological habitats at the surface;
- semiarid climate with low precipitation and a high evapotranspiration rate, which limits the extent of subsurface moisture percolation and the amount of moisture available to leach radionuclides or other hazardous waste constituents; and
- a thick, relatively dry unsaturated (vadose) zone, which significantly restricts or prevents downward migration of contaminants in the liquid phase through the vadose zone to the regional aquifer.

These and other elements of the environmental setting at MDA U are useful in evaluating site investigation data with respect to the potential fate and transport of contamination from historical site activities.

3.1 Surface Conditions

The elevation of DP Mesa in the vicinity of MDA U ranges from 7116 ft to 7122 ft asl, with a slope north toward DP Canyon of approximately 10%. The canyon slope ranges in elevation from 7020 ft asl in the bottom of DP Canyon to 7122 ft asl on the south edge of MDA U.

MDA U is a relatively flat area vegetated with grasses and forbs commonly found in disturbed soils. Chamisa (*Chrysothamnus nauseosus)* is present site-wide. The outlines of the absorption beds are no longer visible at the surface because fill had been placed at the site (in 1985 and again in 1987) and the vegetation is dense. MDA U is inactive, and no operations are currently being conducted at the site. It is surrounded by a chainlink fence and posted as an underground radioactive materials site.

3.1.1 Surface Water

Mesas of the Pajarito Plateau are generally dry, both on the surface and within the bedrock forming the mesa. Canyons range from wet to relatively dry; the wettest canyons contain continuous streams and perennial groundwater in the canyon-bottom alluvium. Dry canyons, such as DP Canyon, have only occasional surface stream flow and transient alluvial groundwater.

The Laboratory's ENV-RS project has developed a procedure to assess the potential for erosion and sediment transport at individual SWMUs (Standard Operating Procedure [SOP] 02.01, Surface Water Site Assessments). Erosion potential is numerically rated from 1 to 100 using a matrix system. SWMUs with scores greater than 60 have high erosion potentials. The three SWMUs comprising MDA U, SWMUs 21-017(a), (b), and (c), were given a score of 8.8 in 1999, indicating a low erosion potential.

No streams occur on DP Mesa; stormwater and snowmelt generally run off the mesa as sheet flow or in small drainages off the mesa sides. Because of the vegetative cover and the relatively flat topography of MDA U, which slopes gently to the north towards DP Canyon, surface runoff generation is minimal. A run-on diversion channel has been cut on the south side of MDA U to direct potential run-on from impervious surfaces upgradient of MDA U to the northeast around the MDA towards DP Canyon. This diversion channel flows into a small drainage leading into DP Canyon north of MDA U. DP Canyon also receives runoff from several historic TA-21 outfalls, MDAs A and T, and several other SWMUs.

3.1.2 Soils

At TA-21, natural or undisturbed surface soil cover has been disturbed as a result of Laboratory operations, such as waste disposal, building construction, and demolition. The present-day mesa surface in the area of MDA U is predominantly fill. Where undisturbed, soils on the mesa surface are thin and poorly developed. They tend to be sandy near the surface and more clay-rich beneath the surface. Soil profiles tend to have higher organic content on north slopes, such as those below MDA U. A discussion of the soils in the Los Alamos area can be found in section 2.2.1.3 of the ER Project installation work plan (LANL 1998, 62060, p. 2-21) and in Nyhan et al. (1978, 05702, pp. 24–25).

3.2 Subsurface Conditions

3.2.1 Stratigraphy

The generalized stratigraphy of DP Mesa in the area of MDA U is shown in Figure 3.2-1. DP Mesa consists of Bandelier Tuff (Qbt) overlain by a thin layer of alluvium and soil. The Bandelier Tuff unit is subdivided into two members, in ascending order: the Otowi and the Tshirege. MDA U is situated within the Tshirege Member, which is a compound sequence divided into four distinct units (units 4, 3, 2, 1v/1g) (Broxton and Eller 1995, 58207, pp. 45–51). Unit 4 does not occur at TA-21; bedrock directly underlying TA-21 is unit 3 (Qbt3), a cliff-forming nonwelded to partially welded tuff. Below MDA U, the Otowi and Tshirege Members are separated at about 300 ft bgs by the Cerro Toledo (Qct) interval, a 10-ft-thick sequence of volcaniclastic sediments deposited in braided stream systems (Broxton and Eller 1995, 58207, p. 40). The Bandelier Tuff and deposits of the Cerro Toledo interval are derived primarily from explosive volcanic eruptions approximately 1.2 million years ago (Broxton and Eller 1995, 58207, p. 7). The Guaje Pumice Bed is the basal layer of the Bandelier Tuff that directly overlies the underlying clastic fanglomerate sediments of the Puye Formation (Tp). The Guaje Pumice Bed was not encountered in the bulk-rock samples collected from exposed bedrock units in on the north wall of Los Alamos Canyon south of MDA U (Broxton and Eller 1995, 58207, p. 35). At TA-21, the Otowi Member of the Bandelier Tuff directly overlies the Puye Formation.

3.2.2 Cliff Retreat and Fractures

According to a geomorphic study at DP Mesa and vicinity (Broxton and Eller 1995, 58207, pp. 66–69), tributary stream systems and their canyons (including DP Canyon) developed before the incision of Los Alamos Canyon, and minimal cliff retreat has occurred in these canyons since then. The report states that exposure of most of the MDAs at TA-21 on DP Mesa, including MDA U, through cliff retreat is improbable over periods exceeding 10,000 years. A thorough study of fracture orientations and apertures was conducted on cooling unit 2 of the Bandelier Tuff (Broxton and Eller 1995, 58207). The general fracture characteristics from cooling unit 2 can be extrapolated to cooling unit 3, which directly underlies

MDA U. The mean strike of the two predominant fracture orientations was N40E and N27W. Fractures were nearly vertical with a mean dip of 9 degrees to the north. The mean fracture aperture was 0.6 cm.

3.2.3 Hydrogeology

3.2.3.1 Infiltration

The proposed hydrogeologic conceptual model for the Pajarito Plateau (Figure 3.2-2) (LANL 1998, 59599, p. 5) predicts the infiltration of water into the subsurface and subsequent transport of water, vapor, and solutes through the upper regions of the vadose zone. This process is heavily influenced by surface conditions such as topography, surface water flow, and precipitation. The natural source of moisture in the vadose zone is precipitation, most of which is removed as runoff, and evaporation and transpiration or "evapotranspiration" (LANL 1997, 63131). The subsurface movement of the remaining moisture (often referred to as recharge) is predominantly vertical in direction and is influenced by the properties and conditions of the vadose zone.

The degree of surface disturbance and the geologic properties of the tuff lead to differences in recharge rates. Mesa-top recharge can be locally significant when vegetation is removed, soil and near-surface bedrock are disturbed, or water is artificially added to the local hydrologic system by activities such as effluent disposal. All these conditions have existed in the past at MDA U. However, no effluent has been discharged to the absorption beds since 1976, and the site is currently densely vegetated with native shrubs and grasses.

Two geologic properties of the Bandelier Tuff that influence recharge rates are the degree of welding and devitrification, both the effects of a prolonged presence of residual gases and high temperatures following deposition. Because different tuff units were deposited at different temperatures and because individual units were laid out in variable thicknesses over different landscapes, cooling was not uniform. Consequently, welding varies spatially, both between and within separate depositional layers. Welded tuffs tend to be more fractured than nonwelded tuffs. Fractures within the tuff do not enhance the movement of dissolved contaminants unless saturated conditions exist.

Although saturated conditions do not currently exist at MDA U, they may have existed beneath the absorption beds during active wastewater disposal (1945 through 1976). A gravimetric water content of 38% is the typical value for saturation in Bandelier Tuff. The moisture levels measured in boreholes drilled under the absorption beds during the Phase I RFI are relatively low. From 0 to 75 ft bgs, the gravimetric water content was measured at values between 3% and 16% (LANL 2004, 87454). At these moisture levels, the fractures beneath the site are unlikely to be saturated. Only in situations when substantial infiltration occurs from the ground surface, as was potentially the case under the active absorption beds, will the fractures become wet and conduct water. However, modeling studies predict that when fractures disappear at contacts between stratigraphic subunits, when fracture fills are encountered, or when fracture coatings are interrupted, fracture moisture is absorbed into the tuff matrix (Soll and Birdsell 1998, 70011, pp. 193–202).

3.2.3.2 Perched Groundwater

Observations of perched intermediate groundwater in Laboratory wells are rare on the Pajarito Plateau. Perched zones are defined as saturated zones located above the regional aquifer and are thought to form mainly at horizons where medium properties change dramatically, such as at paleosol horizons with clay or caliche found in basalt and volcanic sediment sequences. The Cerro Toledo interval, Guaje Pumice

Bed, and Puye Formation are examples of significant hydrogeologic property changes in the local stratigraphic sequence, where a perched horizon may exist.

The Cerro Toledo interval was intersected during the drilling of LADP-4, located less than 500 m northeast of MDA U in DP Canyon, but water was not observed (Figure 3.2-3). Perched intermediate groundwater has been observed in some locations on the plateau within approximately 2 km of MDA U, such as at LADP-3 to the southwest in Los Alamos Canyon (in the Guaje Pumice Bed at 6430 ft asl), R-7 to the south (in the Puye Formation at 6420 ft asl), and Otowi-4 on the eastern base of DP Mesa (in the Puye Formation at 6380 ft asl) (Figure 3.2-3). The Cerro Toledo interval beneath MDA U is expected to be at approximately 6780 ft asl. A perched horizon is not anticipated but has not yet been investigated. Saturated conditions were not encountered in the boring at location 21-02523, drilled approximately 1 km to the west of MDA U. This boring was drilled into the Otowi Member of the Bandelier Tuff, to a depth of 660 ft bgs (approximately 6500 ft asl). A new regional groundwater well, R-6, is currently being drilled on a bench at the eastern end of DP Mesa to provide additional information regarding hydrogeologic conditions at DP Mesa.

Other evidence of perched groundwater in the vicinity of TA-21 includes DP Spring, which discharges at the contact of older alluvium (estimated at approximately 37,000 years from carbon-14 dating) and Bandelier Tuff unit Qbt1g. Surface water runoff generally associated with summer precipitation and snowmelt is temporarily stored in the older alluvium and then discharges as DP Spring. Discharge at DP Spring is variable, generally ranging from zero flow to less than one gal./min, and responds rapidly to surface water runoff from upper DP Canyon (LANL 2004, 87390, pp. 7–20). Several chemicals of potential concern (COPCs), including strontium-90, isotopic uranium, and tritium, have been detected in samples from DP Spring, as noted in the Los Alamos and Pueblo Canyons investigation report (LANL 2004, 87390) submitted to NMED in April 2004.

3.2.3.3 Regional Aquifer

The regional aquifer in the Los Alamos area rises westward from the Rio Grande within the Santa Fe Group into the Puye Formation beneath the central and western portion of the Pajarito Plateau. The depth of the aquifer decreases from about 1200 ft bgs along the western margin of the plateau to about 600 ft bgs along the eastern margin. The elevation of DP Mesa at MDA U is approximately 7120 ft asl. The regional aquifer was encountered in deep wells proximal to MDA U at 5870 ft asl (R-7), 5850 ft asl (Otowi-4), and 5835 ft asl (R-8, downgradient of MDA U) (Figure 3.2-3) (LANL 1998, 59599). Thus, the regional aquifer is approximately 1300 ft below MDA U.

4.0 SCOPE OF ACTIVITIES

The purpose of the activities prescribed in this investigation work plan is to achieve the objectives defined in section 1.2 and the data needs assessment presented in section 2.6 of this work plan.
The characterization activities have been developed to address the requirements outlined in the September 1, 2004, proposed Consent Order issued by NMED to DOE and UC (hereafter referred to as the Order), as well as the data needs identified in section 2.6. Table 4.0-1 presents a summary of the Order requirements, the sampling proposed in this investigation work plan, and justifications for deviations from the sampling requirements specified in the Order.

Although SWMU 21-022(f) is part of consolidated SWMU 21-017(a)-99, subsequent inspection of the subsurface concrete vault housing the sump and drainline indicated it is more feasible to address this SWMU as part of the "Investigation Work Plan for Delta Prime Site Aggregate Area at Technical Area 21" (LANL 2004, 87451). Therefore, SWMU 21-022(f) is not addressed in this work plan.

4.1 Surface Soil Investigations

Surface soil samples (0 to 0.5 ft bgs) will be collected at each of the four proposed borehole locations (Figure 4.1-1). These samples will be screened in the field for radioactivity as described in section 5.2. Soil samples will then be analyzed for radioactivity (gross alpha, beta, and gamma) and radionuclides (actinium-227 progeny, americium-241, strontium-90, isotopic uranium, isotopic plutonium, tritium); inorganic chemicals (target analyte list [TAL] metals); VOCs and semivolatile organic compounds (SVOCs); PCBs; perchlorate; cyanide; and nitrate. Alpha spectroscopy is prescribed for this investigation to quantify the activities of actinium-227 progeny. Table 4.1-1 specifies the analytical suites for surface samples.

4.2 Subsurface Investigations

A total of four vertical boreholes are proposed for MDA U. Including the boreholes drilled during the 1998 campaign, the total number of boreholes drilled at MDA U will be 12.

One borehole (BH-4) will be drilled to a target depth of 360 ft bgs and penetrate the entire Cerro Toledo interval to constrain the vertical extent of tritium and VOCs and to determine if saturated zones are encountered at or above the Cerro Toledo interval (Figure 4.1-1). This borehole will be drilled at the former location of the distribution box between the two absorption beds. The Cerro Toledo interval beneath MDA U is anticipated to be at an elevation of approximately 6780 ft asl.

Three additional boreholes (BH-1, BH-2, and BH-3) will be drilled approximately 50–100 ft from the MDA U fence, as shown in Figure 4.1-1. The boreholes will be drilled 20 ft into unit 2 of the Tshirege Member of the Bandelier Tuff (Qbt2), which is anticipated to occur at approximately 100 ft bgs, for a TD of 120 ft bgs. These boreholes will bound the lateral extent of tritium and actinium-227 contamination identified in the fractured/clay-interbed zone observed at a depth of 50–75 ft bgs in boreholes drilled during the 1998 RFI. This interval is an important target sampling depth because core samples collected within the clay-rich zone were above background values, but samples collected above or below this zone were at or below background values (LANL 1998, 59730). In addition, because the bottom of Qbt3 is a nonwelded horizon and the top of Qbt2 is a welded horizon, the contact between these units (approximately 100 ft bgs) may be a zone of potential contaminant accumulation and is an important target sampling depth.

4.2.1 Borehole Samples

In addition to the surface soil samples, subsurface samples will be collected from a minimum of four depths at each borehole. In the deep borehole (BH-4), target sample depths include

(1) the interval of the highest field screening result,

(2) the interval of the deepest field screening detection,

(3) the interval corresponding to the depth of the absorption beds, and

(4) the TD of the borehole.

In the three 120-ft boreholes (BH-1, BH-2, and BH-3), target sample depths include

(1) the interval corresponding to the depth of the absorption beds,

(2) the depth of the fractured/clay-interbed zone,

(3) the interval containing the Qbt3/Qbt2 contact, and

(4) the TD of the borehole.

Core from all boreholes will be continuously screened for radiological contamination, visually inspected, and geologically logged. Additional field screening for organic vapors will be completed once per 10 ft of borehole advancement. In all boreholes, additional samples may be collected based on field screening results or field observations of biasing features such as elevated moisture zones, staining, fracture zones (including a paired unfractured sample), clay-rich zones, geologic contacts, or other indicators of possible contaminant accumulation. Table 4.2-1 summarizes the core and sample intervals and field screening approach for the boreholes.

All borehole samples will be analyzed for radioactivity (gross alpha, beta, and gamma) and radionuclides (actinium-227 progeny, americium-241, strontium-90, isotopic uranium, isotopic plutonium, tritium); inorganic chemicals (target analyte list [TAL] metals); VOCs and SVOCs; PCBs (shallowest subsurface interval only); perchlorate; cyanide; and nitrate. Alpha spectroscopy is prescribed for this investigation to quantify the activities of actinium-227 progeny. Table 4.1-1 specifies the analytical suites for borehole samples.

4.2.2 Geotechnical Analysis

Geotechnical analysis will be conducted on samples from the deep borehole (BH-4). Moisture content samples will be collected at 5-ft intervals in the upper 40 ft of the hole and at 10-ft intervals at depths below 40 ft. Samples for saturated and unsaturated hydraulic conductivity, matric potential, porosity, chloride, and bulk density analysis will be collected once in soil, once in each tuff unit, and, at a minimum, twice from the Cerro Toledo interval. The samples collected from the Cerro Toledo interval will be selected from core representative of all observed textural intervals.

4.2.3 Subsurface Pore Gas

Subsurface pore-gas samples will be collected from all boreholes. In each borehole, one sample will be collected at the depth in the borehole nearest to the depth of the targeted disposal unit, and the second sample will be collected at the TD of the borehole. Subsurface pore-gas samples will be collected and submitted for analysis of VOCs and tritium. If air-rotary drilling is used to reach total borehole depth, a second round of pore-gas sampling may be conducted 30 days after the first round of sampling. The decision to install pore-gas monitoring wells will be based on the results of both rounds of sampling. The boreholes will remain open, but protected, until the decision is made whether to install vapor-monitoring wells.

4.2.4 Perched Saturation

If saturation is encountered during borehole advancement, drilling will be stopped to determine whether sufficient water volume is available for sampling and analysis. If the necessary volume of groundwater cannot be collected, the borehole will be continued to the planned TD or until saturation is again encountered, at which point the process is repeated. If sufficient volume exists, a groundwater sample will be collected and analyzed for metals, VOCs, SVOCs, radionuclides, tritium, nitrates, perchlorate, anions, alkalinity, total organic carbon, total inorganic carbon, and total dissolved solids.

5.0 INVESTIGATION METHODS

The current versions of the SOPs applicable to the investigation methods proposed in this plan are presented in Table 5.0-1. Additional procedures may be added as necessary to describe and document quality-affecting activities.

5.1 Drilling Methods

All the 120-ft boreholes will be installed using hollow-stem auger drilling methods. The deep borehole, BH-4, may require the use of a rotary-drill rig capable of coring and deep-borehole production to reach the planned TD. The decision to switch drilling methods for BH-4 will be made in the field based on the performance of hollow-stem auger drilling. All drilling activities will follow appropriate Laboratory guidance documents and protocols to ensure that health and safety issues are reviewed and addressed during field operations.

Each shallow borehole (BH-1 through BH-3) will be continuously cored using 9-in. auger flights with a split-barrel sampler to TD. Shallow boreholes (up to 120 ft bgs) will be drilled in select areas to collect information on the lateral extent of contamination. The depth and sampling plan for each proposed borehole and sampling location are described in Table 4.2-1. The exact location of each borehole will be determined by the investigation team and take into consideration site access, locations of utilities identified during the excavation permitting process, and other potential risks and limitations. Profiles of planned boreholes are shown in Figure 5.1-1.

Backfilling (abandonment) of investigation boreholes will be conducted according to procedures outlined in SOP-5.03, which takes into account any subsurface characteristics (perched zones, etc.) requiring isolation. The use of backfill materials, such as bentonite and cement, volume of backfill materials (calculated and actual), intervals of placement, and additives used to enhance backfilling will be documented in a field logbook. Drill cuttings will be handled as waste (see Appendix B).

5.2 Methods of Collecting Soil and Rock Samples

The most common method for surface- and shallow-subsurface sampling will be the spade and scoop method, described in SOP-6.09. A sample is taken by digging a hole to the desired depth and collecting a discrete grab sample. Stainless-steel shovels, spades, scoops, and bowls are used because they are easy to decontaminate. Disposable tools made of polystyrene or Teflon may also be used, if necessary. In some cases, hand-augering tools may be used to collect shallow subsurface samples if geologic material conditions permit. The tools used, and their use, are described in SOP-6.10. If the surface location is within bedrock, an axe or hammer and chisel may be used to collect samples.

Surface samples will be field screened using a model 139 rate meter for gross alpha and an ESP-1 for beta/gamma. Field screening for alpha, beta, and gamma radiation will be conducted within 6 in. of the sample material. All instrument background checks, background ranges, and calibration procedures will be documented daily in the field logbooks. Following field screening, the samples will be placed in resealable bags and/or sample jars as grab samples derived from hand augers, scoops, or chiseling devices according to the applicable SOPs (Table 5.0-1). Surface samples will then be shipped through the Sample Management Office (SMO) to fixed laboratories for analysis.

Subsurface samples will be collected according to SOP 6.26 and field screened using a model 139 rate meter for gross alpha and an ESP-1 for beta/gamma. Field screening for alpha, beta, and gamma radiation will be conducted within 6 in. of the core material. All instrument background checks, background ranges, and calibration procedures will be documented daily in the field logbooks. Vapor screening of subsurface core for VOCs will be conducted using a photo-ionization detector (PID) equipped with an 11.7 electron volt (eV) lamp and will follow SOP 06.33. The PID will provide resolution to 1 part per million. The maximum value and the ambient-air temperature will be recorded in the field-boring or test-pit log for each sample. The PID will be calibrated daily following the manufacturer's standard for instrument operation and the results documented in the field logbook. Field screening for VOCs will be accomplished through headspace analysis at 10-ft intervals in each borehole. Core samples will then be evaluated for lithologic and structural features, removed from the split-barrel sampler, and placed into seam-sealed plastic sleeves or heat-sealed bags to preserve the moisture content of the core. Sample jars and/or resealable bags will be filled with discrete segments of the core. Subsurface samples will then be shipped through the SMO to fixed laboratories for analysis.

Quality assurance/quality control (QA/QC) samples will include trip blanks for VOC analyses as well as (1) field duplicates to assess the reproducibility of the sampling technique and (2) rinsate blanks to evaluate decontamination procedures. These samples will be collected according to SOP-1.05. Field documentation of samples collected from fractures will include a detailed physical description of the fracture-fill material and rock matrix sampled. The volumes of fracture-fill and rock-matrix materials included in the samples will be estimated from field measurements. An additional sample will be collected from the rock matrix adjacent to the fracture sample material to allow for comparison. The fracture and matrix samples will be paired and assigned unique identifiers.

5.3 Collection of Geotechnical Data

All boreholes will be cored continuously to TD. The proposed deep borehole (BH-4) will be geologically logged, including lithology, apparent moisture, structural features (specifically fracture occurrence, orientation, and density), and core recovery compared to the interval drilled, according to SOP 12.01 and SOP-4.01. Rock-quality designation (RQD) will also be documented in the field. The RQD is defined as the collective length of core in excess of 2 by 4 in. expressed as a percentage of total core drilled, thus giving the percentage of solid core obtained, which depends on the strength and number of discontinuities in the rock mass. Low numbers reflect incompetent, heavily fractured, or sandy formations. High numbers indicate competent formations. Brass sleeves will be used at BH-4 in the relatively unconsolidated Cerro Toledo interval to improve recovery and maintain the structural integrity of the core for geotechnical characterization.

Analyses for saturated and unsaturated hydraulic conductivity, porosity, and bulk density will be performed using analytical methods specified by contract requirements of the Laboratory's SMO (LANL 2000, 71233). One field duplicate for every 20 geotechnical samples taken will be collected and analyzed.

Competent boreholes will allow for geophysical logging in accordance with SOP-4.04, which may provide additional data for tuff matrix characterization, such as porosity, saturation, and matric potential.

5.4 Pore-Gas Sampling and Pore-Gas Monitoring Well Installation

Subsurface vapor samples will be collected following SOP-6.31, Rev. 1. In each borehole, one sample will be collected at the depth of the adjacent absorption bed; the second sample will be collected at TD. Pore-gas samples will be collected using a straddle packer to isolate discrete depths within the borehole. Each interval will be purged before sampling, until measurements of carbon dioxide and oxygen are stable and representative of subsurface conditions. Subsurface pore-gas samples will be collected in SUMMA canisters and submitted for VOC analysis using Environmental Protection Agency (EPA) Method TO-14 and in silica gel samplers for tritium analysis using EPA Method 906.0.

QA/QC samples for VOCs in pore gas will consist of an equipment blank and field duplicate for each sampling round. After sampling and purge decontamination, the equipment blank will be collected by pulling zero gas (99.9% ultrahigh-purity nitrogen) through the packer sampling apparatus. This sample will be used to evaluate decontamination procedures. The field duplicate sample will be used to evaluate the reproducibility of the sampling technique. A field duplicate sample will also be collected for tritium. QA/QC samples will be collected according to SOP-1.05, Rev. 1, and will be collected once during each sampling event

The borehole will be left open in a protected condition pending analytical results. If there is a potential for the borehole to collapse, particularly in the upper interval, a temporary polyvinyl chloride (PVC) casing may be installed in the borehole. If pore-gas results indicate the need for continuous or extended monitoring of VOCs, pore-gas monitoring wells will be installed. The pore-gas monitoring well design will be produced outlining target intervals, port types and quantity, and packer configurations (Figure 5.4-1). The well design will be submitted to NMED for approval. If pore-gas monitoring wells are installed, a regular monitoring program will be implemented for data collection and analysis (section 6.0).

5.5 Perched Saturation Zone Sampling and Monitoring Well Installation

During drilling operations, zones of elevated moisture content, localized saturation, and groundwater may be encountered. These zones may not be assignable to either an alluvial or the regional groundwater system and may represent a localized phenomenon. The Laboratory's decision process for characterizing these zones is presented in the flowchart shown in Figure 5.5-1 and described in the following text. If saturation is encountered as a borehole advances, drilling will be stopped to determine whether sufficient water volume is available to analyze the water quality. These analyses may include metals, anions, perchlorate, alkalinity, organic carbon, total inorganic carbon, and total dissolved solids. Generally, the total volume required is approximately 0.5 to 1 L. Of this volume, 100 mL is unfiltered and unpreserved; another 100 mL is filtered and preserved with nitric acid. If this minimum volume of groundwater cannot be collected, the borehole will be drilled to the planned TD or until saturation is encountered again and the process is repeated. A porous cup lysimeter or absorbent membrane will be installed at the depth of saturation to monitor the zone if the borehole is completed for pore-gas monitoring. Insufficient water sample volumes from discreet depths will not be composited to reach the required volume for screening analysis.

If sufficient volume exists, a groundwater sample will be collected and analyzed for the screening constituents on a rapid turnaround basis at a Los Alamos National Laboratory geochemistry laboratory. Typically, results of groundwater screening samples are available in the R-well drilling program within 48 hr. During this time, the borehole will be advanced to the base of saturation, or the perching horizon, and then drilling will be halted. If possible, the perching horizon will be identified and not penetrated. This activity will determine the thickness of the zone of saturation and the characteristics of the perching horizon. Borehole drilling will cease, a monitoring well will be designed, and the design will be submitted to NMED for approval. Following approval of the design, the well will be installed. A borehole will be drilled adjacent to the well and the saturated zone isolated with a double-wall casing-advancement drilling method to prevent contamination migration.

5.6 Equipment Decontamination

Following sampling activities, project personnel will decontaminate all equipment. Residual material adhering to equipment will be removed using dry decontamination methods, including wire brushes and scrapers (SOP-1.08). If equipment cannot be free-released following dry decontamination, a high-pressure sprayer, along with long-handled brushes and rods, will be used to remove contaminated material from equipment more effectively. If necessary, equipment will be pressure washed on a temporary wash pad with a high-density polyethylene liner. Cleaning solutions and wash water will be collected and contained for proper disposal. Decontamination solutions will be sampled to determine final disposition. Air filters on equipment operating in the exclusion zone will be considered contaminated and will be removed and replaced before equipment leaves the site. Equipment that has been decontaminated and is ready for demobilization will be surveyed by a Health, Safety, and Radiation (HSR) radiation control technician (RCT) before being released from the site.

6.0 MONITORING AND SAMPLING PROGRAM

After this work plan is implemented, additional monitoring will probably not be required at MDA U. However, intermediate groundwater monitoring wells or vapor-monitoring wells will be installed if the investigation results indicate the presence of shallow perched water or pore-gas plumes. If any monitoring wells are necessary, a monitoring plan will be submitted to NMED for approval. The monitoring plan will detail the parameters to be monitored, monitoring frequency, and procedures to be followed. No monitoring is currently being performed at MDA U.

7.0 SCHEDULE

Following approval of this work plan by the NMED, readiness-review and site-preparation activities will begin. Implementation of the fieldwork is anticipated to require two months, from preparation activities through demobilization from the site. Samples will be sent to the SMO by this time. Receipt of analytical data is anticipated within 30 days of demobilization. An investigation report will be written and is due to NMED on January 31, 2006. The schedule is based on NMED's approval of the work plan by May 31, 2005.

8.0 REFERENCES

The following list includes all documents cited in this plan. Parenthetical information following each reference provides the author, publication date, and ER ID number. This information is also included in text citations. ER ID numbers are assigned by the ENV-RS Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the ENV-RS Project reference set titled "Reference Set for Material Disposal Areas, Technical Area 21."

Copies of the reference sets are maintained at the NMED Hazardous Waste Bureau; the DOE Los Alamos Site Office; the EPA, Region 6; and the ENV-RS project. The sets were developed to ensure the administrative authority has all material needed to review this document, and they are updated periodically as needed. Documents previously submitted to the administrative authority are not included.

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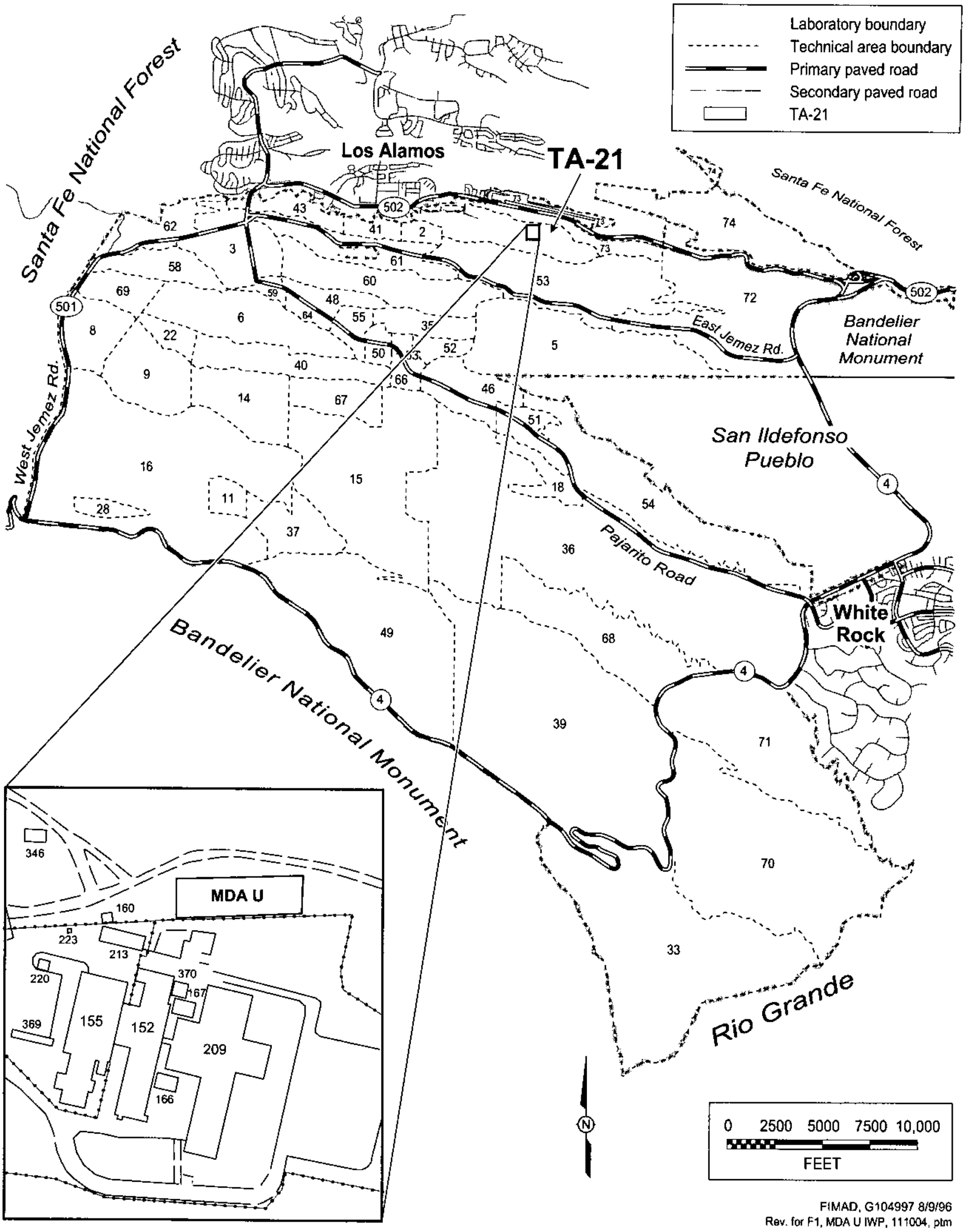


Figure 1.1-1. Location of MDA U in TA-21 with respect to Laboratory technical areas and surrounding land holdings

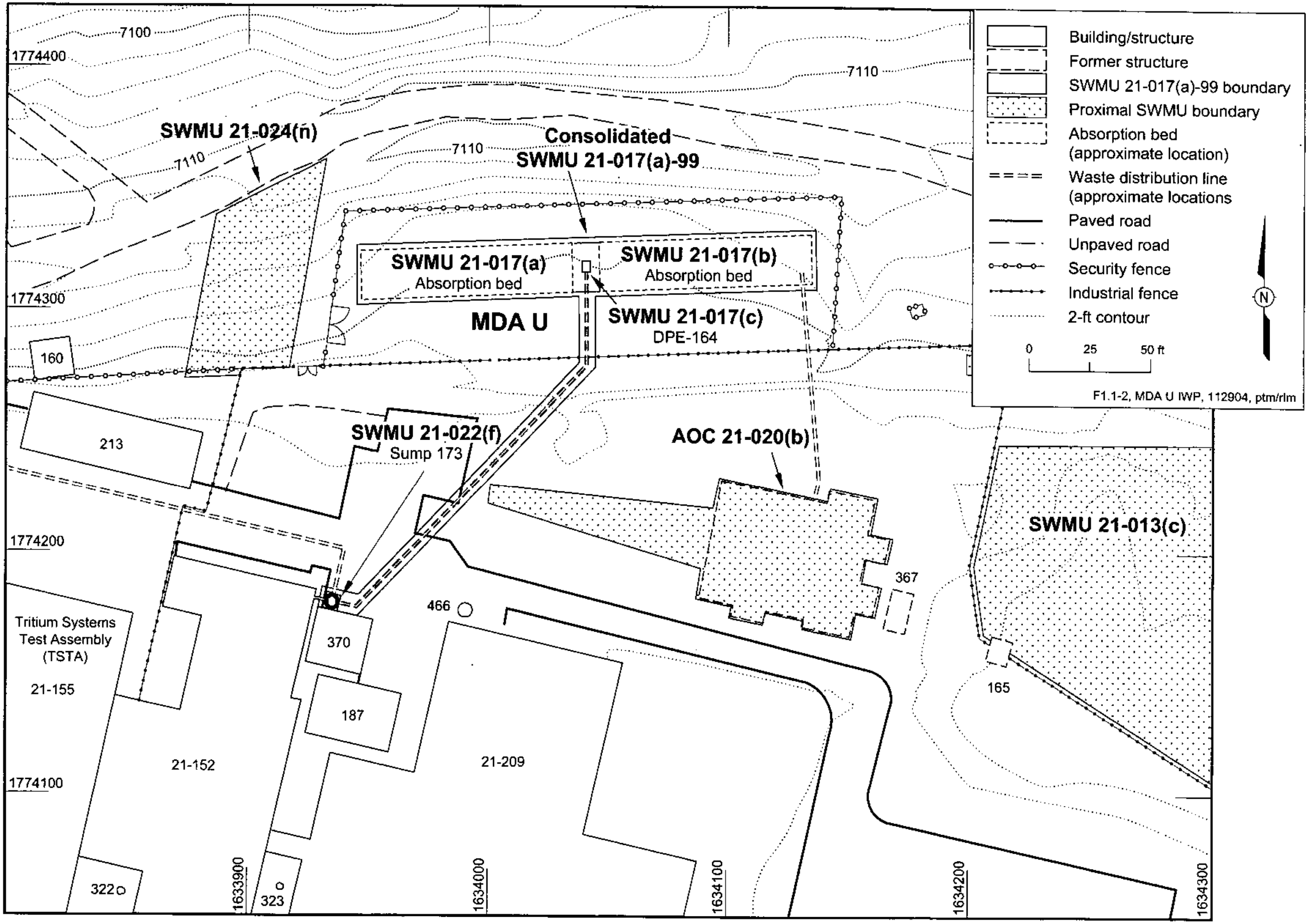
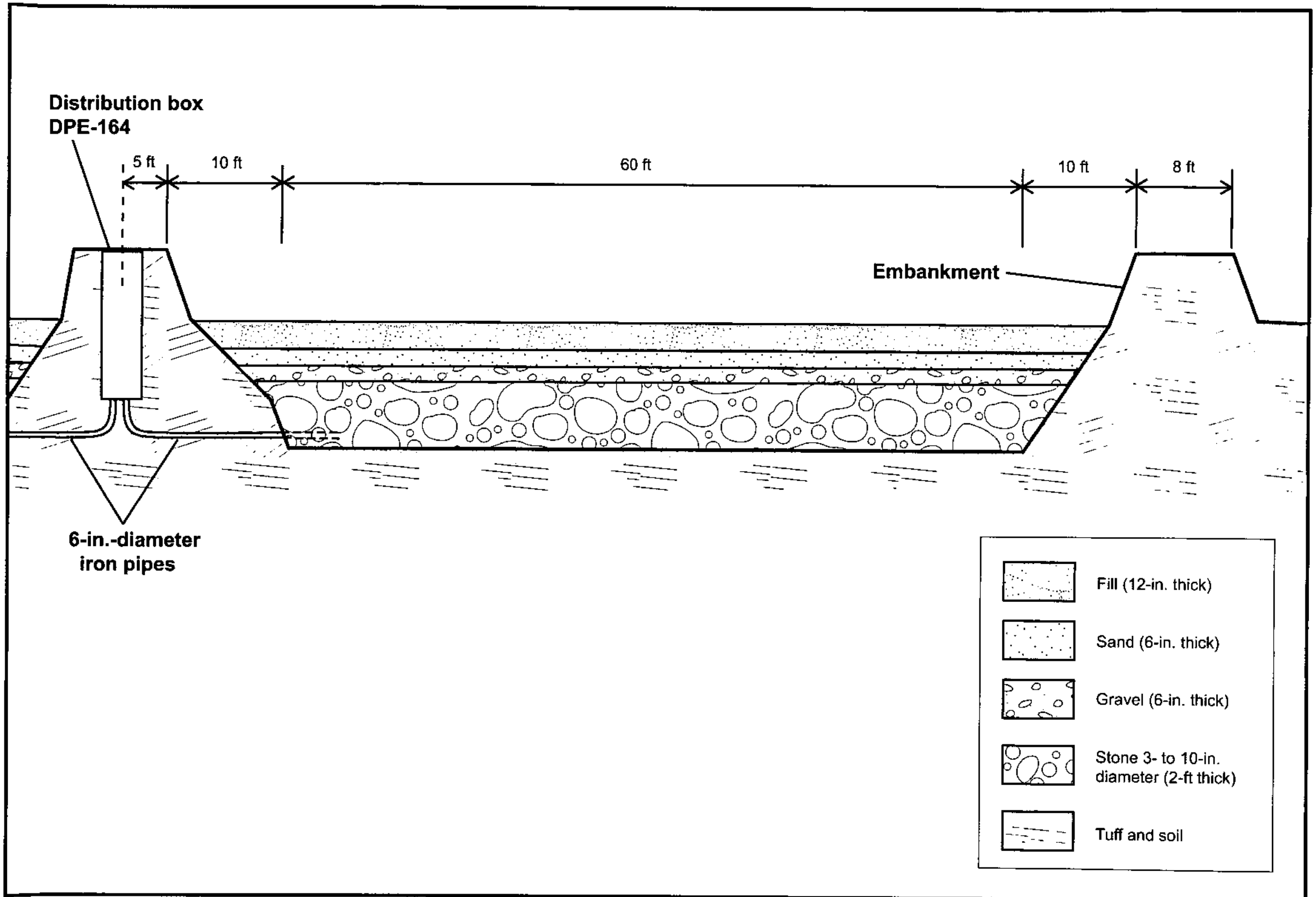


Figure 1.1-2. Site map of MDA U [consolidated SWMU 21-018(a)-99] and adjacent SWMUs/AOCs



Source: LASL ENG-C2216 6/6/45; modified for F2.2-3/MDA U RFI/011203/rlm; modified for F2.1-1, MDA U IWP, 110804, ptm

Figure 2.1-1. Schematic of MDA U absorption bed design

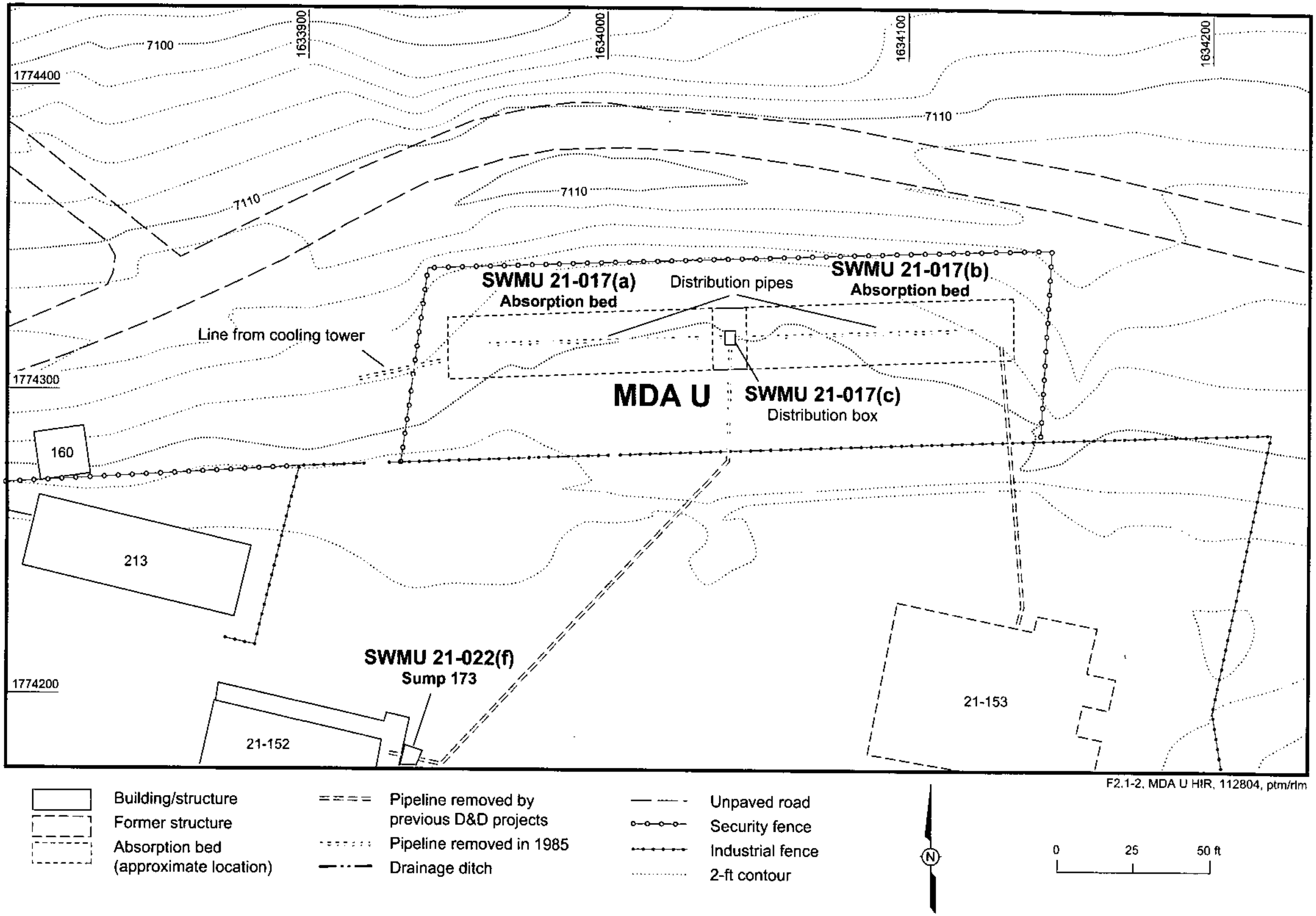
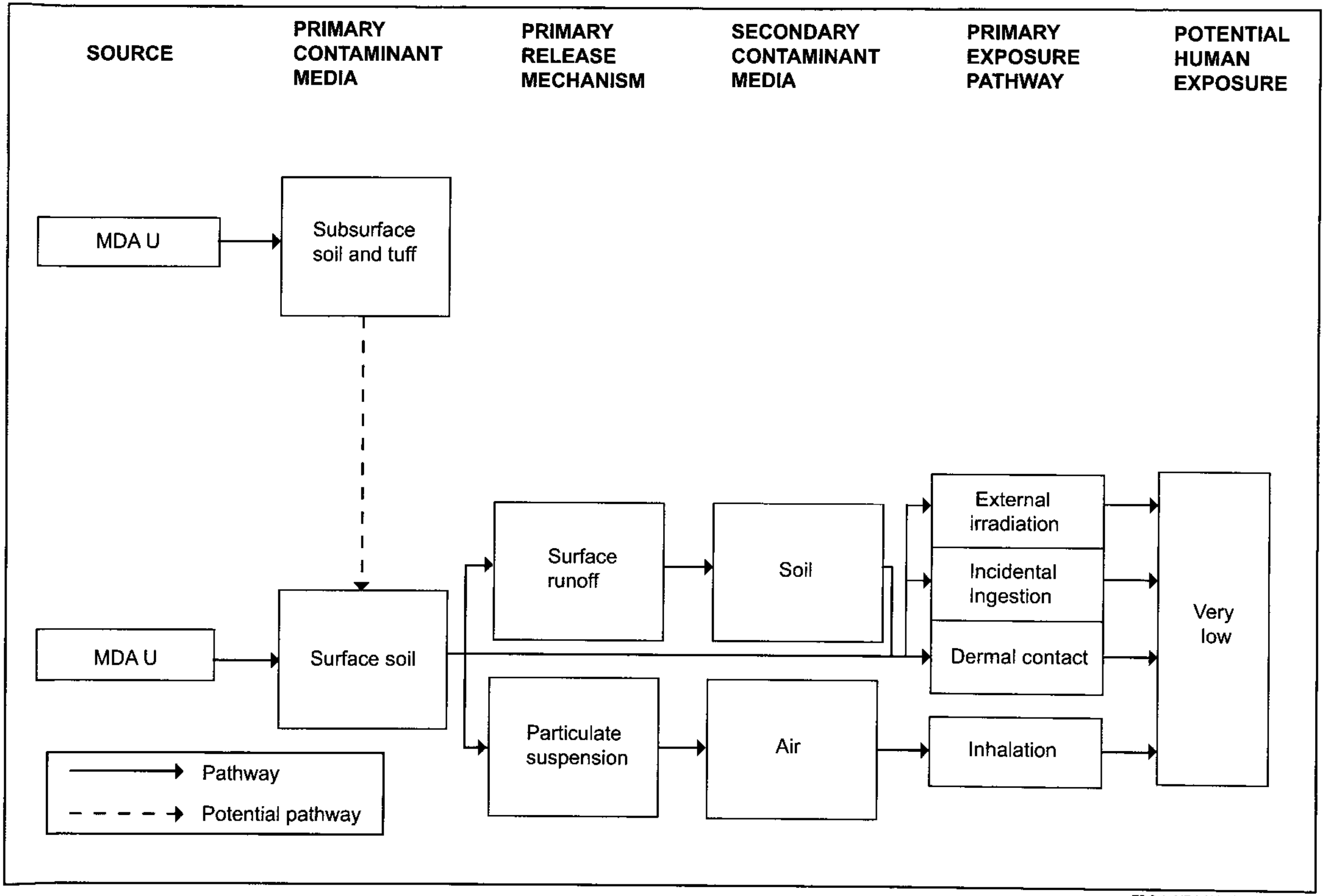


Figure 2.1-2. MDA U pipeline removal schematic



F2.3-1, MDA U IWP, 110804, ptm

Figure 2.3-1. Conceptual site model for human receptors at MDA U

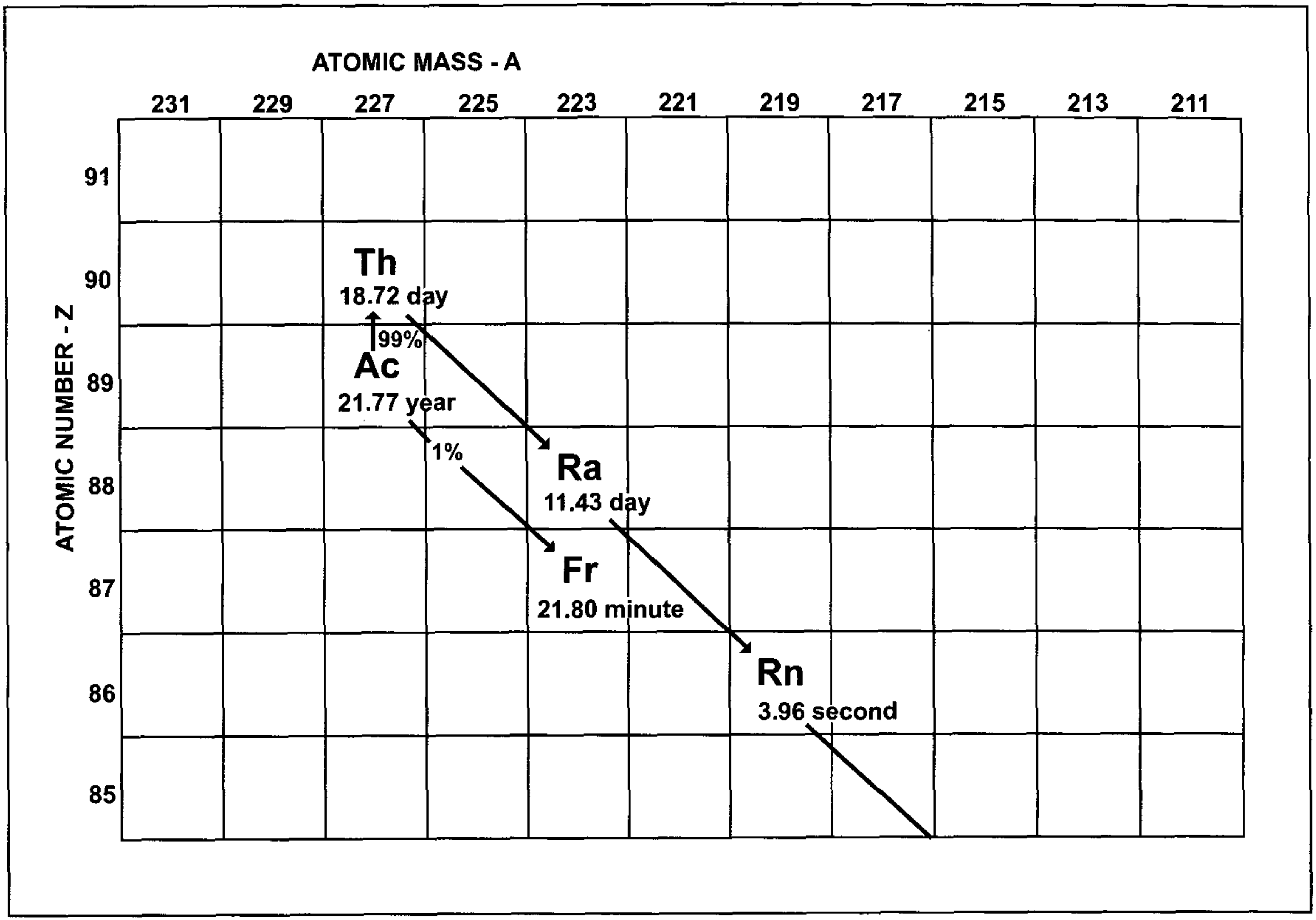


Figure 2.4-1. Decay scheme for actinium-227

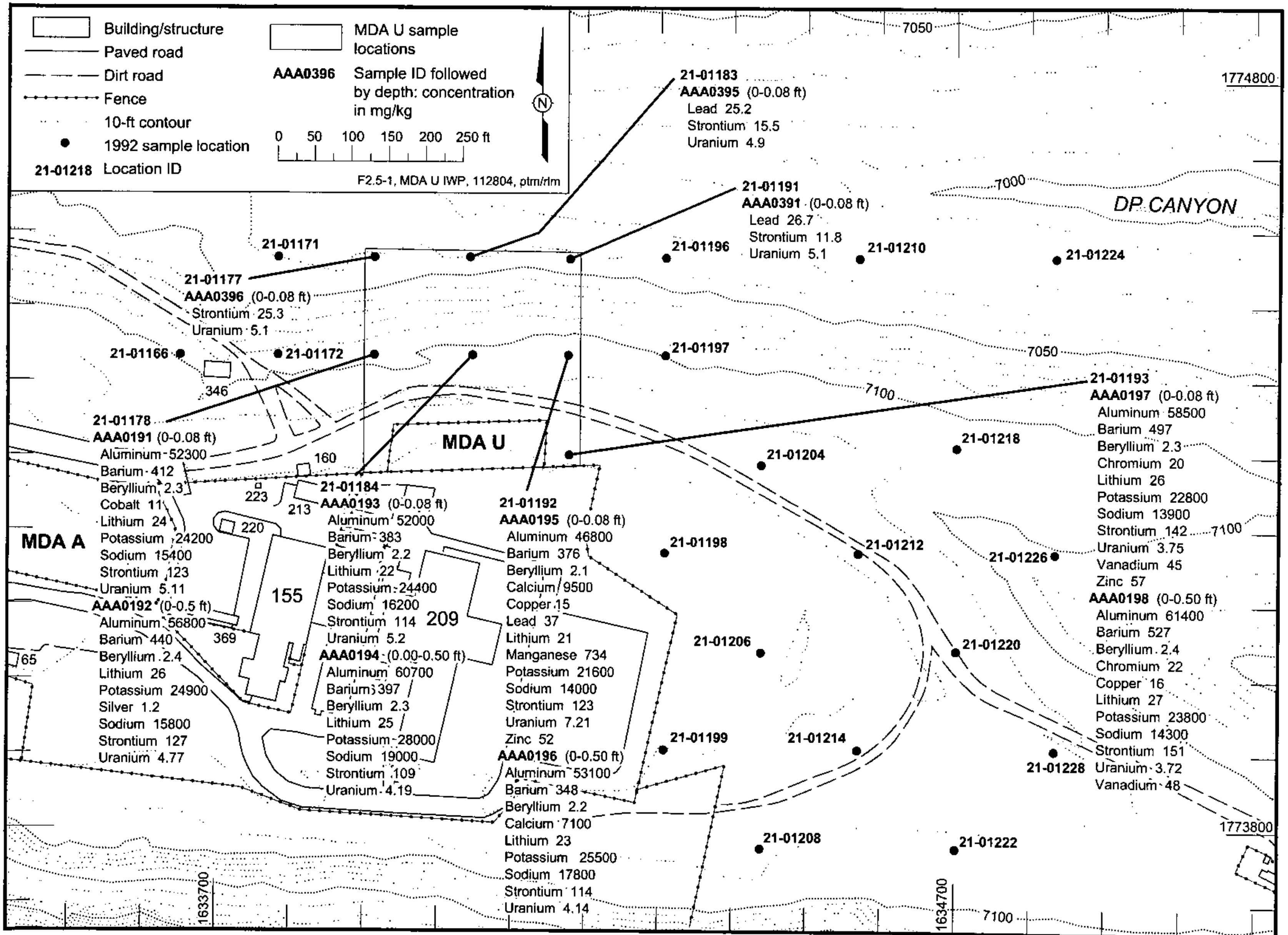


Figure 2.5-1. Inorganic chemicals above background values in 1992 surface samples

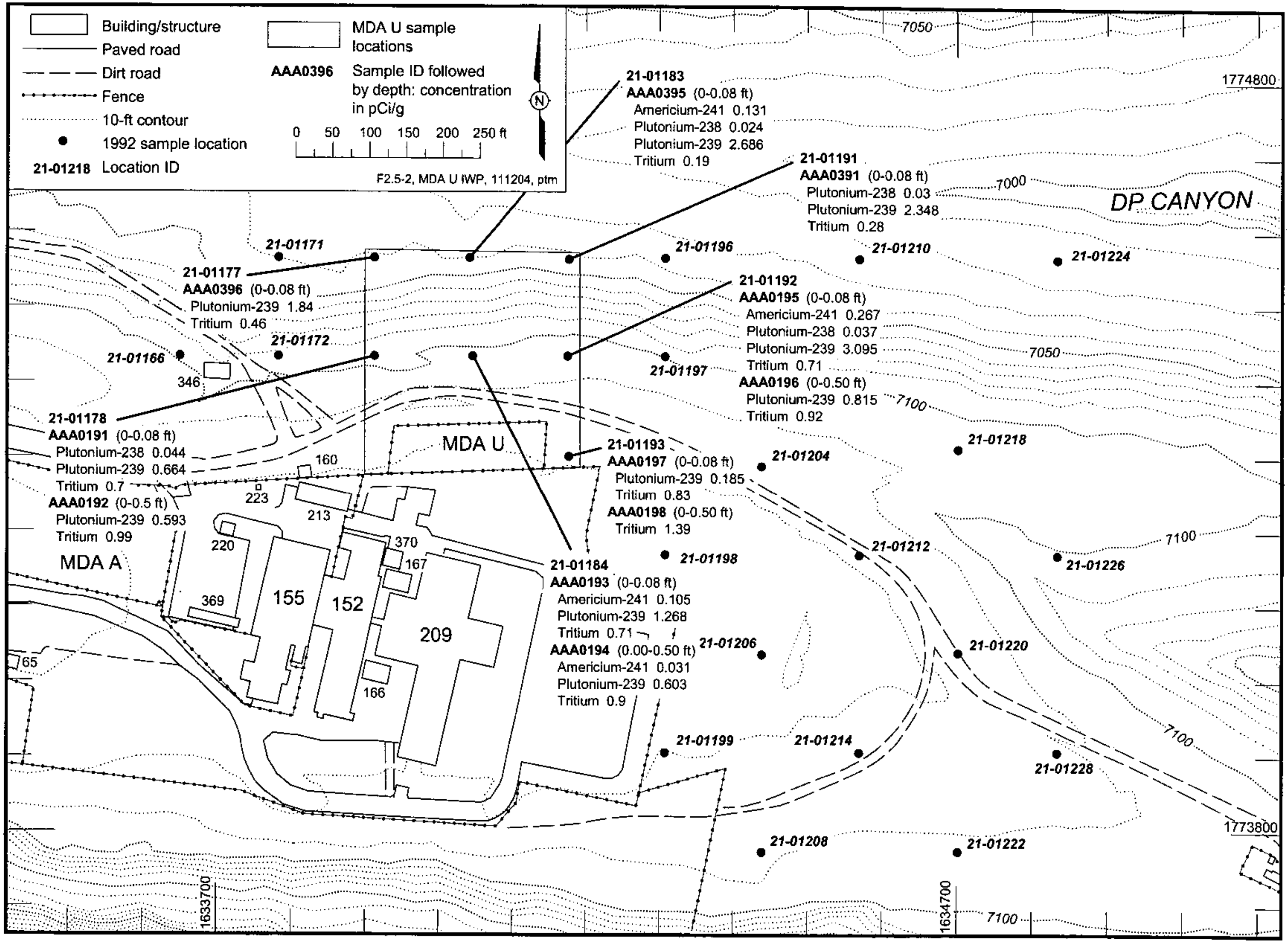
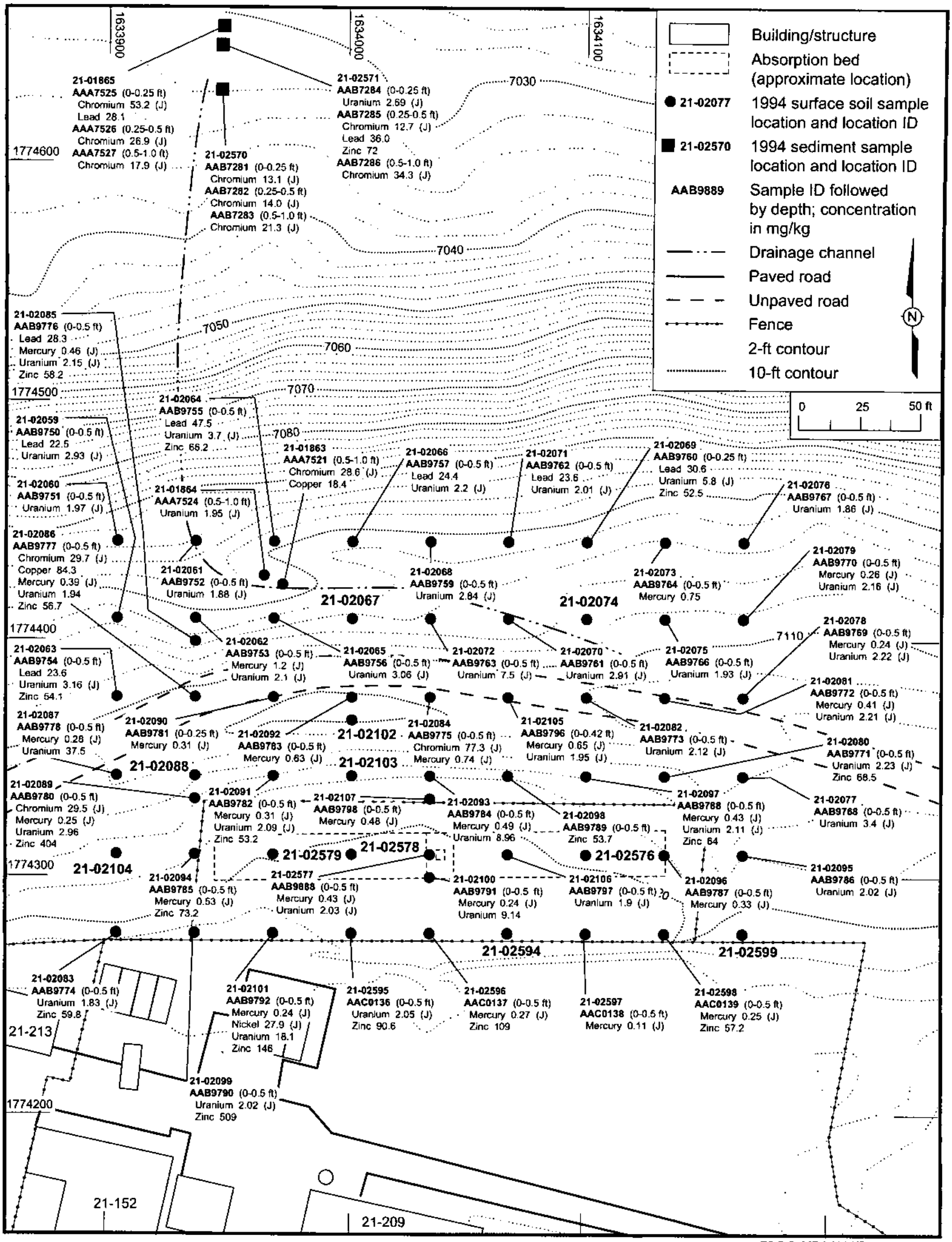
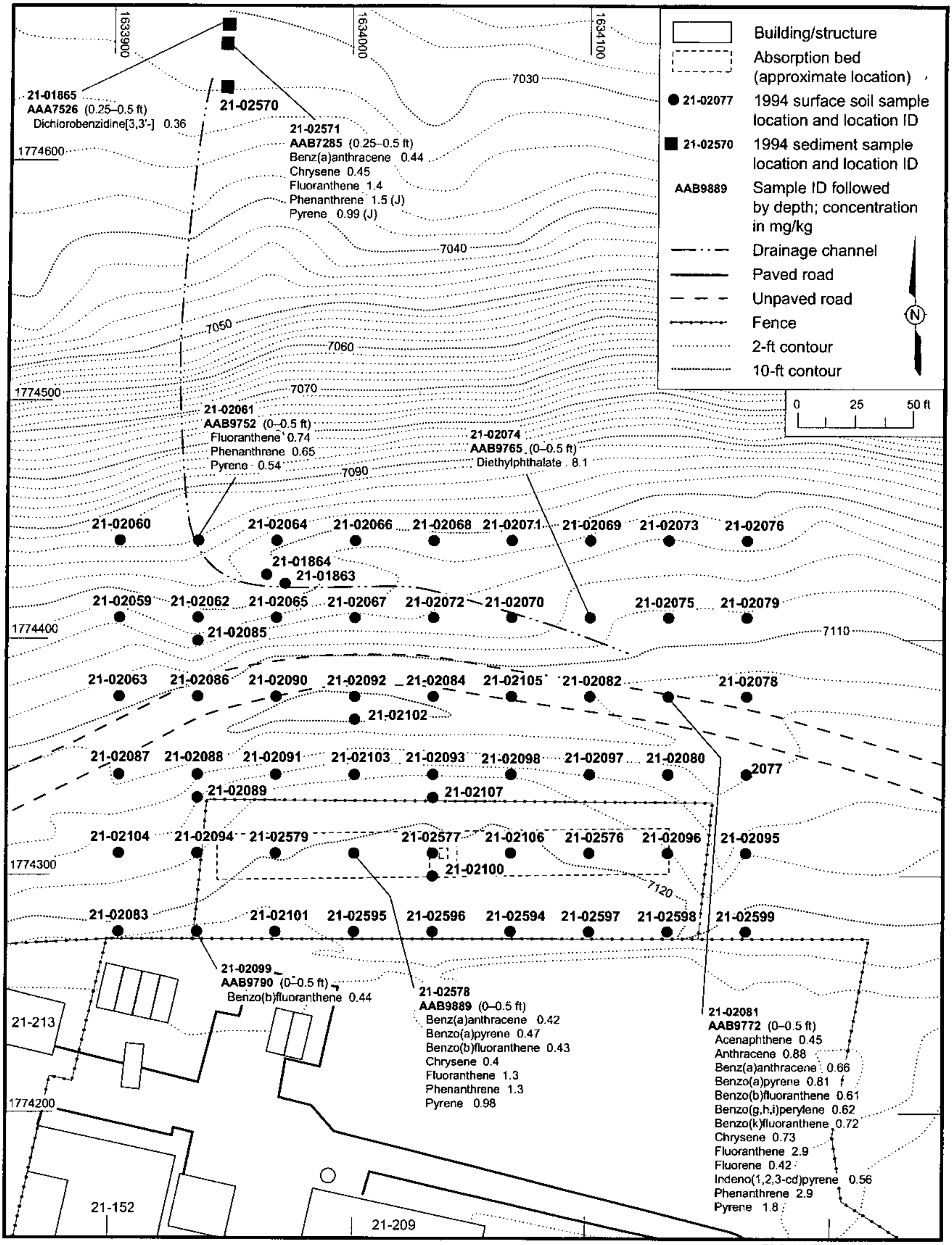


Figure 2.5-2. Radionuclides above background values in 1992 surface samples



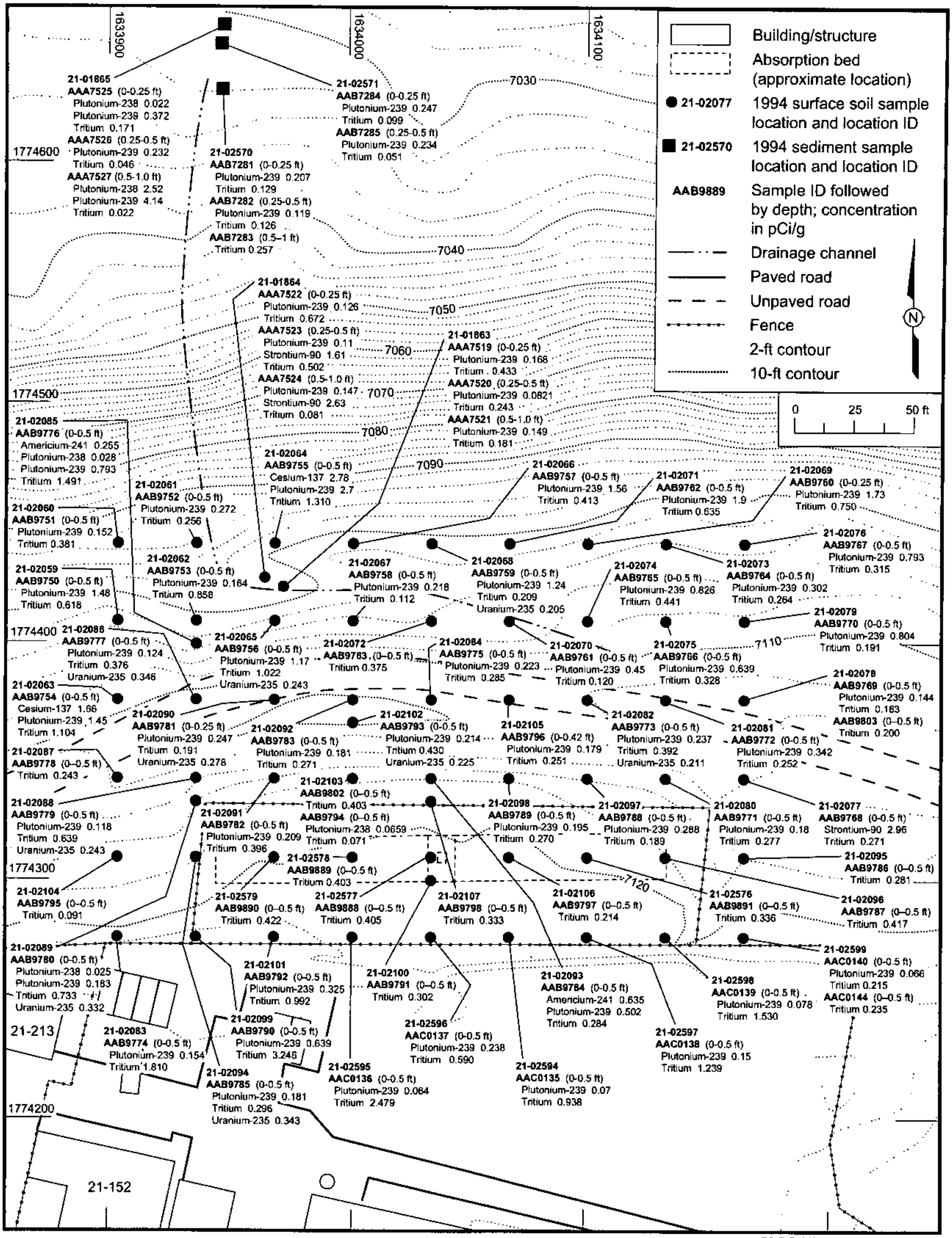
F2.5-3, MDA U IWP, 111004, ptm

Figure 2.5-3. Inorganic chemicals above background values in 1994 surface soil and sediment samples



F2.5-4, MDA U IWP, 111004, ptm

Figure 2.5-4. Organic chemicals detected in 1994 surface soil and sediment samples



F2.5-5, MDA U IWP, 112904, ptm

Figure 2.5-5. Radionuclides detected above background values/fallout values in 1994 surface soil and sediment samples

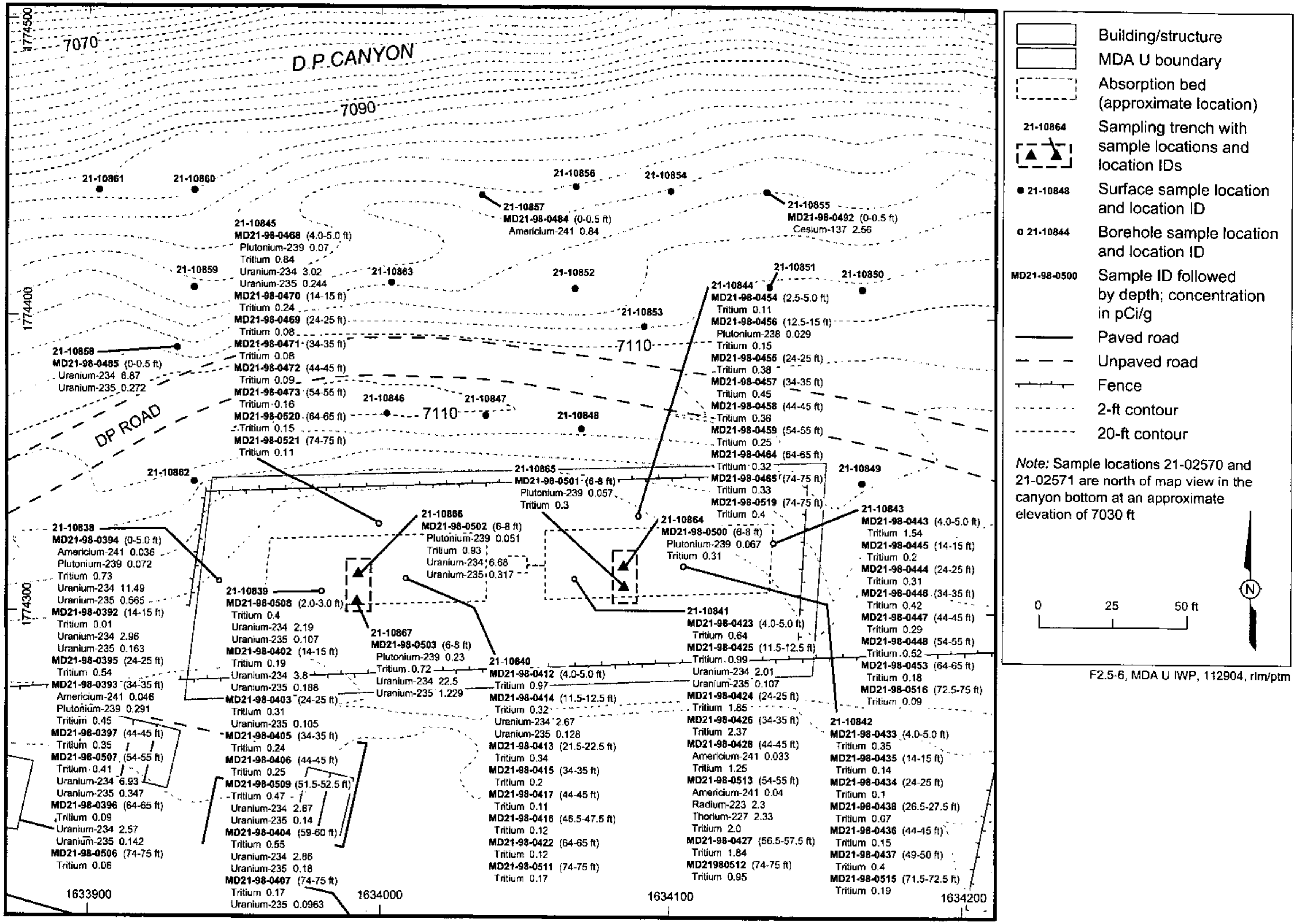


Figure 2.5-6. Radionuclides detected above background values/fallout values in 1998 surface and subsurface samples

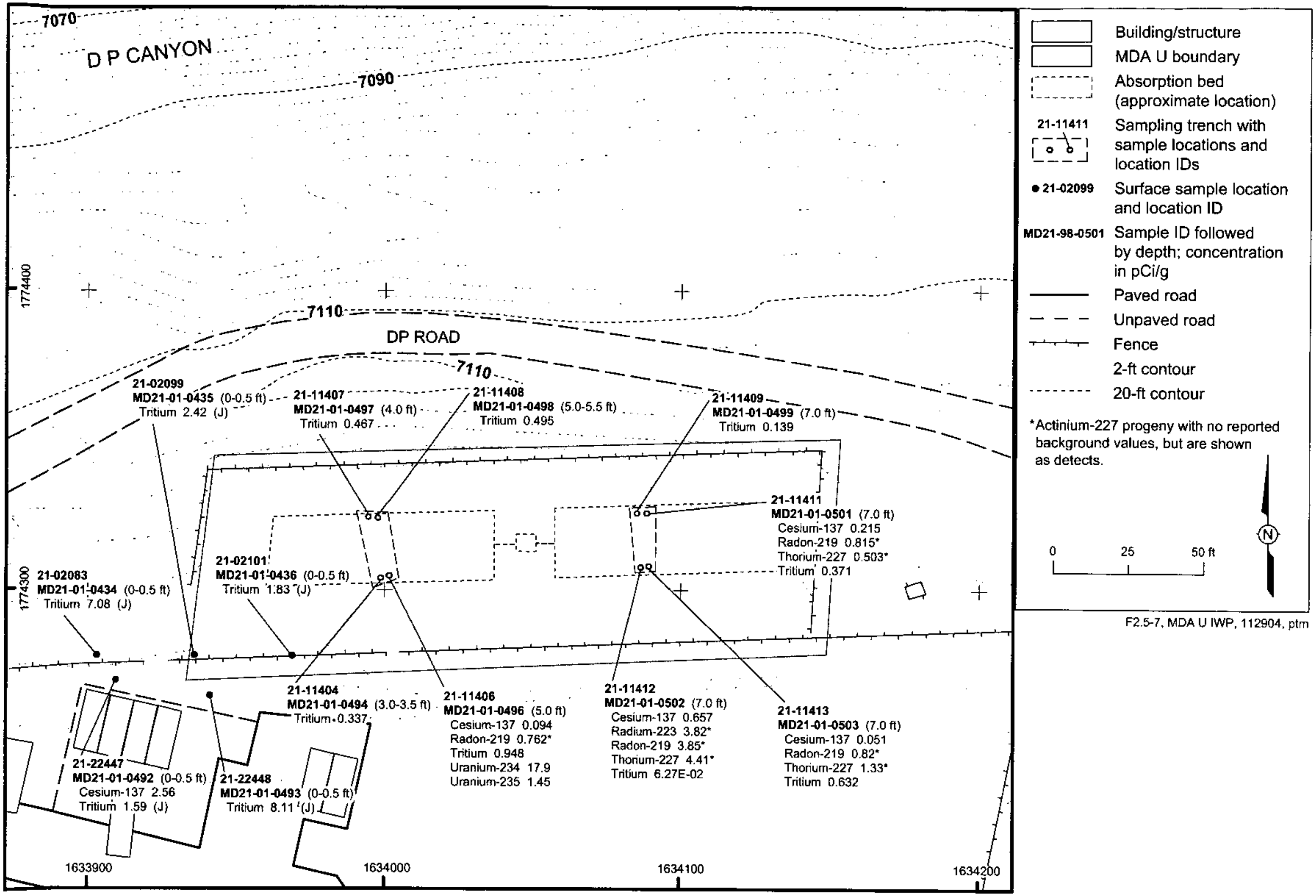


Figure 2.5-7. Radionuclides detected above background values/fallout values in 2001 surface soil and absorption bed sampling

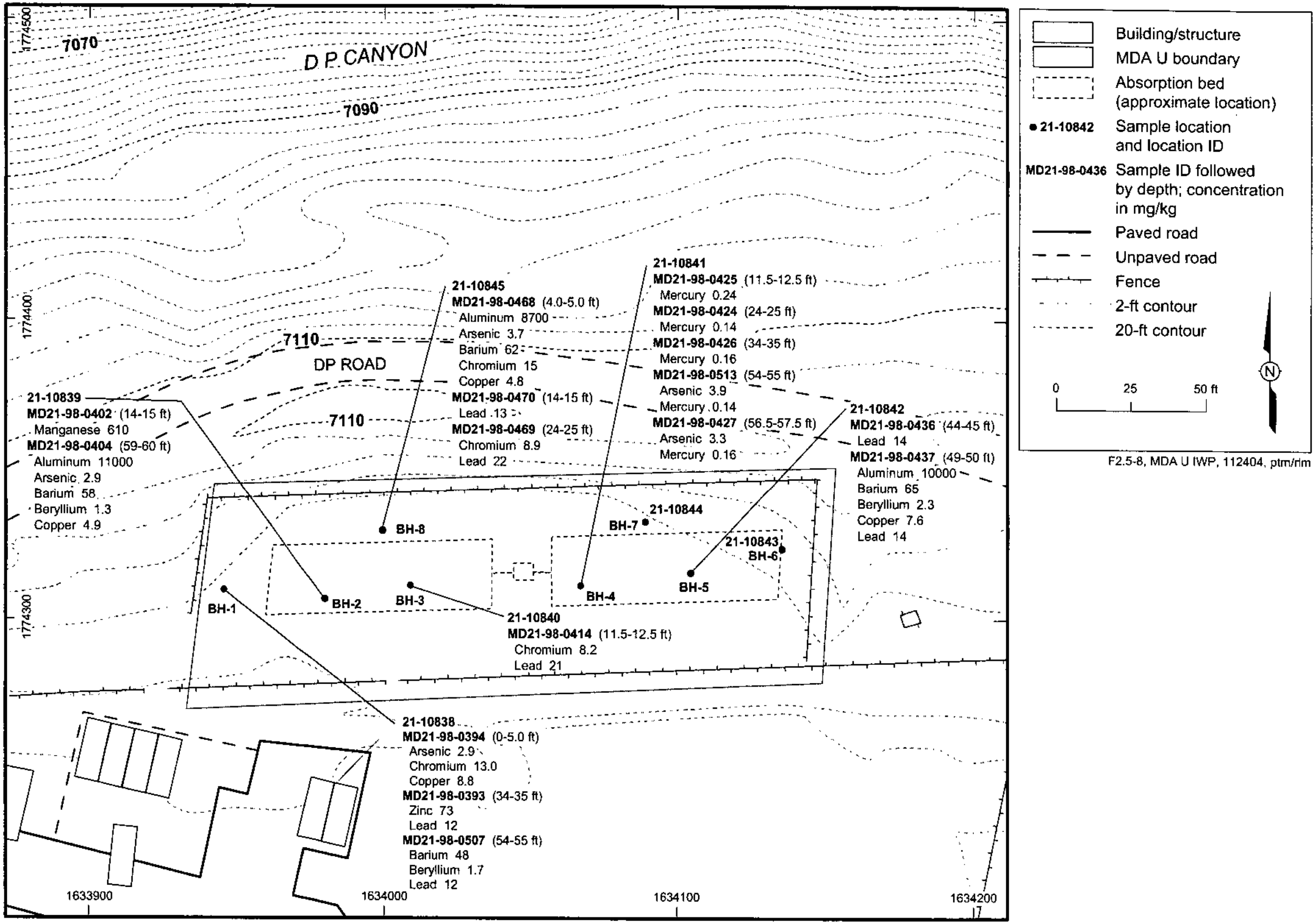


Figure 2.5-8. Inorganic chemicals above background values in 1998 borehole samples

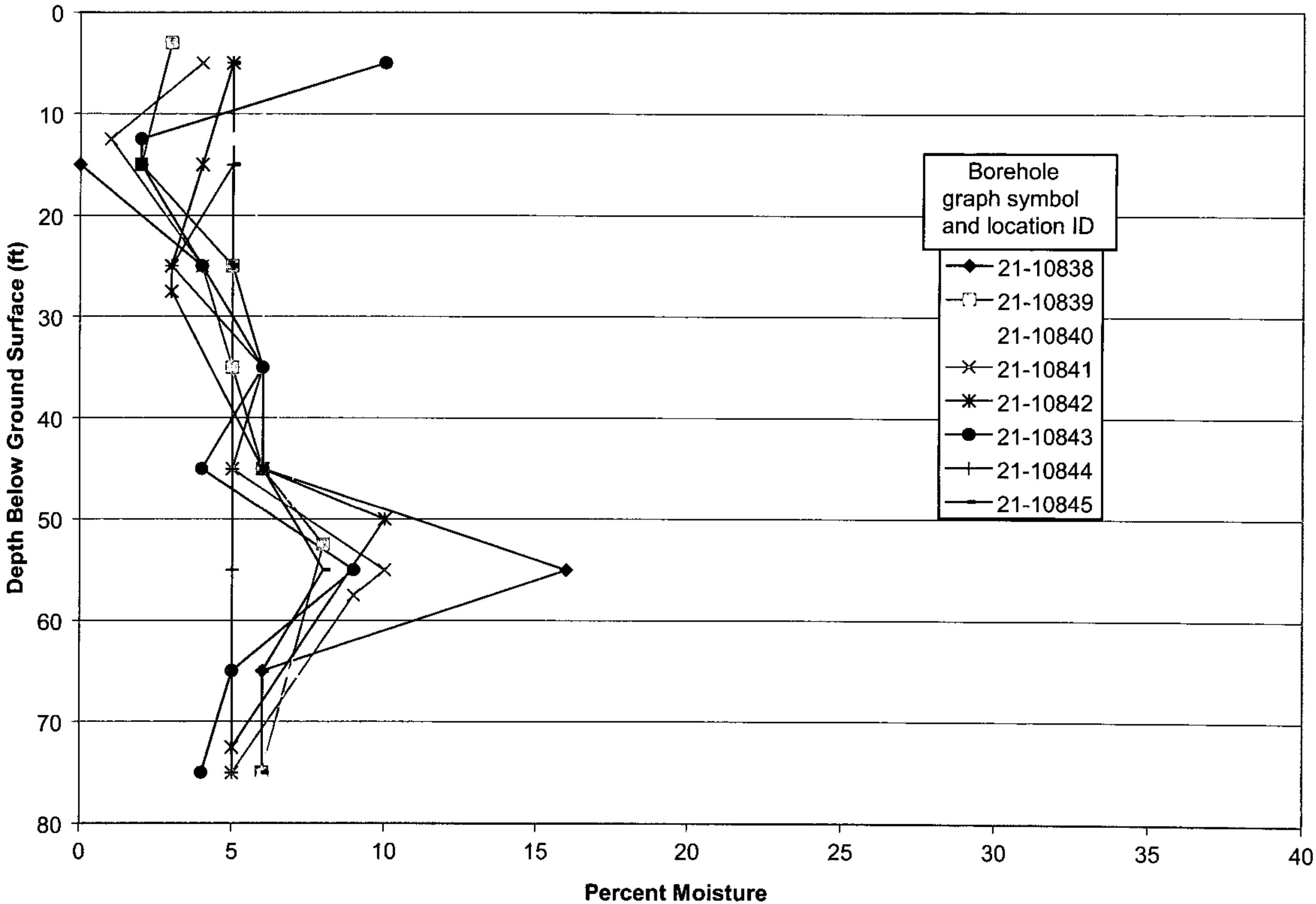


Figure 2.5-9. MDA U moisture profiles from 1998 borehole investigations

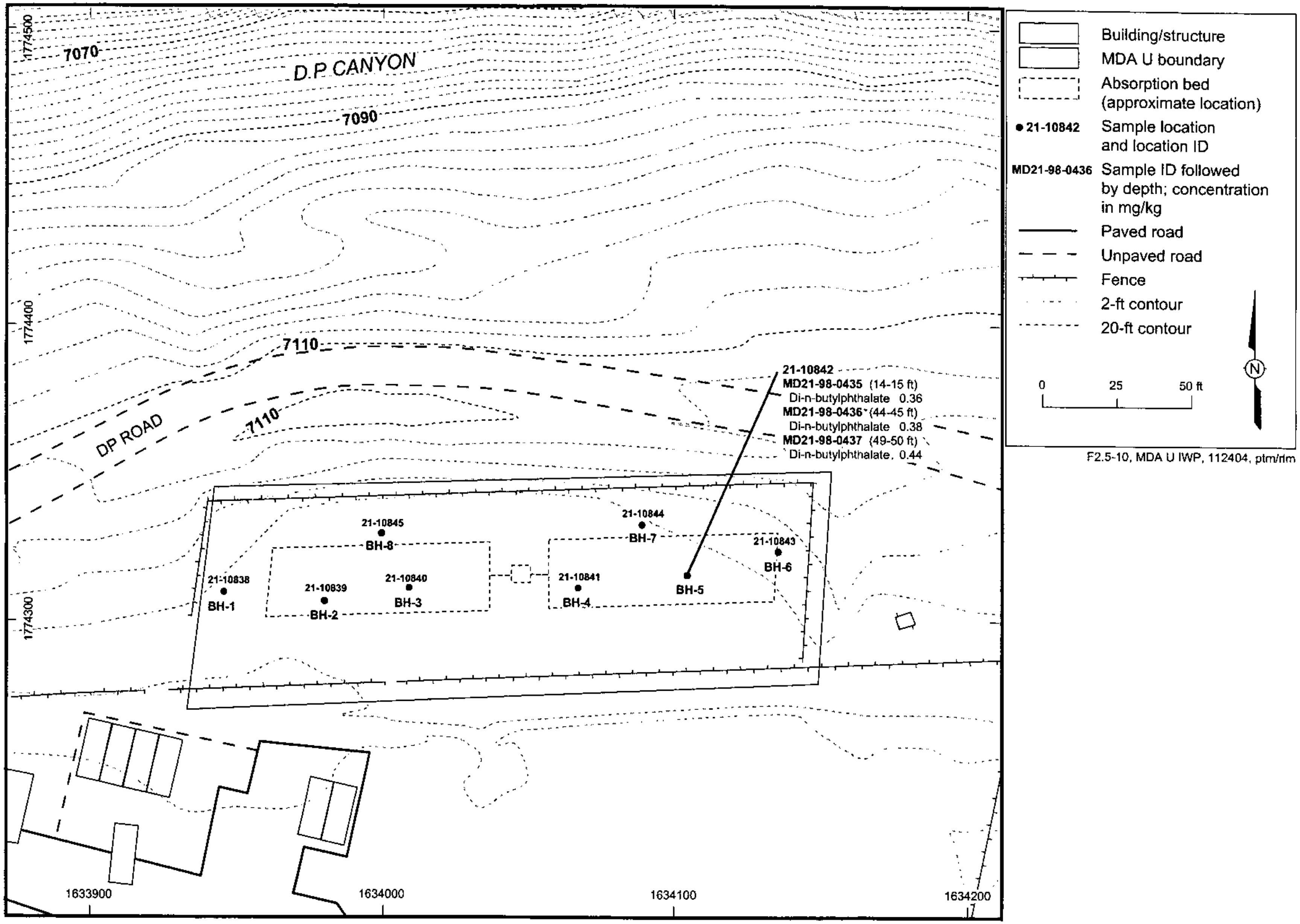


Figure 2.5-10. Organic chemicals detected in 1998 borehole samples

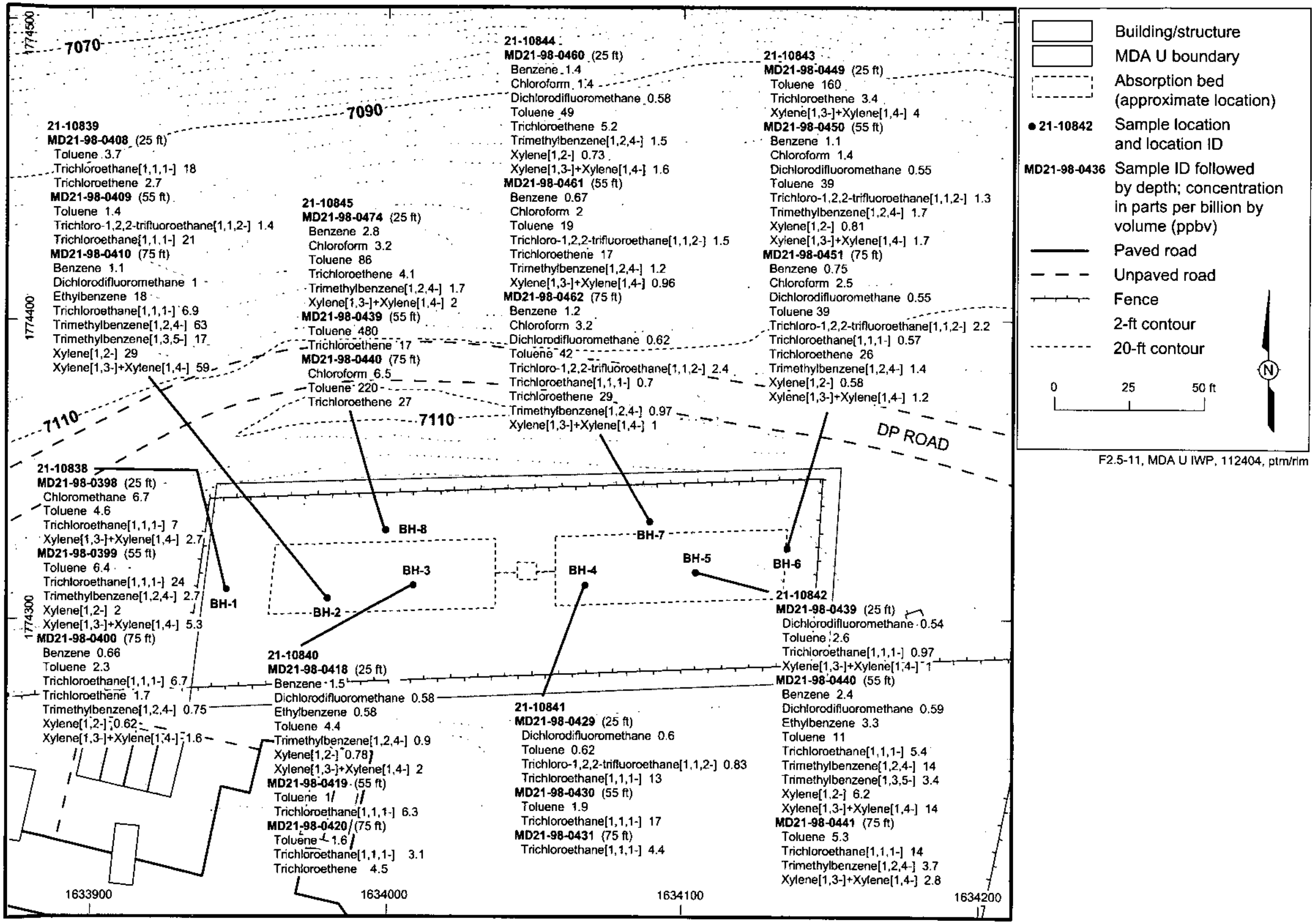
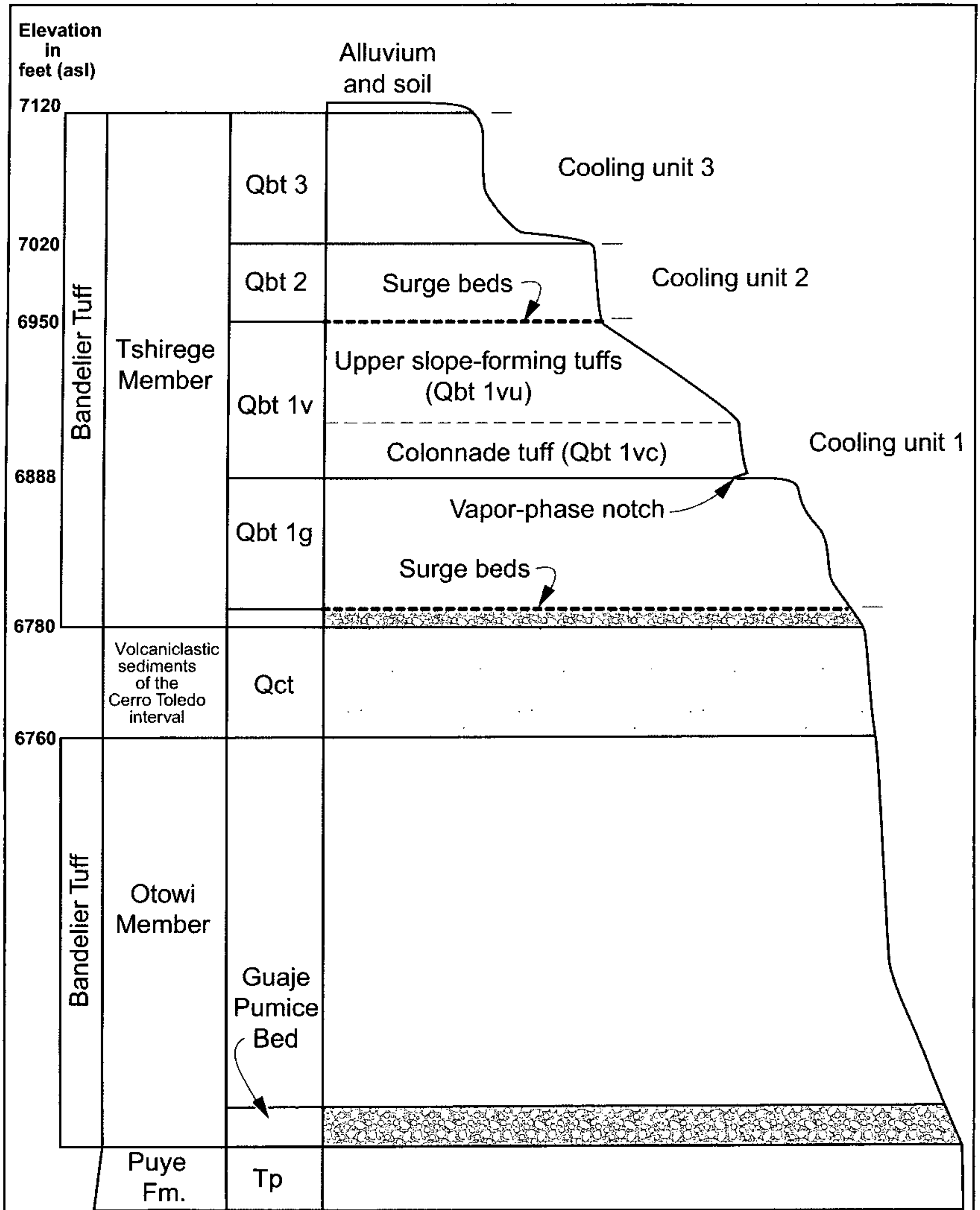


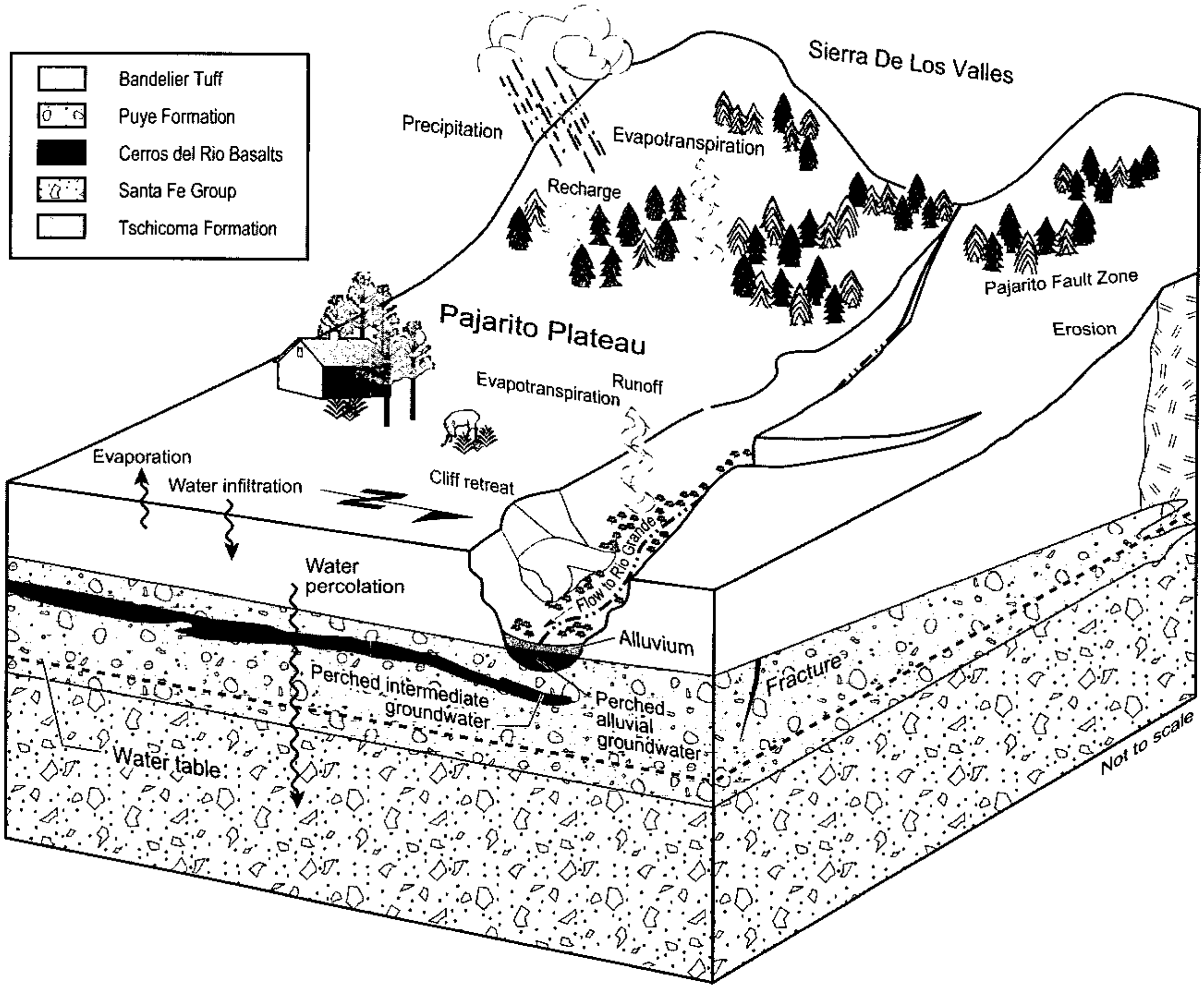
Figure 2.5-11 . Detected pore-gas results in 1998 borehole samples



Note: Elevations of contacts approximated from Stratigraphic Section 2 measured on the south side of DP Mesa. (Broxton and Eller 1995,58207.1)

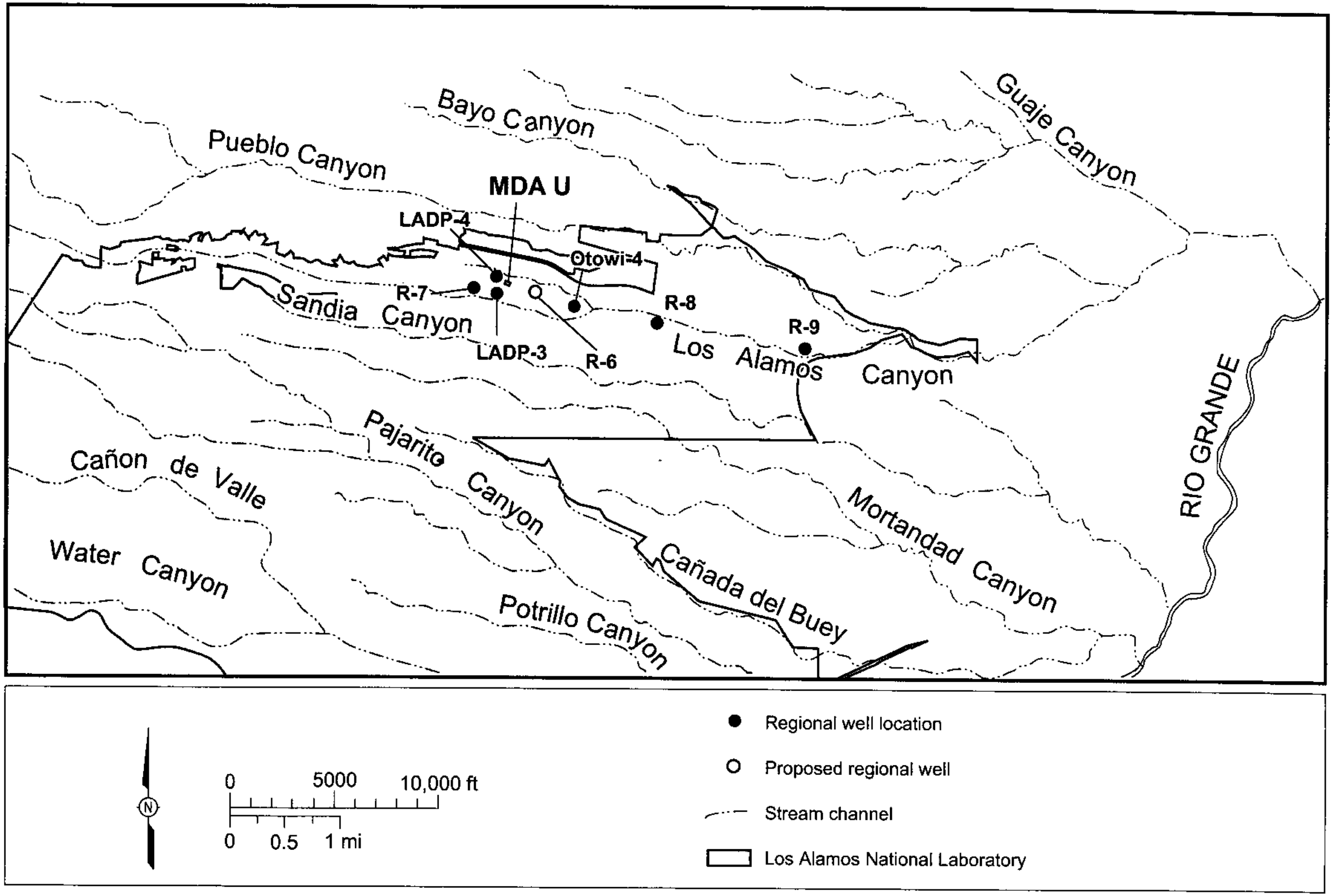
F3.2-1, MDA U IWP, 111004, ptm

Figure 3.2-1. Generalized stratigraphy under MDA U



Source: LANL 1998, 59599; F3.2-2, MDA U IWP, 112904, ptm

Figure 3.2-2. Schematic of the hydrogeologic conceptual model for the Pajarito Plateau



F3.2-3, MDA U IWP, 112404, ptm/rlm

Figure 3.2-3. Locations of wells drilled to the regional aquifer near MDA U

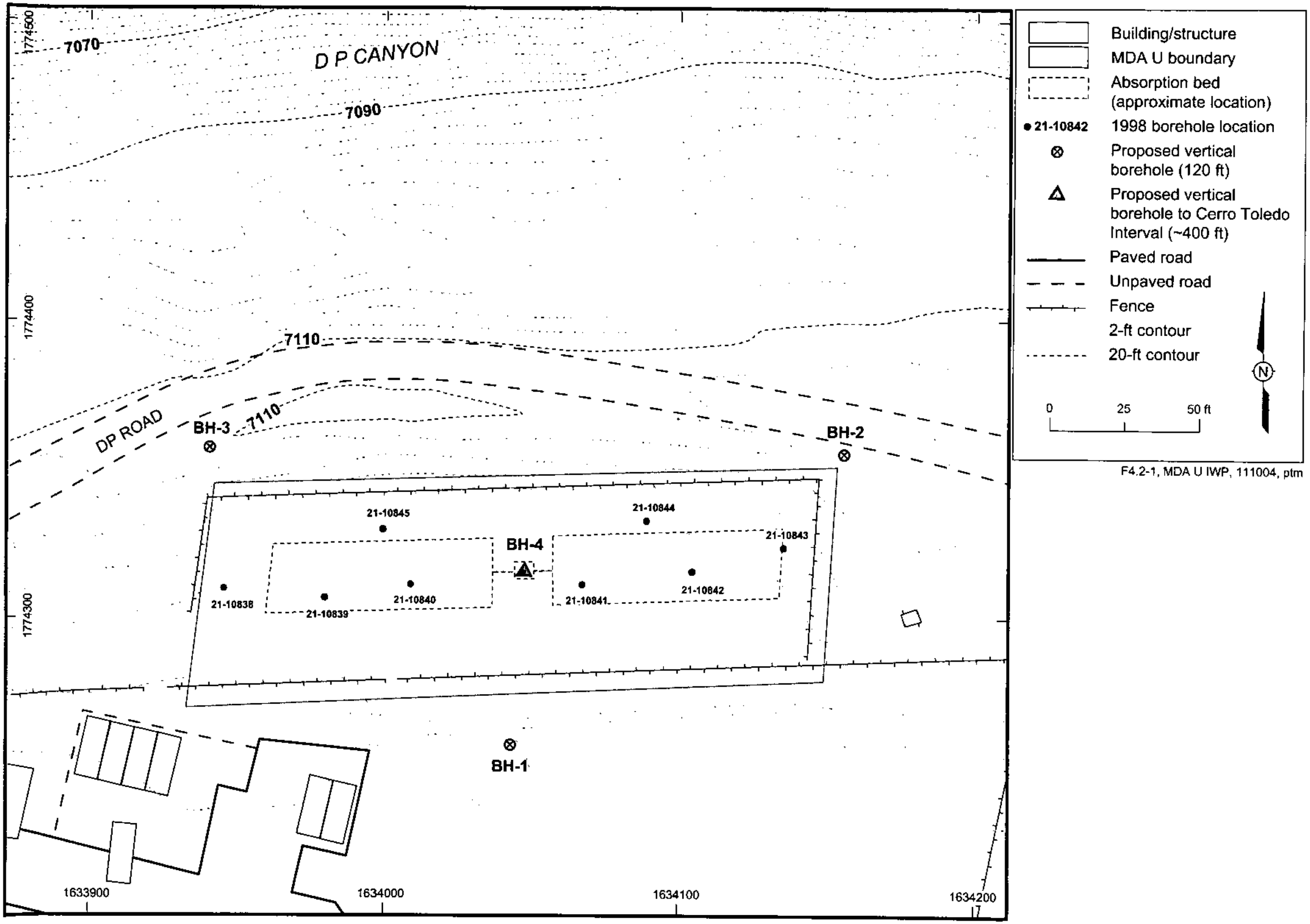
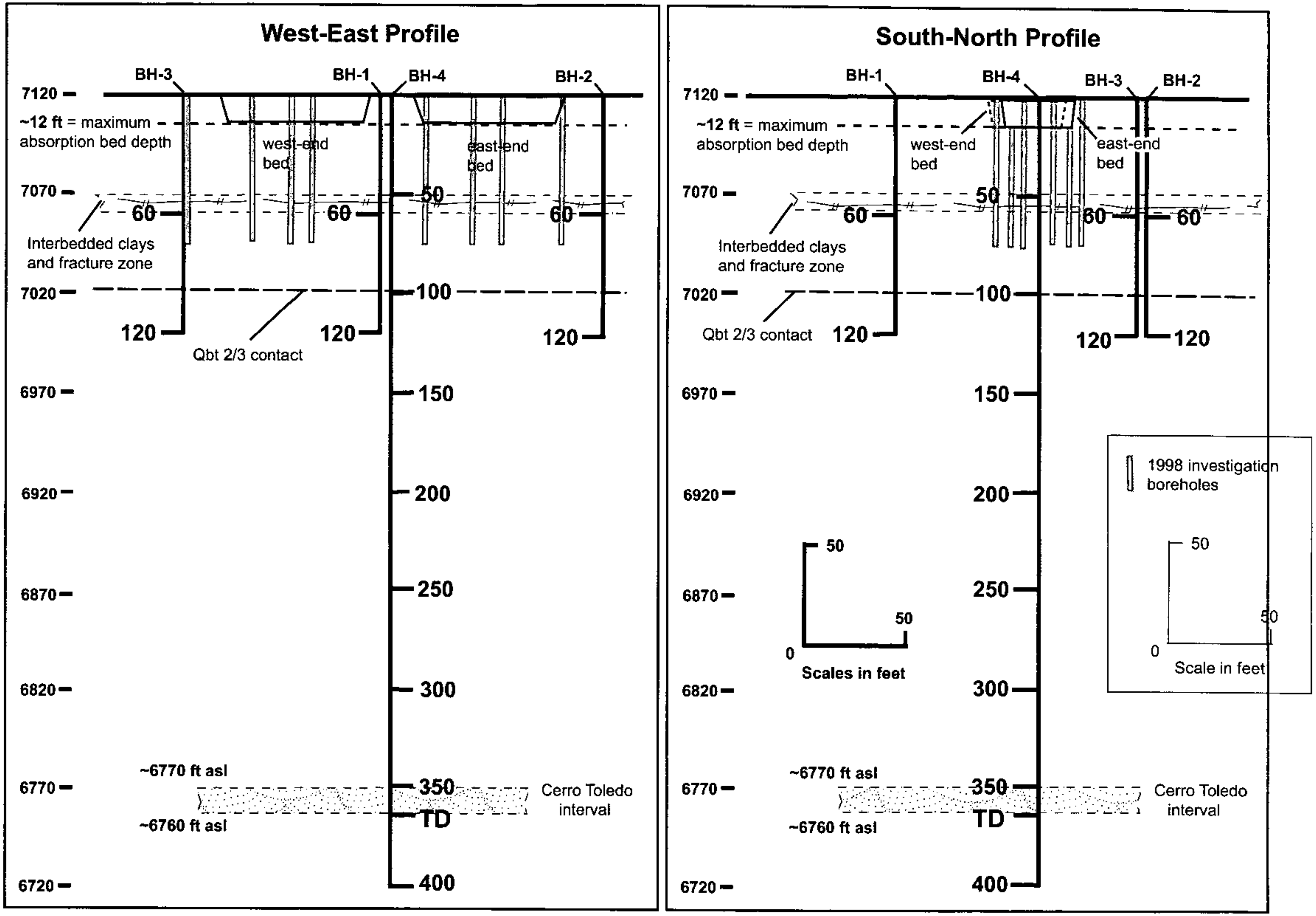


Figure 4.2-1. Proposed borehole locations at MDA U



F5.1-1, MDA U IWP, 112904, ptm

Figure 5.1-1. East-west and north-south profiles of the four proposed boreholes at MDA U

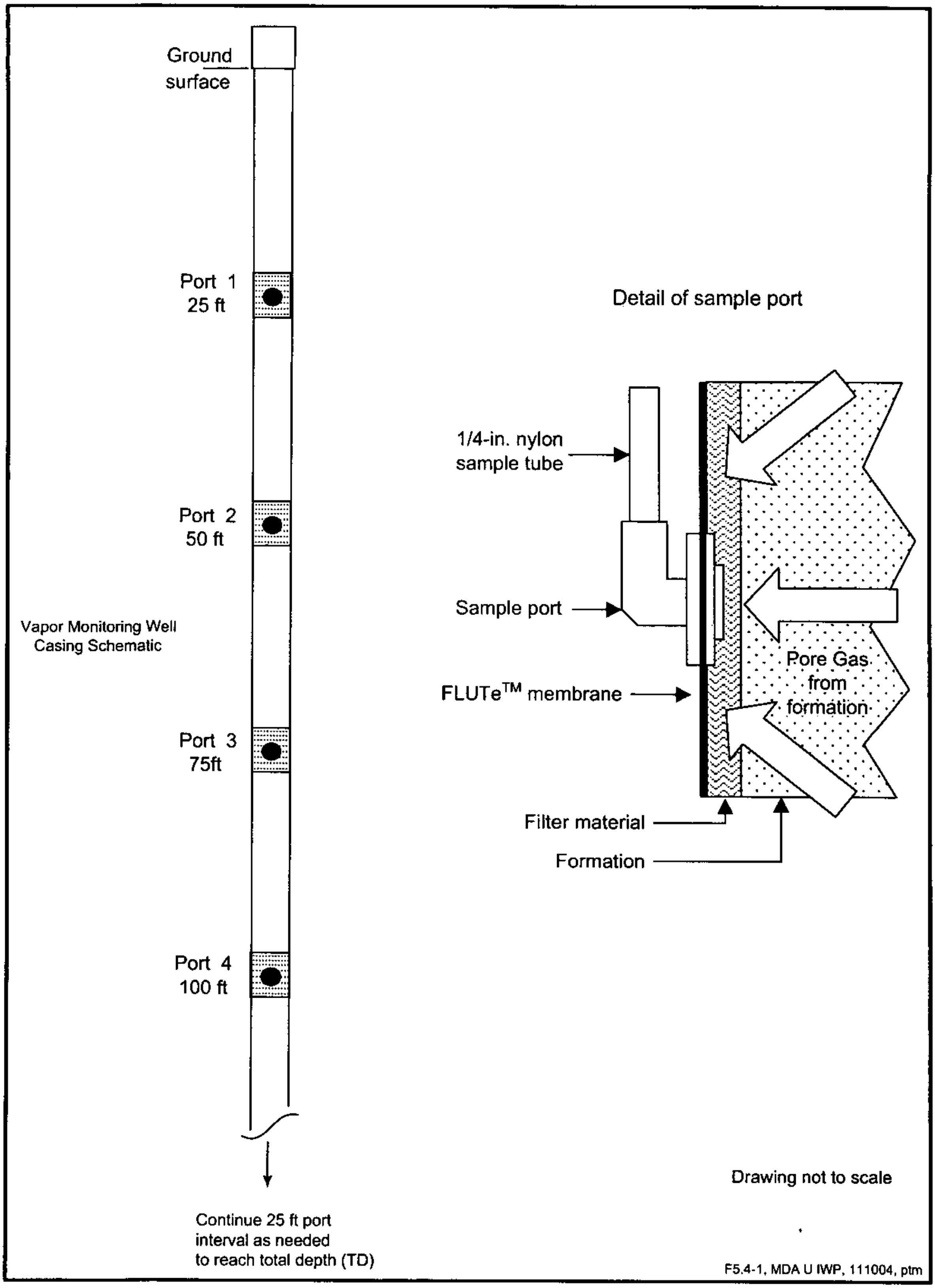


Figure 5.4-1. General diagram for construction of a vapor-monitoring borehole

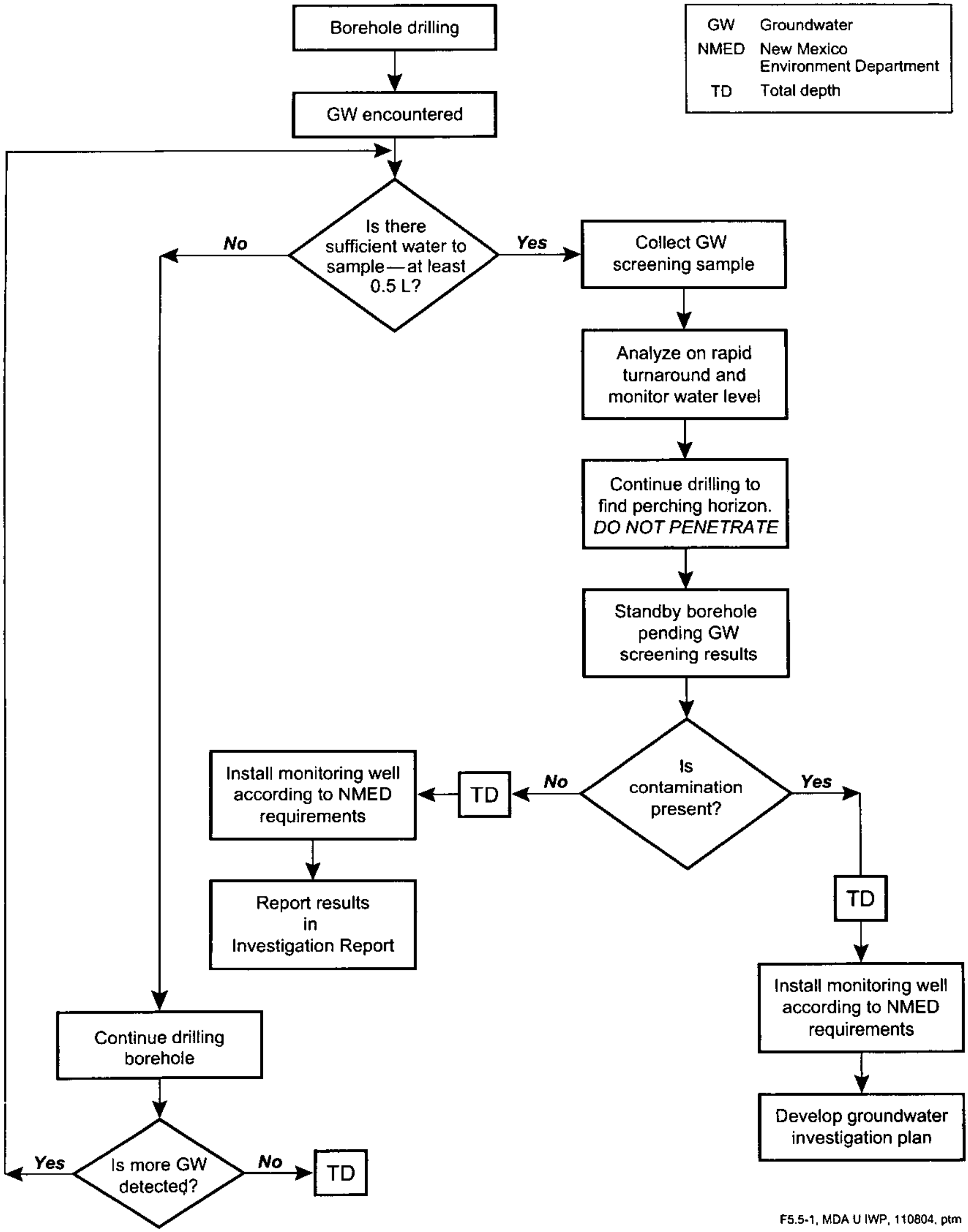


Figure 5.5-1. MDA U perched groundwater flow chart

Table 2.5-1
Frequency of Inorganic Chemicals above Background Values

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Background Value (mg/kg)	Frequency of Detects above Background Value	Frequency of Nondetects above Background Value	Industrial SSL[b] (mg/kg)
Aluminum	Soil	77	77	3410 to 61400	29200	8/77	0/77	100000
Aluminum	Sed	9	9	2210 to 7250	15400	0/9	0/9	100000
Aluminum	Qbt3	62	62	220 to 11000	7340	3/62	0/62	100000
Antimony	Soil	76	0	[0.21 to 29.9]	0.83	0/76	12/76	454
Antimony	Sed	9	0	[0.21 to 0.27]	0.83	0/9	0/9	454
Antimony	Qbt3	41	0	[10 to 11]	0.5	0/41	41/41	454
Arsenic	Soil	77	59	[0.2 to 74.8]	8.17	0/77	3/77	17.7
Arsenic	Sed	9	1	[1.4] to 2.6	3.98	0/9	0/9	17.7
Arsenic	Qbt3	62	60	1.1 to 3.9	2.79	5/62	0/62	17.7
Barium	Soil	77	77	49 to 527	295	8/77	0/77	78300
Barium	Sed	9	8	[41.2] to 105	127	0/9	0/9	78300
Barium	Qbt3	62	62	1.6 to 65	46	4/62	0/62	78300
Beryllium	Soil	77	9	[0.11] to 2.4	1.83	8/77	0/77	2250
Beryllium	Sed	9	0	[0.28 to 0.63]	1.31	0/9	0/9	2250
Beryllium	Qbt3	62	16	[0.5] to 2.3	1.21	3/62	0/62	2250
Cadmium	Soil	77	0	[0.06 to 2]	0.4	0/77	19/77	1128[c]
Cadmium	Sed	9	0	[0.41 to 0.98]	0.4	0/9	9/9	1128[c]
Cadmium	Qbt3	62	1	[0.5] to 1.2	1.63	0/62	0/62	1128[c]
Calcium	Soil	77	76	1150 to 9500	6120	4/77	0/77	N.A.[d]
Calcium	Sed	9	7	[925] to 2000	4420	0/9	0/9	N.A.
Calcium	Qbt3	62	62	200 to 1900	2200	0/62	0/62	N.A.
Chromium	Soil	77	76	[3.2] to 77.3	19.3	6/77	0/77	500
Chromium	Sed	9	9	4.8 to 53.2	10.5	8/9	0/9	500
Chromium	Qbt3	62	38	1 to 15	7.14	4/62	0/62	500
Cobalt	Soil	77	11	[1.6] to 11	8.64	1/77	0/77	20000
Cobalt	Sed	9	0	[2.2 to 6.7]	4.73	0/9	1/9	20000
Cobalt	Qbt3	62	18	0.69 to 2.6	3.14	0/62	0/62	20000
Copper	Soil	77	30	[1.7] to 84.3	14.7	4/77	0/77	45400
Copper	Sed	9	0	[1.8 to 5.5]	11.2	0/9	0/9	45400
Copper	Qbt3	57	37	[1] to 8.8	4.66	4/57	0/57	45400
Iron	Soil	77	77	1200 to 19500	21500	0/77	0/77	100000
Iron	Sed	9	9	3230 to 7900	13800	0/9	0/9	100000
Iron	Qbt3	62	62	860 to 7900	14500	0/62	0/62	100000
Lead	Soil	77	77	4.4 to 47.5	22.3	10/77	0/77	750
Lead	Sed	9	9	7.2 to 36	19.7	2/9	0/9	750

Table 2.5-1 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Background Value (mg/kg)	Frequency of Detects above Background Value	Frequency of Nondetects above Background Value	Industrial SSL[b] (mg/kg)
Lead	Qbt3	61	61	2.1 to 22	11.2	7/61	0/61	750
Lithium	Soil	11	8	21 to [29.9]	N.A.	8/11	n/a[e]	23000
Magnesium	Soil	77	68	[690] to 4200	4610	0/77	0/77	N.A.
Magnesium	Sed	9	2	[526] to 1410	2370	0/9	0/9	N.A.
Magnesium	Qbt3	62	62	64 to 1600	1690	0/62	0/62	N.A.
Manganese	Soil	77	77	144 to 734	671	1/77	0/77	21800
Manganese	Sed	9	9	199 to 478	543	0/9	0/9	21800
Manganese	Qbt3	61	61	71 to 610	482	1/61	0/61	21800
Mercury	Soil	114	45	[0.017] to 1.2	0.1	25/114	16/114	340
Mercury	Qbt3	62	5	[0.1] to 0.24	0.1	5/62	41/62	340
Molybdenum	Soil	11	0	[4 to 7.5]	N.A.	0/11	n/a	5680
Nickel	Soil	77	15	[2.8] to 27.9	15.4	1/77	0/77	22500
Nickel	Sed	9	0	[2.2 to 5.2]	9.38	0/9	0/9	22500
Nickel	Qbt3	62	12	[2] to 6.3	6.58	0/62	0/62	22500
Potassium	Soil	77	62	[574] to 28000	3460	8/77	0/77	N.A.
Potassium	Sed	9	0	[344 to 896]	2690	0/9	0/9	N.A.
Potassium	Qbt3	62	62	64 to 1100	3500	0/62	0/62	N.A.
Selenium	Soil	77	1	[0.2 to 74.8]	1.52	0/77	3/77	5680
Selenium	Sed	9	0	[0.62 to 0.76]	0.3	0/9	9/9	5680
Selenium	Qbt3	62	0	[0.52 to 1.2]	0.3	0/62	62/62	5680
Silver	Soil	77	1	[0.1 to 3]	1	1/77	10/77	5680
Silver	Sed	9	0	[2.1 to 2.5]	1	0/9	9/9	5680
Silver	Qbt3	62	0	[2 to 2.4]	1	0/62	62/62	5680
Sodium	Soil	77	17	[0.25] to 19000	915	14/77	0/77	N.A.
Sodium	Sed	9	0	[30.2 to 110]	1470	0/9	0/9	N.A.
Sodium	Qbt3	62	62	61 to 280	2770	0/62	0/62	N.A.
Strontium	Soil	11	11	11.8 to 151	n/a	11/11	N.A.	100000
Thallium	Soil	77	0	[0.21 to 74.8]	0.73	0/77	26/77	74.9
Thallium	Sed	9	0	[0.21 to 0.25]	0.73	0/9	0/9	74.9
Thallium	Qbt3	62	0	[0.25 to 2.2]	1.1	0/62	38/62	74.9
Uranium	Soil	76	76	0.957 to 37.5	1.82	50/76	0/76	200
Uranium	Sed	8	8	1.11 to 2.69	2.22	1/8	0/8	200
Vanadium	Soil	77	69	[7.9] to 48	39.6	2/77	0/77	7950
Vanadium	Sed	9	1	[6.2] to 15.7	19.7	0/9	0/9	7950
Vanadium	Qbt3	62	53	[0.52] to 10	17	0/62	0/62	7950
Zinc	Soil	77	77	18.1 to 509	48.8	19/77	0/77	100000

Table 2.5-1 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Background Value (mg/kg)	Frequency of Detects above Background Value	Frequency of Nondetects above Background Value	Industrial SSL[b] (mg/kg)
Zinc	Sed	9	9	18.5 to 72	60.2	1/9	0/9	100000
Zinc	Qbt3	62	62	9.4 to 73	63.5	1/62	0/62	100000

[a] Brackets indicate detection limits for nondetected results.

[b] SSLs are taken from NMED (2004, 85615) with the exception of chromium, lithium, and mercury, which are from EPA Region 6 (EPA 2003, 81724) and uranium, which is from EPA Region 9 (http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf)

[c] Calculated incorrectly in NMED 2004, 85615. Recalculated using NMED equation and parameters.

[d] N.A. = Not available.

[e] n/a = Not applicable.

Table 2.5-2
Frequency of Detected Organic Chemicals

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Frequency of Detects	Industrial SSL[b] (mg/kg)
Acenaphthene	Soil	70	1	[0.33 to 0.46]	1/70	34800
Anthracene	Soil	70	1	[0.33] to 0.88	1/70	100,000
Benz(a)anthracene	Soil	70	2	[0.33] to 0.66	2/70	23.4
Benz(a)anthracene	Sed	9	1	[0.34 to 0.46]	1/9	23.4
Benzo(a)pyrene	Soil	70	2	[0.33] to 0.81	2/70	2.34
Benzo(b)fluoranthene	Soil	70	3	[0.33] to 0.61	3/70	23.4
Benzo(g,h,i)perylene	Soil	70	1	[0.33] to 0.62	1/70	31300[c]
Benzo(k)fluoranthene	Soil	70	1	[0.33] to 0.72	1/70	234
Chrysene	Soil	70	2	[0.33] to 0.73	2/70	2340
Chrysene	Sed	9	1	[0.34 to 0.46]	1/9	2340
3,3'-Dichlorobenzidine	Sed	9	1	[0.34 to 0.46]	1/9	42.6
Diethylphthalate	Soil	70	1	[0.33] to 8.1	1/70	100000
Di-n-butylphthalate	Qbt3	62	3	[0.33] to 0.44	3/62	68400
Fluoranthene	Soil	70	3	[0.33] to 2.9	3/70	24400
Fluoranthene	Sed	9	1	[0.34] to 1.4	1/9	24400
Fluorene	Soil	70	1	[0.33 to 0.46]	1/70	29400
Indeno(1,2,3-cd)pyrene	Soil	70	1	[0.33] to 0.56	1/70	23.4
Phenanthrene	Soil	70	3	[0.33] to 2.9	3/70	20500
Phenanthrene	Sed	9	1	[0.34] to 1.5	1/9	20500
Pyrene	Soil	70	3	[0.33] to 1.8	3/70	31300
Pyrene	Sed	9	1	[0.34] to 0.99	1/9	31300

[a] Brackets indicate detection limits for nondetected results.

[b] SSLs are taken from NMED (2004, 85615).

[c] Pyrene is used as a surrogate for benzo(g,h,I)perylene based on structural similarity.

Table 2.5-3
Frequency of Detected Radionuclides above Background Value/Fallout Values

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (pCi/g)	Background/ Fallout Value (pCi/g)	Frequency of Detects above Background/ Fallout Value	Industrial SAL[b] (pCi/g)
Americium-241	Soil	80	7	[-0.4599] to 0.84	0.013	7/80	140.3
Americium-241	Sed	2	0	[0.01 to 0.06]	0.04	0/2	140.3
Americium-241	Qbt3	66	6	[-0.0108] to 0.046	n/a[c]	6/66	140.3
Cesium-134	Soil	27	0	[-0.075 to 0.083]	N.A.[d]	0/27	8.3
Cesium-134	Sed	2	0	[-0.004 to 0.044]	N.A.	0/2	8.3
Cesium-134	Qbt3	66	0	[-0.068 to 0.086]	n/a	0/66	8.3
Cesium-137	Soil	59	50	[-0.012] to 2.779	1.65	7/59	19.7
Cesium-137	Sed	7	7	0.212 to 0.5228	0.9	0/7	19.7
Cesium-137	Qbt3	66	0	[-0.061 to 0.16]	n/a	0/66	19.7
Cobalt-60	Soil	27	0	[-0.136 to 0.074]	N.A.	0/27	4.4
Cobalt-60	Sed	2	0	[-0.003 to 0.008]	N.A.	0/2	4.4
Cobalt-60	Qbt3	66	0	[-0.072 to 0.092]	n/a	0/66	4.4
Europium-152	Soil	27	0	[-0.27 to 0.11]	N.A.	0/27	9.7
Europium-152	Sed	2	0	[-0.06 to –0.017]	N.A.	0/2	9.7
Europium-152	Qbt3	66	0	[-0.17 to 0.22]	n/a	0/66	9.7
Plutonium-238	Soil	76	30	[-0.001] to 0.066	0.023	7/76	176.4
Plutonium-238	Sed	9	2	[-0.0004] to 2.516	0.006	2/9	176.4
Plutonium-238	Qbt3	66	1	[-0.0145] to 0.0291	n/a	1/66	176.4
Plutonium-239	Soil	76	67	[-0.0006] to 3.095	0.054	61/76	158.9
Plutonium-239	Sed	9	9	0.0226 to 4.136	0.068	7/9	158.9
Plutonium-239	Qbt3	66	7	[-0.0065] to 0.291	n/a	7/66	158.9
Radium-223	Soil	1	1	3.82 to 3.82	N.A.	1/1	N.A.
Radium-223	Qbt3	1	1	2.3 to 2.3	n/a	1/1	N.A.
Radon-219	Soil	4	4	0.762 to 3.85	N.A.	4/4	N.A.
Ruthenium-106	Soil	27	0	[-0.38 to 0.75]	N.A.	0/27	71.0
Ruthenium-106	Sed	2	0	[-0.18 to 0.05]	N.A.	0/2	71.0
Ruthenium-106	Qbt3	66	0	[-0.77 to 0.45]	n/a	0/66	71.0
Sodium-22	Soil	27	0	[-0.086 to 0.089]	N.A.	0/27	5.5
Sodium-22	Sed	2	0	[0.006 to 0.011]	N.A.	0/2	5.5
Sodium-22	Qbt3	66	0	[-0.118 to 0.072]	n/a	0/66	5.5
Strontium-90	Soil	77	14	[-0.3] to 2.96	1.31	3/77	1615
Strontium-90	Sed	9	4	[0.04] to 0.86	1.04	0/9	1615
Strontium-90	Qbt3	66	0	[-0.27 to 0.47]	n/a	0/66	1615
Thorium-227	Soil	3	3	0.503 to 4.41	N.A.	3/3	N.A.
Thorium-227	Qbt3	1	1	2.33 to 2.33	N.A.	1/1	N.A.

Table 2.5-3 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (pCi/g)	Background/ Fallout Value (pCi/g)	Frequency of Detects above Background/ Fallout Value	Industrial SAL[b] (pCi/g)
Thorium-228	Soil	5	1	1.43 to [5.569]	2.28	0/5	7.2
Thorium-230	Soil	1	1	1.3 to 1.3	2.29	0/1	15.1
Thorium-232	Soil	1	1	1.3 to 1.3	2.33	0/1	3.8
Tritium	Soil	90	90	0.063 to 8.11	n/a	90/90	15140
Tritium	Sed	9	8	[0.006] to 0.257	0.093	5/9	15140
Tritium	Qbt3	66	63	[0.01] to 2.37	n/a	63/66	15140
Uranium-234	Soil	28	28	0.549 to 17.9	2.59	2/28	1087
Uranium-234	Sed	2	2	0.978 to 1.249	2.59	0/2	1087
Uranium-234	Qbt3	66	66	0.575 to 22.5	1.98	13/66	1087
Uranium-235	Soil	58	39	[0.022] to 1.45	0.2	11/58	73.1
Uranium-235	Sed	2	2	0.073 to 0.083	0.2	0/2	73.1
Uranium-235	Qbt3	66	66	0.0232 to 1.229	0.09	15/66	73.1
Uranium-238	Soil	28	28	0.433 to 1.7	2.29	0/28	351.1
Uranium-238	Sed	2	2	0.799 to 0.802	2.29	0/2	351.1
Uranium-238	Qbt3	66	66	0.579 to 1.129	1.93	0/66	351.1

[a] Brackets indicate detection limits for nondetected results.

[b] SALs derived using RESRAD version 6.21.

[c] n/a = Not applicable.

[d] N.A. = Not available

Table 2.5-4
Summary of Detected Organic Chemicals in Pore-Gas Samples

Analyte	Number of Analyses	Number of Detects	Concentration Range* (ppbv)
Ethylbenzene	24	3	[0.5] to 18
1,3,5-Trimethylbenzene	24	2	[0.5] to 17
Toluene	24	22	0.62 to 480
Chloroform	24	7	[0.5] to 6.5
Benzene	24	10	[0.5 to 5.4]
1,1,1-Trichloroethane	24	16	[0.52] to 24
Chloromethane	24	1	[1.2 to 14]
Dichlorodifluoromethane	24	9	0.54 to [5.4]
1,1,2-Trichloro-1,2,2-trifluoroethane	24	6	[0.52 to 5.4]
Trichloroethene	24	11	[0.5] to 29
1,2-Xylene	24	8	[0.5] to 29
1,2,4-Trimethylbenzene	24	12	[0.5] to 63
1,3-Xylene+1,4-Xylene	24	15	[0.5] to 59

*Brackets indicate detection limits for nondetected results.

Table 4.0-1

Crosswalk between NMED Proposed Consent Order (September 2004) and LANL Response for Investigation Activities at MDA U

No.	Media or Sample Type	NMED Proposed Consent Order Requirements	LANL Response	Justification for Response
1	Disposal Units	**IV.C2.f.ii MDA U Survey of Disposal Units** The dimensions and base elevations of each trench, absorption bed, pit, shaft, and other disposal units at MDA U shall be determined using as-built construction drawings and boring logs.	Specification has been satisfied by previous work.	A combination of design criteria, engineering drawings, borehole logs, trenching, and survey data (corner markers) are available for constraining the depths and lateral extent of the absorption beds, which have been partially remediated.
2	Drilling Explorations	**Section IV.C.2.f.iii MDA U Drilling Explorations** The Respondents shall conduct subsurface explorations in order to obtain sufficient data to characterize the extent of contamination and to characterize fracture density, fracture orientation, and fracture fill material or the absence of fracture fill material at MDA U. The fracture characterization of the rock formations underlying MDA U shall be completed utilizing data acquired from outcrops, cores, and downhole geophysical and video log data. A discussion of the sampling methods and potential locations for collecting rock fracture data shall be included within the required Investigation Work Plan for MDA U. The Department, prior to field investigation and data collection activities, shall approve the methods and locations for the fracture investigation activities.	Specification has been satisfied by previous work to provide both local and mesa-wide fracture characterization. Four more boreholes are currently being proposed. These will provide further fracture characterization at MDA U.	A fracture characterization study was conducted for TA-21 (Broxton and Eller 1995, 58207). In 1998, eight 75-ft boreholes were logged for fractures and samples of fracture fill material were collected (LANL 2004, 87454, Section 2.2-5).

Table 4.0-1 (continued)

No.	Media or Sample Type	NMED Compliance Order Requirements	LANL Response	Justification for Response
3	Drilling Explorations	**IV.C2.f.iii MDA U Drilling Explorations** Twelve (12) borings, or the number defined in the Department-approved MDA U Investigation Work Plan, shall be advanced, using hollow-stem auger drilling methods where practical or by other drilling methods approved by the Department. Three of the borings shall be advanced to the base of the Cerro Toledo interval. All borings shall be drilled in accordance with Section X.B of this Consent Order. The Department, prior to drilling, approve the location of the borings and the drilling method.	LANL proposes drilling a total of four new boreholes. These additional boreholes, coupled with previous investigation information, comply with the drilling requirements. (1) LANL proposes drilling a single new borehole to the Cerro Toledo interval. (2) LANL proposes drilling three new shallow (~100–120 ft bgs) boreholes to bound subsurface detections of tritium and to bound laterally contaminant distribution in the clay-interbed zone.	(1) Justifications: ▪ In 1998, eight 75-ft boreholes were installed at MDA U. ▪ MDA U is of limited areal extent (0.2 acre). ▪ The MDA T work plan proposes three boreholes to the Cerro Toledo interval. ▪ The MDA A work plan proposes a single borehole to the Cerro Toledo interval. The above distribution of boreholes to the Cerro Toledo interval is sufficient for the area of DP Mesa at TA-21. (2) In 1998, eight boreholes were drilled to 75 ft bgs using hollow-stem auger drilling methods. The eight borings partially satisfy the intent of the proposed Consent Order. Two were downgradient of the beds, four were within the beds, and two were outside the beds. No MDA U borings have been drilled to the base of Cerro Toledo interval.
4	Drilling Explorations	Selected boreholes, as specified in the Department-approved work plan, shall be characterized using geophysical logging techniques approved by the Department.	No deviation. Borehole to Cerro Toledo interval will be logged with geophysics tools.	n/a*
5	Drilling Explorations	A monitoring well(s) shall be installed if groundwater (perched or regional) is encountered during drilling activities or if geophysical results indicate possible zone(s) of saturation. The wells shall be constructed in accordance with Section X of this Consent Order.	No deviation. If saturated zones are encountered in any of the four proposed boreholes, monitoring wells will be completed.	n/a

Table 4.0-1 (continued)

No.	Media or Sample Type	NMED Compliance Order Requirements	LANL Response	Justification for Response
6	Drilling Explorations	Vapor monitoring wells shall be installed in the borings if vapor-phase contamination is detected during drilling activities.	No deviation. Pore-gas samples are proposed to be collected at two depths at each proposed borehole. If air-rotary drilling is used, two rounds of samples will be collected; otherwise, only one sample will be taken. After reviewing the results, the investigation team will decide whether to install a pore-gas monitoring well.	n/a
7	Drilling Explorations	All borings not completed as monitoring wells (vapor or groundwater monitoring wells) shall be properly plugged and abandoned. Documentation of proper well abandonment shall be submitted to the Department within 30 days of abandonment.	No deviation. Proposed boreholes will be plugged and abandoned if they are not completed as monitoring wells.	n/a
8	Sampling, soil and rock	**IV.C.2.f.iv MDA U Soil and Rock Sampling** Soil samples shall be collected continuously for the first 40 ft and at ten-ft intervals thereafter.	Continuous core samples will be collected from each borehole.	The collection of continuous core provides better stratigraphic data than the collection of samples at discrete intervals.
9	Sampling, soil and rock	Samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.	Samples will be visually inspected, screened for VOCs, and screened for radiological contamination.	n/a
10	Sampling, soil and rock	A minimum of one core sample from the tuff overlying the Cerro Toledo shall be collected and submitted for laboratory permeability testing in accordance with Section IX.B of this Consent Order.	No deviation. A sample will be collected from the one borehole drilled to the Cerro Toledo interval.	n/a

Table 4.0-1 (continued)

No.	Media or Sample Type	NMED Compliance Order Requirements	LANL Response	Justification for Response
11	Sampling, soil and rock	Field screening and laboratory sample selection shall be biased toward evidence of contamination, lithologic contacts, fractures, fracture fill material, surge beds, and other higher permeability units identified during investigation activities. The samples shall be collected and screened in accordance with the methods described in Section IX.B of this Consent Order.	The following field indicators will be used to bias sample collection: evidence of contamination (for example, staining, elevated radioactivity or organic vapor screening results); lithologic contacts; structural features; elevated moisture content; fractures; fracture-fill material; surge beds; or a higher permeability unit.	Sample selection criteria will be based on field indicators and screening results. Radionuclides are a primary contaminant of concern. Radiological screening is the best method for directing sampling efforts.
12	Sampling, soil and rock	Sediment, soil, and rock samples shall be obtained from each boring at the intervals described in Paragraph 1 above and from the bedrock directly below the base elevation of each absorption bed or shaft. A sample also shall be obtained at the maximum depth of each boring.	No deviation.	n/a
13	Sampling, soil and rock	A minimum of four samples shall be selected from each boring for submittal to a laboratory for analysis of VOCs, SVOCs, explosive compounds, pH, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, and cyanide. The sample exhibiting the highest field screening detection; the sample obtained from the maximum depth in each boring that displays field screening evidence of contamination; the sample located immediately below the base of any pit, tank, or other structure; and the sample from the total boring depth shall be submitted for laboratory analysis. The Department may require that additional samples, collected from the borings, be submitted for laboratory analyses.	The proposed boreholes will be analyzed for the full suite as outlined in the proposed Consent Order, with the exception of dioxins, furans, and high explosives (HE). Actinium-227 progeny will be analyzed for by alpha spectroscopy.	Historical records, process knowledge, and site interviews report ▪ No evidence for HEs at DP Mesa. ▪ Dioxins and furans are created when products such as herbicides are made. They are also created in the pulp and paper industry from a process that bleaches the wood pulp. In addition, they can be produced when products are burned. None of these processes were associated with MDA U. Gamma spectroscopy is not adequate for actinium-227 progeny analysis; alpha spectroscopy is a better tool.

Table 4.0-1 (continued)

No.	Media or Sample Type	NMED Compliance Order Requirements	LANL Response	Justification for Response
14	Sampling, sediment	**IV.C.2.f.v MDA U Sediment Sampling** The Respondents shall investigate contaminant transport from MDA U to canyon alluvial sediments through the implementation of the Work Plan for Los Alamos and Pueblo Canyons, dated November 1995, and the addendum to the Work Plan, dated February 2002, as described in Section IV.B.1.b.i of this Consent Order.	No deviation.	n/a
15	Vapor Monitoring	**IV.C.2.f.vi MDA U Vapor Monitoring** (1) Subsurface vapor samples shall be collected from all newly drilled borings during site investigation activities. (2) An investigation vapor monitoring and sampling plan shall be prepared in accordance with the format described in Section XI.B of this Consent Order and submitted by the Respondents to the Department for approval. (3) Subsurface vapor sampling shall be conducted at MDA U in each existing and newly constructed vapor well and boring specified in the approved work plan. (4) Samples of subsurface vapors shall be collected by the Respondents from subsurface vapor monitoring points at discrete zones selected, based on investigation and monitoring results. The monitoring points must be approved by the Department prior to sample collection.	No deviation. Pore-gas samples are proposed to be collected at two depths at each proposed borehole. If air-rotary drilling is used, two rounds of samples will be collected; otherwise, only one sample will be taken. After review of the pore-gas results, the investigation team will decide whether to install a pore-gas monitoring well.	n/a
16	Intermediate Groundwater	**IV.C.2.f.vii MDA U Intermediate Groundwater Well Installation** If intermediate zone groundwater is encountered or if geophysical or other evidence suggests the presence of intermediate perched groundwater during the required subsurface investigations for MDA U, the Department will require a work plan for the installation of intermediate groundwater monitoring well(s).	No deviation. If intermediate perched saturated zones are encountered in the deep borehole (BH-4), then the appropriate intervals will be screened and targeted.	n/a

Table 4.0-1 (continued)

No.	Media or Sample Type	NMED Compliance Order Requirements	LANL Response	Justification for Response
17	Regional Groundwater	**IV.C.2.f.viii MDA U Regional Groundwater Well Installation** If the Department determines the need for additional wells intersecting the regional groundwater aquifer associated with TA-21 based on investigation data, the Respondents shall submit to the Department for review and written approval a work plan for the installation of such wells.	Regional groundwater well installation is not proposed in this work plan. Regional well R-6 is located approximately 2000 ft east of MDA U and should be completed by December 2004.	Regional groundwater well installation is covered by the Laboratory's hydrogeologic workplan. (LANL 1998, 59599)
18	Groundwater Monitoring	**IV.C.2.f.ix MDA U Groundwater Monitoring** The Respondents shall monitor and sample all wells specified below containing alluvial, intermediate, and regional groundwater in accordance with the Interim Plan approved by the Department under Section IV.A.3.b that meets the requirements listed below, subject to procedures in Section III.M of this Consent Order.	Groundwater monitoring is not proposed in this work plan. Regional well R-6 is located approximately 2000 ft east of MDA U and should be completed by December 2004.	Groundwater monitoring will be conducted in accordance with a facility-wide groundwater monitoring plan as required by Section IV.A.3 of the proposed Consent Order.

*n/a = Not applicable

Table 4.1-1
Analytical Suites for Proposed Samples at MDA U

Location//Issue Addressed	Location	Geologic Units Anticipated	VOCs[a]	SVOCs	TAL Metals	Perchlorate	Cyanide	PCBs	Nitrate	Geotechnical Properties	Gamma Spectroscopy	Alpha Spectroscopy[b]	Americium-241	Isotopic Plutonium	Isotopic Uranium	Strontium-90	Tritium	Pore Gas VOCs	Pore Gas Tritium
BH-4: Vertical bounds of absorption bed contamination and perched saturated zones.	Former location of distribution box between east and west absorption bed.	Fill, soil, Quaternary Bandelier Tuff (Qbt) Units 3, 2, 1 and Cerro Toledo interval[c]	X[d]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BH-1, BH-2, and BH-3: lateral bounds of subsurface contamination	3 locations outside of MDA U fence	Fill, soil, Quaternary Bandelier Tuff (Qbt) 3 and 2	X	X	X	X	X	X	X	—[e]	X	X	X	X	X	X	X	X	X
Surface Soils	4 borehole locations	Soil	—	X	X	X	X	X	X	—	X	X	X	X	X	X	X	—	—

[a] VOCs for pore gas by EPA Method TO-14.

[b] Alpha spectroscopy is the recommended analysis for actinium-227 progeny.

[c] Tuff sample for permeability tests immediately above Qbt2/Qct contact in borings that pass into the Cerro Toledo interval.

[d] X = Analysis will be conducted.

[e] — = Analysis will not be conducted.

Table 4.2-1
Summary of Proposed Sampling at MDA U

Sample Location	Location	Approximate Total Depth	Minimum Number of Samples*	Field Screening Intervals	Core Intervals
BH-4	Former location of distribution box between east and west absorption bed.	360 ft bgs	1 surface and a minimum of 4 subsurface (Total = 5)	Continuous for radiological contamination Every 10 ft for VOCs or if any field indicators of contamination found	Continuous
BH-1 BH-2 BH-3	2 north and 1 south of MDA U	120 ft bgs	1 surface and a minimum of 4 subsurface per borehole (Total = 15)	Continuous for radiological contamination Every 10 ft for VOCs or if any field indicators of contamination found	Continuous

* Additional samples will be collected if any of the following features are present: evidence of contamination (i.e., staining or elevated screening levels); lithologic contacts; fractures; fracture-fill material; surge beds; or a higher permeability unit. These criteria do not apply to the sediment samples.

Table 5.0-1
Summary of Applicable SOPs

Procedure	Title	Summary
SOP 01.01	General Instructions for Field Investigations	This standard operating procedure (SOP) provides an overview of instructions regarding activities to be performed before, during, and after field investigations completed by the Los Alamos National Laboratory's Environmental Stewardship, Remediation Services (ENV-RS) project. It is assumed that field investigations involve standard sampling equipment, personal protective equipment, waste-management, and site-control equipment/materials. The procedure covers premobilization activities, mobilization to the site, documentation and sample-collection activities, sample-media evaluation, surveying, and completing lessons learned.
SOP 01.02	Sample Containers and Preservation	This SOP describes the specific requirements/process for sample containers, preservation techniques, and holding times as specified by field regulations and guidance documents. The use of specific types of sample containers, and preservation techniques is mandatory for hazardous site investigations because the integrity of any sample is diminished over time. Physical factors (light, pressure, temperature, etc.), chemical factors (changes in pH, volatilization, etc.), and biological factors may alter the original quality of the sample. Because the various target parameters are uniquely altered at varying rates, distinct sample containers, preservation techniques, and holding times have been established to maintain sample integrity for a reasonable and acceptable period of time. The procedure covers documenting SOP deviations, using proper sample containers and preservatives, performing data entry, implementing containment procedures, preserving samples, implementing holding times, completing documentation, implementing postoperation activities, and performing lessons learned.
SOP 01.03	Handling, Packaging, and Shipping of Samples	This SOP directs field team members in the preparation of environmental and waste characterization samples for transportation to the Sample Management Office or an approved radiation-screening laboratory. In general, samples taken for the Remediation Services Project are expected to have a low concentration of potential contaminants, although higher concentrations will be present in some cases. Those low-concentration samples that do not satisfy the U.S. Department of Transportation (DOT) hazard-class definitions are classified as environmental samples and are not subject to DOT regulations. Historical data, knowledge of processes, and field screening results assist the team members in making decisions as to whether a sample can be designated as "environmental" or needs to be treated as a DOT-regulated material. The procedure covers the transportation of environmental and DOT-regulated samples.
SOP 01.04	Sample Control and Field Documentation	This SOP describes the process for documenting samples collected for the ENV-RS project using sample control and field documentation, specifically, container labels, sample collection logs, chain of custody (COC)/request for analysis forms, and daily activity log forms or field notebooks. The procedure covers performing request notification, generating sample control and field documentation, completing sample collection logs, using field chain-of-custody forms, delivering samples to the Sample Management Office (SMO), delivering samples to another analytical laboratory, using custody seals, collecting the samples, completing field investigation summaries, and performing field closeouts.

Table 5.0-1 (continued)

Procedure	Title	Summary
SOP 01.05	Field Quality Control Samples	This SOP describes the requirements for the collection of field quality control (QC) samples to ensure the reliability and validity of field and laboratory data. Field QC samples shall be collected as described in this procedure and taken to the Los Alamos National Laboratory SMO with the regular field samples for subsequent chemical and physical testing. The procedure covers preoperation activities, collecting and preparing each type of QC sample including equipment rinsate blank, field duplicate, and trip blank.
SOP 01.06	Management of Environmental Restoration Project Wastes	This SOP describes the process for managing waste generated during corrective action activities. This procedure outlines the preparation, approval, and retention of all required documents associated with waste generation. The procedure covers waste identification and characterization, waste minimization/recycling, waste generation/storage, segregation, waste treatment, authorized release limits, packaging/transportation, disposal options, and specific ENV-RS project policies, including the area of contamination policy, environmental media, and "contained in" policy.
SOP 01.08	Field Decontamination of Drilling and Sampling Equipment	This SOP describes the process for the general field decontamination of drilling and sampling equipment. It is intended to help ensure the integrity of soil, sediment, rock, water, and other samples collected from potentially contaminated sites and to minimize the potential for cross contamination between sampling locations. Implementation of this procedure will help protect site and project personnel, requiring that equipment not be removed from a controlled area without proper decontamination. The procedure covers set up of dry and wet decontamination areas, drilling/excavation equipment decontamination, and sampling equipment decontamination.
SOP-01-10	Waste Characterization	This SOP describes the development of a strategy for characterizing wastes generated during projects performed. Specifically, this document (1) identifies the steps involved in waste identification and characterization, and (2) provides instructions for completing a Waste Characterization Strategy Form (WCSF), a task that is required before every project.
SOP 03.11	Geodetic Surveys	This SOP describes the methodology for coordinating and evaluating geodetic surveys and establishing quality assurance (QA) and control for geodetic survey data. The procedure covers evaluating geodetic survey requirements, preparing to perform a geodetic survey, performing geodetic survey field activities, preparing geodetic survey data for QA review, performing QA review of geodetic survey data, and submitting geodetic survey data.
SOP 04.01	Drilling Methods and Drill-Site Management	This SOP describes the drilling methods and drilling-package implementation to meet subsurface sampling requirements. Various drilling methods have been developed to achieve successful subsurface contact for retrieving suitable formation, gas, and water samples. These include, but are not limited to, solid-stem augering, hollow-stem augering, direct rotary drilling, reverse rotary drilling, cable-tool drilling, and hand augering.

Table 5.0-1 (continued)

Procedure	Title	Summary
SOP- 04.04	Contract Geophysical Logging	This SOP states the responsibilities and describes the general process for obtaining borehole logging data of acceptable quality regardless of the logging system or logging contractor, to meet site-characterization and/or subsurface-sampling requirements of the investigation. Borehole-logging techniques are used in situ to determine physical, chemical, geological, and hydrological conditions in an open borehole. The procedure covers precontract considerations, preoperation activities, borehole geophysical logging activities, and postoperation activities. Main concerns during logging activities are monitoring the logging equipment as it emerges from the borehole or before it leaves the work site for contamination, verifying field calibration both immediately before and immediately after a logging run or runs with a given logging tool, and ensuring that the logging equipment is decontaminated between sampling events.
SOP 05.01	Well Construction	This SOP describes the process to properly construct a well. A properly constructed well allows access to formation fluids or gases for the collection of samples and for determining in situ characteristics. The procedure covers general well installation record keeping, using a sand pack, using an intermediate bentonite seal, placement of an annular well seal, drill casing retraction during backfill operations, volume calculations for materials introduced into the borehole, sounding backfill depths, installing protective casing around monitoring wells, recording well-construction details, and documenting the final well configuration.
SOP 05.02	Well Development	This SOP describes procedures for the development of monitoring wells after drilling and installation. All well drilling and installation procedures create a skin, or filter cake, on the borehole wall. During well development, the fine particulate matter is removed from the well or saturated formation near the screen. A secondary function of development is to settle the annular fill to a stable position. Different techniques may be effective in developing wells, depending on the hydrogeologic conditions encountered in the aquifer, the drilling method used, and well design. The following techniques are described: wire-brush method, bailing method, mechanical surging, swabbing method, high-velocity jetting, overpumping, and pump development.
SOP-05.03	Monitoring Well and RFI Borehole Abandonment	This SOP describes the process for monitoring well and RFI borehole abandonment. Procedures described in this SOP are consistent with acceptable practice for monitoring well and borehole abandonment under RCRA (Resource Conservation and Recovery Act) facility investigation (RFI) guidance. The procedure covers monitoring well and RFI borehole abandonment, placement of the appropriate sealing and fill material, options for destroying monitoring wells and RFI boreholes in urban areas and near active technical areas, and reporting requirements.
SOP-05.07	Operation of LANL Owned Borehole Logging Trailer	This SOP describes the process for the operation and maintenance of the borehole video/geophysics logging trailer. The procedure covers running the borehole video camera system, running the borehole caliper tool, running the borehole conductivity/resistivity (induction) tool, running the gamma tool, and running the borehole spontaneous potential/single-point resistance tool.

Table 5.0-1 (continued)

Procedure	Title	Summary
SOP-06.01	Purging and Sampling Methods for Single Completion Wells	This SOP describes the methods used for evacuating stagnant water from a well bore in sufficient quantities so that the water samples that are collected afterwards are representative of the formation interval open to the well bore. Groundwater that is stagnant in the well bore is subject to chemical reactions that may significantly alter the composition of the formation water. Before collecting a representative ground-water sample for laboratory analysis, ground water must be purged. The procedure covers preliminary activities, preoperation field activities, well-purging operations, water-sampling operations, and postoperation activities.
SOP-06.03	Sampling for Volatile Organic Compounds in Groundwater	This SOP states the responsibilities and describes the process for the sampling for volatile organic compounds (VOCs) in groundwater. This SOP also describes the selection of equipment and materials used in the sampling process. The objectives are to collect valid samples for volatile organic analysis and to subject samples to the least amount of turbulence and subsequent possible aeration. This procedure covers conducting preoperation activities, sampling, preparing documentation, and conducting postoperation activities.
SOP-06.09	Spade and Scoop Method for the Collection of Soil Samples	This SOP describes the process for spade-and-scoop collection of shallow (i.e., typically 0 to 12 inches) soil samples. The "spade-and-scoop" method involves digging a hole to the desired depth, as prescribed in the sampling and analysis plan, and collecting a discrete grab or portion of a composite sample. The procedure covers presampling activities, sampling activities, and post sampling activities.
SOP-06.10	Hand Auger and Thin-Wall Tube Sampler	This SOP states the responsibilities and describes the process for collecting surface and subsurface (up to about 15 ft) soil samples with a hand auger and thin-wall tube sampler. This procedure describes the selection and use of sampling methods and equipment at sites that may include contamination with hazardous or radioactive materials. The procedure covers presampling activities, sampling activities, collecting field duplicates, and postsampling activities.
SOP-06.24	Sample Collection from Split-Spoon Samplers and Shelby-Tube Samplers	This SOP states the responsibilities and describes the process for collecting soil and sediment samples using either split-spoon samplers or Shelby-tube samplers. A split-spoon sampler is used to take subsurface soil or sediment samples by forcefully driving the sampler into the soil or sediment at the bottom of a borehole. The Shelby tube is a similar type of sampling apparatus. The split spoon is a multipiece sampler; the Shelby tube is a single-piece metal tube of thinner gauge. This procedure covers presampling activities, sampling activities, and post sampling activities.
SOP 06.26	Core-Barrel Sampling for Subsurface Earth Materials	This SOP describes the process for collecting core-barrel samples of subsurface earth materials. The field team may sample for other constituents under this SOP (or modifications thereof). The procedure covers presampling activities, sampling activities, and postsampling activities.
SOP-06.31	Sampling of Subatmospheric Air	This SOP describes the process of sampling subatmospheric air from vapor ports in monitoring wells and boreholes. The procedure covers presampling activities, B&K (Brüel & Kjaer) sampling (a B&K gas analyzer is a portable photoacoustic multigas analyzer that is used to detect and quantify gaseous organic concentration in air), SUMMA sampling (a passive collection and containment system of laboratory-quality air samples), adsorbent column sampling (the column contains adsorbents such as silica that are analyzed to determine the concentration of the absorbed constituents. e.g., subsurface water vapor analyzed for tritium concentrations), sampling through the packer system (a sampling system that uses inflatable bladders to seal off a desired interval in an open borehole or at the end of drill casing in order to obtain a sample from a discrete section), and postsampling activities.

Table 5.0-1 (continued)

Procedure	Title	Summary
SOP-06.33	Headspace Vapor Screening with a Photoionization Detector	This SOP describes the process for screening headspace vapor for VOC in soil samples with a photoionization detector (PID). The PID is a portable, nonspecific, vapor/gas detector employing the principle of photoionization to detect and measure real-time concentrations of a variety of chemical compounds in air. Procedure covers: performing field calibration, operating, and post operating activities.
SOP-07.05	Subsurface Moisture Measurements Using a Neutron Probe	This SOP describes the process of collecting subsurface moisture measurements using a neutron probe for the ENV-RS project. A neutron probe is used to measure the subsurface moisture using a probe containing a source of high-energy neutrons and a slow neutron detector. The procedure covers performing a daily field standard count, preparing instruments for field measurements, taking a field measurement, and documenting the results of the field measurement.
SOP 12.01	Field Logging, Handling, and Documentation of Borehole Materials	This SOP prescribes the specific borehole material management methods to be followed and the documentation to be prepared, during handling and field logging of selected borehole materials identified in the site guidance documents and waste-characterization strategy form. This procedure is limited to the activities necessary to take custody of core and cuttings from drill rig personnel, conduct field screening, remove time-sensitive analytical samples and subsamples for preliminary characterization, complete photo documentation when necessary, perform field structural and lithologic description, and mark, package, and temporarily store the borehole materials at a drill-site borehole material storage trailer. This procedure describes the handling of the subset of borehole materials to be curated from the time they are withdrawn from the borehole to the time they are ready to be transported to the Remediation Services Project's Field Support Facility for curating and archiving. For the purposes of this SOP, borehole material may also refer to other solid materials, such as drive samples or augured materials. This procedure covers borehole material staging, temporary packaging of time-sensitive analytical samples, measurement and determination of material loss, marking core (depth notation and stripes), core photography, core logging, removal of analytical samples (core), and core-box loading and storing.

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Appendix A

Acronyms, Glossary, and Metric Conversion Table

ACRONYMS

AOC	area of concern
asl	above sea level
B&K	Brüel & Kjaer
bgs	below ground surface
COC	chain of custody
DP	Delta Prime
DOE	Department of Energy
DOT	Department of Transportation
ENV-ECR	Environmental Stewardship Division–Environmental Characterization and Remediation
ENV-RS	Environmental Stewardship Division–Remediation Services
EPA	Environmental Protection Agency
ER	Environmental Restoration Project
HIR	historical investigation report
HSR	Health, Safety, and Radiation
IDW	investigation-derived waste
Laboratory	Los Alamos National Laboratory
LANL	Los Alamos National Laboratory
LASL	Los Alamos Scientific Laboratory
LIR	Laboratory Implementation Requirements
LLW	low-level radioactive waste
MDA	material disposal area
MLLW	mixed low-level waste
NMED	New Mexico Environment Department
NOI	Notice of Intent
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
PPBV	parts per billion by volume
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act

RCT	radiological control technician
RFI	RCRA facility investigation
RPF	Record Processing Facility
RQD	rock-quality designation
SAL	screening action level
SMO	Sample Management Office
SOP	standard operating procedure
SSL	soil screening level
SWMU	solid waste management unit
SVOC	semivolatile organic compound
TA	technical area
TAL	target analyte list
TCLP	toxicity characteristic leaching procedure
TD	total depth
TSTA	Tritium Systems Test Assembly
UC	University of California
VOC	volatile organic compound
WCSF	waste characterization strategy form
WPF	waste profile form

GLOSSARY

chemical of potential concern (COPC)—A *chemical*, detected at a site, that has the potential to adversely affect human *receptors* due to its concentration, distribution, and mechanism of toxicity. A COPC remains a concern until *exposure pathways* and *receptors* are evaluated in a site-specific human health *risk assessment*.

groundwater—Interstitial water that occurs in saturated earth material and that is capable of entering a well in sufficient amounts to be utilized as a water supply.

migration—The movement of inorganic and organic species through unsaturated or saturated materials.

migration pathway—A route (e.g., a stream or subsurface flow path) that controls the potential movement of *contaminants* to environmental *receptors* (plants, animals, humans).

operable unit (OU)—At the Laboratory, one of 24 areas originally established for administering the ER Project. Set up as groups of *potential release sites*, the OUs were aggregated based on geographic proximity for the purpose of planning and conducting *RCRA facility assessments* and *RCRA facility investigations*. As the project matured, it became apparent that 24 were too many to allow efficient communication and to ensure consistency in approach. Therefore, in 1994, the 24 OUs were reduced to six administrative "field units."

outfall—The vent or end of a drain, pipe, sewer, ditch, or other conduit that carries wastewater, sewage, storm runoff or other *effluent* into a stream.

polychlorinated biphenyls (PCBs)—Any *chemical* substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substances. PCBs are colorless, odorless compounds that are chemically, electrically, and thermally stable and have proven to be toxic to both humans and animals.

radionuclide—A nuclide (species of atom) that exhibits radioactivity.

RCRA facility investigation (RFI)—The investigation that determines if a *release* has occurred and the nature and extent of the contamination at a *hazardous waste* facility. The RFI is generally equivalent to the remedial investigation portion of the Comprehensive Environment Response, Compensation, and Liability Act (CERCLA) process.

receptor—A person, plant, animal, or geographical location that is exposed to a *chemical* or physical agent *released* to the environment by human activities.

regional aquifer—Geologic material(s) or unit(s) of regional extent whose saturated portion yields significant quantities of water to wells, contains the regional zone of saturation, and is characterized by the regional *water table* or *potentiometric surface*.

release—Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, *leaching*, dumping, or disposing of *hazardous waste* or *hazardous constituents* into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles that contain any *hazardous wastes* or *hazardous constituents*).

Resource Conservation and Recovery Act (RCRA)—The Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976. (40 CFR 270.2)

screening action level (SAL)—*Medium*-specific concentration level for a *radionuclide* derived using conservative criteria below for which it is generally assumed that there is no potential for unacceptable *dose* to human health. The derivation of a SAL is based on conservative exposure and land-use assumptions.

sample—A portion of a material (e.g., rock, soil, water, air), which, alone or in combination with other samples, is expected to be representative of the material or area from which it is taken. Samples are typically sent to a laboratory for *analysis* or inspection or are analyzed in the field. When referring to samples of environmental media, the term *field sample* may be used.

sample matrix—In *chemical analysis*, that portion of a *sample* that is exclusive of the *analytes* of interest. Together, the *matrix* and *analytes* of interest form the *sample*.

sediment—(1) A mass of fragmented inorganic solid that comes from the weathering of rock and is carried or dropped by air, water, gravity, or ice; or a mass that is accumulated by any other natural agent and that forms in layers on the earth's surface such as sand, gravel, silt, mud, fill, or loess. (2) A solid material that is not in solution and either is distributed through the liquid or has settled out of the liquid.

screening action level (SAL)—*Medium*-specific concentration level for a *chemical* derived using conservative criteria below for which it is generally assumed that there is no potential for unacceptable *risk* to human health. The derivation of a SAL is based on conservative exposure and land-use assumptions. However, if an applicable *regulatory standard* exists that is less than the value derived by *risk*-based computations, it will be used for the SAL.

soil screening level (SSL)—*Medium*-specific concentration level for a *chemical* derived using conservative criteria below for which it is generally assumed that there is no potential for unacceptable *risk* to human health. The derivation of a SSL is based on conservative exposure and land-use assumptions. However, if an applicable *regulatory standard* exists that is less than the value derived by *risk*-based computations, it will be used for the SSL.

standard operating procedure (SOP)—A document that details the method for an operation, *analysis*, or action with thoroughly prescribed techniques and steps, and is officially approved as the method for performing certain routine or repetitive tasks.

technical area (TA)—The Laboratory established technical areas as administrative units for all its operations. There are currently 49 active TAs spread over 43 square miles.

tuff—A compacted deposit of volcanic ash and dust that contains rock and mineral fragments accumulated during an eruption.

US Department of Energy (DOE)—Federal agency that sponsors energy research and regulates nuclear materials for weapons production.

US Environmental Protection Agency (EPA)—Federal agency responsible for enforcing environmental laws. Although state regulatory agencies may be authorized to administer some of this responsibility, the EPA retains oversight authority to ensure the protection of human health and the environment.

METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain US Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (µm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (µg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

Appendix B

Investigation-Derived Waste Management

This appendix to the investigation work plan describes how waste generated during the investigation of Material Disposal Area (MDA) U at Los Alamos National Laboratory (LANL or the Laboratory) will be managed. Investigation-derived waste (IDW) is solid waste generated during field investigations and may include, but is not limited to, drill cuttings, contaminated personal protective equipment (PPE), sampling supplies and plastic, fluids from the decontamination of PPE and sampling equipment, and all other wastes that may potentially come in contact with contaminants.

All IDW generated during the MDA U field investigation will be managed in accordance with applicable Environmental Stewardship Division–Environmental Characterization and Remediation (ENV-ECR) standard operating procedures (SOPs). These SOPs incorporate the requirements of all applicable Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) regulations, Department of Energy (DOE) orders, and Laboratory Implementation Requirements (LIRs). SOPs applicable to the characterization and management of IDW are

- SOP-1.06, Management of Environmental Restoration Project Waste and
- SOP-1.10, Waste Characterization.

These SOPs are summarized in Table 5.0-1 of the investigation work plan and complete versions of the SOPs may be found at the following URL: http://erproject.lanl.gov/documents/procedures.html.

The ENV Remediation Services (-RS) Waste Minimization Awareness Plan will be implemented during field investigations at MDA U to minimize waste generation. This plan is updated annually as a requirement of Module VIII of the Laboratory's Hazardous Waste Facility Permit.

The IDW waste streams associated with the investigation of MDA U are identified in Table B-1 and are briefly described below. Table B-1 also summarizes the waste types, estimated volumes, characterization methods, methods of on-site management, and expected disposition path for each of the following waste streams.

Drill cuttings. The drill cuttings waste stream will consist of cuttings from the four boreholes proposed for MDA U. Drill cuttings will be collected and containerized at the point of generation (i.e., at the drill rig). The drill cuttings waste stream will be characterized with analytical results from core samples, augmented by direct sampling of the containerized waste, if needed. Contaminants of concern are expected to include organic and inorganic chemicals and radionuclides. The maximum detected concentrations of radionuclides will be compared with background/fallout values. If their maximum concentrations are above background/fallout values, the waste cuttings will be designated as low-level radioactive waste (LLW). Maximum concentrations of toxicity characteristic leaching procedure (TCLP) constituents will be compared with 20 times the TCLP regulatory limit. If concentrations are less than 20 times the regulatory limit, the waste cuttings will be designated as nonhazardous. If concentrations exceed 20 times the regulatory limit, the waste will be sampled and analyzed using the TCLP to determine if it is hazardous. If listed waste constituents are detected in tuff samples, the maximum concentrations will be compared to NMED soil screening levels (SSLs). If concentrations are less than SSLs, a "no longer contained in" determination will be requested from NMED. If concentrations exceed SSLs, the wastes will be designated as listed hazardous waste. Based on the results of previous investigations, the Laboratory expects these wastes to be designated as LLW that will be disposed of at Technical Area (TA-) 54, Area G.

Spent PPE. The spent PPE waste stream will consist of PPE that has "contacted" contaminated environmental media (i.e., core and/or drill cuttings) and that cannot be decontaminated. The bulk of this waste stream will consist of protective clothing such as coveralls, gloves, and shoe covers. Spent PPE will be collected in containers at personnel decontamination stations. Characterization of this waste stream will be performed through acceptable knowledge of the waste materials, the methods of generation, and the levels of contamination observed in the associated environmental media. The Laboratory expects these wastes to be designated as LLW that will be disposed of at Area G of TA-54.

Disposable sampling supplies. The disposable sampling supplies waste stream will consist of all equipment and materials necessary for the collection of samples that come into direct contact with contaminated environmental media and that cannot be decontaminated. This waste stream also includes wastes associated with dry decontamination activities. This waste stream will consist primarily of paper and plastic items collected in bags at the sampling location and transferred to accumulation drums. Characterization of this waste stream will be performed through acceptable knowledge of the waste materials, the methods of generation, and the levels of contamination observed in the associated environmental media. The Laboratory expects these wastes to be designated as LLW that will be disposed of at Area G in TA-54.

Decontamination fluids. The decontamination fluids waste stream will consist of liquid wastes from decontamination activities (i.e., decontamination solutions and rinse waters). Consistent with waste minimization practices, the Laboratory employs dry decontamination methods to the extent possible. If dry decontamination cannot be performed, liquid decontamination wastes will be collected in containers at the point of generation and transferred to accumulation drums. If less than six gallons per day of decontamination fluids are generated and these are determined to be nonhazardous, they may be disposed of by discharge to the ground in accordance with an existing Notice of Intent (NOI) for discharge to groundwater approved by the NMED Ground Water Quality Bureau. Otherwise, the decontamination fluids waste stream will be accumulated in drums and characterized with analytical results from direct sampling of the containerized waste. The Laboratory expects these wastes would be designated as nonhazardous liquid waste that would be sent to the radioactive liquid waste treatment facility at TA-50 for disposal.

Before the start of field investigation activities, a Waste Characterization Strategy Form (WCSF) will be prepared and approved per requirements of SOP 01.10. The WCSF will provide detailed information on IDW characterization, management, containerization, and possible volumes. IDW characterization will be completed through review of existing data and/or documentation, by direct sampling of the IDW, and/or by sampling the media being investigated (i.e., surface soil, subsurface soil, etc.). If sampling is necessary, it will be described in a sampling and analysis plan developed in conjunction with the WCSF.

The selection of waste containers will be based on appropriate U. S. Department of Transportation requirements, waste types, and estimated volumes of IDW to be generated. Immediately following containerization, each waste container will be individually labeled with a unique identification number and with information regarding waste classification, item(s), radioactivity (if applicable), and date generated. The wastes will be contained in clearly marked and appropriately constructed waste accumulation areas. Waste accumulation area postings, regulated storage duration, and inspection requirements will be based on the type of IDW and its classification. Container and storage requirements will be detailed in the WCSF and approved before waste is generated.

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Table B-1
Summary of Estimated IDW Generation and Management for MDA U

Waste Stream	Expected Waste Type	Estimated Volume	Characterization Method	On-Site Management	Expected Disposition
Drill cuttings [a]	LLW	20 cubic yards (yd^3)	Analytical results from core and waste samples	55-gal. drums or covered roll-off containers	Disposal at TA-54, Area G
Spent PPE	LLW	5 yd^3	Acceptable knowledge	Accumulation in 55-gal. drums	Disposal at TA-54, Area G
Disposable sampling supplies	LLW	1 yd^3	Acceptable knowledge	Accumulation in 55-gal. drums	Disposal at TA-54, Area G
Decontamination fluids (<6 gal. per day)	Non-hazardous	< 6 gal./day [b]	Acceptable knowledge	Discharge to ground	Discharge to ground
Decontamination fluids (>6 gal. per day)	Non-hazardous	<55 gal.	Analytical results from waste samples	Accumulation in 55-gal. drums	Treatment at TA-50 Radioactive Liquid Waste Treatment Facility

[a] Estimated total volume of cuttings expected to be generated.

[b] Dry decontamination methods will be used to the maximum extent possible, and only minimal amounts of decontamination fluids are expected to be generated.

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November 2004
ER2004-0570

Historical Investigation Report for Material Disposal Area U, Solid Waste Management Unit 21-017(a)-99, at Technical Area 21

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Prepared by
Environmental Stewardship Division–Remediation Services

LA-UR-04-7267
ER2004-0570

Historical Investigation Report for Material Disposal Area U, Solid Waste Management Unit 21-017(a)-99, at Technical Area 21

November 2004

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EXECUTIVE SUMMARY

This historical investigation report (HIR) provides an operational history and a summary of the field investigations and associated environmental data collected to date for Material Disposal Area (MDA) U, designated as Solid Waste Management Unit 21-017(a)-99, located at Technical Area 21. This HIR also provides supporting information for the proposed sampling design necessary to complete the investigation of MDA U as presented in the investigation work plan for MDA U.

MDA U received effluent from Buildings 21-152, 21-153, and 21-155 from 1945 until 1976. In 1985, the absorption beds and associated structures were partially removed. The excavated zone was backfilled with uncontaminated tuff, covered with 6 in. of topsoil, graded for drainage, and revegetated.

The earliest investigation conducted at MDA U was in 1946 and the most recent in 2001. This HIR summarizes both Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) and pre-RFI (i.e., those conducted prior to 1992) activities. The primary pre-RFI activities at MDA U included effluent sampling in 1946; an investigation of surface soil and water in 1976; an investigation of soil, vegetation, and tar in 1980; a subsurface investigation in 1983; and an investigation of soil and vegetation in 1984.

RFI activities were conducted at MDA U in 1992, 1994, 1998, and 2001. During each of these sampling campaigns, surface samples (soil and/or sediment) were collected. Results of inorganic chemical analyses indicated concentrations above background values for chromium, lead, mercury, total uranium, and zinc. Organic chemicals were detected infrequently and at generally low concentrations. The radionuclide results showed concentrations of americium-241, plutonium-238, plutonium-239, and tritium exceeding background values.

Fill material from the absorption beds was sampled in 1998 and 2001. The 2001 sampling confirmed the presence of tritium and uranium-234 above background values. In addition, actinium-227 progeny (thorium-227, radon-219, and radium-223) were detected in the eastern absorption bed.

Subsurface tuff samples were collected at MDA U in 1998, and several inorganic chemicals, including aluminum, arsenic, barium, beryllium, chromium, copper, lead, manganese, and mercury, were detected slightly above background values. No inorganic chemicals were detected above background values at depths greater than 60 ft below ground surface (bgs). Di-n-butylphthalate was detected at only one borehole, and all results were less than 0.5 mg/kg. Uranium-234 and uranium-235 were detected at concentrations above background values at depth in two boreholes on the western side of MDA U. Actinium-227 progeny were detected in one borehole within the eastern absorption bed in a fractured interval at 54–55 ft bgs. Tritium was detected in all eight boreholes, although all results were less than 1 pCi/g. At two locations, tritium was detected at 75 ft bgs, the total depth of the boreholes. Subsurface pore-gas samples had numerous low-level detections of organic chemicals. One borehole had elevated toluene concentrations at multiple depths (86 parts per billion by volume [ppbv] at 25 ft; 480 ppbv at 55 ft; and 220 ppbv at 75 ft, which was the total depth of the borehole).

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1.0 INTRODUCTION

This historical investigation report (HIR) provides an operational history and a summary of the field investigations and associated environmental data collected to date for Material Disposal Area (MDA) U, designated Solid Waste Management Unit (SWMU) 21-017(a)-99, at Technical Area (TA-) 21. This HIR provides information to support future MDA U investigations. MDA U is inactive and currently undergoing corrective action.

2.0 DESCRIPTION AND OPERATIONAL HISTORY

2.1 Site Description

MDA U is located at the northeastern section of Delta Prime (DP) Mesa within Los Alamos National Laboratory (LANL or the Laboratory) TA-21 (Figure 2.1-1). From 1945 to 1978, TA-21 was used primarily for plutonium research, metal production, and related activities. Since 1978, various administrative and chemical research activities have been conducted at TA-21.

MDA U consists of four SWMUs, shown in Figure 2.1-2, that were consolidated into SWMU 21-017(a)-99 in 1999 according to their related operational history. These SWMUs include

- SWMU 21-017(a), an absorption bed on the west side of the MDA;
- SWMU 21-017(b), an absorption bed on the east side of the MDA;
- SWMU 21-017(c), a distribution box, formerly located between the two absorption beds, that was removed in 1985; and
- SWMU 21-022(f), a sump (21-173) that received effluent from Building 21-152 and was connected to the distribution box; located outside the fence surrounding MDA U adjacent to Building 21-370.

2.2 Operational History

The DP East area began operation in 1945 at Buildings 21-152, 21-153, and 21-155 (Figure 2.1-2). These facilities were used to process polonium and actinium and to produce weapon components. Process waste from the various research and production activities consisted of both solids and liquids. In the late 1940s, it was determined that the natural soils and clays at TA-21 were effective in separating radioactive contaminants from waste liquids (Merrill 1990, 11721). Therefore, absorption beds were constructed and effluent was discharged into trenches filled with cobbles, gravel, and fine sand (LASL 1945, 01093). MDA U is one of the areas where absorption beds were used for disposing of liquid wastes.

Operations at MDA U ceased in 1976. In 1985, site stabilization of the absorption beds began. A trench measuring 20 ft wide, 100 ft long, and 4 to 13 ft deep was excavated, and soil contaminated with actinium-227 was removed from MDA U and taken to MDA G at TA-54 for disposal (Merrill 1990, 11721, p. 11). The distribution box and iron pipes within the absorption beds and a portion of the line from the cooling tower were excavated and also were taken to MDA G (LANL 1991, 07529, p. 16-199) (Figure 2.2-1). Material above the iron pipes was stockpiled and later used to backfill the trench. The absorption beds were not completely excavated. A piece of plastic sheeting was placed on the bottom and sides of the excavated zone to mark the extent of the removal. The excavated zone was backfilled, covered with 6 in. of topsoil, graded for drainage, and revegetated.

In 1987, additional site-stabilization activities were completed. A ditch was constructed on the south side to divert surface water runoff from upslope. Within the MDA U fence, more topsoil was added, and the area was reseeded. Four brass markers were placed to mark the corners of the MDA. In 1990, additional controls were emplaced to prevent runoff from the surrounding area from flowing across MDA U. Site photographs from 1946 to the present are provided in Appendix B.

2.3 Disposals, Discharges, and Releases

The TA-21 work plan (LANL 1991, 07529) refers to a 1945 memorandum (Veltman 1945, 01305) describing the presumed design requirements for the MDA U absorption beds. The memorandum states the requirements as follows:

> A pit will be dug on the north side of the mesa approximately 6-ft deep and 10 x 50 ft in area for Building 52. A graded gravel absorption bed will fill this pit with relatively large stones in the bottom and ordinary soil on top. This arrangement will allow satisfactory draining of process sewage.[1]

The engineering drawing for MDA U indicates each bed was approximately 80 ft long, 20 ft wide, and 6 ft deep (LASL 1945, 00109, and Appendix C). Each bed had an estimated surface area of approximately 1800 ft^2 (Merrill 1990, 11721, p. 11) and an estimated volume of 9600 ft^3. The absorption beds were filled with a 24-in. layer of 5-in.- to 10-in.-diameter cobbles, overlain by a 6-in. layer of gravel and a 6-in. layer of fine sand (Figure 2.3-1). These materials were covered with 12 in. of soil. Effluent was discharged to the absorption beds through a distribution box, located between the two beds. Liquid waste received by MDA U included

- effluent from Building 21-152 that flowed from sump 21-173 into the distribution box via a 6-in.-diameter vitrified clay pipe (Francis 1998, 76205);
- effluent from Building 21-153 that drained directly into the eastern absorption bed, and
- effluent from Building 21-155 that drained directly into the western absorption bed or to MDA U through the distribution box.

Historical records for MDA U state that polonium-210, actinium-227, plutonium, and tritium were the primary radionuclides released to the absorption beds. Between 1945 and 1968, it was estimated that MDA U received a total waste volume of 18,000 ft^3 (135,000 gal.) of effluent (Walker 1981, 06277). The primary contaminant released to MDA U was polonium-210 (Christenson 1973, 00940), but no records exist on the amounts discharged. Polonium-210 has a half-life of 138.4 days, decays to stable lead, and has decayed to undetectable levels (Christenson 1973, 00940). A 1946 memorandum (Tribby 1946, 01540) indicates that plutonium, as well as polonium, was measured in effluent from sewers 22 and 23 that may have discharged to the absorption beds; the exact locations of these sewers is not known. However, Francis (2001, 76211) indicates that acid waste sump 21-223 and acid waste manhole 21-222 were part of the TA-21 east acid waste system, and it is possible these were the sewers, subsequently renumbered, referenced in the 1946 memorandum. Records also indicated that about 2.5 Ci of actinium-227 (21.8 year half-life) were discharged into the MDA U absorption beds in 1953 (Christenson 1973, 00940). The actinium came primarily from Building 21-153, a filter building (decommissioned in 1978) where actinium-227 was scrubbed out of the air from several process buildings at TA-21 (DOE 1979, 08610). A drain line from the cooling tower associated with Building 21-155 terminated in the

[1] Buildings 52 and 53 were renumbered to 152 and 153. This quote refers to what is now Building 21-152.

western absorption bed [SWMU 21-017(a)] (Mayfield 1985, 01172). Purtymun (1976, 01107) stated, "on December 19, 1975, water from a cooling process was being released into the west pit from a nearby building." Building 21-153 was not used after March 1970 (LASL 1974, 01308, p. 1). It was dismantled and demolished in 1978, and the debris was placed in MDA G at TA-54 (Garde 1977, 06452, p. 1).

In addition, oil from precipitrons was disposed of at MDA U (Drager 1946, 01562). The precipitrons were air filters installed in the filter building (Building 21-153) through which air exhausted from Building 21-152 passed (Francis 1996, 76137). No information is available on the composition of the oil used in the filtering process, but the process resulted in the contamination of the oil, and the contaminated oil "got to the seepage pit MDA U through the floor drains [at Building 21-152]" (Francis 1996, 76137). Drager (1946, 01562) reported, "these pits are not functioning properly and the oil washing down from the precipitrons is lying on top of the ground. This is very definitely contaminated to a high degree."

MDA U received effluent from 1945 until 1976. In 1968, the disposal of effluent at MDA U from Buildings 21-152 and 21-153 ceased (Hakonson 1987, 07422). MDA U continued to receive cooling water from the cooling tower to the western absorption bed until 1976 (Purtymun 1976, 01107).

SWMU 21-022(f) (sump 21-173) is approximately 5.5 ft in diameter by 6 ft deep. Effluent from Building 21-152 and several other unspecified process buildings at TA-21 was carried from the sump to MDA U through a 6-in.-diameter cast-iron pipe. The amounts and types of waste discharged to the absorption beds through sump 21-173 are not known, and no specific information (constituents or volumes) has been located on nonradionuclide waste generated at these facilities.

3.0 PREVIOUS INVESTIGATION ACTIVITIES AND RESULTS

The earliest investigation conducted at MDA U was in 1946 and the most recent in 2001. This HIR summarizes both Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) and pre-RFI (i.e., those prior to 1992) activities.

3.1 Pre-RFI Activities (Prior to 1992)

The primary pre-RFI activities at MDA U included effluent sampling in 1946; investigation of surface soil and water in 1976; investigation of soil, vegetation, and tar in 1980; investigation of the subsurface in 1983; and investigation of soil and vegetation in 1984.

Pre-RFI activities are described in the TA-21 operable unit RFI work plan (LANL 1991, 07529). The RFI work plan frequently compared historical investigation data to radionuclide background concentrations available at the time the work plan was written. The sources for background values used included Purtymun (1987, 06687, pp. 1–16) and the Laboratory's Environmental Surveillance Group (1980, 05961). The qualitative comparisons of site data to background values in the work plan are presented in the following sections. Current-day RFI data are compared to one standardized and accepted Laboratory background data set (LANL 1998, 59730).

The following subsections summarize the pre-RFI activities. Data quality is not addressed in this section because the pre-RFI data cannot be validated and are presented for informational purposes only.

3.1.1 1946 Effluent Sampling

A 1946 memorandum (Tribby 1946, 01540) reported the results of plutonium (isotope not specified) and polonium-210 analyses in effluent discharged to chemical sewer numbers 22 (drain from Building 21-153) and 23 (drain from Building 21-152). Assuming the units of disintegrations per minute per liter (dpm/L) imply the measurements were calibrated properly, the values may be converted to pCi/L. These values ranged from 35 to 645 pCi/L of plutonium in the effluent. Concentrations of polonium-210 ranged from 109 to 21,200 pCi/L. The effluent may or may not have been discharged into the absorption beds.

3.1.2 1976 Soil and Water Sampling

During 1976, the Laboratory's Environmental Studies and Waste Management Group (H-8) collected soil samples outside and within the absorption beds, which were still uncovered at the time. These samples showed elevated gross alpha activity levels both inside and outside the fence (Purtymun 1976, 01107). One water sample was taken in the western absorption bed. Purtymun referred to this water as "permanent in the west pit" (1976, 01107). The locations of the samples are shown in Figure 3.1-1. Results of the gross alpha values are provided in Table 3.1-1. Cooling tower water from Building 21-155 was the only known influent to the absorption beds in 1976.

3.1.3 1980 Soil, Vegetation, and Tar Sampling

Soil and vegetation samples were collected in 1980 (Mayfield 1985, 01172) and analyzed for radionuclides. The analytical results are presented in Tables 3.1-2 and 3.1-3. Three sampling locations were noted: U-1 at the west end of the western absorption bed, U-2 at the east end of the eastern absorption bed, and U-3 at the northeast corner immediately outside of the fenced area (Figure 3.1-1).

The soil data show plutonium-239/240 in surface soil from western and eastern absorption beds (17.5 pCi/g and 2.4 pCi/g, respectively) and actinium-227 daughters in the eastern absorption bed. Tritium was detected at concentrations of up to 37,200 pCi/L of soil moisture in surface soil from the eastern absorption bed but was not elevated in samples from the western absorption bed. Total uranium concentrations were highest in surface soil from the western absorption bed (maximum of 26.1 µg/g) but were only slightly elevated above background levels in samples from the eastern absorption bed. The sample collected from outside the fence (U-3) contained tritium and uranium at levels slightly higher than background levels, and plutonium-239/240 that was two orders of magnitude above background.

Tritium in vegetation (willow, ponderosa pine, and downy chess) from absorption beds, at concentrations of up to 7200 pCi/L of tissue moisture, was lower than in absorption bed soils. Plutonium-239/240 ranged from 0.8 to 1.1 pCi/g in ash from the same vegetation types from locations U-1 and U-2. (Table 3.1-3) (Mayfield 1985, 01172). Location U-3 yielded one vegetation sample containing elevated levels of tritium (snakeweed, 3300 pCi/L) and one containing elevated levels of plutonium-239/240 (downy chess, 2.3 pCi/g).

Tar samples were also collected during the 1980 sampling event. Only qualitative information on these sample results was reported. The highest measurements of external penetrating radiation were located "over a tar puddle in the east absorption bed," and actinium-227 daughters were identified in tar samples, also from the eastern absorption bed (Mayfield 1985, 01172). The tar is assumed to have originated from oil from the precipitrons (Drager 1946, 01562). The contaminated oil probably made its way from Building 21-153 to MDA U through the floor drains at Building 21-152, where the precipitrons were located (Francis 1996, 76137).

3.1.4 1983 Subsurface Sampling Data

In 1983, subsurface samples were collected from two boreholes outside the MDA U fence: one north of the eastern absorption bed (U-E) and one northwest of the western absorption bed (U-W). At each location, samples were collected at depths ranging from 0 to 58 ft and analyzed for tritium, uranium, and cesium-137. The data for this study are reported in Table 3.1-4. Tritium values in both boreholes at all depths were elevated when compared to background levels (Purtymun 1987, 06687). In the east borehole (U-E), beginning at a depth of 33 ft, tritium levels increased consistently with depth, ranging from 18,100 pCi/L to 78,000 pCi/L (Figure 3.1-2). In the west borehole (U-W), tritium levels were highest at 8 ft below ground surface (bgs) and generally decreased with depth. All cesium-137 values were below the maximum background level. Total uranium results in both boreholes slightly exceeded the background level.

3.1.5 1984 Soil and Vegetation Sampling

In 1984, soil samples were collected at 12 locations around MDA U, one of which was within the fenced area. Samples were collected at three depths (0–1 cm, 1–10 cm, and 10–30 cm) and analyzed for tritium, uranium, and plutonium-239/240. The results are presented in Figures 3.1-3, 3.1-4, and 3.1-5. Not all locations and depths were analyzed for each radionuclide; the most complete data are for the 0–1 cm interval. Ten vegetation samples were collected, only three of which were within the boundaries of MDA U.

Figures 3.1-6, 3.1-7, and 3.1-8 show the concentration contours for each of the radionuclides based on kriging concentration levels above the maximum background levels. With only 12 data points, the uncertainty is great; however, the contour plots show tritium to be highest in the eastern absorption bed and total uranium to be highest in the western absorption bed. The highest value of plutonium-239/240 (5.10 pCi/g) occurs north of MDA U in the 0 to 1 cm interval (Figure 3.1-5).

Tritium concentrations in vegetation (Figure 3.1-9 ranged from 3100 pCi/L to 10,000 pCi/L vegetation moisture, above the background level of 800 pCi/L reported by the Laboratory's Environmental Surveillance Group (1987, 00667).

3.2 RFI Activities (1992 to Present)

The plans for RFI investigations at MDA U are presented in the 1991 work plan for TA-21 (LANL 1991, 07529) and subsequent sampling and analysis plans. The following investigations were completed to support the RFI:

- 1992—DP Mesa-wide soil sampling
- 1994—surface soil and sediment sampling
- 1998—surface soil, subsurface tuff, subsurface pore-gas, and absorption bed sampling
- 2001—surface soil and absorption bed sampling

No environmental investigations of sump 21-173 have been conducted.

Analytical data for the RFIs associated with MDA U reside in the Environmental Restoration Database (ERDB). A complete record of the analytical data associated with RFI sampling is provided on compact disc in Appendix D. Table 3.2-1 lists collected RFI samples and associated analytical suites. A summary of data quality and usability for the RFI data appears in section 3.3, and the results of RFI sampling are summarized in section 3.4.

3.2.1 1992 TA-21 Site-Wide Background and Stack Emission Investigation

In 1992, surface sampling was conducted at TA-21 to establish site-wide baseline concentrations for a comprehensive suite of analytes and to identify contaminant trends across TA-21 resulting from airborne stack emissions. Samples were collected at the nodes of a 131- by 131-ft grid covering DP Mesa, Los Alamos Canyon, and DP Canyon (LANL 1994, 26073; LANL 1995, 52350, p. 2-1). During this event, seven samples were collected on DP Mesa East and downslope of MDA U from two different depths at each location (0–1 in. and 0–6 in.) (Figure 3.2-1). The samples were analyzed for inorganic chemicals, organic chemicals, and radionuclides (americium, tritium, isotopic plutonium, isotopic thorium, and strontium-90).

3.2.2 1994 Surface Soil and Sediment Sampling

The goals of the 1994 RFI at MDA U were to (1) identify areas of surface soil contamination within the MDA U boundary and between MDA U and the edge of DP Canyon to the north and (2) determine if contaminants were migrating into the DP Canyon drainage (LANL 1997, 58979). The locations of samples collected during the 1994 investigation are shown in Figure 3.2-2. Surface soil samples were collected from a grid covering the entire MDA and extending to the edge of DP Mesa. A total of 54 samples were collected from the grid, and 7 additional samples were collected from points off of the grid nodes. Nine channel sediment samples (three locations sampled at three depth intervals [0–0.25, 0.25–0.5, and 0.5–1 ft]) were collected in the small drainage leading into DP Canyon. Soil and sediment samples were sent to off-site analytical laboratories for analysis of radionuclides (tritium, total uranium, isotopic plutonium, strontium-90, and gamma-emitting radionuclides by gamma spectroscopy); semivolatile organic compounds (SVOCs); and inorganic chemicals.

3.2.3 1998 Sampling

3.2.3.1 1998 Surface Soil Sampling

In 1998, surface soil samples were collected on the mesa top in the area north of MDA U, between the SWMU and the mesa edge, and in the DP Canyon drainage north of MDA U at some of the same locations sampled in 1994. Figure 3.2-3 shows sample locations for 1998 surface samples. The 1998 samples were collected to address data quality issues identified during a review of the 1994 analytical data (LANL 1999, 87295). Eighteen samples from mesa-top locations were analyzed for polychlorinated biphenyls (PCBs) and radionuclides (isotopic uranium and gamma-emitting radionuclides by gamma spectroscopy), and two samples from the DP Canyon drainage locations were analyzed for isotopic uranium.

3.2.3.2 1998 Borehole Investigation

Eight vertical boreholes were drilled within and around the two absorption beds in 1998 to define the vertical extent of contamination (Figure 3.2-3) (LANL 1998, 62549). Two boreholes were located within the western absorption bed, and two were located within the eastern absorption bed. The remaining four boreholes were located outside of the absorption beds, but within the MDA U fence. As indicated in the borehole logs (Appendix E), samples were collected at depths of 5, 15, 25, 35, 45, 65, and 75 ft bgs. Borehole samples were analyzed for inorganic chemicals, SVOCs, PCBs (5- and 15-ft intervals only), and radionuclides (americium-241, isotopic plutonium and uranium, tritium, strontium-90, and gamma-emitting radionuclides by gamma spectroscopy).

Three samples of pore gas were collected for volatile organic compound (VOC) analysis from each of the eight boreholes. The samples were collected in evacuated SUMMA canisters at intervals of 25, 55, and 75 ft bgs during drilling by running an extraction tube to the bottom of the hole and sealing it off with an inflatable borehole packer. The pore-gas samples were sent to an off-site laboratory for VOC analysis by Environmental Protection Agency (EPA) Method TO-14.

3.2.3.3 1998 Absorption Bed Sampling

In 1998, two samples of fill material were collected from each absorption bed below the plastic liner to estimate the remaining inventory of contamination (LANL 1998, 87294). The samples were collected from the center line of the absorption beds, the area where the distribution line had been located and the highest contaminant concentrations were expected. The samples consisted of the fine material collected from between the cobbles. Sampling locations 21-10864, 21-10865, 21-10866, and 21-10867 are shown in Figure 3.2-3. The samples were analyzed for americium-241, isotopic plutonium, isotopic uranium, strontium-90, tritium, and gamma-emitting radionuclides by gamma spectroscopy.

3.2.4 2001 Surface Soil and Absorption Bed Sampling

3.2.4.1 2001 Surface Soil Sampling

In 2001, the 1994 grid was resampled (Figure 3.2-4), and 54 surface soil samples were collected for analysis of mercury at a depth of 0 to 0.5 ft (LANL 2001, 70230). Five surface soil samples (locations 21-02101, 21-02083, 21-02099, 21-22447, and 21-22448) were collected and analyzed for tritium. These were the only analyses conducted on these soil samples.

3.2.4.2 2001 Absorption Bed Sampling

In 2001, absorption bed samples were collected to evaluate whether residual contamination was present along the edges and beneath the absorption beds, assuming the 1985 excavations had removed the center portion of each absorption bed (LANL 2001, 70230). One trench was excavated (approximately 15 ft long and 5- to 7-ft deep) in each absorption bed. The trenches were used to find the plastic liner placed over the excavated areas when the drain line and absorption bed material were removed in 1985. The trenches were extended to find the north and south extent of the liner and previous excavation locations. A total of eight samples were collected, four samples from each trench (Figure 3.2-4). The samples were analyzed for tritium, isotopic uranium, and radionuclides by gamma spectroscopy.

In the western absorption bed, black plastic was found at a depth of 3.5 to 4 ft. Cobbles up to 20 in. were observed under the liner. Samples were collected from two locations below the liner on the south end (locations 21-11404 and 21-11406) and two locations on the north end (locations 21-11407 and 21-11408) of the trench. The field summary report did not record whether the northern samples were collected below the liner.

Two plastic liners were found in the eastern absorption bed. A clear liner was found at approximately 3 ft bgs, and a black liner at 7 ft bgs was found immediately above a cobble layer. Sample 21-11409 was located beneath the north edge of the black liner in a sandy/gravely material; sample 21-11411 was located nearby at the same depth in a fine-grain horizon. Samples 21-11412 and 21-11413 were located on the south end of the trench, beneath the edge of the black liner in fine-grained material.

3.3 RFI Data Quality Evaluation

The quality and usability of data for inorganic chemicals, organic chemicals, and radionuclides from MDA U RFI datasets are discussed below. The data are deemed usable as qualified and provide an acceptable basis for planning future investigations or corrective actions at this site.

A total of 246 RFI samples were collected and analyzed as follows:

- 202 analyses for inorganic chemicals
- 161 analyses for organic chemicals
- 24 analyses for VOCs in pore gas
- 186 analyses for radionuclides

In addition, field duplicates were collected for quality control purposes.

These analytical numbers reflect only data that have not been rejected for quality reasons and can be used to evaluate contamination at MDA U. The following subsections summarize data quality, including the rejected data.

3.3.1 Inorganic Chemical Data Quality

Soil, sediment, and tuff samples were analyzed for inorganic chemicals. Several inorganic chemical results were qualified as estimated (J) because the results were less than the practical quantitation limit (PQL), but greater than the method detection limit (MDL).

- Results for lead, manganese, mercury, and antimony were detected but estimated (J), or not detected with estimated detection limits (UJ), because the analytes were recovered below the lower acceptance level (LAL of 75%) but at levels greater than 30% in the associated matrix spike sample.
- Some results were rejected (R) for the following reasons:
    - Antimony (23 rejected results), copper (5 rejected results), lead (1 rejected result), and manganese (1 rejected result) data were rejected because the associated matrix spike sample recovery was less than 30%.
    - Fifteen mercury results were rejected because the samples were analyzed after twice the appropriate holding time.

3.3.2 Organic Chemical Data Quality

Soil, sediment, and tuff samples were analyzed for VOCs, SVOCs and PCBs. Some results for SVOC analytes (phenanthrene and pyrene) were qualified as estimated (J) because the results were less than the PQL but greater than the MDL.

- Reporting limits for many SVOC analytes were qualified as UJ because surrogate recoveries were less than the LAL but greater than 10% recovery.
- Reporting limits for PCBs were qualified UJ because surrogate recoveries were less than the LAL but greater than 10% recovery.

Pore-gas samples were analyzed for VOCs. The pore-gas results had no data quality issues.

3.3.3 Radionuclide Data Quality

Radionuclide analytes in soil, sediment, and tuff included americium-241, radionuclides by gamma spectroscopy, tritium, isotopic plutonium, isotopic uranium, and strontium-90. Some radiological results were rejected (R) because spectral interference prevented positive identification of the analytes. Results rejected for this reason include americium-241 (26 samples rejected) and plutonium-238 and plutonium-239 (one sample rejected for each isotope).

3.4 RFI Results

The following sections summarize the results of RFI sampling at MDA U. Results of individual sampling events are also summarized in the figures and tables showing inorganic chemicals above current Laboratory background values (LANL 1998, 59730, p. 44), radionuclides above background or fallout values (LANL 1998, 59730, p. 45), and detected organic chemicals.

3.4.1 Surface Soil Results

Surface soil sampling was conducted as part of RFI activities in 1992, 1994, 1998, and 2001. A total of 140 surface soil samples were collected, although no one sample was analyzed for every analyte.

3.4.1.1 Inorganic Chemicals

The concentrations of inorganic chemicals in surface soil samples were compared with Laboratory background values (LANL 1998, 59730, p. 44). Surface soils were analyzed for inorganic chemicals in 1992 and 1994. Table 3.4-1 presents the frequency with which inorganic chemicals were reported above background values in surface soil, and Table 3.4-2 presents the sample data for inorganic chemicals above background values. Figures 3.4-1 and 3.4-2 show by location the inorganic chemical results above background values for 1992 and 1994 sampling events, respectively.

Several inorganic chemicals were detected above Laboratory background values, most notably lead, mercury, total uranium, and zinc. Other inorganic chemicals detected above background values in fewer than ten surface soil samples include aluminum, barium, beryllium, chromium, cobalt, copper, manganese, nickel, silver, and vanadium. Lithium and strontium, which do not have background values, were also detected in surface soil samples at MDA U.

3.4.1.2 Organic Chemicals

No organic chemical was detected in more than three of 70 surface soil samples (Table 3.4-3). Organic chemicals (primarily polyaromatic hydrocarbons [PAHs]) were detected in five surface soil locations from the 1994 sampling event, as shown in Figure 3.4-3. The three sample locations shown far to the north and downslope from MDA U in Figure 3.4-3 are 1994 sediment samples, which are discussed in section 3.4.2. Analysis for PCBs in 1998 soil samples resulted in no detections. Table 3.4-4 provides the data for detected organic chemicals.

3.4.1.3 Radionuclides

The concentrations of radionuclides in surface soil samples were compared with Laboratory soil background values or fallout values (LANL 1998, 59730, p. 45), depending on whether the radionuclide is naturally occurring or a fallout radionuclide. Fallout radionuclides (americium-241, cesium-137, cobalt-60, tritium, plutonium-238, plutonium-239, and strontium-90) were compared with fallout values only if the samples were taken within 0.5 ft of the ground surface. Isotopes of uranium and thorium, which are naturally occurring radionuclides, were compared with surface soil background values regardless of sample depth. Table 3.4-5 presents the frequency with which radionuclides were detected above background/fallout values in surface soil and Table 3.4-6 presents the sample data for radionuclides above background/fallout values. Figures 3.4-4, 3.4-5, 3.4-6, and 3.4-7 show results above background for the 1992, 1994, 1998, and 2001 surface soil sample campaigns, respectively.

Plutonium-239 was reported above the fallout value in 61 of 76 samples. The highest plutonium-239 concentration occurred to the north and west of MDA U, but was either not detected or detected at low levels within MDA U. Values increase on the benches farther to the north where surface soil eroding from the slopes is expected to accumulate. Tritium was detected in 90 of 90 samples. The tritium data generally show low values across, and north of, MDA U, with higher values along the southern edge of MDA U. Uranium-235 was reported above background value in 11 of 58 samples.

Other radionuclides detected above background/fallout values at lower frequencies (i.e., fewer than 10 samples) include americium-241, cesium-137, plutonium-238, strontium-90, uranium-234. radium-223, radon-219, and thorium-227 have no background values but were detected at low levels (approximately 4 pCi/g).

3.4.2 Sediment Sample Results

In 1994, nine sediment samples (three locations sampled at three depths) were collected downslope of MDA U but above the floodplain in DP Canyon. At each sample location, samples were collected from 0-0.25 ft, 0.25–0.5 ft, and 0.5–1 ft depths.

3.4.2.1 Inorganic Chemicals

The concentrations of inorganic chemicals in channel sediment samples were compared with Laboratory-wide canyon sediment background values (LANL 1998, 59730, p. 44). All mercury data were rejected because the holding time had been exceeded. Table 3.4-1 presents the frequency with which inorganic chemicals were detected above background values in channel sediment samples and Table 3.4-2 presents the sample data for inorganic chemicals above background levels, and Figure 3.4-2 shows these results by location.

Chromium was detected above the sediment background value of 10.5 mg/kg in 8 out of 9 samples. Lead, total uranium, and zinc were detected in only 1 or 2 of the 9 sediment samples. All other detected inorganic chemicals were below background values. Detection limits exceeded background values for cadmium, cobalt, selenium, and silver.

3.4.2.2 Organic Chemicals

Table 3.4-3 summarizes the frequency of detected SVOCs in channel sediments at MDA U, and Table 3.4-4 provides the sample data for detected organic chemicals. Six SVOCs, primarily PAHs, were detected at concentrations of 1.5 mg/kg or less (Figure 3.4-3).

3.4.2.3 Radionuclides

Detected concentrations of radionuclides were compared with either the sediment background or fallout values (LANL 1998, 59730, p. 45). Table 3.4-5 presents the frequency with which radionuclides were detected above background/fallout values in sediment and Table 3.4-6 presents the sample data for radionuclides above background/fallout values. Figure 3.4-5 shows the results above background/fallout values by location.

Plutonium-239 was detected above its fallout value (0.068 pCi/g) in 7 of 9 samples. The highest detected concentration of plutonium-239 (4.14 pCi/g) was at location 21-01865 in the DP Canyon sediments downgradient of MDA U. Plutonium-238 was detected above its fallout value (0.0006 pCi/g) in 2 of 9 samples and tritium was detected above its fallout value (0.093 pCi/g) in 5 of 9 samples. All other detected radionuclides were below background or fallout values.

3.4.3 Subsurface Tuff Results

Sixty-six tuff (Qbt3) samples were collected from ten locations within and around MDA U.

3.4.3.1 Inorganic Chemicals

Analytical results for subsurface tuff samples were compared with background values for Qbt3 (LANL 1998, 59730, p. 44). Table 3.4-1 presents the frequency with which inorganic chemicals were detected above background values in subsurface tuff, and Table 3.4-2 presents the sample data for inorganic chemicals above background values. Figure 3.4-8 shows the results above background values by location.

Several inorganic chemicals were detected above Qbt3 background values but in no more than 7 of the 62 subsurface samples. These include aluminum, arsenic, barium, beryllium, chromium, lead, manganese, mercury, and zinc. No inorganic chemicals were detected above background values at depths greater than 60 ft bgs. Detection limits for antimony, mercury selenium, silver, and thallium exceeded background values in a large number of subsurface samples.

3.4.3.2 Organic Chemicals

The subsurface tuff samples were analyzed for SVOCs. Table 3.4-3 summarizes the frequency with which SVOCs were detected in subsurface tuff at MDA U, and Table 3.4-4 provides the sample data for detected organic chemicals. Di-n-butylphthalate was detected in 3 of 62 samples, all from location 21-10842 (Figure 3.4-9), and all detections were less than 0.5 mg/kg. No other SVOCs were detected in tuff, nor were PCBs detected.

3.4.3.3 Radionuclides

Naturally occurring uranium isotopes were compared to Laboratory-wide background values from the appropriate tuff unit (LANL 1998, 59730, p. 45). Fallout radionuclides (americium-241, cesium-137, plutonium-238, plutonium-239, and tritium) were evaluated on the basis of detection status. Table 3.4-5 lists the frequency with which radionuclides were detected or detected above background values in subsurface tuff, and Table 3.4-6 presents the sample data for radionuclides detected or detected above background values. Figure 3.4-6 shows these data by location.

Tritium was detected in most (63 out of 66) of the subsurface tuff samples collected at MDA U, although all detected values were less than 2.4 pCi/g. At two locations, tritium was detected at the total depth of the borehole (75 ft bgs). Americium-241 and plutonium-239 were detected in 6 and 7 of 66 subsurface tuff samples, respectively. Radium-223 and thorium-227 (actinium-227 progeny) were detected in one subsurface sample, collected from a fractured interval at 54–55 ft bgs beneath the eastern absorption bed (Figure 3.4-6). Uranium-234 and –235, naturally occurring radionuclides, were detected above Qbt3 background values in 13 and 15, respectively, of 66 tuff samples. Elevated uranium-234 and uranium-235 were detected at depth in two boreholes at depths from 54 to 75 ft on the western part of MDA U (Figure 3.4-6). No uranium-234 or uranium-235 was detected in subsurface tuff from the eastern part of MDA U.

3.4.3.4 Moisture Analyses

Moisture measurements were made on the core samples submitted for tritium analyses in 1998 (LANL 1999, 87295). The moisture results are shown in Figure 3.4-10 and reported in Table 3.4-7. These results show a uniformly low moisture content (3% to 16% by weight) and do not indicate saturated conditions exist beneath MDA U. Results from samples associated with clay-rich fractures or interbeds are boldfaced in the table. No strong correlation between moisture content and tritium concentration was found.

3.4.4 Pore-Gas Results

The frequency with which VOCs were detected in pore-gas samples is listed in Table 3.4-8, and the data are presented in Table 3.4-9. Borehole location 21-10845 had the highest toluene concentrations at multiple depths, including the bottom of the borehole (86 parts per billion by volume [ppbv] at 25 ft; 480 ppbv at 55 ft; and 220 ppbv at 75 ft) (Figure 3.4-11). The boreholes closest to location 21-10845 (21-10839 and 21-10840) did not have elevated concentrations of toluene. VOC concentrations in pore gas from other boreholes were low (less than 60 ppbv).

3.4.5 Absorption Bed Results

The absorption beds were sampled in 1998 and 2001. Figure 3.4-6 shows the results of the 1998 absorption bed samples, and Figure 3.4-7 shows the 2001 sample locations.

In 1998, uranium-234 and uranium-235 were detected above background values in the western absorption bed (Figure 3.4-6). Low plutonium-239 (<0.25 pCi/g) and tritium (<1 pCi/g) concentrations were detected in both absorption beds (Figure 3.4-6). The 2001 sampling confirmed the presence of low tritium concentrations and uranium-234 above background value (Figure 3.4-7). In addition, actinium-227 progeny (thorium-227, radon-219, and radium-223) were detected, primarily in the eastern absorption bed (Figure 3.4-7). Cesium-137 was detected at very low (<0.7 pCi/g) concentrations in both absorption beds.

4.0 REFERENCES

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Copies of the reference sets are maintained at the New Mexico Environment Department (NMED) Hazardous Waste Bureau; the Department of Energy (DOE) Los Alamos Site Office; the EPA Region 6; and the ENV-RS project. The sets were developed to ensure that the administrative authority has all material needed to review this document, and they are updated periodically as needed. Documents previously submitted to the administrative authority are not included.

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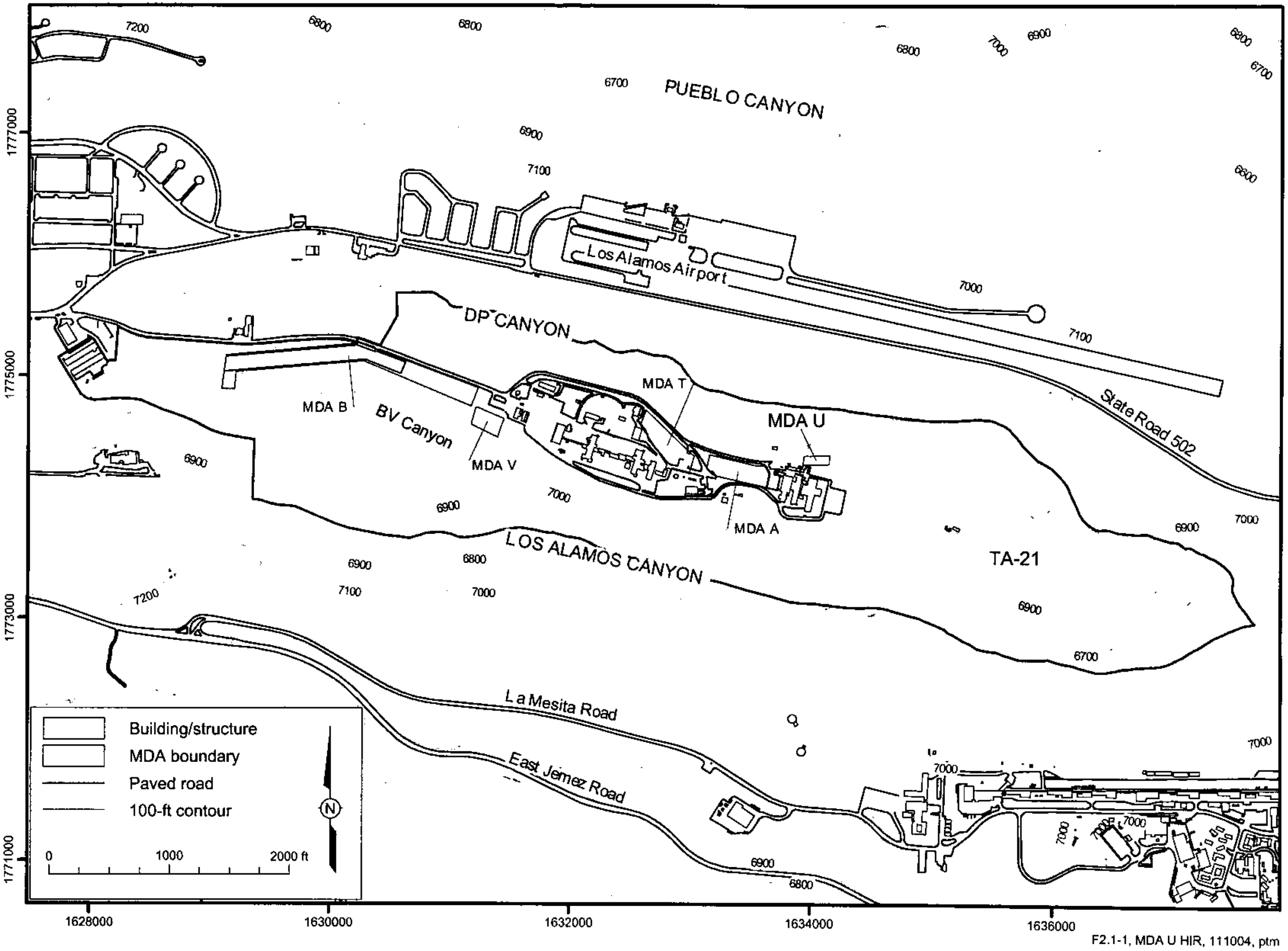


Figure 2.1-1. Material disposal areas in TA-21

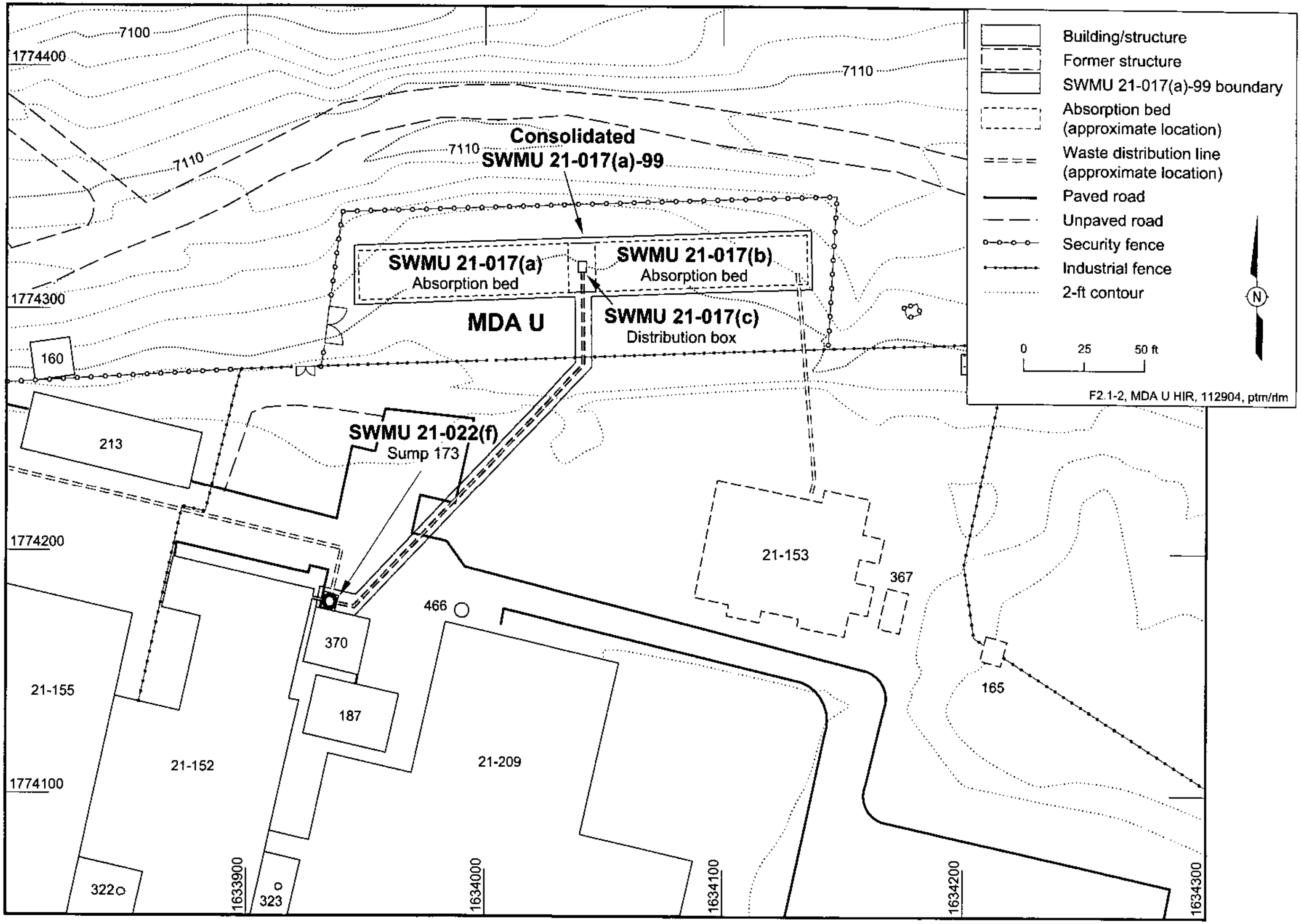


Figure 2.1-2. Consolidated SWMU 21-017(a)-99

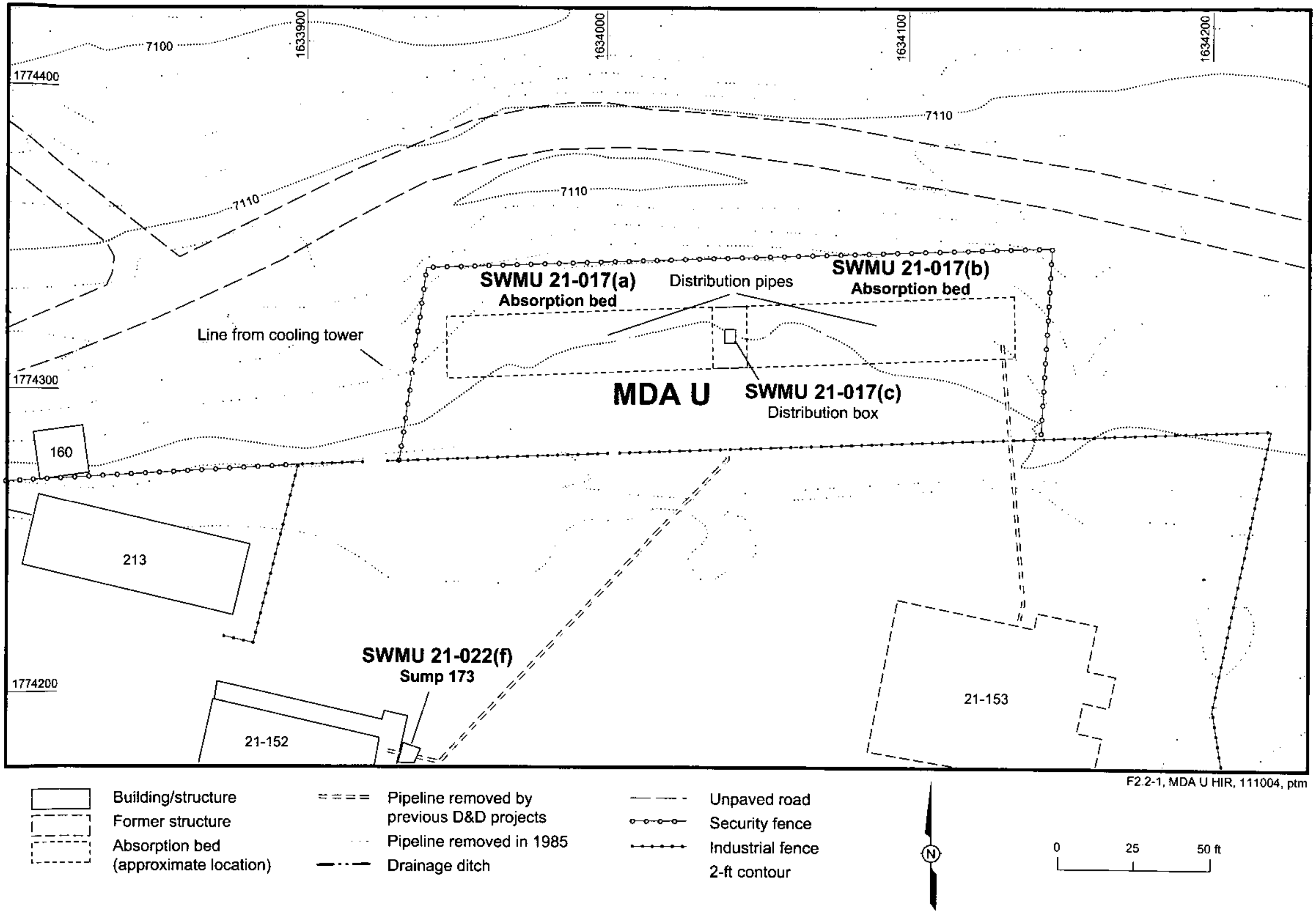
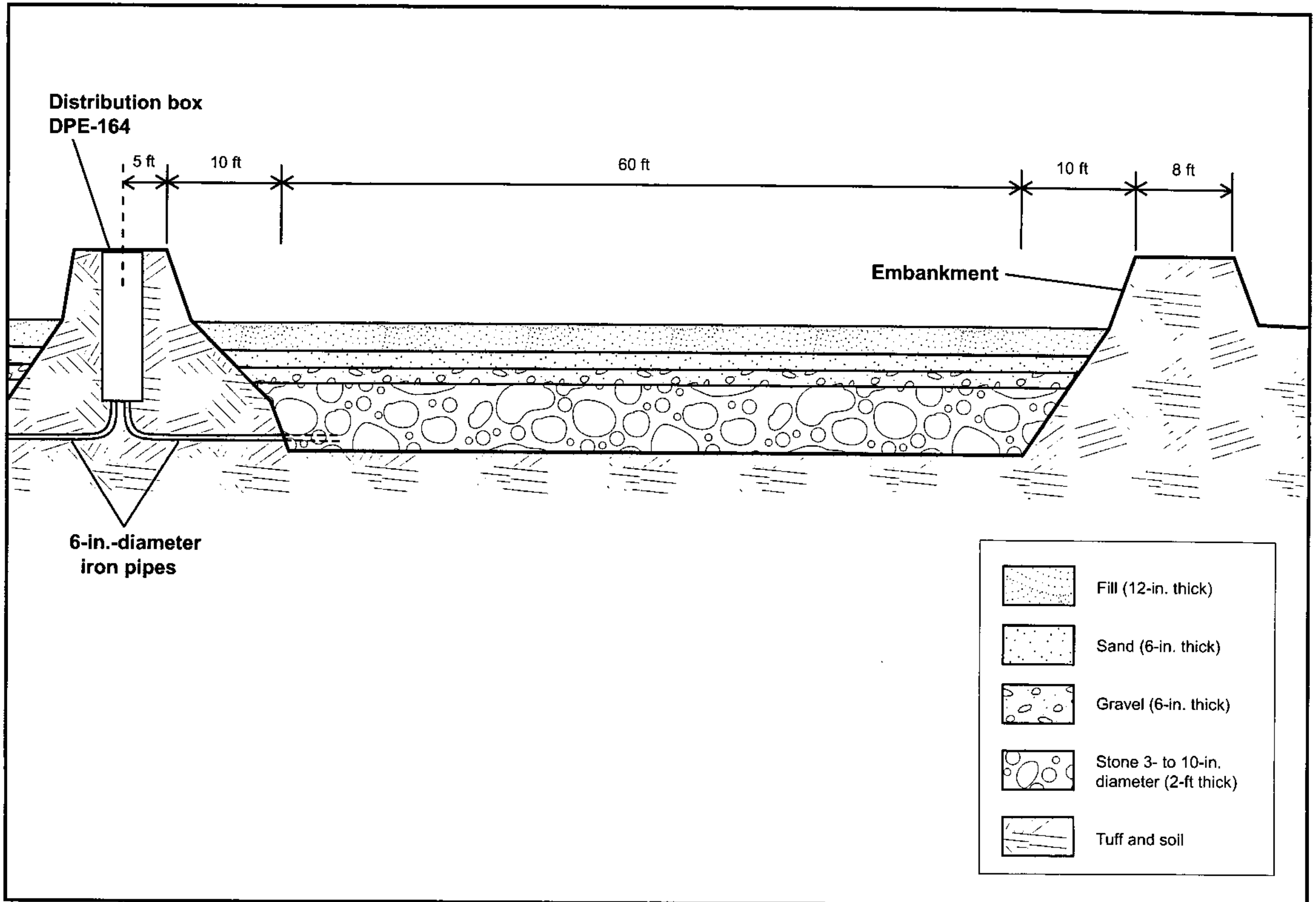
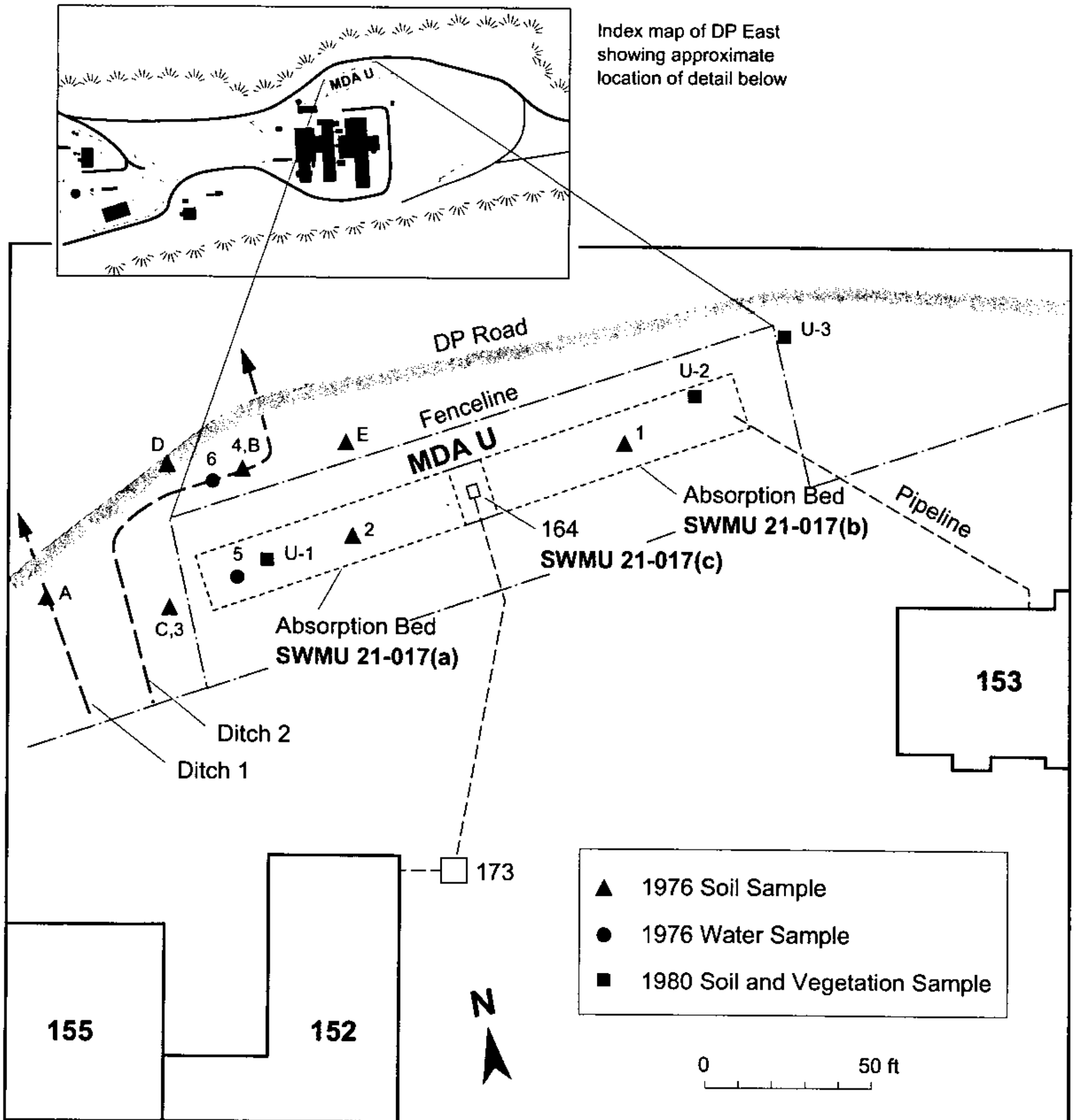


Figure 2.2-1. **1985 stabilization activities at MDA U**



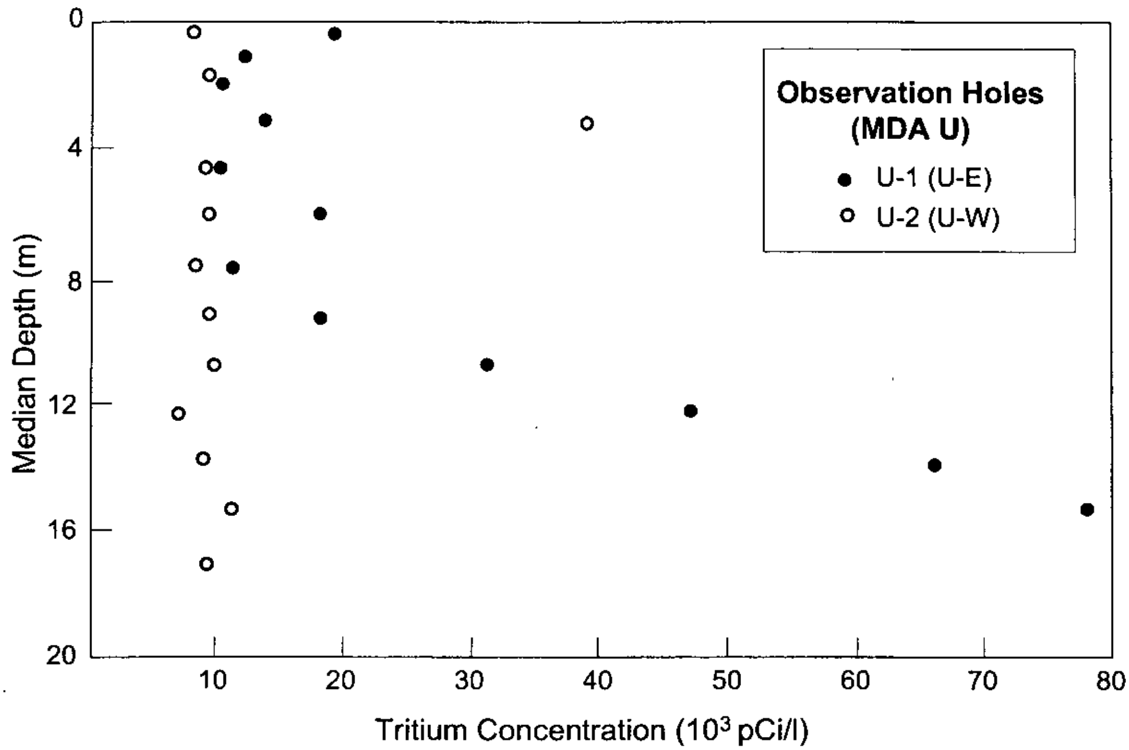
Source: LASL ENG-C2216 6/6/45; modified for F2.2-3/MDA U RFI/011203/rlm; modified for F2.3-1, MDA U HIR, 110804, ptm

Figure 2.3-1. Schematic of MDA U absorption bed design



Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-1, p. 16-207); modified for F3.1-1, MDA U HIR, 112804, ptm

Figure 3.1-1. Soil, water, and vegetation samples taken at MDA U in 1976 and 1980



Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-9, p. 16-215)
F3.1-2, MDA U HIR, 112804, ptm/rlm

Figure 3.1-2. 1983 borehole investigation tritium results

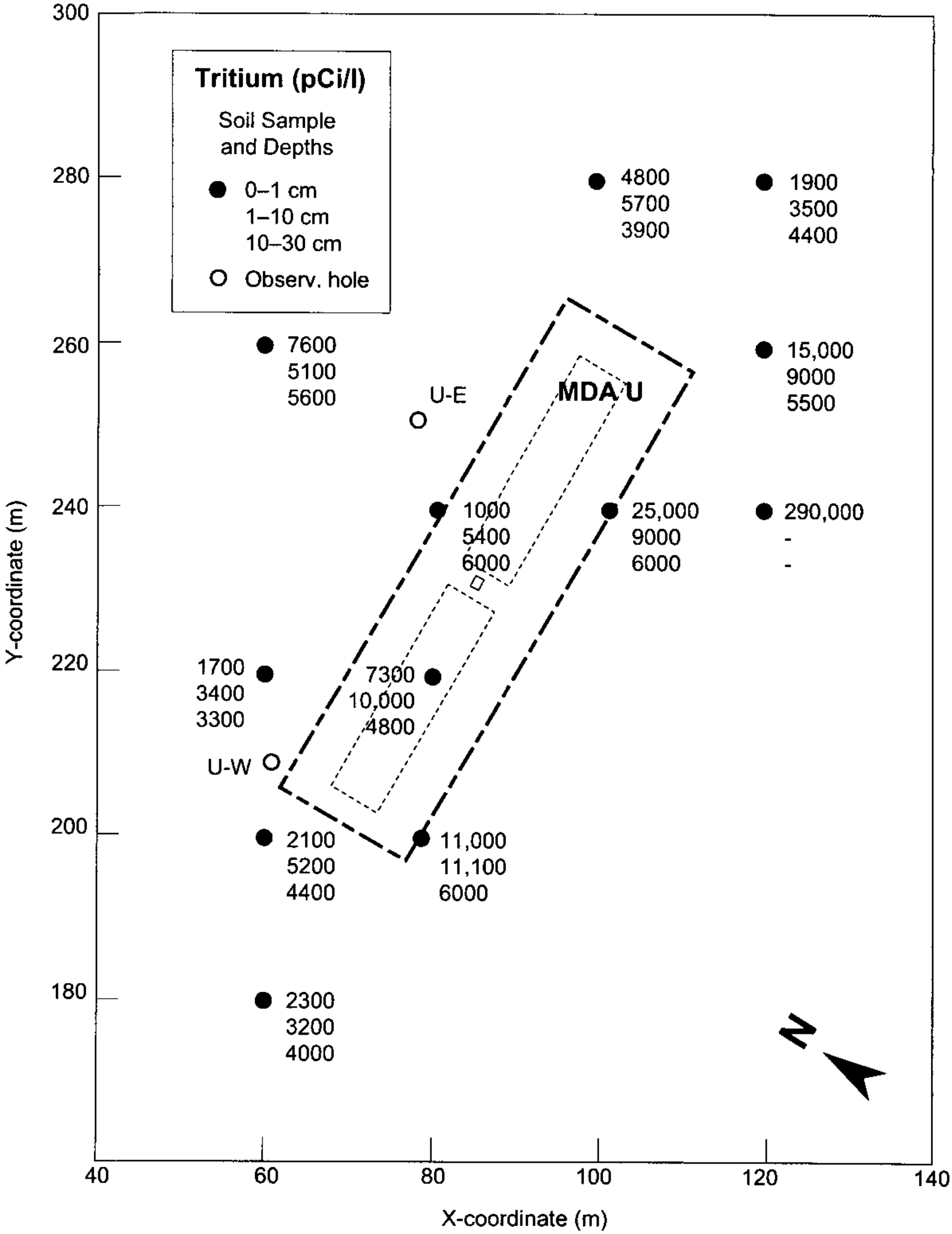


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Figure 3.1-3. 1984 MDA U tritium data for soils

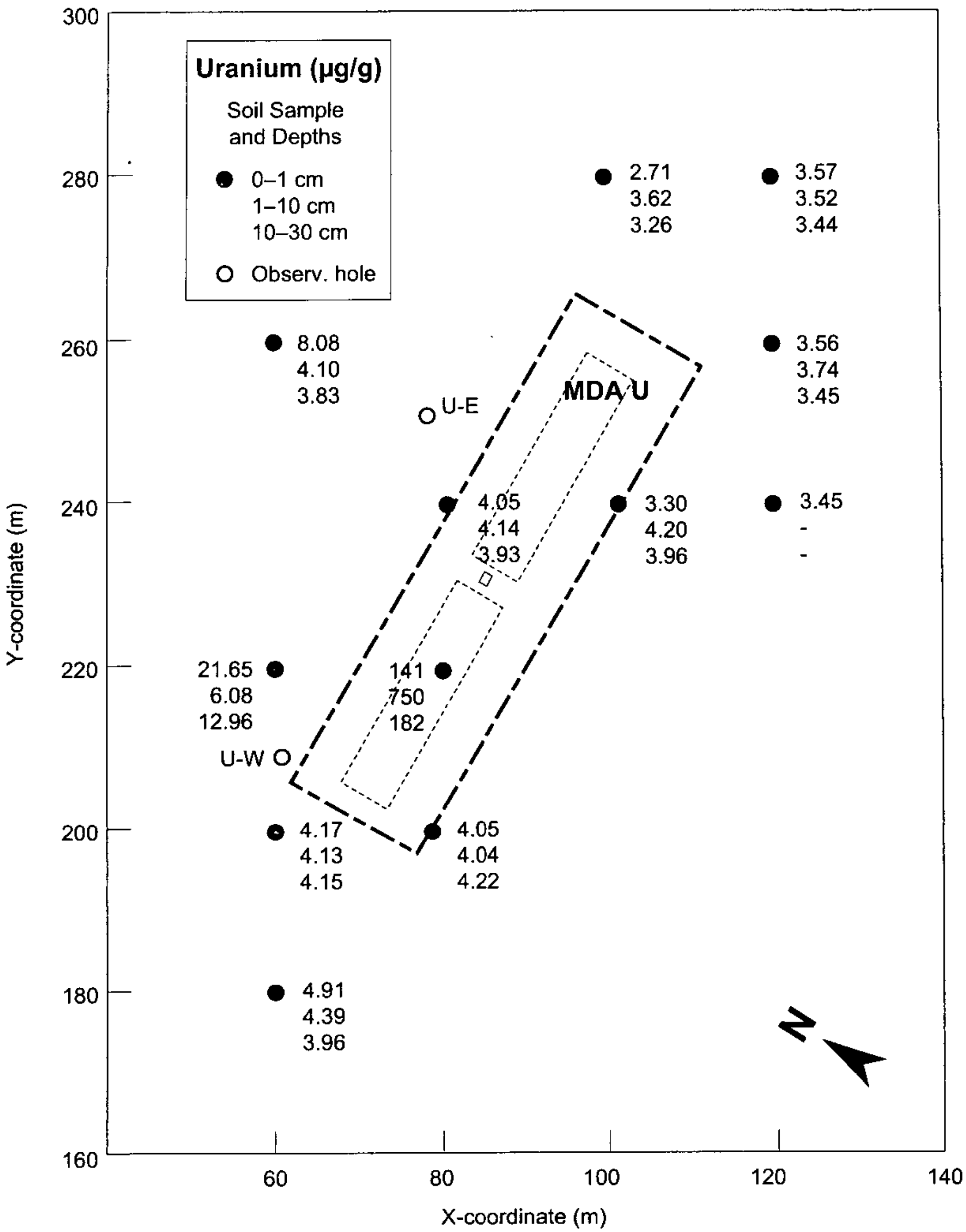

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Figure 3.1-4. 1984 MDA U uranium data for soils

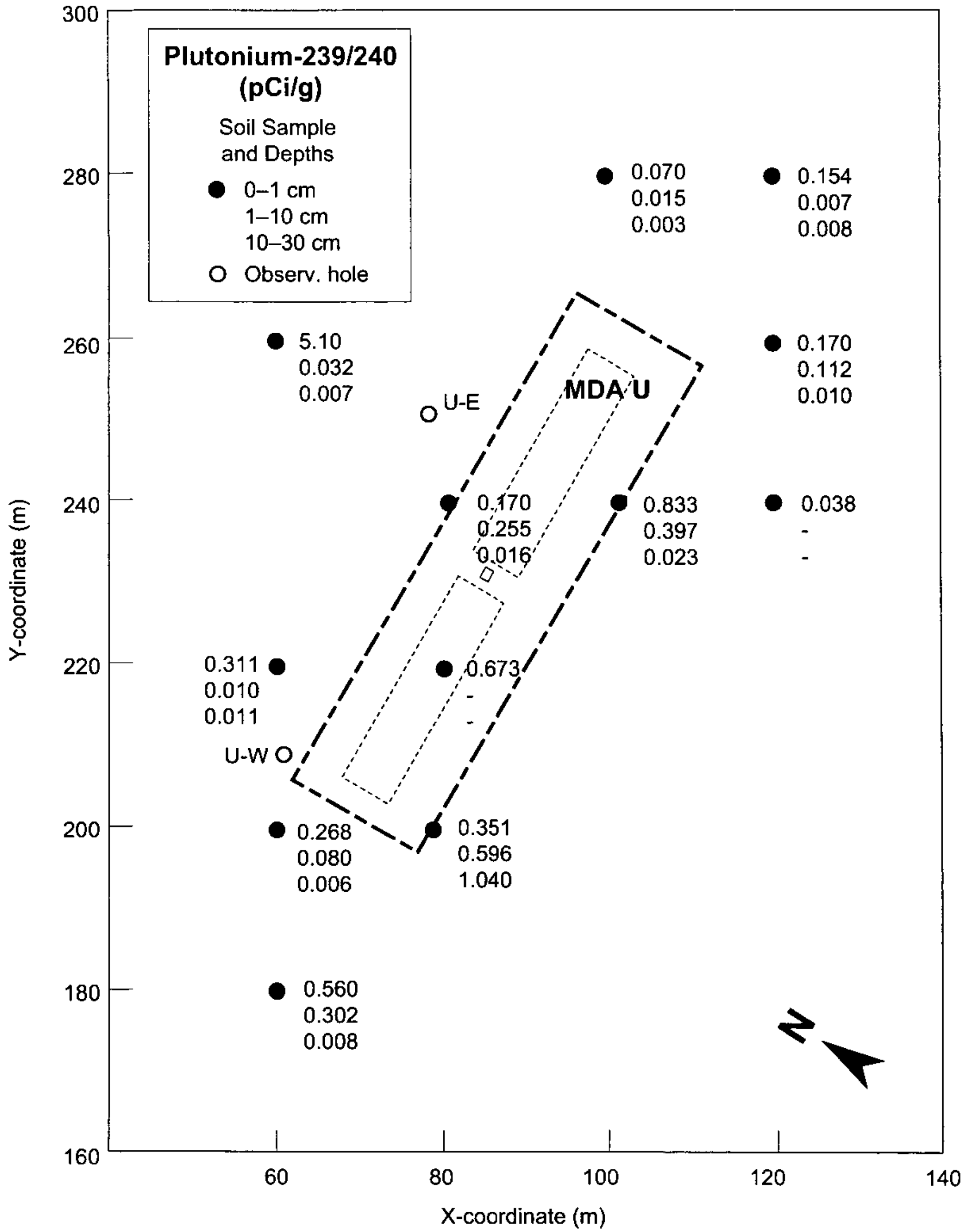

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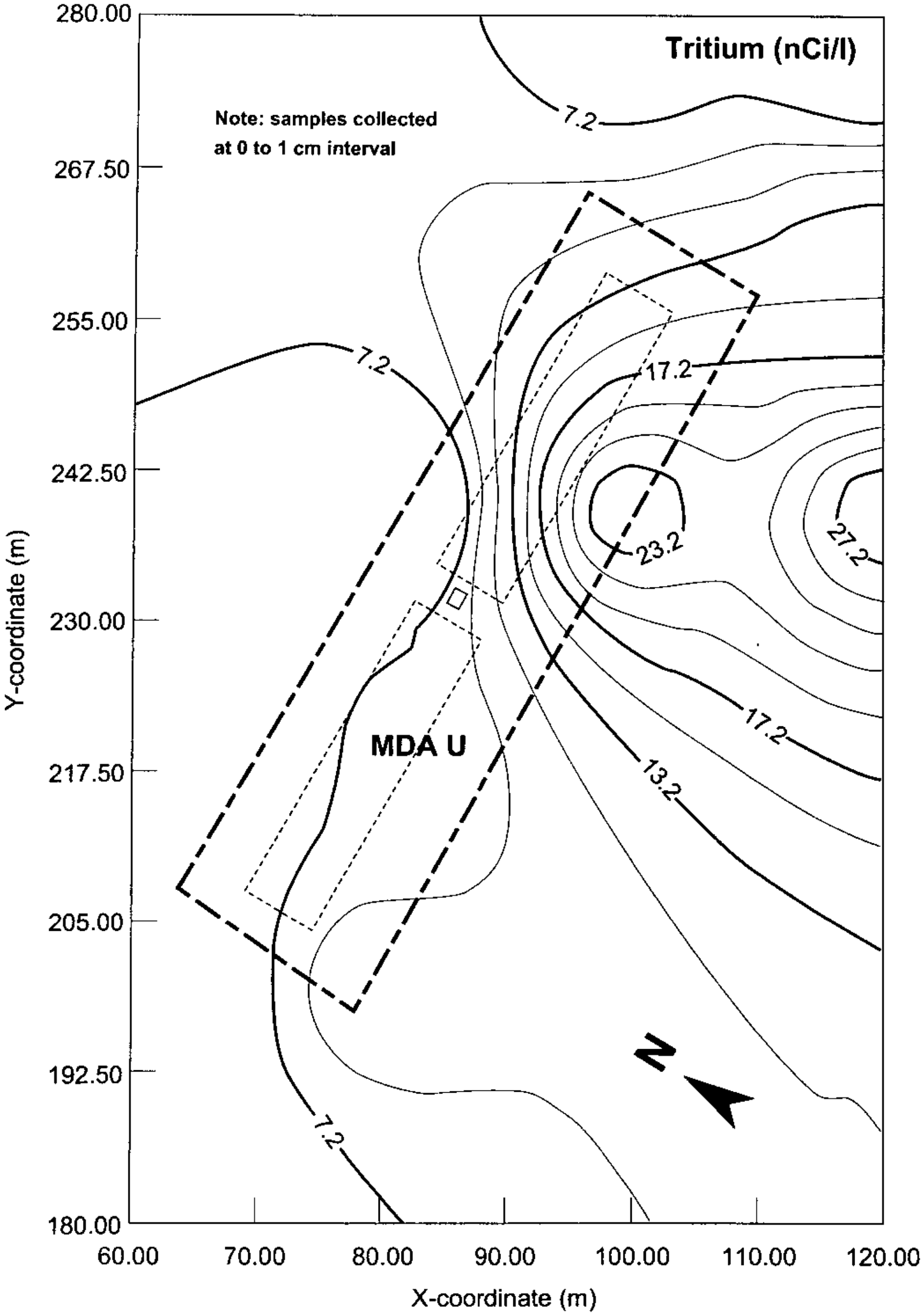
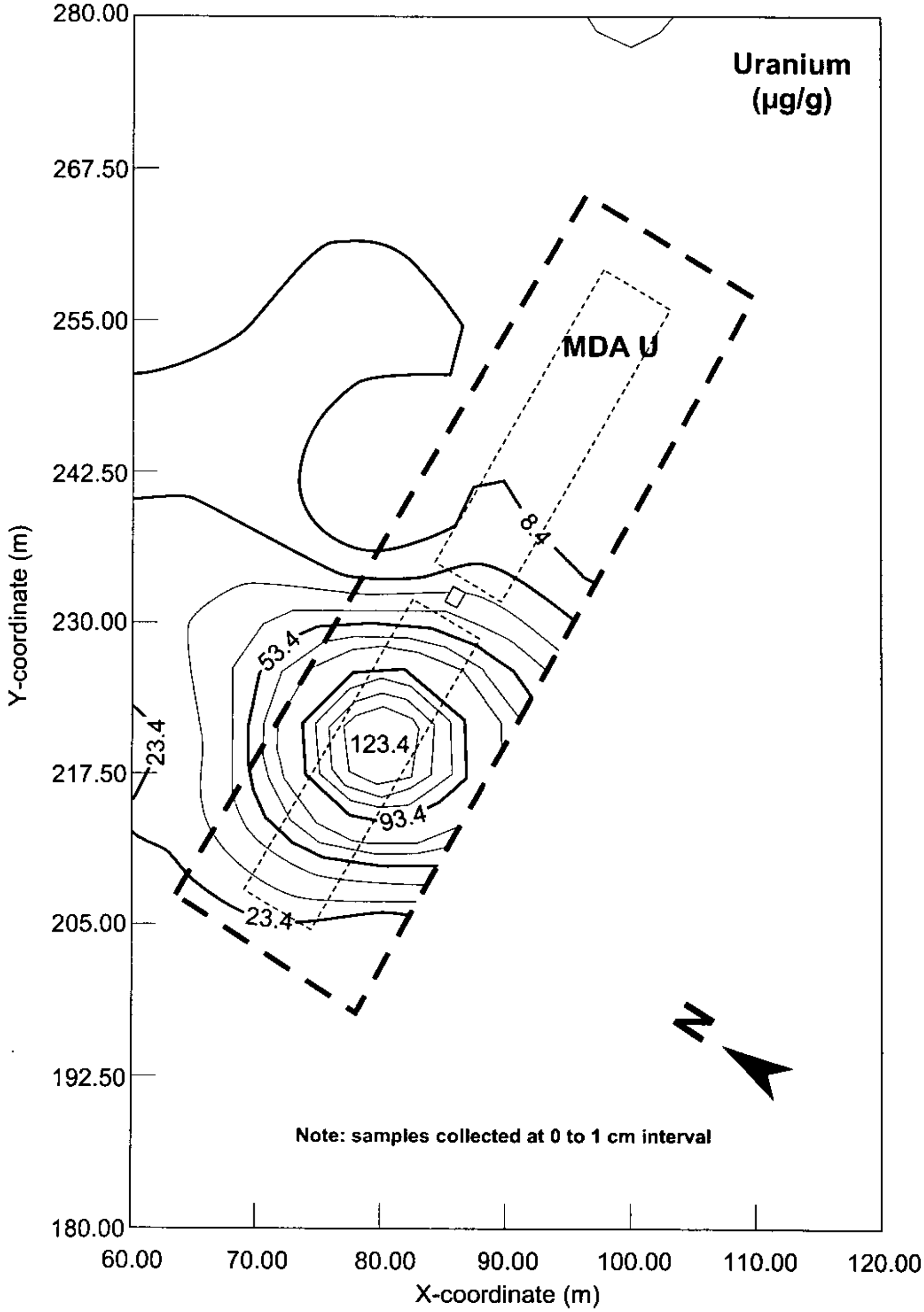
Figure 3.1-5. 1984 MDA U plutonium-239/240 data for soils



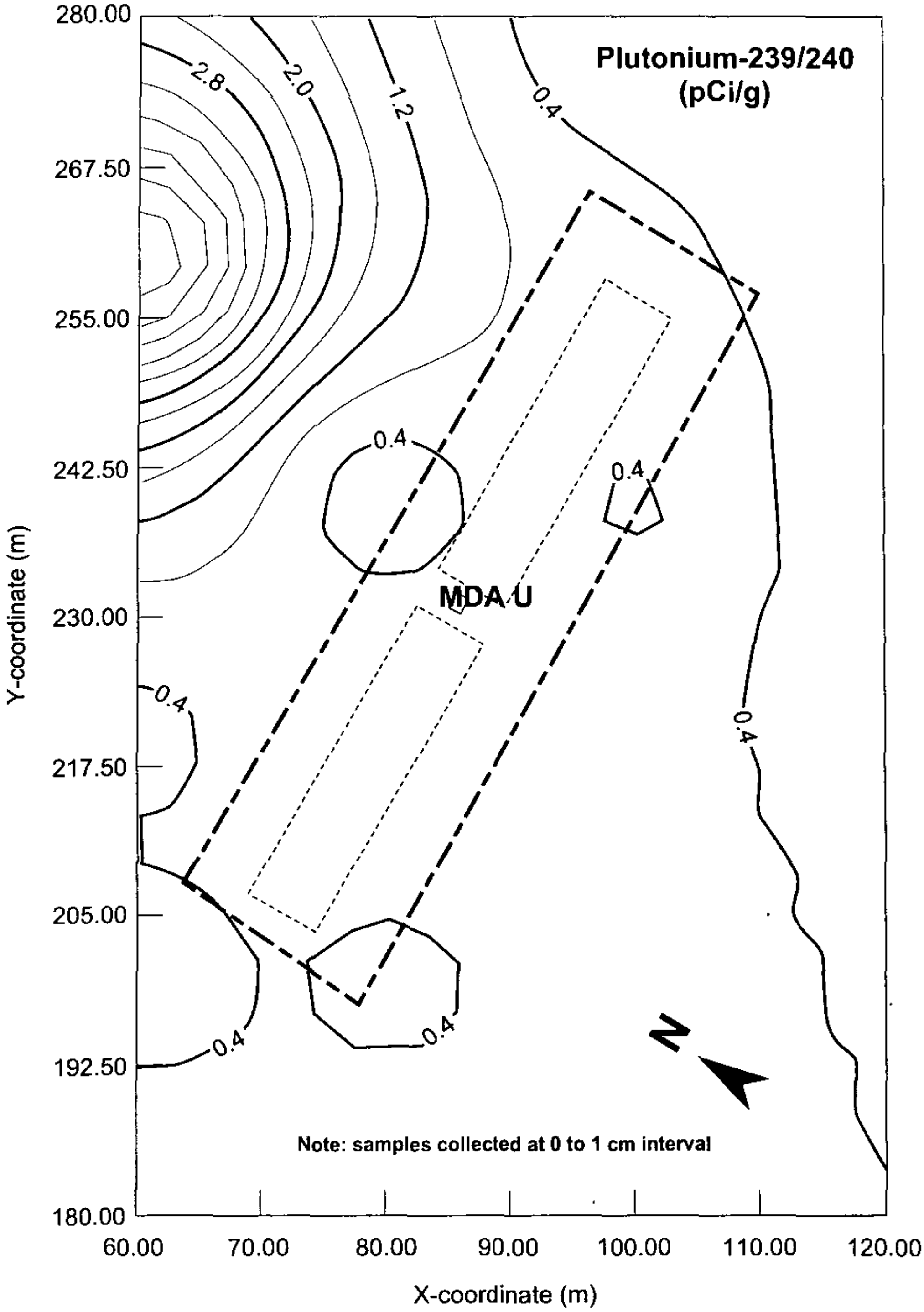
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-5, p. 16-211)
modified for F3.1-6, MDA U HIR, 111004, ptm

Figure 3.1-6. Concentration contours for tritium from the 1984 surface soil samples at MDA U



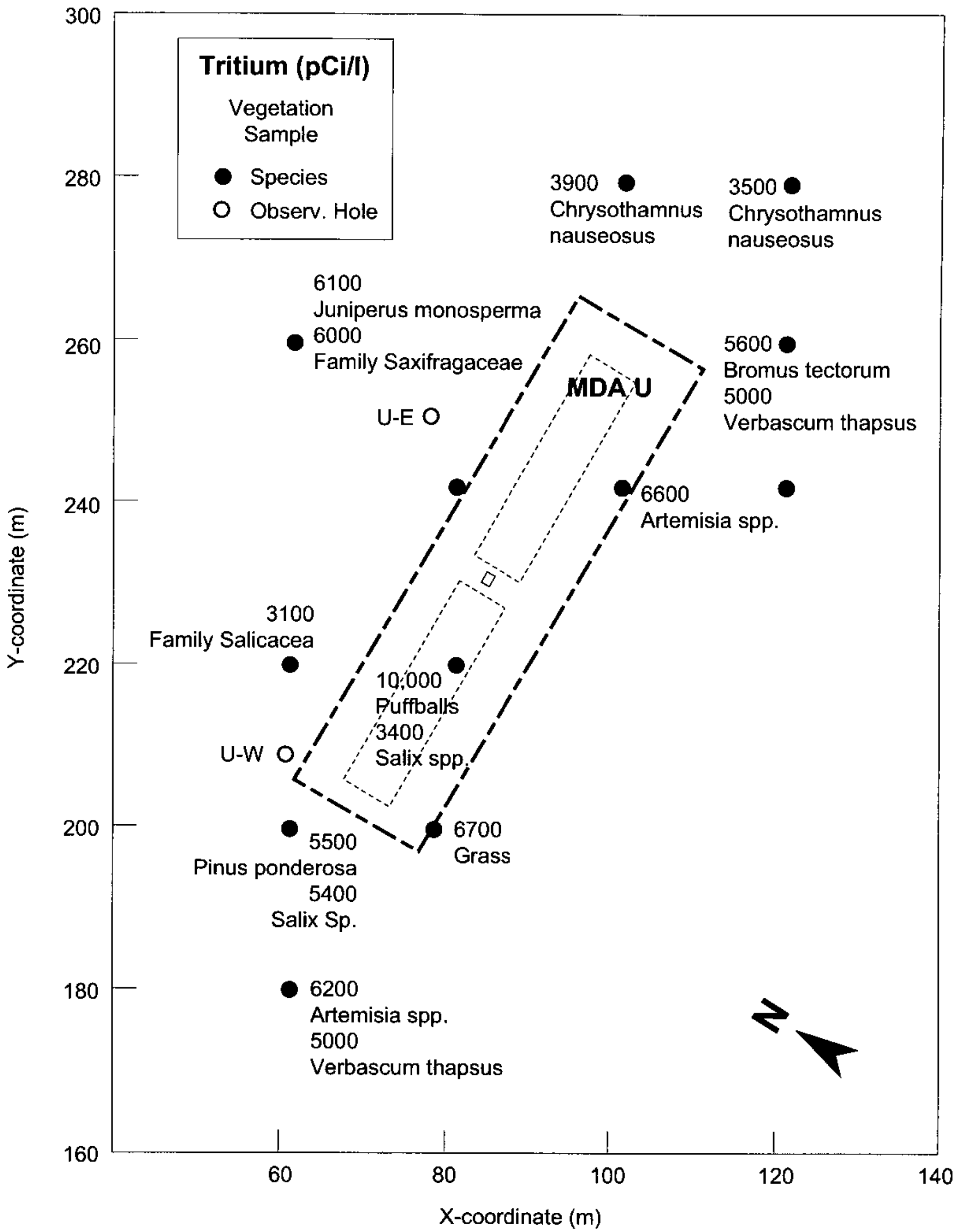
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-6, p. 16-212)
modified for F3.1-7, MDA U HIR, 112804, ptm/rlm

Figure 3.1-7. Concentration contours for uranium from the 1984 surface soil samples at MDA U



Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-7, p. 16-213)
modified for F3.1-8, MDA U HIR, 112804, ptm/rlm

Figure 3.1-8. Concentration contours for plutonium-239/240 from the 1984 surface soil samples at MDA U



Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-8, p. 16-214) modified for F3.1-9, MDA U HIR, 112804, ptm/rlm

Figure 3.1-9. 1984 MDA U tritium data for vegetation

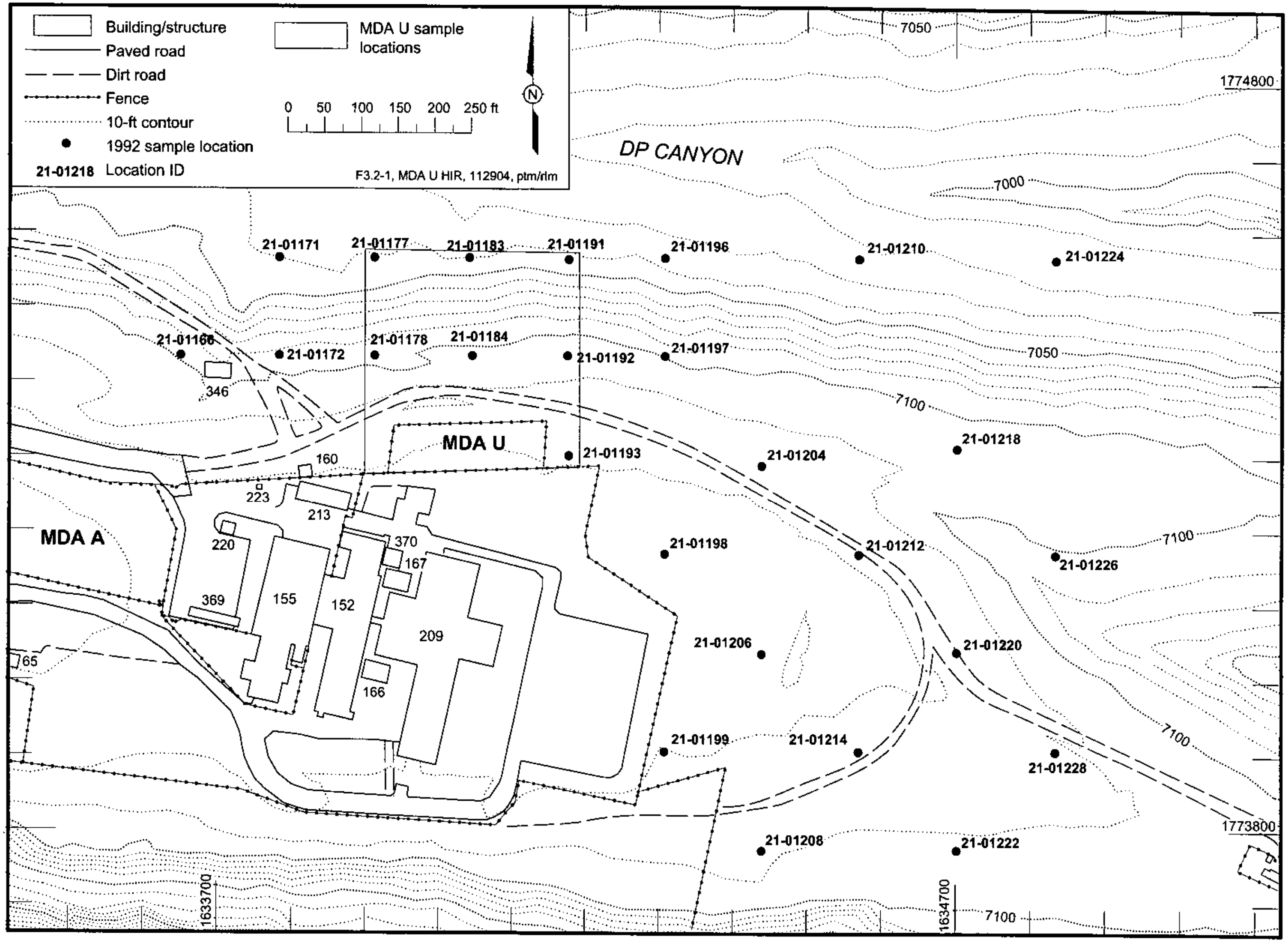


Figure 3.2-1. Locations for 1992 surface samples on the east end of DP Mesa

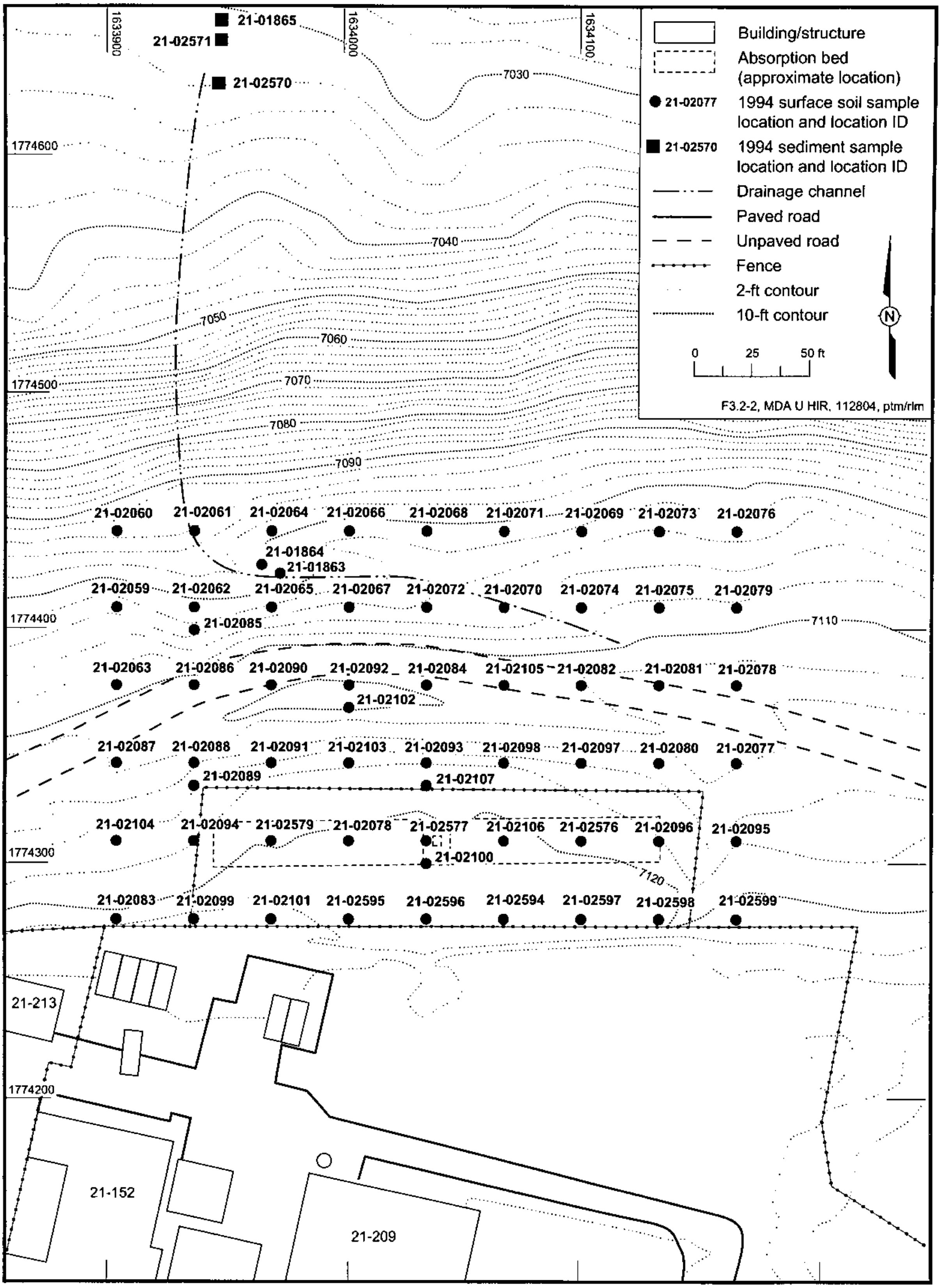


Figure 3.2-2. Locations for 1994 surface soil and sediment samples

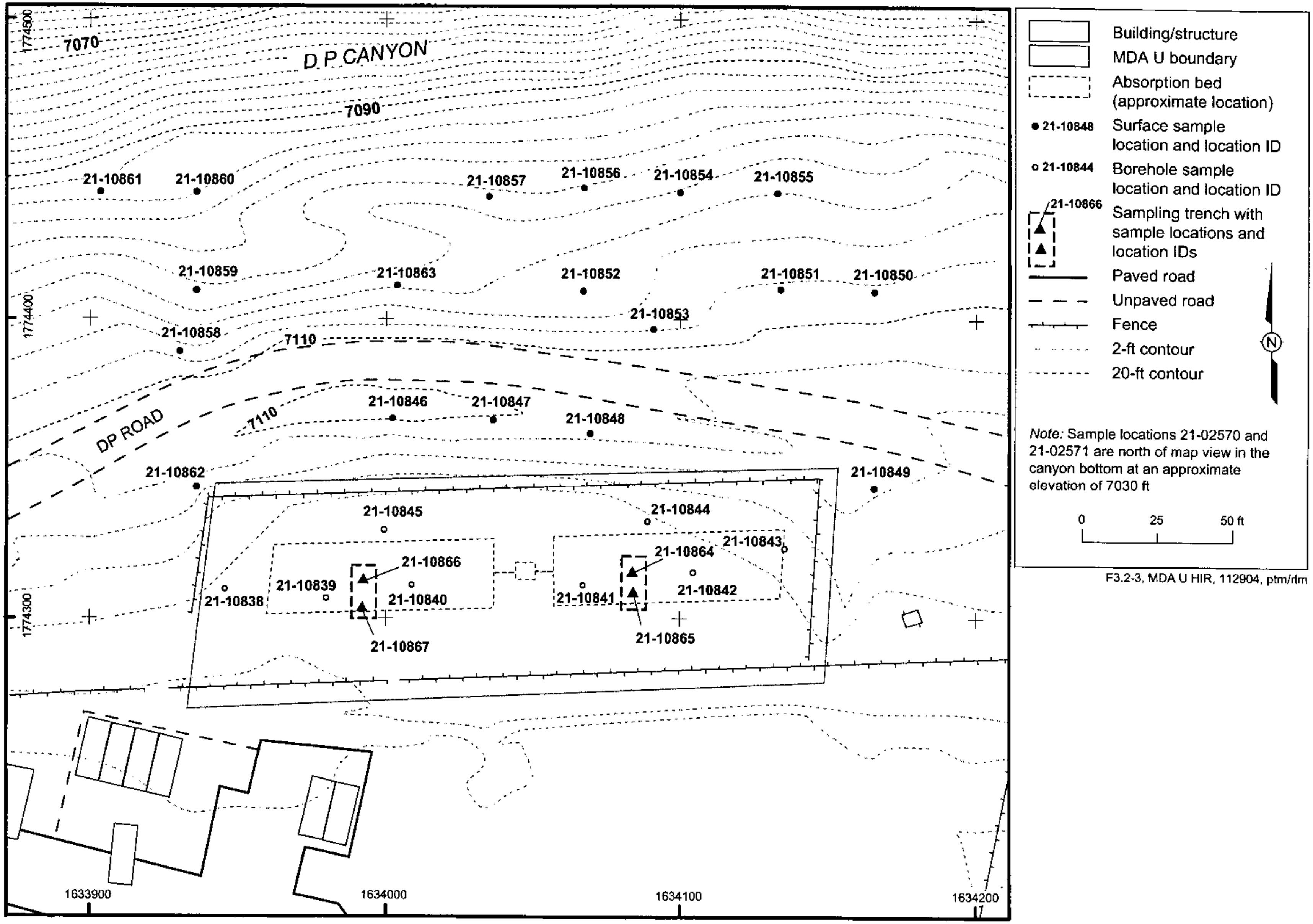


Figure 3.2-3. Locations for 1998 absorption bed, surface, and subsurface sampling

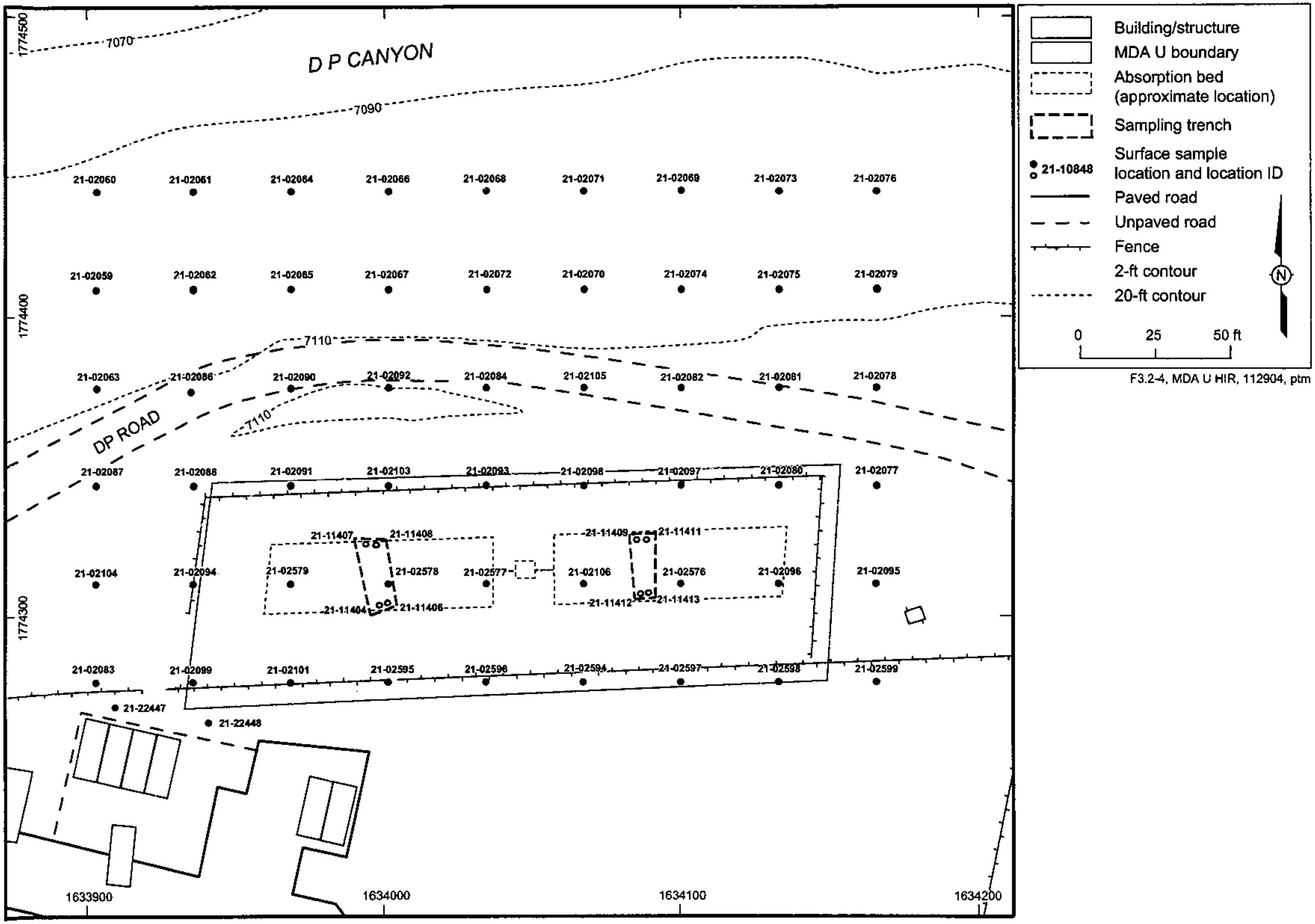


Figure 3.2-4. Locations for 2001 absorption bed and surface soil sampling

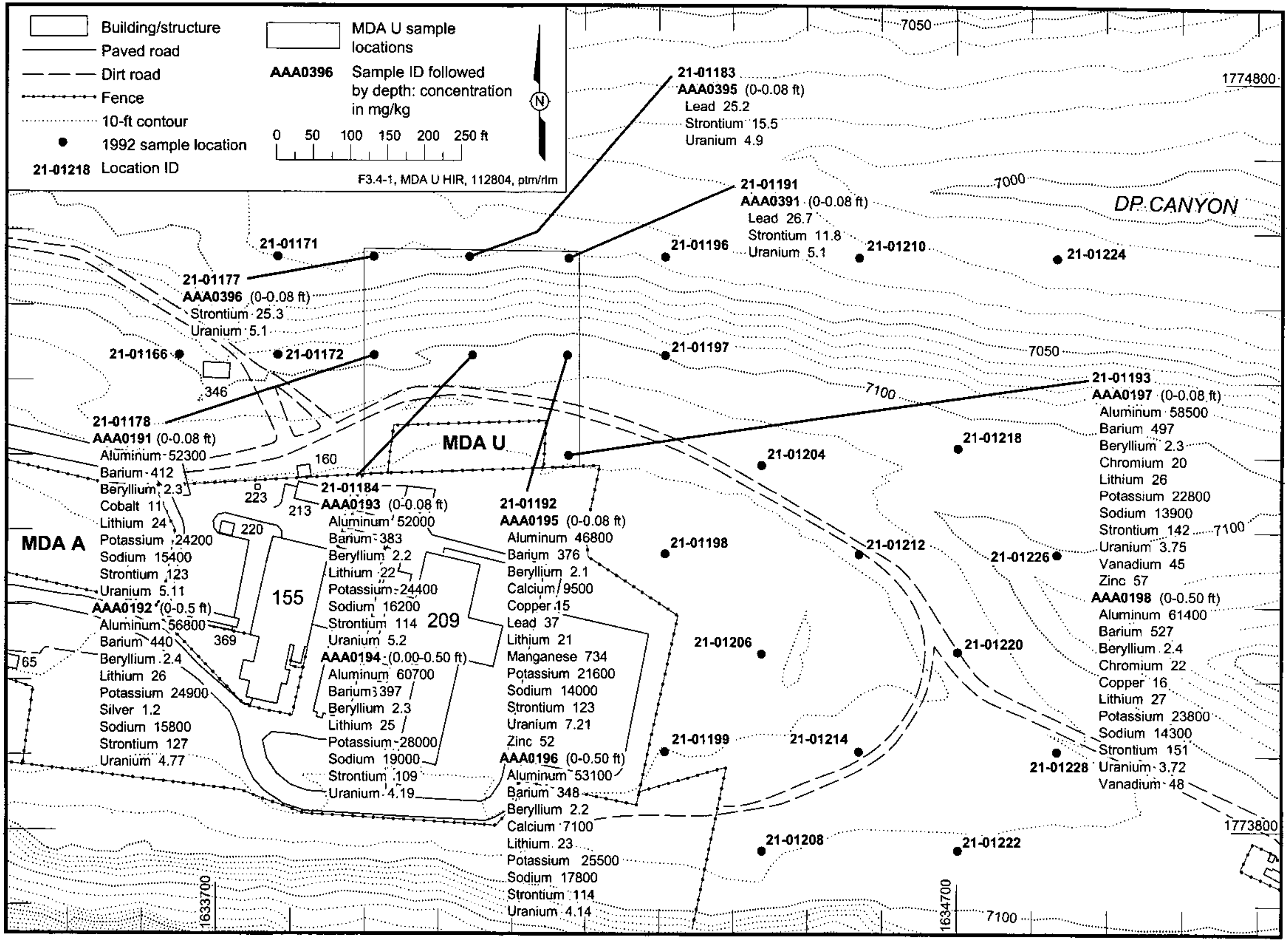
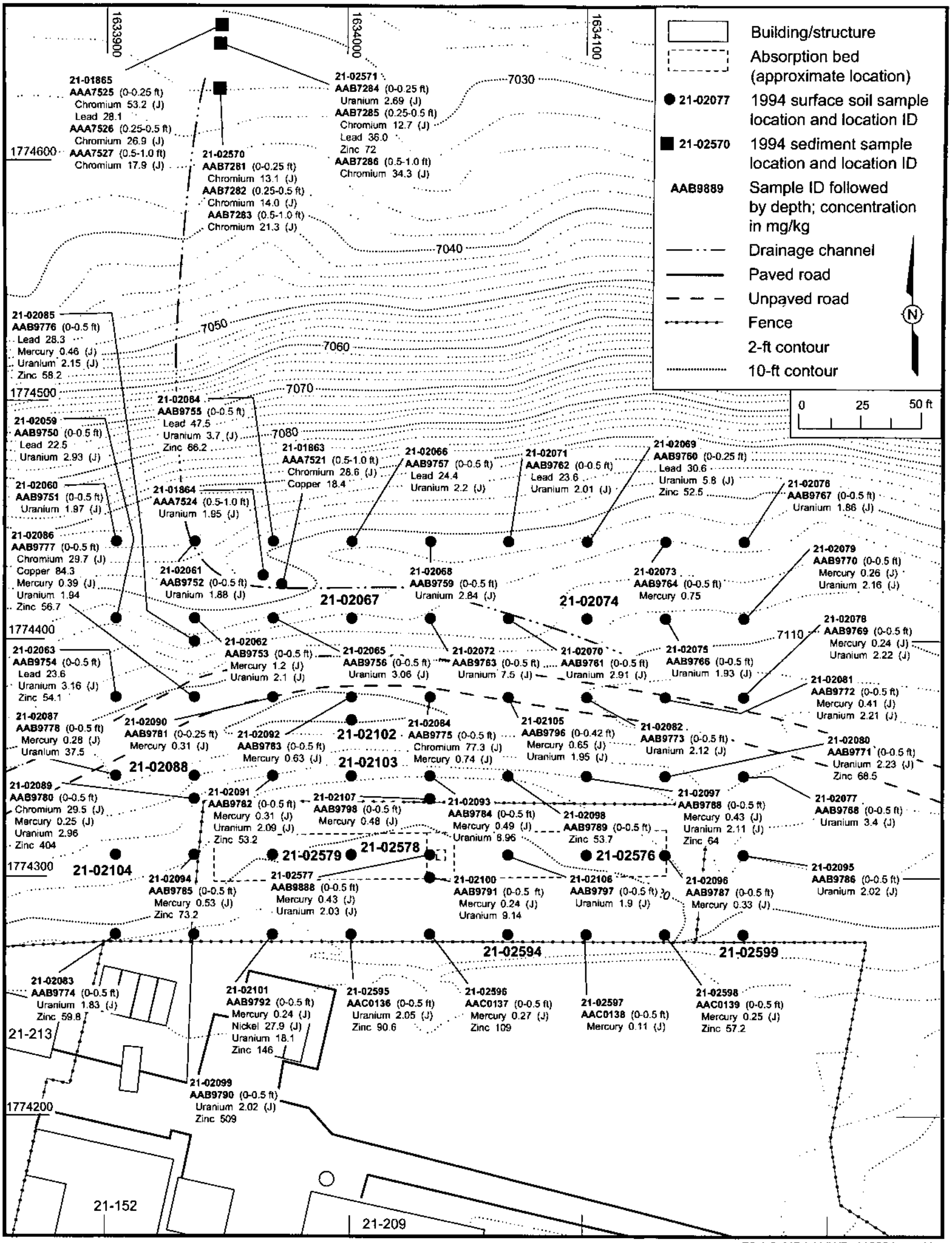
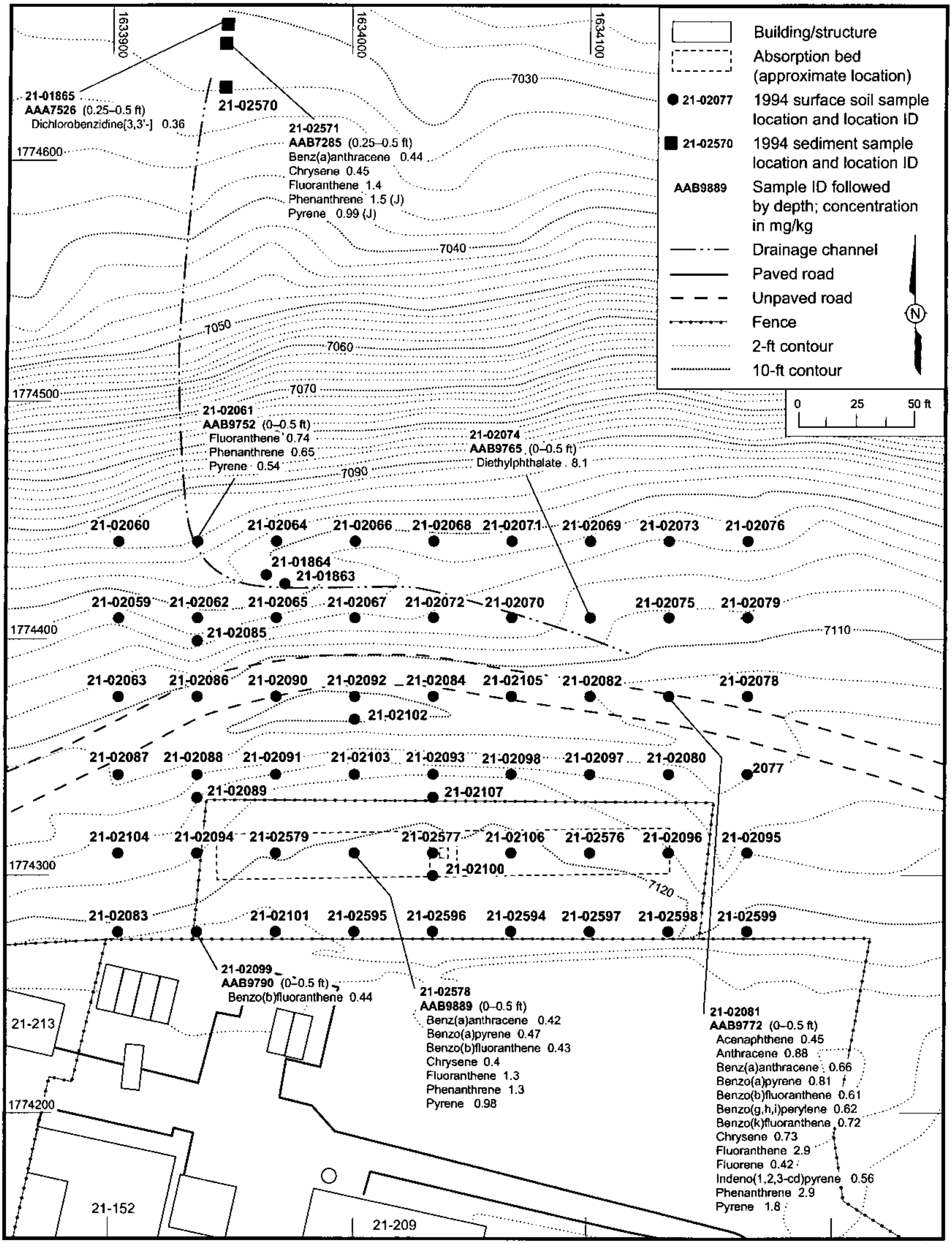


Figure 3.4-1. Inorganic chemicals above background values in 1992 surface samples



F3.4-2, MDA U IWP, 112804, ptm/rlm

Figure 3.4-2. Inorganic chemicals above background values in 1994 surface soil and sediment samples



F3.4-3, MDA U IWP, 112804, ptm/rlm

Figure 3.4-3. Organic chemicals detected in 1994 surface soil and sediment samples

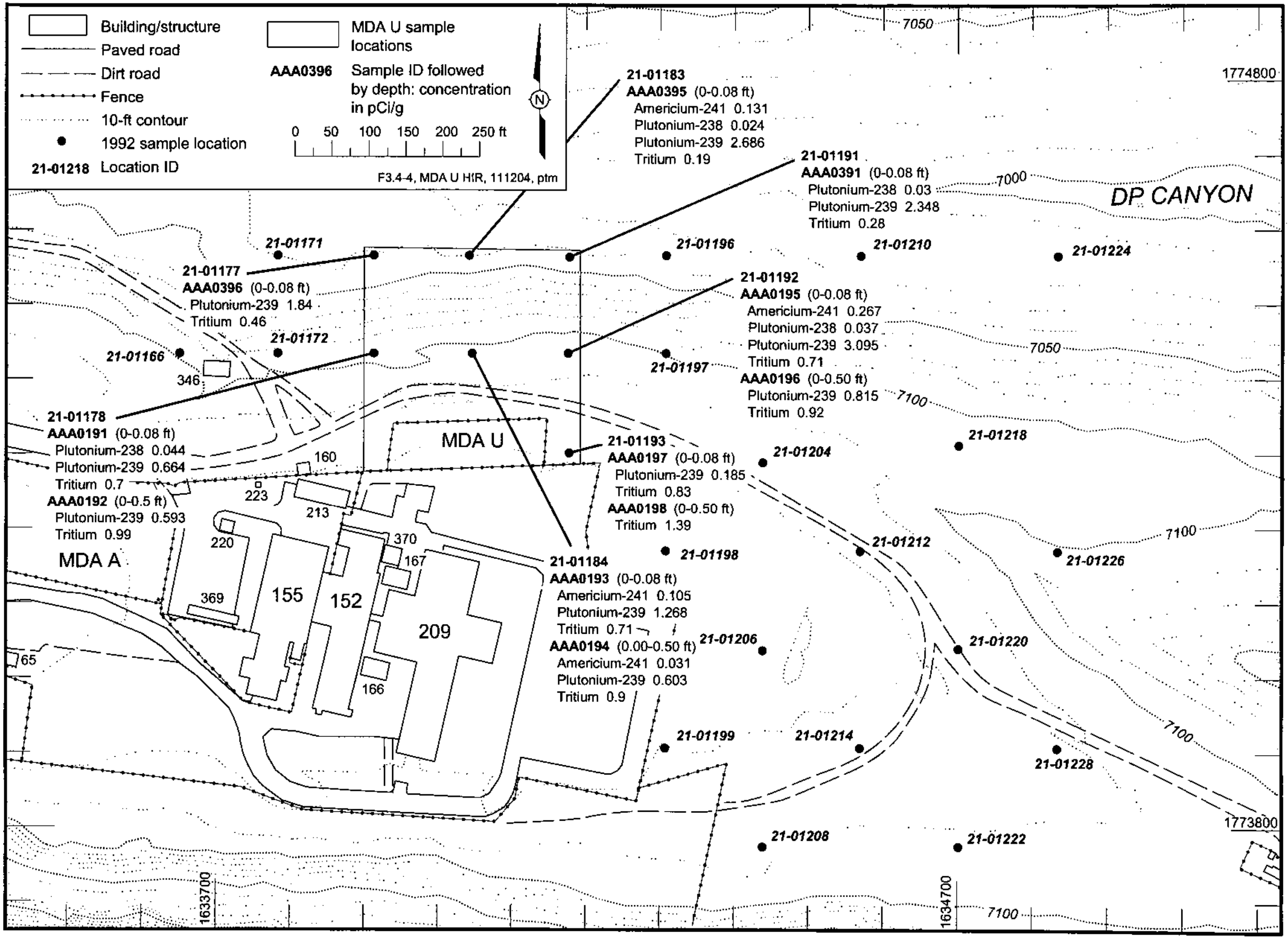
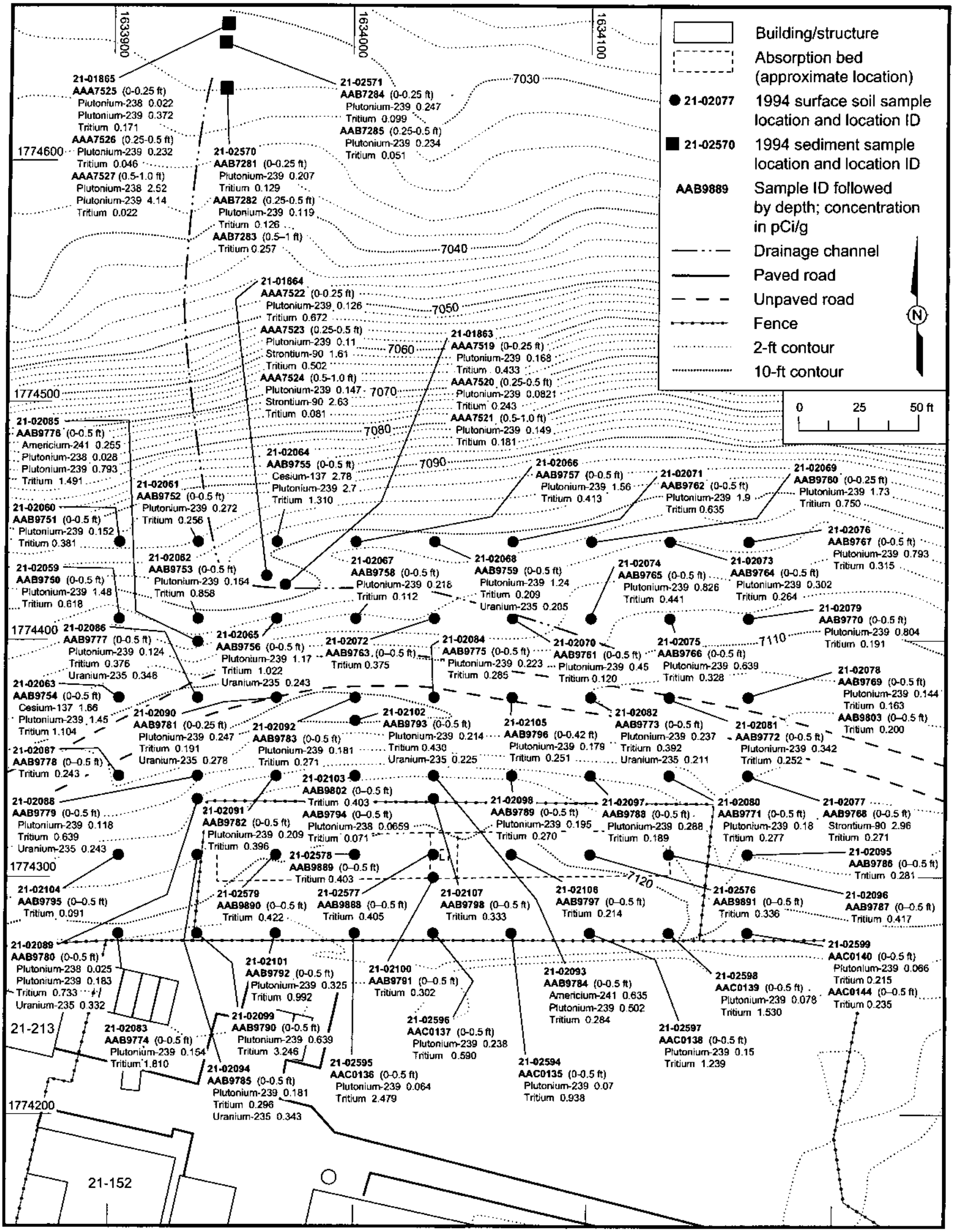


Figure 3.4-4. Radionuclides above background values in 1992 surface samples



F3.4-5, MDA U HIR, 112904, ptm

Figure 3.4-5. Radionuclides detected above background values/fallout values in 1994 surface soil and sediment samples

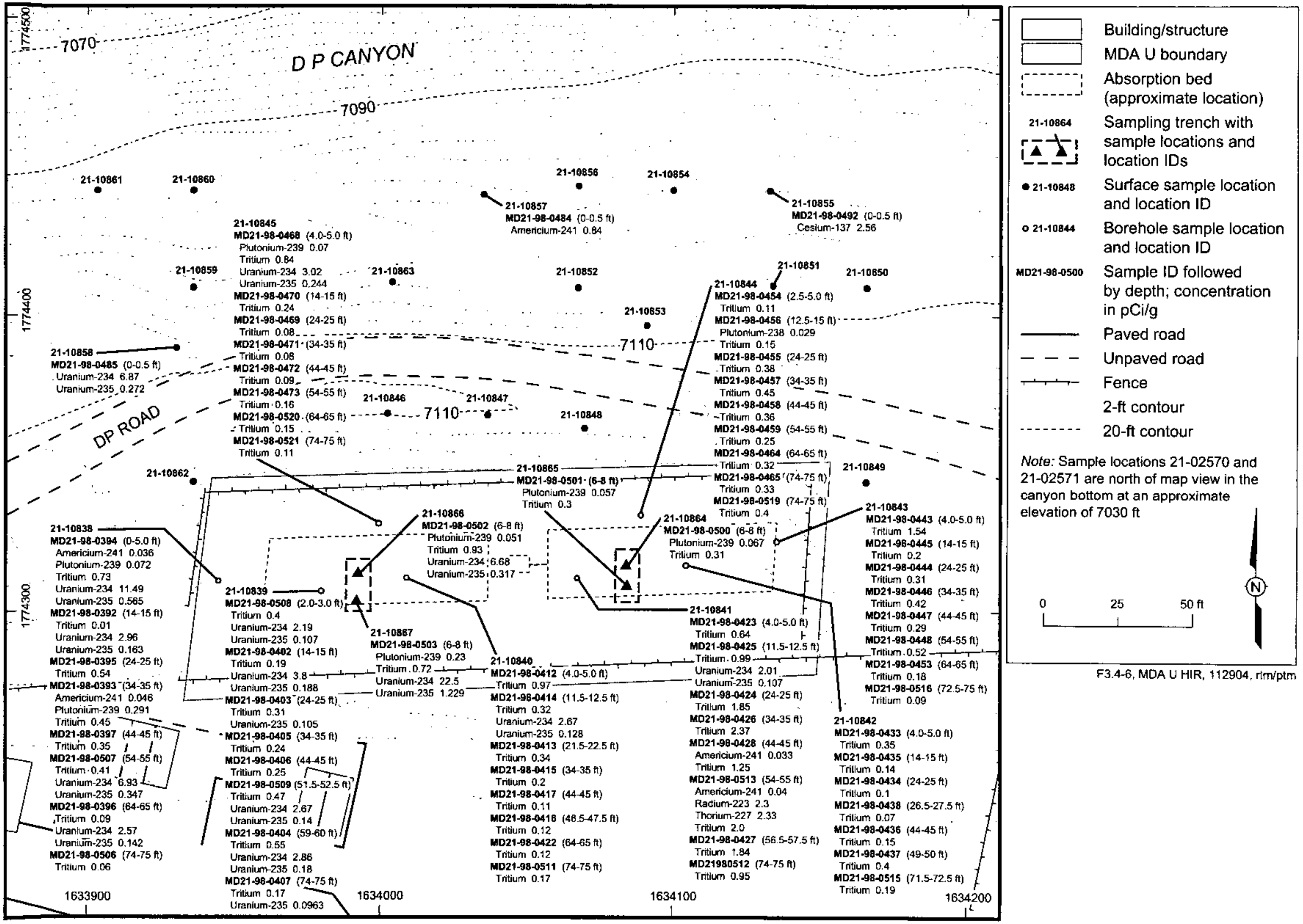
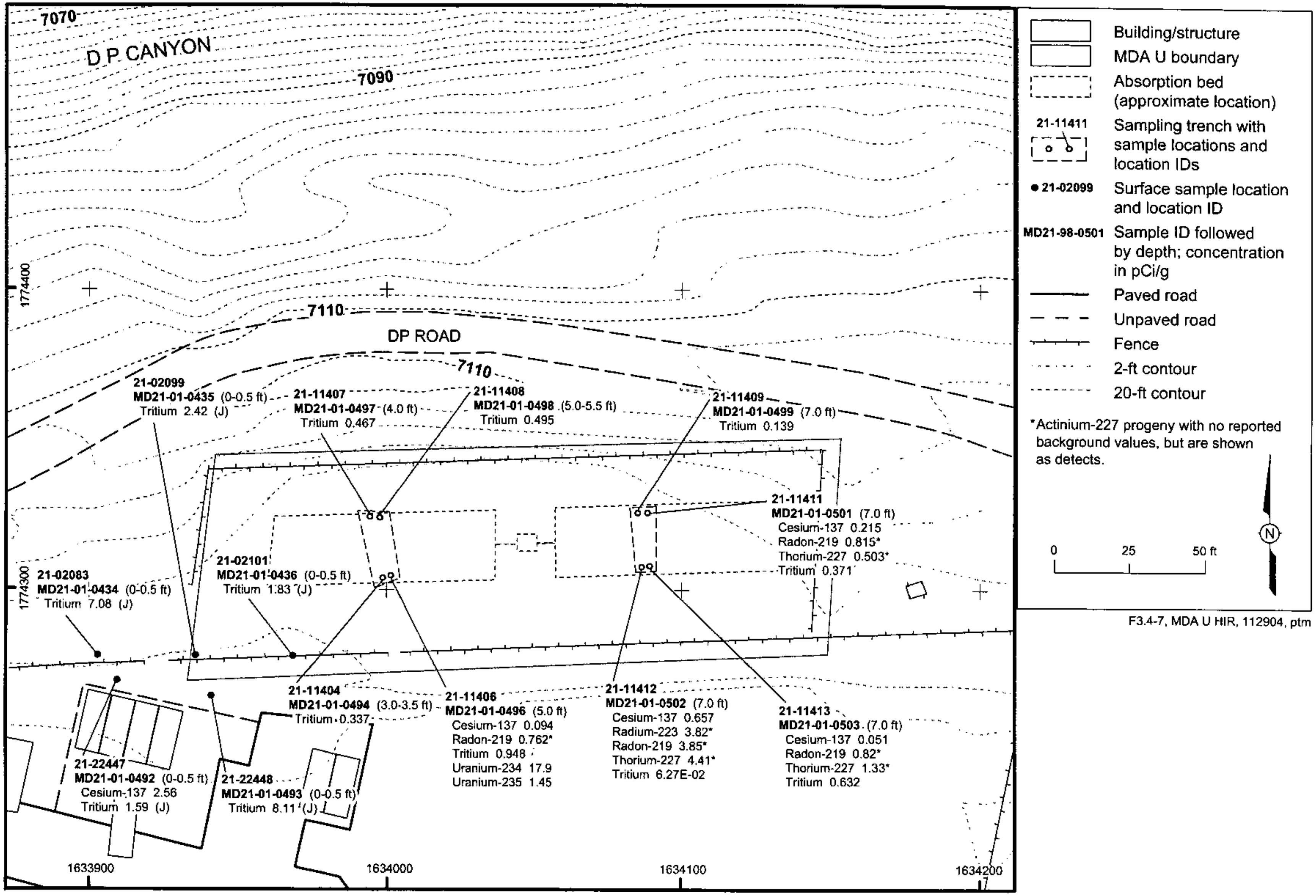


Figure 3.4-6. Radionuclides detected above background values/fallout values in 1998 surface and subsurface samples



F3.4-7, MDA U HIR, 112904, ptm

Figure 3.4-7. Radionuclides detected above background values/fallout values in 2001 surface soil and absorption bed sampling

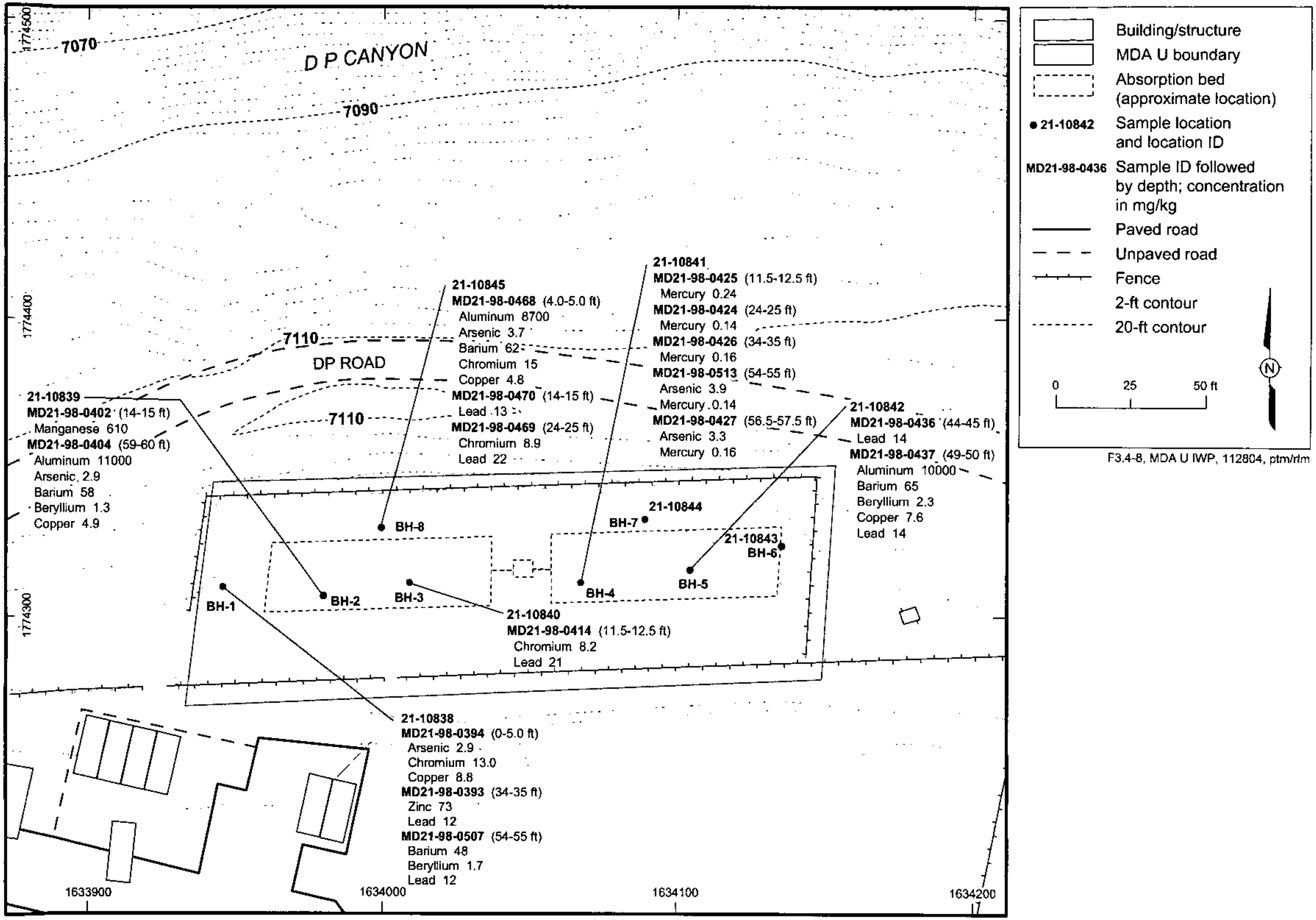


Figure 3.4-8. Inorganic chemicals above background values in 1998 borehole samples

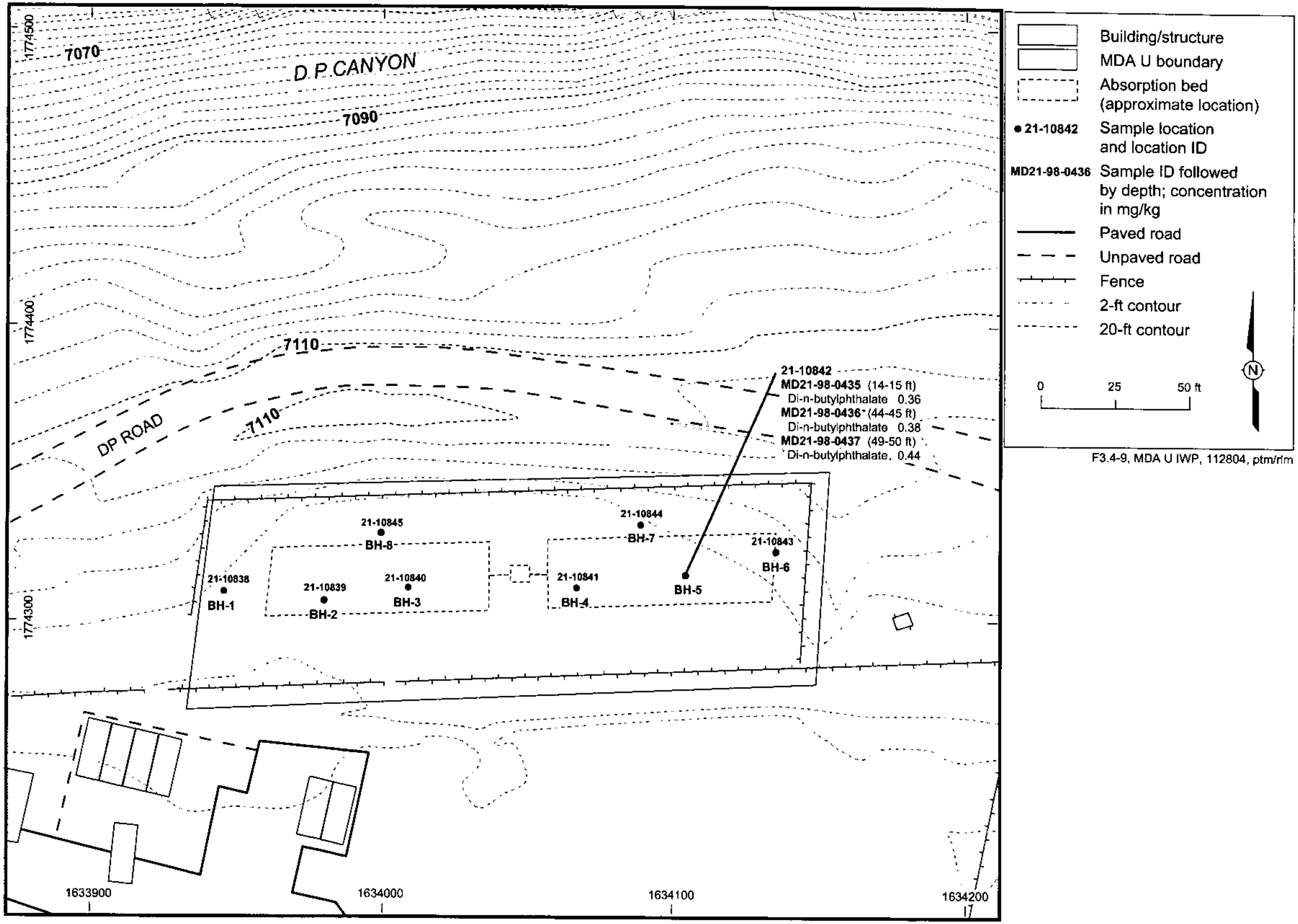


Figure 3.4-9. Organic chemicals detected in 1998 borehole samples

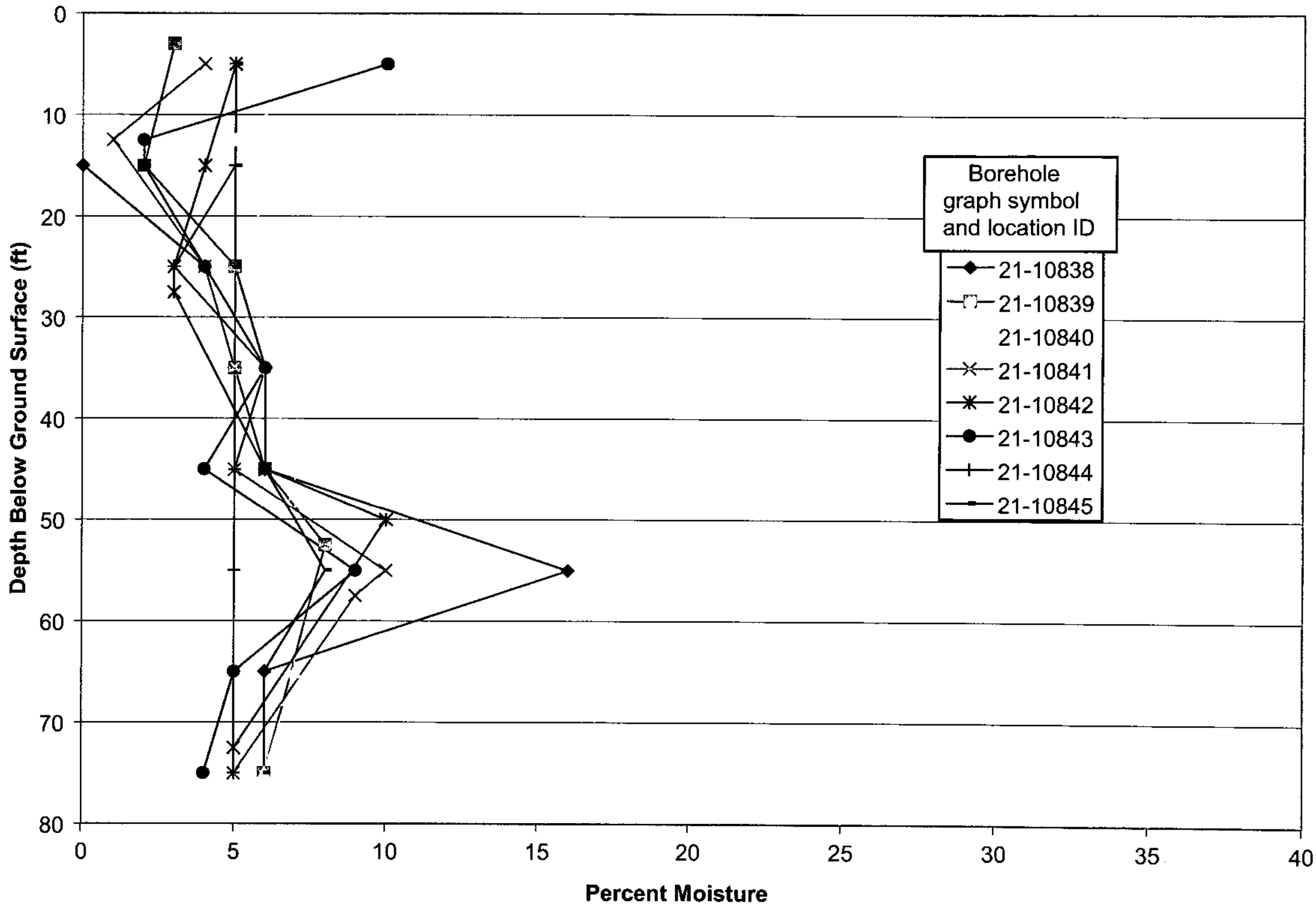


Figure 3.4-10. **MDA U moisture profiles from 1998 borehole investigations**

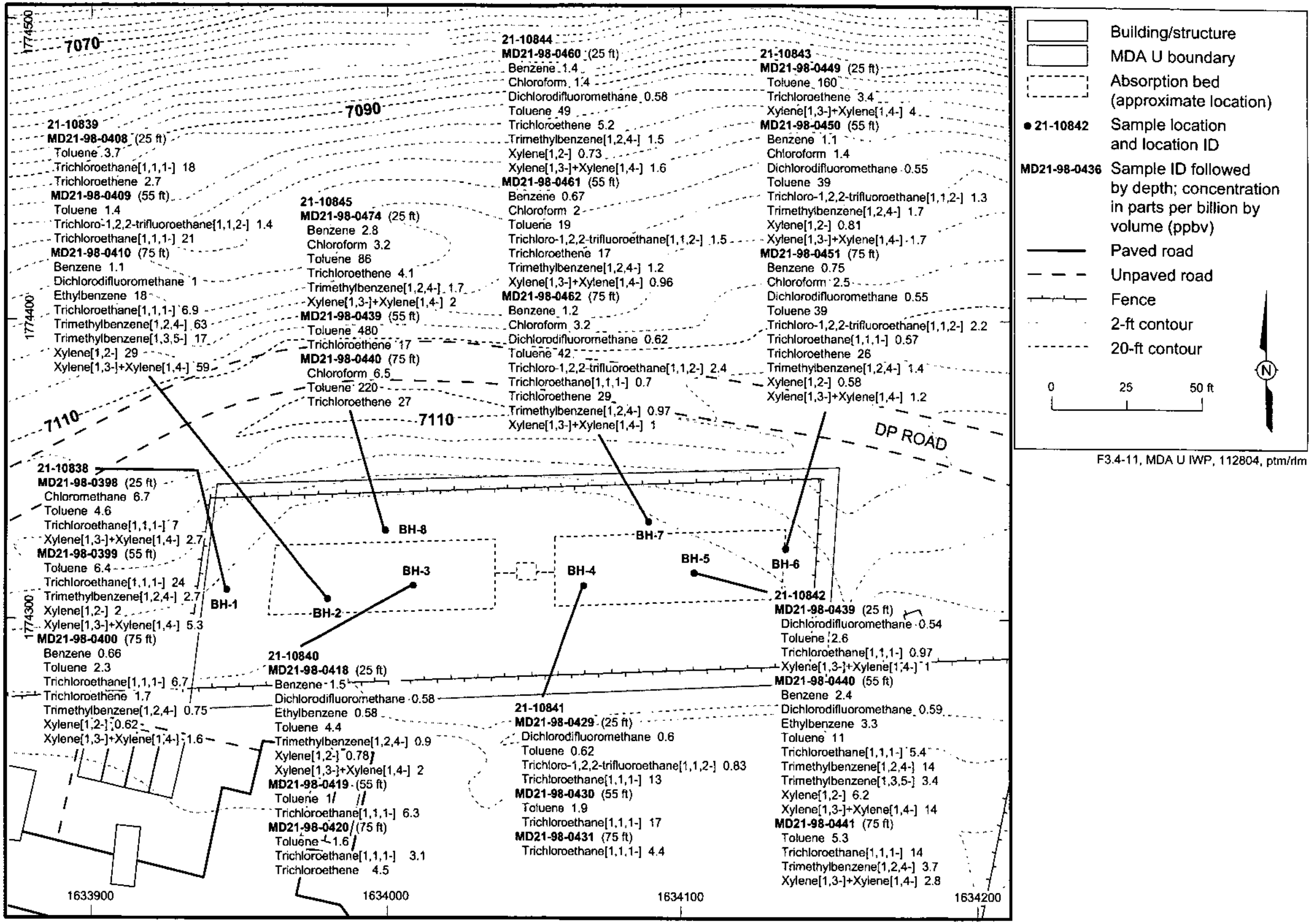


Figure 3.4-11. Detected pore-gas results in 1998 borehole samples

Table 3.1-1
1976 Analytical Results for Gross Alpha at MDA U

Location	Description	Gross Alpha[a] (d/m/g[b])	Gross Alpha[c] (pCi/g)
Group H-7 Analysis (12/12/75)			
1	Soil 0–2 in. (East Pit)	7360	3345
1	Soil 2–4 in. (East Pit)	730	331
2	Muck surface (West Pit)	1990	904
3	Soil surface (outside fence)	12.5	6
4	Soil surface (Drain 2)	7.4	3
5	Water (West Pit)	40	18
6	Water (Drain 2)	148	67
Group H-8 Soil Analyses (12/22/75)			
Location	**Description**	**Gross Alpha[d] (d/m/g)**	**Gross Alpha[c] (pCi/g)**
A	Surface (Drain 1)	<44	<20
B	Surface (same as H-7 Loc. 4)	120	55
C	Surface (same as H-7 Loc. 3)	<44	<20
D	Surface (composite road)	<44	<20
E	Surface (slope)	<44	<20

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Table 16.6-II, p. 16-219).

[a] Acid leach.

[b] d/m/g = Disintegrations per minute per gram.

[c] Assumes original measurements were properly calibrated to d/m/g.

[d] Direct soil counting with a zinc sulfide gross alpha detection system.

Table 3.1-2
Selected Radionuclide Analyses for 1980 Soil Samples

Location	Depth (cm)	Tritium (pCi/L[a])	Total Uranium (µg/g[b])	Plutonium-239/240 (pCi/g)	Gamma Spectra
Background[c]		7200	3.4	0.023	
U-1	0–1	2700±400	26.1±2.6	tracer swamped	Total U is high enriched with ^{235}U
	1–10	3900±400	25.6±2.6	17.5±0.3	
	10–30	3800±400	10.9±1.1	2.2±0.0	
U-2	0–1	37200±800	7.0±0.7	2.4±0.1	^{227}Ac daughters in great abundance
	1–10	11800±500	6.3±0.6	2.2±0.1	
	10–30	27300±700	4.3±0.5	0.1±0.0	
U-3	0–1	10600±500	4.7±0.5	1.6±0.0	Normal
	1–10	6500±500	4.4±0.5	2.5±0.1	Normal
	10–30	5400±500	4.5±0.5	2.0±0.1	Normal

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Table 16.6-III, p. 16-220).
[a] pCi/L = picoCuries per liter of soil moisture.
[b] µg/g = microgram per gram of soil.
[c] Upper limit background levels from Purtymun (1987, 06687).

Table 3.1-3
Selected Radionuclide Analyses for 1980 Vegetation Samples

Location	Species	Tritium (pCi/L[a])	Plutonium-239/240 (pCi/g[b])
Background[c]		800	0.00023
U-1	Salix sp. (willow)	7200±400	0.8±0.1
U-2	Pinus pon. (ponderosa)	5800±300	0.6±0.0
	Bromus tec. (downy chess)	-9800±1300	1.1±0.1
U-3	Guttierezia s. (snakeweed)	3300±300	0.2±0.0
	Bromus tec. (downy chess)	-800±300	2.3±0.1
	Artemesia car. (wormwood)	300±300	1.8±0.0

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Table 16.6-III, p. 16-220).
[a] pCi/L = picoCuries per liter of tissue moisture.
[b] pCi/g = picoCuries per gram of ash.
[c] Upper limit background levels from The Environmental Surveillance Group (1987, 06678).

Table 3.1-4
1983 Vertical Distribution of Selected Radionuclides in Test Holes North of MDA U

Test Hole U-E				Test Hole U-W			
Depth (m)	Tritium (pCi/L)	Total Uranium (μg/g)	Cesium-137 (pCi/g)	Depth (m)/(ft)	Tritium (pCi/L)	Total Uranium (μg/g)	Cesium-137 (pCi/g)
Background*	7200	3.40	1.09	Background*	7200	3.40	1.09
0–0.9	19000±2000	3.79±0.18	0.18±0.07	0–0.9 / 0–2.9	7800±800	4.75±0.18	0.16±0.07
0.9–1.5	11700±1200	3.76±0.18	0.10±0.04	0.9–2.4 / 2.9–7.9	9200±±1000	3.88±0.18	0.01±0.04
1.5–2.4	10100±1000	3.46±0.18	0.09±0.04	2.4–4.0 / 7.9–13	39000±4000	3.70±0.18	0.02±0.07
2.4–4.0	13500±1400	3.75±0.18	0.03±0.03	4.0–5.5 / 13–18	9000±900	3.80±0.18	0.07±0.03
4.0–5.5	10200±1000	3.49±0.18	0.08±0.04	5.5–7.0 / 18–23	9300±1000	3.63±0.18	0.06±0.05
5.5–7.0	17700±1800	3.65±0.18	0.06±0.05	7.0–8.5 / 23–28	8300±900	3.27±0.18	0.10±0.05
7.0–8.5	11100±1100	3.19±0.18	0.04±0.07	8.5–10.1 / 28–33	9600±1000	3.70±0.18	0.02±0.04
8.5–10.1	18100±1800	3.09±0.18	0.02±0.03	10.1–11.6 / 33–38	9300±1000	3.52±0.18	0.06±0.03
10.1–11.6	31000±3000	3.75±0.18	0.06±0.03	11.6–13.1 / 38–43	7100±700	3.51±0.18	0.08±0.04
11.6–13.1	47000±5000	3.41±0.18	0.06±0.03	13.1–14.6 / 43–48	8900±900	3.55±0.18	0.16±0.06
13.1–14.6	66000±7000	3.67±0.18	0.08±0.04	14.6–16.2 / 48–53	11400±1200	3.51±0.18	0.04±0.03
14.6–16.2	78000±8000	3.48±0.18	0.09±0.05	16.2–17.6 / 53–57.8	8900±900	3.11±0.18	0.04±0.03

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Table 16.6-IV, p. 16-221).

*Upper limit background levels from Purtymun (1987, 06687).

Table 3.2-1
Summary of RFI Samples Taken at MDA U

Sample ID	Location ID	Depth (ft)	Media	Metals	Uranium	PCBs	VOCs	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90
AAA0191	21-01178	0–0.08	Soil	X[a]	—[b]	—	—	—	—	—	X	X	—	—	X
AAA0192	21-01178	0–0.5	Soil	X	—	—	—	X	—	—	X	X	—	—	X
AAA0193	21-01184	0–0.08	Soil	X	—	—	—	—	X	—	X	X	—	—	X
AAA0194	21-01184	0–0.5	Soil	X	—	—	—	X	X	—	X	X	—	—	X
AAA0195	21-01192	0–0.08	Soil	X	—	—	—	—	X	—	X	X	—	—	X
AAA0196	21-01192	0–0.5	Soil	X	—	—	—	X	—	—	X	X	—	—	X
AAA0197	21-01193	0–0.08	Soil	X	—	—	—	—	X	—	X	X	—	—	X
AAA0198	21-01193	0–0.5	Soil	X	—	—	—	X	—	—	X	X	X	X	X
AAA0199	21-01193	0–0.08	Soil	X	—	—	—	—	X	—	X	X	—	—	X
AAA0391	21-01191	0–0.08	Soil	X	—	—	—	—	—	—	X	X	—	—	X
AAA0395	21-01183	0–0.08	Soil	X	—	—	—	—	X	—	X	X	—	—	X
AAA0396	21-01177	0–0.08	Soil	X	—	—	—	—	—	—	X	X	—	—	X
AAA7519	21-01863	0–0.25	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAA7520	21-01863	0.25–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAA7521	21-01863	0.5–1	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAA7522	21-01864	0–0.25	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAA7523	21-01864	0.25–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAA7524	21-01864	0.5–1	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAA7525	21-01865	0–0.25	Sediment	X	X	—	—	X	—	X	X	X	—	—	—
AAA7526	21-01865	0.25–0.5	Sediment	X	X	—	—	X	—	X	X	X	—	—	—
AAA7527	21-01865	0.5–1	Sediment	X	X	—	—	X	—	X	X	X	—	—	—
AAB7281	21-02570	0–0.25	Sediment	X	X	—	—	X	—	X	X	X	—	—	—
AAB7282	21-02570	0.25–0.5	Sediment	X	X	—	—	X	—	X	X	X	—	—	—
AAB7283	21-02570	0.5–1	Sediment	X	X	—	—	X	—	X	X	X	—	—	—
AAB7284	21-02571	0–0.25	Sediment	X	X	—	—	X	—	X	X	X	—	—	—
AAB7285	21-02571	0.25–0.5	Sediment	X	—	—	—	X	—	X	X	X	—	—	—
AAB7286	21-02571	0.5–1	Sediment	X	X	—	—	X	—	X	X	X	—	—	—
AAB9750	21-02059	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9751	21-02060	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9752	21-02061	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9753	21-02062	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9754	21-02063	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9755	21-02064	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9756	21-02065	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—

Table 3.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Metals	Uranium	PCBs	VOCs	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90
AAB9757	21-02066	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9758	21-02067	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9759	21-02068	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9760	21-02069	0–0.25	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9761	21-02070	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9762	21-02071	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9763	21-02072	0–0.5	Soil	X	X	—	—	X	—	X	X	—	—	X	—
AAB9764	21-02073	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9765	21-02074	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9766	21-02075	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9767	21-02076	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9768	21-02077	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9769	21-02078	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9770	21-02079	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9771	21-02080	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9772	21-02081	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9773	21-02082	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9774	21-02083	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9775	21-02084	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9776	21-02085	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9777	21-02086	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9778	21-02087	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9779	21-02088	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9780	21-02089	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9781	21-02090	0–0.25	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9782	21-02091	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9783	21-02092	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9784	21-02093	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9785	21-02094	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9786	21-02095	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9787	21-02096	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9788	21-02097	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9789	21-02098	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9790	21-02099	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9791	21-02100	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—

Table 3.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Metals	Uranium	PCBs	VOCs	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90
AAB9792	21-02101	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9793	21-02102	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9794	21-02103	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9795	21-02104	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9796	21-02105	0–0.42	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9797	21-02106	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9798	21-02107	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9802	21-02103	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9803	21-02078	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAB9888	21-02577	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9889	21-02578	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9890	21-02579	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAB9891	21-02576	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	X	—
AAC0135	21-02594	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAC0136	21-02595	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAC0137	21-02596	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAC0138	21-02597	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAC0139	21-02598	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAC0140	21-02599	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
AAC0144	21-02599	0–0.5	Soil	X	X	—	—	X	—	X	X	X	—	—	—
MD21-98-0392	21-10838	14–15	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0393	21-10838	34–35	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0394	21-10838	0–5	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0395	21-10838	24–25	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0396	21-10838	64–65	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0397	21-10838	44–45	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0398	21-10838	25-25	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0399	21-10838	55-55	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0400	21-10838	75-75	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0402	21-10839	14–15	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0403	21-10839	24–25	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0404	21-10839	59–60	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0405	21-10839	34–35	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0406	21-10839	44–45	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0407	21-10839	74–75	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X

Table 3.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Metals	Uranium	PCBs	VOCs	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90
MD21-98-0408	21-10839	25-25	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0409	21-10839	55-55	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0410	21-10839	75-75	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0412	21-10840	4–5	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0413	21-10840	21.5–22.5	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0414	21-10840	11.5–12.5	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0415	21-10840	34–35	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0416	21-10840	46.5–47.5	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0417	21-10840	44–45	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0418	21-10840	25-25	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0419	21-10840	55-55	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0420	21-10840	75-75	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0422	21-10840	64–65	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0423	21-10841	4–5	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0424	21-10841	24–25	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0425	21-10841	11.5–12.5	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0426	21-10841	34–35	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0427	21-10841	56.5–57.5	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0428	21-10841	44–45	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0429	21-10841	25-25	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0430	21-10841	55-55	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0431	21-10841	75-75	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0433	21-10842	4–5	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0434	21-10842	24–25	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0435	21-10842	14–15	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0436	21-10842	44–45	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0437	21-10842	49–50	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0438	21-10842	26.5–27.5	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0439	21-10842	25-25	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0440	21-10842	55-55	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0441	21-10842	75-75	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0443	21-10843	4–5	Soil	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0444	21-10843	24–25	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0445	21-10843	14–15	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0446	21-10843	34–35	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X

Table 3.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Metals	Uranium	PCBs	VOCs	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90
MD21-98-0447	21-10843	44–45	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0448	21-10843	54–55	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0449	21-10843	25-25	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0450	21-10843	55-55	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0451	21-10843	75-75	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0453	21-10843	64–65	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0454	21-10844	2.5–5	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0455	21-10844	24–25	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0456	21-10844	12.5–15	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0457	21-10844	34–35	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0458	21-10844	44–45	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0459	21-10844	54–55	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0460	21-10844	25-25	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0461	21-10844	55-55	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0462	21-10844	75-75	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0464	21-10844	64–65	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0465	21-10844	74–75	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0468	21-10845	4–5	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0469	21-10845	24–25	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0470	21-10845	14–15	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0471	21-10845	34–35	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0472	21-10845	44–45	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0473	21-10845	54–55	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0474	21-10845	25-25	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0475	21-10845	55-55	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0476	21-10845	75-75	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0477	21-10845	75-75	Pore Gas	—	—	—	X	—	—	—	—	—	—	—	—
MD21-98-0478	21-10849	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0479	21-10848	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0480	21-10850	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0481	21-10847	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0482	21-10846	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0483	21-10854	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0484	21-10857	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0485	21-10858	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—

Table 3.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Metals	Uranium	PCBs	VOCs	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90
MD21-98-0486	21-10851	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0487	21-10852	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0488	21-10856	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0489	21-10853	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0490	21-10861	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0491	21-10859	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0492	21-10855	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0493	21-10860	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0494	21-10863	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0495	21-10862	0–0.5	Soil	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0496	21-02571	0–0.5	Sediment	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0497	21-02570	0–0.5	Sediment	—	—	X	—	—	—	X	—	—	—	X	—
MD21-98-0500	21-10864	6–8	Qbt3	—	—	—	—	—	X	X	X	X	—	X	X
MD21-98-0501	21-10865	6–8	Qbt3	—	—	—	—	—	X	X	X	X	—	X	X
MD21-98-0502	21-10866	5–8	Qbt3	—	—	—	—	—	X	X	X	X	—	X	X
MD21-98-0503	21-10867	5–8	Qbt3	—	—	—	—	—	X	X	X	X	—	X	X
MD21-98-0506	21-10838	74–75	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0507	21-10838	54–55	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0508	21-10839	2–3	Qbt3	X	—	X	—	X	X	X	X	X	—	X	X
MD21-98-0509	21-10839	51.5–52.5	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0511	21-10840	74–75	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0512	21-10841	74–75	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0513	21-10841	54–55	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0515	21-10842	71.5–72.5	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0516	21-10843	72.5–75	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0517	21-10843	72.5–75	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0519	21-10844	74–75	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0520	21-10845	64–65	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-98-0521	21-10845	74–75	Qbt3	X	—	—	—	X	X	X	X	X	—	X	X
MD21-01-0434	21-02083	0–0.5	Soil	X	—	—	—	—	—	—	X	—	—	—	—
MD21-01-0435	21-02099	0–0.5	Soil	X	—	—	—	—	—	—	X	—	—	—	—
MD21-01-0436	21-02101	0–0.5	Soil	X	—	—	—	—	—	—	X	—	—	—	—
MD21-01-0437	21-02594	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0438	21-02595	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0439	21-02596	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—

Table 3.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Metals	Uranium	PCBs	VOCs	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90
MD21-01-0440	21-02597	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0441	21-02598	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0442	21-02096	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0443	21-02576	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0444	21-02577	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0445	21-02106	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0446	21-02578	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0447	21-02579	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0448	21-02094	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0449	21-02104	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0450	21-02088	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0451	21-02087	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0452	21-02103	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0453	21-02091	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0454	21-02093	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0455	21-02098	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0456	21-02077	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0457	21-02080	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0458	21-02097	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0459	21-02082	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0460	21-02081	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0461	21-02078	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0462	21-02095	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0463	21-02090	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0464	21-02092	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0465	21-02084	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0466	21-02105	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0467	21-02086	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0468	21-02063	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0469	21-02059	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0470	21-02065	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0471	21-02062	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0472	21-02072	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0473	21-02067	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0474	21-02070	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—

Table 3.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Metals	Uranium	PCBs	VOCs	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90
MD21-01-0475	21-02074	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0476	21-02076	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0477	21-02075	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0478	21-02079	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0479	21-02073	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0480	21-02071	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0481	21-02069	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0482	21-02068	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0483	21-02066	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0484	21-02061	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0485	21-02064	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0486	21-02060	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0487	21-02599	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0488	21-02599	0–0.5	Soil	X	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0490	21-02083	0–0.5	Soil	X	—	—	—	—	—	—	X	—	—	—	—
MD21-01-0492	21-01001	0–0.5	Soil	—	—	—	—	—	—	—	X	—	—	—	—
MD21-01-0493	21-01001	0–0.5	Soil	—	—	—	—	—	—	—	X	—	—	—	—
MD21-01-0494	21-11404	3–3.5	Soil	—	—	—	—	—	—	X	X	—	—	X	—
MD21-01-0495	21-11404	3–3.5	Soil	—	—	—	—	—	—	X	X	—	—	X	—
MD21-01-0496	21-11406	5–5	Soil	—	—	—	—	—	—	X	X	—	—	X	—
MD21-01-0497	21-11407	4–4	Soil	—	—	—	—	—	—	X	X	—	—	X	—
MD21-01-0498	21-11408	5–5.5	Soil	—	—	—	—	—	—	X	X	—	—	X	—
MD21-01-0499	21-11409	7–7	Soil	—	—	—	—	—	—	X	X	—	—	X	—
MD21-01-0500	21-11409	7–7	Soil	—	—	—	—	—	—	X	X	—	—	X	—
MD21-01-0501	21-11411	7–7	Soil	—	—	—	—	—	—	X	X	—	—	X	—
MD21-01-0502	21-11412	7–7	Soil	—	—	—	—	—	—	X	X	—	—	X	—
MD21-01-0503	21-11413	7–7	Soil	—	—	—	—	—	—	X	X	—	—	X	—

[a] X = Analysis requested.

[b] — = Analysis not requested.

Table 3.4-1
Frequency of Inorganic Chemicals Detected Above Background Values

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Soil	77	77	3410 to 61400	29200	8/77	0/77
Aluminum	Sediment	9	9	2210 to 7250	15400	0/9	0/9
Aluminum	Qbt3	62	62	220 to 11000	7340	3/62	0/62
Antimony	Soil	76	0	[0.21 to 29.9]	0.83	0/76	12/76
Antimony	Sediment	9	0	[0.21 to 0.27]	0.83	0/9	0/9
Antimony	Qbt3	41	0	[10 to 11]	0.5	0/41	41/41
Arsenic	Soil	77	59	[0.2 to 74.8]	8.17	0/77	3/77
Arsenic	Sediment	9	1	[1.4] to 2.6	3.98	0/9	0/9
Arsenic	Qbt3	62	60	1.1 to 3.9	2.79	5/62	0/62
Barium	Soil	77	77	49 to 527	295	8/77	0/77
Barium	Sediment	9	8	[41.2] to 105	127	0/9	0/9
Barium	Qbt3	62	62	1.6 to 65	46	4/62	0/62
Beryllium	Soil	77	9	[0.11] to 2.4	1.83	8/77	0/77
Beryllium	Sediment	9	0	[0.28 to 0.63]	1.31	0/9	0/9
Beryllium	Qbt3	62	16	[0.5] to 2.3	1.21	3/62	0/62
Cadmium	Soil	77	0	[0.06 to 2]	0.4	0/77	19/77
Cadmium	Sediment	9	0	[0.41 to 0.98]	0.4	0/9	9/9
Cadmium	Qbt3	62	1	[0.5] to 1.2	1.63	0/62	0/62
Calcium	Soil	77	76	1150 to 9500	6120	4/77	0/77
Calcium	Sediment	9	7	[925] to 2000	4420	0/9	0/9
Calcium	Qbt3	62	62	200 to 1900	2200	0/62	0/62
Chromium	Soil	77	76	[3.2] to 77.3	19.3	6/77	0/77
Chromium	Sediment	9	9	4.8 to 53.2	10.5	8/9	0/9
Chromium	Qbt3	62	38	1 to 15	7.14	4/62	0/62
Cobalt	Soil	77	11	[1.6] to 11	8.64	1/77	0/77
Cobalt	Sediment	9	0	[2.2 to 6.7]	4.73	0/9	1/9
Cobalt	Qbt3	62	18	0.69 to 2.6	3.14	0/62	0/62
Copper	Soil	77	30	[1.7] to 84.3	14.7	4/77	0/77
Copper	Sediment	9	0	[1.8 to 5.5]	11.2	0/9	0/9
Copper	Qbt3	57	37	[1] to 8.8	4.66	4/57	0/57
Iron	Soil	77	77	1200 to 19500	21500	0/77	0/77
Iron	Sediment	9	9	3230 to 7900	13800	0/9	0/9
Iron	Qbt3	62	62	860 to 7900	14500	0/62	0/62
Lead	Soil	77	77	4.4 to 47.5	22.3	10/77	0/77
Lead	Sediment	9	9	7.2 to 36	19.7	2/9	0/9
Lead	Qbt3	61	61	2.1 to 22	11.2	7/61	0/61
Lithium	Soil	11	8	21 to [29.9]	N.A.[b]	8/11	n/a [c]

Table 3.4-1 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Magnesium	Soil	77	68	[690] to 4200	4610	0/77	0/77
Magnesium	Sediment	9	2	[526] to 1410	2370	0/9	0/9
Magnesium	Qbt3	62	62	64 to 1600	1690	0/62	0/62
Manganese	Soil	77	77	144 to 734	671	1/77	0/77
Manganese	Sediment	9	9	199 to 478	543	0/9	0/9
Manganese	Qbt3	61	61	71 to 610	482	1/61	0/61
Mercury	Soil	114	45	[0.017] to 1.2	0.1	25/114	16/114
Mercury	Qbt3	62	5	[0.1] to 0.24	0.1	5/62	41/62
Molybdenum	Soil	11	0	[4 to 7.5]	N.A.	0/11	n/a
Nickel	Soil	77	15	[2.8] to 27.9	15.4	1/77	0/77
Nickel	Sediment	9	0	[2.2 to 5.2]	9.38	0/9	0/9
Nickel	Qbt3	62	12	[2] to 6.3	6.58	0/62	0/62
Potassium	Soil	77	62	[574] to 28000	3460	8/77	0/77
Potassium	Sediment	9	0	[344 to 896]	2690	0/9	0/9
Potassium	Qbt3	62	62	64 to 1100	3500	0/62	0/62
Selenium	Soil	77	1	[0.2 to 74.8]	1.52	0/77	3/77
Selenium	Sediment	9	0	[0.62 to 0.76]	0.3	0/9	9/9
Selenium	Qbt3	62	0	[0.52 to 1.2]	0.3	0/62	62/62
Silver	Soil	77	1	[0.1 to 3]	1	1/77	10/77
Silver	Sediment	9	0	[2.1 to 2.5]	1	0/9	9/9
Silver	Qbt3	62	0	[2 to 2.4]	1	0/62	62/62
Sodium	Soil	77	17	[0.25] to 19000	915	14/77	0/77
Sodium	Sediment	9	0	[30.2 to 110]	1470	0/9	0/9
Sodium	Qbt3	62	62	61 to 280	2770	0/62	0/62
Strontium	Soil	11	11	11.8 to 151	N.A.	11/11	n/a
Thallium	Soil	77	0	[0.21 to 74.8]	0.73	0/77	26/77
Thallium	Sediment	9	0	[0.21 to 0.25]	0.73	0/9	0/9
Thallium	Qbt3	62	0	[0.25 to 2.2]	1.1	0/62	38/62
Uranium	Soil	76	76	0.957 to 37.5	1.82	50/76	0/76
Uranium	Sediment	8	8	1.11 to 2.69	2.22	1/8	0/8
Vanadium	Soil	77	69	[7.9] to 48	39.6	2/77	0/77
Vanadium	Sediment	9	1	[6.2] to 15.7	19.7	0/9	0/9
Vanadium	Qbt3	62	53	[0.52] to 10	17	0/62	0/62
Zinc	Soil	77	77	18.1 to 509	48.8	19/77	0/77
Zinc	Sediment	9	9	18.5 to 72	60.2	1/9	0/9
Zinc	Qbt3	62	62	9.4 to 73	63.5	1/62	0/62

[a] Brackets indicate detection limits for nondetected results.
[b] N.A. = Not available.
[c] n/a = Not applicable.

Table 3.4-2
Inorganic Chemicals Detected Above Background Values

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt
Soil Background Value[a]				**29200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**
Qbt2,3,4 Background Value[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**
Sediment Background Value[a]				**15400**	**0.83**	**3.98**	**127**	**1.31**	**0.4**	**4420**	**10.5**	**4.73**
Industrial Soil Screening Levels[b]				**1.0E+5**	**454**	**17.7**	**7.8E+4**	**2250**	**1128**[c]	**n/a**[d]	**450**	**2.03E+4**
AAA0396	21-01177	0–0.08	Soil	—[e]	29.9 (U)[f]	74.8 (U)	—	—	1.5 (U)	—	—	—
AAA0191	21-01178	0–0.08	Soil	52300	6 (U)	—	412	2.3	2 (U)	—	—	11
AAA0192	21-01178	0–0.5	Soil	56800	6 (U)	—	440	2.4	2 (U)	—	—	—
AAA0395	21-01183	0–0.08	Soil	—	25.3 (U)	63.3 (U)	—	—	1.3 (U)	—	—	—
AAA0193	21-01184	0–0.08	Soil	52000	6 (U)	—	383	2.2	2 (U)	—	—	—
AAA0194	21-01184	0–0.5	Soil	60700	6 (U)	—	397	2.3	2 (U)	—	—	—
AAA0391	21-01191	0–0.08	Soil	—	25.3 (U)	63.2 (U)	—	—	1.3 (U)	—	—	—
AAA0195	21-01192	0–0.08	Soil	46800	6 (U)	—	376	2.1	2 (U)	9500	—	—
AAA0196	21-01192	0–0.5	Soil	53100	6 (U)	—	348	2.2	2 (U)	7100	—	—
AAA0197	21-01193	0–0.08	Soil	58500	6 (U)	—	497	2.3	2 (U)	—	20	—
AAA0198	21-01193	0–0.5	Soil	61400	6 (U)	—	527	2.4	2 (U)	—	22	—
AAA0199[j]	21-01193	0–0.08	Soil	57300	6 (U)	—	466	2.3	2 (U)	—	—	—
AAA7519	21-01863	0–0.25	Soil	—	—	—	—	—	0.75 (U)	—	—	—
AAA7520	21-01863	0.25–0.5	Soil	—	—	—	—	—	0.43 (U)	—	—	—
AAA7521	21-01863	0.5–1	Soil	—	—	—	—	—	0.5 (U)	—	28.6 (J)[g]	—
AAA7522	21-01864	0–0.25	Soil	—	—	—	—	—	0.79 (U)	—	—	—
AAA7523	21-01864	0.25–0.5	Soil	—	—	—	—	—	0.54 (U)	—	—	—
AAA7524	21-01864	0.5–1	Soil	—	—	—	—	—	0.52 (U)	—	—	—
AAA7525	21-01865	0–0.25	Sediment	—	—	—	—	—	0.46 (U)	—	53.2 (J)	—
AAA7526	21-01865	0.25–0.5	Sediment	—	—	—	—	—	0.52 (U)	—	26.9 (J)	—
AAA7527	21-01865	0.5–1	Sediment	—	—	—	—	—	0.41 (U)	—	17.9 (J)	—
AAB9750	21-02059	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9751	21-02060	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9752	21-02061	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9753	21-02062	0–0.5	Soil	—	—	—	—	—	—	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt
Soil Background Value				**29200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**
Qbt2,3,4 Background Value				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**
Sediment Background Value				**15400**	**0.83**	**3.98**	**127**	**1.31**	**0.4**	**4420**	**10.5**	**4.73**
Industrial Soil Screening Level				**1.0E+5**	**454**	**17.7**	**7.8E+4**	**2250**	**1128**[c]	**n/a**	**450**	**2.0E+4**
AAB9754	21-02063	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9755	21-02064	0–0.5	Soil	—	—	—	—	—	—	6650	—	—
AAB9756	21-02065	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9757	21-02066	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9758	21-02067	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9759	21-02068	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9760	21-02069	0–0.25	Soil	—	—	—	—	—	—	—	—	—
AAB9761	21-02070	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9762	21-02071	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9763	21-02072	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9764	21-02073	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9765	21-02074	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9766	21-02075	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9767	21-02076	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9768	21-02077	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9769	21-02078	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9803[j]	21-02078	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9770	21-02079	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9771	21-02080	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9772	21-02081	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9773	21-02082	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9774	21-02083	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9775	21-02084	0–0.5	Soil	—	—	—	—	—	—	—	77.3 (J)	—
AAB9776	21-02085	0–0.5	Soil	—	0.87 (U)	—	—	—	—	—	—	—
AAB9777	21-02086	0–0.5	Soil	—	—	—	—	—	0.43 (U)	—	29.7 (J)	—
AAB9778	21-02087	0–0.5	Soil	—	—	—	—	—	—	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt
Soil Background Value				**29200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**
Qbt2,3,4 Background Value				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**
Sediment Background Value				**15400**	**0.83**	**3.98**	**127**	**1.31**	**0.4**	**4420**	**10.5**	**4.73**
Industrial Soil Screening Level				**1.0E+5**	**454**	**17.7**	**7.8E+4**	**2250**	**1128[c]**	**n/a**	**450**	**2.0E+4**
AAB9779	21-02088	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9780	21-02089	0–0.5	Soil	—	—	—	—	—	—	—	29.5 (J)	—
AAB9781	21-02090	0–0.25	Soil	—	—	—	—	—	—	—	—	—
AAB9782	21-02091	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9783	21-02092	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9784	21-02093	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9785	21-02094	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9786	21-02095	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9787	21-02096	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9788	21-02097	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9789	21-02098	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9790	21-02099	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9791	21-02100	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9792	21-02101	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9794	21-02103	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9802[l]	21-02103	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9795	21-02104	0–0.5	Soil	—	—	—	—	—	—	7440	—	—
AAB9796	21-02105	0–0.42	Soil	—	—	—	—	—	—	—	—	—
AAB9797	21-02106	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB9798	21-02107	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAB7281	21-02570	0–0.25	Sediment	—	—	—	—	—	0.67 (U)	—	13.1 (J)	—
AAB7282	21-02570	0.25–0.5	Sediment	—	—	—	—	—	0.81 (U)	—	14 (J)	—
AAB7283	21-02570	0.5–1	Sediment	—	—	—	—	—	0.98 (U)	—	21.3 (J)	—
AAB7284	21-02571	0–0.25	Sediment	—	—	—	—	—	0.65 (U)	—	—	6.7 (U)
AAB7285	21-02571	0.25–0.5	Sediment	—	—	—	—	—	0.42 (U)	—	12.7 (J)	—
AAB7286	21-02571	0.5–1	Sediment	—	—	—	—	—	0.74 (U)	—	34.3 (J)	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt
Soil Background Value				**29200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**
Qbt2,3,4 Background Value				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**
Sediment Background Value				**15400**	**0.83**	**3.98**	**127**	**1.31**	**0.4**	**4420**	**10.5**	**4.73**
Industrial Soil Screening Level				**1.0E+5**	**454**	**17.7**	**7.8E+4**	**2250**	**1128[c]**	**n/a**	**450**	**2.0E+4**
AAB9888	21-02577	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAC0135	21-02594	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAC0136	21-02595	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAC0137	21-02596	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAC0138	21-02597	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAC0139	21-02598	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAC0140	21-02599	0–0.5	Soil	—	—	—	—	—	—	—	—	—
AAC0144[j]	21-02599	0–0.5	Soil	—	—	—	—	—	—	—	—	—
MD21-98-0394	21-10838	0–5	Qbt3	—	—	2.9	—	—	—	—	13	—
MD21-98-0392	21-10838	14–15	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0395	21-10838	24–25	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0393	21-10838	34–35	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0397	21-10838	44–45	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0507	21-10838	54–55	Qbt3	—	—	—	48	1.7	—	—	—	—
MD21-98-0396	21-10838	64–65	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0506	21-10838	74–75	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0508	21-10839	2–3	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0402	21-10839	14–15	Qbt3	—	10 (U)	—	—	—	—	—	—	—
MD21-98-0403	21-10839	24–25	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0405	21-10839	34–35	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0406	21-10839	44–45	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0509	21-10839	51.5–52.5	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0404	21-10839	59–60	Qbt3	11000	11 (U)	2.9	58	1.3	—	—	—	—
MD21-98-0407	21-10839	74–75	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0412	21-10840	4–5	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0414	21-10840	11.5–12.5	Qbt3	—	11 (U)	—	—	—	—	—	8.2	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt
Soil Background Value				**29200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**
Qbt2,3,4 Background Value				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**
Sediment Background Value				**15400**	**0.83**	**3.98**	**127**	**1.31**	**0.4**	**4420**	**10.5**	**4.73**
Industrial Soil Screening Level				**1.0E+5**	**454**	**17.7**	**7.8E+4**	**2250**	**1128**[c]	**n/a**	**450**	**2.0E+4**
MD21-98-0413	21-10840	21.5–22.5	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0415	21-10840	34–35	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0417	21-10840	44–45	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0416	21-10840	46.5–47.5	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0422	21-10840	64–65	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0511	21-10840	74–75	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0423	21-10841	4–5	Qbt3	—	10 (U)	—	—	—	—	—	—	—
MD21-98-0425	21-10841	11.5–12.5	Qbt3	—	10 (U)	—	—	—	—	—	—	—
MD21-98-0424	21-10841	24–25	Qbt3	—	10 (U)	—	—	—	—	—	—	—
MD21-98-0426	21-10841	34–35	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0428	21-10841	44–45	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0513	21-10841	54–55	Qbt3	—	11 (U)	3.9	—	—	—	—	—	—
MD21-98-0427	21-10841	56.5–57.5	Qbt3	—	11 (U)	3.3	—	—	—	—	—	—
MD21-98-0512	21-10841	74–75	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0433	21-10842	4–5	Qbt3	—	11 (UJ)[h]	—	—	—	—	—	—	—
MD21-98-0435	21-10842	14–15	Qbt3	—	10 (UJ)	—	—	—	—	—	—	—
MD21-98-0434	21-10842	24–25	Qbt3	—	10 (UJ)	—	—	—	—	—	—	—
MD21-98-0438	21-10842	26.5–27.5	Qbt3	—	10 (UJ)	—	—	—	—	—	—	—
MD21-98-0436	21-10842	44–45	Qbt3	—	11 (UJ)	—	—	—	—	—	—	—
MD21-98-0437	21-10842	49–50	Qbt3	10000	11 (UJ)	—	65	2.3	—	—	—	—
MD21-98-0515	21-10842	71.5–72.5	Qbt3	—	11 (UJ)	—	—	—	—	—	—	—
MD21-98-0443	21-10843	4–5	Soil	—	—	—	—	—	0.56 (U)	—	—	—
MD21-98-0445	21-10843	14–15	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0444	21-10843	24–25	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0446	21-10843	34–35	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0447	21-10843	44–45	Qbt3	—	—	—	—	—	—	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt
Soil Background Value				**29200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**
Qbt2,3,4 Background Value				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**
Sediment Background Value				**15400**	**0.83**	**3.98**	**127**	**1.31**	**0.4**	**4420**	**10.5**	**4.73**
Industrial Soil Screening Level				**1.0E+5**	**454**	**17.7**	**7.8E+4**	**2250**	**1128[c]**	**n/a**	**450**	**2.0E+4**
MD21-98-0448	21-10843	54–55	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0453	21-10843	64–65	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0516	21-10843	72.5–75	Qbt3	—	10 (U)	—	—	—	—	—	—	—
MD21-98-0517[J]	21-10843	72.5–75	Qbt3	—	10 (U)	—	—	—	—	—	—	—
MD21-98-0454	21-10844	2.5–5	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0456	21-10844	12.5–15	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0455	21-10844	24–25	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0457	21-10844	34–35	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0458	21-10844	44–45	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0459	21-10844	54–55	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0464	21-10844	64–65	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0465[c]	21-10844	74–75	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0519	21-10844	74–75	Qbt3	—	—	—	—	—	—	—	—	—
MD21-98-0468	21-10845	4–5	Qbt3	8700	11 (U)	3.7	62	—	—	—	15	—
MD21-98-0470	21-10845	14–15	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0469	21-10845	24–25	Qbt3	—	11 (U)	—	—	—	—	—	8.9	—
MD21-98-0471	21-10845	34–35	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0472	21-10845	44–45	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0473	21-10845	54–55	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0520	21-10845	64–65	Qbt3	—	11 (U)	—	—	—	—	—	—	—
MD21-98-0521	21-10845	74–75	Qbt3	—	11 (U)	—	—	—	—	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Copper	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Potassium
Soil Background Value				**14.7**	**22.3**	**N.A.[i]**	**671**	**0.1**	**N.A.**	**15.4**	**3460**
Qbt2,3,4 Background Value				**4.66**	**11.2**	**N.A.**	**482**	**0.1**	**N.A.**	**6.58**	**3500**
Sediment Background Value				**11.2**	**19.7**	**N.A.**	**543**	**0.1**	**N.A.**	**9.38**	**2690**
Industrial Soil Screening Level				**4.54E+4**	**750**	**2.30E+4**	**2.18E+4**	**341**	**5680**	**2.25E+4**	**n/a**
AAA0396	21-01177	0–0.08	Soil	—	—	29.9 (U)	—	—	7.5 (U)	—	—
AAA0191	21-01178	0–0.08	Soil	—	—	24	—	—	4 (U)	—	24200
AAA0192	21-01178	0–0.5	Soil	—	—	26	—	—	4 (U)	—	24900
AAA0395	21-01183	0–0.08	Soil	—	25.2	25.3 (U)	—	—	6.3 (U)	—	—
AAA0193	21-01184	0–0.08	Soil	—	—	22	—	—	4 (U)	—	24400
AAA0194	21-01184	0–0.5	Soil	—	—	25	—	—	4 (U)	—	28000
AAA0391	21-01191	0–0.08	Soil	—	26.7	25.3 (U)	—	—	6.3 (U)	—	—
AAA0195	21-01192	0–0.08	Soil	15	37	21	734	—	4 (U)	—	21600
AAA0196	21-01192	0–0.5	Soil	—	—	23	—	—	4 (U)	—	25500
AAA0197	21-01193	0–0.08	Soil	—	—	26	—	—	4 (U)	—	22800
AAA0198	21-01193	0–0.5	Soil	16	—	27	—	—	4 (U)	—	23800
AAA0199[j]	21-01193	0–0.08	Soil	—	—	25	—	—	4 (U)	—	22800
AAA7519	21-01863	0–0.25	Soil	—	—	—	—	—	—	—	—
AAA7520	21-01863	0.25–0.5	Soil	—	—	—	—	—	—	—	—
AAA7521	21-01863	0.5–1	Soil	18.4	—	—	—	—	—	—	—
AAA7522	21-01864	0–0.25	Soil	—	—	—	—	—	—	—	—
AAA7523	21-01864	0.25–0.5	Soil	—	—	—	—	—	—	—	—
AAA7524	21-01864	0.5–1	Soil	—	—	—	—	—	—	—	—
AAA7525	21-01865	0–0.25	Sediment	—	28.1	—	—	—	—	—	—
AAA7526	21-01865	0.25–0.5	Sediment	—	—	—	—	—	—	—	—
AAA7527	21-01865	0.5–1	Sediment	—	—	—	—	—	—	—	—
AAB9750	21-02059	0–0.5	Soil	—	22.5	—	—	—	—	—	—
AAB9751	21-02060	0–0.5	Soil	—	—	—	—	0.11 (U)	—	—	—
AAB9752	21-02061	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9753	21-02062	0–0.5	Soil	—	—	—	—	1.2 (J)	—	—	—
AAB9754	21-02063	0–0.5	Soil	—	23.6	—	—	0.11 (U)	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Copper	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Potassium
Soil Background Value				**14.7**	**22.3**	**N.A.**[i]	**671**	**0.1**	**N.A.**	**15.4**	**3460**
Qbt2,3,4 Background Value				**4.66**	**11.2**	**N.A.**	**482**	**0.1**	**N.A.**	**6.58**	**3500**
Sediment Background Value				**11.2**	**19.7**	**N.A.**	**543**	**0.1**	**N.A.**	**9.38**	**2690**
Industrial Soil Screening Level				**4.54E+4**	**750**	**2.30E+4**	**2.18E+4**	**341**	**5680**	**2.25E+4**	**n/a**
AAB9755	21-02064	0–0.5	Soil	—	47.5	—	—	0.13 (U)	—	—	—
AAB9756	21-02065	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9757	21-02066	0–0.5	Soil	—	24.4	—	—	0.11 (U)	—	—	—
AAB9758	21-02067	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9759	21-02068	0–0.5	Soil	—	—	—	—	0.11 (U)	—	—	—
AAB9760	21-02069	0–0.25	Soil	—	30.6	—	—	0.12 (U)	—	—	—
AAB9761	21-02070	0–0.5	Soil	—	—	—	—	0.11 (U)	—	—	—
AAB9762	21-02071	0–0.5	Soil	—	23.6	—	—	0.11 (U)	—	—	—
AAB9763	21-02072	0–0.5	Soil	—	—	—	—	0.11 (U)	—	—	—
AAB9764	21-02073	0–0.5	Soil	—	—	—	—	0.75	—	—	—
AAB9765	21-02074	0–0.5	Soil	—	—	—	—	0.12 (U)	—	—	—
AAB9766	21-02075	0–0.5	Soil	—	—	—	—	0.11 (U)	—	—	—
AAB9767	21-02076	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9768	21-02077	0–0.5	Soil	—	—	—	—	0.11 (U)	—	—	—
AAB9769	21-02078	0–0.5	Soil	—	—	—	—	0.24 (J)	—	—	—
AAB9803[j]	21-02078	0–0.5	Soil	—	—	—	—	0.31 (J)	—	—	—
AAB9770	21-02079	0–0.5	Soil	—	—	—	—	0.26 (J)	—	—	—
AAB9771	21-02080	0–0.5	Soil	—	—	—	—	0.11 (U)	—	—	—
AAB9772	21-02081	0–0.5	Soil	—	—	—	—	0.41 (J)	—	—	—
AAB9773	21-02082	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9774	21-02083	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9775	21-02084	0–0.5	Soil	—	—	—	—	0.74 (J)	—	—	—
AAB9776	21-02085	0–0.5	Soil	—	28.3	—	—	0.46 (J)	—	—	—
AAB9777	21-02086	0–0.5	Soil	84.3	—	—	—	0.39 (J)	—	—	—
AAB9778	21-02087	0–0.5	Soil	—	—	—	—	0.28 (J)	—	—	—
AAB9779	21-02088	0–0.5	Soil	—	—	—	—	0.11 (U)	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Copper	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Potassium
Soil Background Value				**14.7**	**22.3**	**N.A.**[i]	**671**	**0.1**	**N.A.**	**15.4**	**3460**
Qbt2,3,4 Background Value				**4.66**	**11.2**	**N.A.**	**482**	**0.1**	**N.A.**	**6.58**	**3500**
Sediment Background Value				**11.2**	**19.7**	**N.A.**	**543**	**0.1**	**N.A.**	**9.38**	**2690**
Industrial Soil Screening Level				**4.54E+4**	**750**	**2.30E+4**	**2.18E+4**	**341**	**5680**	**2.25E+4**	**n/a**
AAB9780	21-02089	0–0.5	Soil	—	—	—	—	0.25 (J)	—	—	—
AAB9781	21-02090	0–0.25	Soil	—	—	—	—	0.31 (J)	—	—	—
AAB9782	21-02091	0–0.5	Soil	—	—	—	—	0.31 (J)	—	—	—
AAB9783	21-02092	0–0.5	Soil	—	—	—	—	0.63 (J)	—	—	—
AAB9784	21-02093	0–0.5	Soil	—	—	—	—	0.49 (J)	—	—	—
AAB9785	21-02094	0–0.5	Soil	—	—	—	—	0.53 (J)	—	—	—
AAB9786	21-02095	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9787	21-02096	0–0.5	Soil	—	—	—	—	0.33 (J)	—	—	—
AAB9788	21-02097	0–0.5	Soil	—	—	—	—	0.43 (J)	—	—	—
AAB9789	21-02098	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9790	21-02099	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9791	21-02100	0–0.5	Soil	—	—	—	—	0.24 (J)	—	—	—
AAB9792	21-02101	0–0.5	Soil	—	—	—	—	0.24 (J)	—	27.9 (J)	—
AAB9794	21-02103	0–0.5	Soil	—	—	—	—	0.11 (U)	—	—	—
AAB9802[j]	21-02103	0–0.5	Soil	—	—	—	—	0.11 (U)	—	—	—
AAB9795	21-02104	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9796	21-02105	0–0.42	Soil	—	—	—	—	0.65 (J)	—	—	—
AAB9797	21-02106	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9798	21-02107	0–0.5	Soil	—	—	—	—	0.48 (J)	—	—	—
AAB7281	21-02570	0–0.25	Sediment	—	—	—	—	—	—	—	—
AAB7282	21-02570	0.25–0.5	Sediment	—	—	—	—	—	—	—	—
AAB7283	21-02570	0.5–1	Sediment	—	—	—	—	—	—	—	—
AAB7284	21-02571	0–0.25	Sediment	—	—	—	—	—	—	—	—
AAB7285	21-02571	0.25–0.5	Sediment	—	36	—	—	—	—	—	—
AAB7286	21-02571	0.5–1	Sediment	—	—	—	—	—	—	—	—
AAB9888	21-02577	0–0.5	Soil	—	—	—	—	0.43 (J)	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Copper	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Potassium
Soil Background Value				**14.7**	**22.3**	**N.A.**[i]	**671**	**0.1**	**N.A.**	**15.4**	**3460**
Qbt2,3,4 Background Value				**4.66**	**11.2**	**N.A.**	**482**	**0.1**	**N.A.**	**6.58**	**3500**
Sediment Background Value				**11.2**	**19.7**	**N.A.**	**543**	**0.1**	**N.A.**	**9.38**	**2690**
Industrial Soil Screening Level				**4.54E+4**	**750**	**2.30E+4**	**2.18E+4**	**341**	**5680**	**2.25E+4**	**n/a**
AAC0135	21-02594	0–0.5	Soil	—	—	—	—	—	—	—	—
AAC0136	21-02595	0–0.5	Soil	—	—	—	—	—	—	—	—
AAC0137	21-02596	0–0.5	Soil	—	—	—	—	0.27 (J)	—	—	—
AAC0138	21-02597	0–0.5	Soil	—	—	—	—	0.11 (J)	—	—	—
AAC0139	21-02598	0–0.5	Soil	—	—	—	—	0.25 (J)	—	—	—
AAC0140	21-02599	0–0.5	Soil	—	—	—	—	—	—	—	—
AAC0144[j]	21-02599	0–0.5	Soil	—	—	—	—	—	—	—	—
MD21-98-0394	21-10838	0–5	Qbt3	8.8	—	—	—	—	—	—	—
MD21-98-0392	21-10838	14–15	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0395	21-10838	24–25	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0393	21-10838	34–35	Qbt3	—	12	—	—	0.11 (U)	—	—	—
MD21-98-0397	21-10838	44–45	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0507	21-10838	54–55	Qbt3	—	12	—	—	0.12 (U)	—	—	—
MD21-98-0396	21-10838	64–65	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0506	21-10838	74–75	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0508	21-10839	2–3	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0402	21-10839	14–15	Qbt3	—	—	—	610	—	—	—	—
MD21-98-0403	21-10839	24–25	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0405	21-10839	34–35	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0406	21-10839	44–45	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0509	21-10839	51.5–52.5	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0404	21-10839	59–60	Qbt3	4.9	—	—	—	0.11 (U)	—	—	—
MD21-98-0407	21-10839	74–75	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0412	21-10840	4–5	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0414	21-10840	11.5–12.5	Qbt3	—	21	—	—	0.11 (U)	—	—	—
MD21-98-0413	21-10840	21.5–22.5	Qbt3	—	—	—	—	0.11 (U)	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Copper	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Potassium
Soil Background Value				**14.7**	**22.3**	**N.A.**[1]	**671**	**0.1**	**N.A.**	**15.4**	**3460**
Qbt2,3,4 Background Value				**4.66**	**11.2**	**N.A.**	**482**	**0.1**	**N.A.**	**6.58**	**3500**
Sediment Background Value				**11.2**	**19.7**	**N.A.**	**543**	**0.1**	**N.A.**	**9.38**	**2690**
Industrial Soil Screening Level				**4.54E+4**	**750**	**2.30E+4**	**2.18E+4**	**341**	**5680**	**2.25E+4**	**n/a**
MD21-98-0415	21-10840	34–35	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0417	21-10840	44–45	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0416	21-10840	46.5–47.5	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0422	21-10840	64–65	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0511	21-10840	74–75	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0423	21-10841	4–5	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0425	21-10841	11.5–12.5	Qbt3	—	—	—	—	0.24	—	—	—
MD21-98-0424	21-10841	24–25	Qbt3	—	—	—	—	0.14	—	—	—
MD21-98-0426	21-10841	34–35	Qbt3	—	—	—	—	0.16	—	—	—
MD21-98-0428	21-10841	44–45	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0513	21-10841	54–55	Qbt3	—	—	—	—	0.14	—	—	—
MD21-98-0427	21-10841	56.5–57.5	Qbt3	—	—	—	—	0.16	—	—	—
MD21-98-0512	21-10841	74–75	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0433	21-10842	4–5	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0435	21-10842	14–15	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0434	21-10842	24–25	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0438	21-10842	26.5–27.5	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0436	21-10842	44–45	Qbt3	—	14	—	—	0.11 (U)	—	—	—
MD21-98-0437	21-10842	49–50	Qbt3	7.6	14	—	—	0.11 (U)	—	—	—
MD21-98-0515	21-10842	71.5–72.5	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0443	21-10843	4–5	Soil	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0445	21-10843	14–15	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0444	21-10843	24–25	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0446	21-10843	34–35	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0447	21-10843	44–45	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0448	21-10843	54–55	Qbt3	—	—	—	—	0.11 (U)	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Copper	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Potassium
Soil Background Value				**14.7**	**22.3**	**N.A.[i]**	**671**	**0.1**	**N.A.**	**15.4**	**3460**
Qbt2,3,4 Background Value				**4.66**	**11.2**	**N.A.**	**482**	**0.1**	**N.A.**	**6.58**	**3500**
Sediment Background Value				**11.2**	**19.7**	**N.A.**	**543**	**0.1**	**N.A.**	**9.38**	**2690**
Industrial Soil Screening Level				**4.54E+4**	**750**	**2.30E+4**	**2.18E+4**	**341**	**5680**	**2.25E+4**	**n/a**
MD21-98-0453	21-10843	64–65	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0516	21-10843	72.5–75	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0517[j]	21-10843	72.5–75	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0454	21-10844	2.5–5	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0456	21-10844	12.5–15	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0455	21-10844	24–25	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0457	21-10844	34–35	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0458	21-10844	44–45	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0459	21-10844	54–55	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0464	21-10844	64–65	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0465[j]	21-10844	74–75	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0519	21-10844	74–75	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0468	21-10845	4–5	Qbt3	4.8	—	—	—	0.11 (U)	—	—	—
MD21-98-0470	21-10845	14–15	Qbt3	—	13	—	—	0.11 (U)	—	—	—
MD21-98-0469	21-10845	24–25	Qbt3	—	22	—	—	0.11 (U)	—	—	—
MD21-98-0471	21-10845	34–35	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0472	21-10845	44–45	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0473	21-10845	54–55	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0520	21-10845	64–65	Qbt3	—	—	—	—	0.11 (U)	—	—	—
MD21-98-0521	21-10845	74–75	Qbt3	—	—	—	—	0.11 (U)	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Selenium	Silver	Sodium	Strontium	Thallium	Uranium	Vanadium	Zinc
Soil Background Value				**1.52**	**1**	**915**	**N.A.**	**0.73**	**1.82**	**39.6**	**48.8**
Qbt2,3,4 Background Value				**0.3**	**1**	**2770**	**N.A.**	**1.1**	**2.40**	**17**	**63.5**
Sediment Background Value				**0.3**	**1**	**1470**	**N.A.**	**0.73**	**2.22**	**19.7**	**60.2**
Industrial Soil Screening Level				**5680**	**5680**	**n/a**	**1.0E+5**	**74.9**	**200**	**7950**	**1.0E+5**
AAA0396	21-01177	0–0.08	Soil	74.8 (U)	3 (U)	—	25.3	74.8 (U)	5.1	—	—
AAA0191	21-01178	0–0.08	Soil	—	—	15400	123	20 (U)	5.11	—	—
AAA0192	21-01178	0–0.5	Soil	—	1.2	15800	127	20 (U)	4.77	—	—
AAA0395	21-01183	0–0.08	Soil	63.3 (U)	2.5 (U)	—	15.5	63.3 (U)	4.9	—	—
AAA0193	21-01184	0–0.08	Soil	—	—	16200	114	20 (U)	5.2	—	—
AAA0194	21-01184	0–0.5	Soil	—	—	19000	109	20 (U)	4.19	—	—
AAA0391	21-01191	0–0.08	Soil	63.2 (U)	2.5 (U)	—	11.8	63.2 (U)	5.1	—	—
AAA0195	21-01192	0–0.08	Soil	—	—	14000	123	20 (U)	7.21	—	52
AAA0196	21-01192	0–0.5	Soil	—	—	17800	114	20 (U)	4.14	—	—
AAA0197	21-01193	0–0.08	Soil	—	—	13900	142	20 (U)	3.75	45	57
AAA0198	21-01193	0–0.5	Soil	—	—	14300	151	20 (U)	3.72	48	—
AAA0199[j]	21-01193	0–0.08	Soil	—	—	14200	134	20 (U)	3.65	42	58
AAA7519	21-01863	0–0.25	Soil	—	2.4 (U)	—	—	—	—	—	—
AAA7520	21-01863	0.25–0.5	Soil	—	2.2 (U)	—	—	—	—	—	—
AAA7521	21-01863	0.5–1	Soil	—	2.1 (U)	—	—	—	—	—	—
AAA7522	21-01864	0–0.25	Soil	—	2.4 (U)	—	—	—	—	—	—
AAA7523	21-01864	0.25–0.5	Soil	—	2.2 (U)	—	—	—	—	—	—
AAA7524	21-01864	0.5–1	Soil	—	2.1 (U)	—	—	—	1.95 (J)	—	—
AAA7525	21-01865	0–0.25	Sediment	0.69 (U)	2.3 (U)	—	—	—	—	—	—
AAA7526	21-01865	0.25–0.5	Sediment	0.67 (U)	2.2 (U)	—	—	—	—	—	—
AAA7527	21-01865	0.5–1	Sediment	0.62 (U)	2.1 (U)	—	—	—	—	—	—
AAB9750	21-02059	0–0.5	Soil	—	—	—	—	—	2.93 (J)	—	—
AAB9751	21-02060	0–0.5	Soil	—	—	—	—	—	1.97 (J)	—	—
AAB9752	21-02061	0–0.5	Soil	—	—	—	—	—	1.88 (J)	—	—
AAB9753	21-02062	0–0.5	Soil	—	—	—	—	—	2.1 (J)	—	—
AAB9754	21-02063	0–0.5	Soil	—	—	—	—	—	3.16 (J)	—	54.1

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Selenium	Silver	Sodium	Strontium	Thallium	Uranium	Vanadium	Zinc
Soil Background Value				**1.52**	**1**	**915**	**N.A.**	**0.73**	**1.82**	**39.6**	**48.8**
Qbt2,3,4 Background Value				**0.3**	**1**	**2770**	**N.A.**	**1.1**	**2.40**	**17**	**63.5**
Sediment Background Value				**0.3**	**1**	**1470**	**N.A.**	**0.73**	**2.22**	**19.7**	**60.2**
Industrial Soil Screening Level				**5680**	**5680**	**n/a**	**1.0E+5**	**74.9**	**200**	**7950**	**1.0E+5**
AAB9755	21-02064	0–0.5	Soil	—	—	—	—	0.78 (U)	3.7 (J)	—	66.2
AAB9756	21-02065	0–0.5	Soil	—	—	—	—	—	3.06 (J)	—	—
AAB9757	21-02066	0–0.5	Soil	—	—	—	—	0.76 (U)	2.2 (J)	—	—
AAB9758	21-02067	0–0.5	Soil	—	—	—	—	0.77 (U)	—	—	—
AAB9759	21-02068	0–0.5	Soil	—	—	—	—	—	2.84 (J)	—	—
AAB9760	21-02069	0–0.25	Soil	—	—	—	—	0.86 (U)	5.8 (J)	—	52.5
AAB9761	21-02070	0–0.5	Soil	—	—	—	—	—	2.91 (J)	—	—
AAB9762	21-02071	0–0.5	Soil	—	—	—	—	—	2.01 (J)	—	—
AAB9763	21-02072	0–0.5	Soil	—	—	—	—	0.75 (U)	7.5 (J)	—	—
AAB9764	21-02073	0–0.5	Soil	—	—	—	—	1.1 (U)	—	—	—
AAB9765	21-02074	0–0.5	Soil	—	—	—	—	0.74 (U)	2.11 (J)	—	—
AAB9766	21-02075	0–0.5	Soil	—	—	—	—	—	1.93 (J)	—	—
AAB9767	21-02076	0–0.5	Soil	—	—	—	—	—	1.86 (J)	—	—
AAB9768	21-02077	0–0.5	Soil	—	—	—	—	—	3.4 (J)	—	—
AAB9769	21-02078	0–0.5	Soil	—	—	—	—	—	2.22 (J)	—	—
AAB9803[j]	21-02078	0–0.5	Soil	—	—	—	—	—	2.37 (J)	—	—
AAB9770	21-02079	0–0.5	Soil	—	—	—	—	—	2.16 (J)	—	—
AAB9771	21-02080	0–0.5	Soil	—	—	—	—	—	2.23 (J)	—	68.5
AAB9772	21-02081	0–0.5	Soil	—	—	—	—	—	2.21 (J)	—	—
AAB9773	21-02082	0–0.5	Soil	—	—	—	—	—	2.12 (J)	—	—
AAB9774	21-02083	0–0.5	Soil	—	—	—	—	—	1.83 (J)	—	59.8
AAB9775	21-02084	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9776	21-02085	0–0.5	Soil	—	—	—	—	0.81 (U)	2.15 (J)	—	58.2
AAB9777	21-02086	0–0.5	Soil	—	—	—	—	—	1.94	—	56.7
AAB9778	21-02087	0–0.5	Soil	—	—	—	—	—	37.5	—	—
AAB9779	21-02088	0–0.5	Soil	—	—	—	—	—	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Selenium	Silver	Sodium	Strontium	Thallium	Uranium	Vanadium	Zinc
Soil Background Value				**1.52**	**1**	**915**	**N.A.**	**0.73**	**1.82**	**39.6**	**48.8**
Qbt2,3,4 Background Value				**0.3**	**1**	**2770**	**N.A.**	**1.1**	**2.40**	**17**	**63.5**
Sediment Background Value				**0.3**	**1**	**1470**	**N.A.**	**0.73**	**2.22**	**19.7**	**60.2**
Industrial Soil Screening Level				**5680**	**5680**	**n/a**	**1.0E+5**	**74.9**	**200**	**7950**	**1.0E+5**
AAB9780	21-02089	0–0.5	Soil	—	—	—	—	—	2.96	—	404
AAB9781	21-02090	0–0.25	Soil	—	—	—	—	—	—	—	—
AAB9782	21-02091	0–0.5	Soil	—	—	—	—	—	2.09 (J)	—	53.2
AAB9783	21-02092	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9784	21-02093	0–0.5	Soil	—	—	—	—	—	8.96	—	—
AAB9785	21-02094	0–0.5	Soil	—	—	—	—	—	—	—	73.2
AAB9786	21-02095	0–0.5	Soil	—	—	—	—	—	2.02 (J)	—	—
AAB9787	21-02096	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9788	21-02097	0–0.5	Soil	—	—	—	—	—	2.11 (J)	—	64
AAB9789	21-02098	0–0.5	Soil	—	—	—	—	—	—	—	53.7
AAB9790	21-02099	0–0.5	Soil	—	—	—	—	—	2.02 (J)	—	509
AAB9791	21-02100	0–0.5	Soil	—	—	—	—	—	9.14	—	—
AAB9792	21-02101	0–0.5	Soil	—	—	—	—	—	18.1	—	146
AAB9794	21-02103	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9802	21-02103	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9795	21-02104	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9796	21-02105	0–0.42	Soil	—	—	—	—	—	1.95 (J)	—	—
AAB9797	21-02106	0–0.5	Soil	—	—	—	—	—	1.9 (J)	—	—
AAB9798	21-02107	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB7281	21-02570	0–0.25	Sediment	0.7 (U)	2.3 (U)	—	—	—	—	—	—
AAB7282	21-02570	0.25–0.5	Sediment	0.67 (U)	2.2 (U)	—	—	—	—	—	—
AAB7283	21-02570	0.5–1	Sediment	0.65 (U)	2.2 (U)	—	—	—	—	—	—
AAB7284	21-02571	0–0.25	Sediment	0.67 (U)	2.2 (U)	—	—	—	2.69 (J)	—	—
AAB7285	21-02571	0.25–0.5	Sediment	0.63 (U)	2.1 (U)	—	—	—	—	—	72
AAB7286	21-02571	0.5–1	Sediment	0.76 (U)	2.5 (U)	—	—	—	—	—	—
AAB9888	21-02577	0–0.5	Soil	—	—	—	—	—	2.03 (J)	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Selenium	Silver	Sodium	Strontium	Thallium	Uranium	Vanadium	Zinc
Soil Background Value				**1.52**	**1**	**915**	**N.A.**	**0.73**	**1.82**	**39.6**	**48.8**
Qbt2,3,4 Background Value				**0.3**	**1**	**2770**	**N.A.**	**1.1**	**2.40**	**17**	**63.5**
Sediment Background Value				**0.3**	**1**	**1470**	**N.A.**	**0.73**	**2.22**	**19.7**	**60.2**
Industrial Soil Screening Level				**5680**	**5680**	**n/a**	**1.0E+5**	**74.9**	**200**	**7950**	**1.0E+5**
AAC0135	21-02594	0–0.5	Soil	—	—	1460 (J)	—	0.84 (U)	—	—	—
AAC0136	21-02595	0–0.5	Soil	—	—	1550 (J)	—	0.85 (U)	2.05 (J)	—	90.6
AAC0137	21-02596	0–0.5	Soil	—	—	1100 (J)	—	0.84 (U)	—	—	109
AAC0138	21-02597	0–0.5	Soil	—	—	1670 (J)	—	0.86 (U)	—	—	—
AAC0139	21-02598	0–0.5	Soil	—	—	1680 (J)	—	0.85 (U)	—	—	57.2
AAC0140	21-02599	0–0.5	Soil	—	—	1480 (J)	—	0.89 (U)	—	—	—
AAC0144[j]	21-02599	0–0.5	Soil	—	—	1370 (J)	—	0.86 (U)	—	—	—
MD21-98-0394	21-10838	0–5	Qbt3	0.52 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0392	21-10838	14–15	Qbt3	1 (U)	2 (U)	—	—	—	—	—	—
MD21-98-0395	21-10838	24–25	Qbt3	1 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0393	21-10838	34–35	Qbt3	1.1 (U)	2.1 (U)	—	—	—	—	—	73
MD21-98-0397	21-10838	44–45	Qbt3	1.1 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0507	21-10838	54–55	Qbt3	1.2 (U)	2.4 (U)	—	—	—	—	—	—
MD21-98-0396	21-10838	64–65	Qbt3	1.1 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0506	21-10838	74–75	Qbt3	1.1 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0508	21-10839	2–3	Qbt3	1 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0402	21-10839	14–15	Qbt3	1 (U)	2 (U)	—	—	—	—	—	—
MD21-98-0403	21-10839	24–25	Qbt3	1.1 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0405	21-10839	34–35	Qbt3	1.1 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0406	21-10839	44–45	Qbt3	1.1 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0509	21-10839	51.5–52.5	Qbt3	1.1 (U)	2.2 (U)	—	—	—	—	—	—
MD21-98-0404	21-10839	59–60	Qbt3	1.1 (U)	2.3 (U)	—	—	—	—	—	—
MD21-98-0407	21-10839	74–75	Qbt3	1.1 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0412	21-10840	4–5	Qbt3	1.1 (U)	2.2 (U)	—	—	—	—	—	—
MD21-98-0414	21-10840	11.5–12.5	Qbt3	0.53 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0413	21-10840	21.5–22.5	Qbt3	0.53 (U)	2.1 (U)	—	—	—	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Selenium	Silver	Sodium	Strontium	Thallium	Uranium	Vanadium	Zinc
Soil Background Value				**1.52**	**1**	**915**	**N.A.**	**0.73**	**1.82**	**39.6**	**48.8**
Qbt2,3,4 Background Value				**0.3**	**1**	**2770**	**N.A.**	**1.1**	**2.40**	**17**	**63.5**
Sediment Background Value				**0.3**	**1**	**1470**	**N.A.**	**0.73**	**2.22**	**19.7**	**60.2**
Industrial Soil Screening Level				**5680**	**5680**	**n/a**	**1.0E+5**	**74.9**	**200**	**7950**	**1.0E+5**
MD21-98-0415	21-10840	34–35	Qbt3	0.53 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0417	21-10840	44–45	Qbt3	0.54 (U)	2.2 (U)	—	—	—	—	—	—
MD21-98-0416	21-10840	46.5–47.5	Qbt3	0.54 (U)	2.2 (U)	—	—	—	—	—	—
MD21-98-0422	21-10840	64–65	Qbt3	0.54 (U)	2.2 (U)	—	—	—	—	—	—
MD21-98-0511	21-10840	74–75	Qbt3	0.53 (U)	2.1 (U)	—	—	—	—	—	—
MD21-98-0423	21-10841	4–5	Qbt3	1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0425	21-10841	11.5–12.5	Qbt3	1 (U)	2 (U)	—	—	2 (U)	—	—	—
MD21-98-0424	21-10841	24–25	Qbt3	1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0426	21-10841	34–35	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0428	21-10841	44–45	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0513	21-10841	54–55	Qbt3	1.1 (U)	2.2 (U)	—	—	2.2 (U)	—	—	—
MD21-98-0427	21-10841	56.5–57.5	Qbt3	1.1 (U)	2.2 (U)	—	—	2.2 (U)	—	—	—
MD21-98-0512	21-10841	74–75	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0433	21-10842	4–5	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0435	21-10842	14–15	Qbt3	1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0434	21-10842	24–25	Qbt3	1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0438	21-10842	26.5–27.5	Qbt3	1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0436	21-10842	44–45	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0437	21-10842	49–50	Qbt3	1.1 (U)	2.2 (U)	—	—	2.2 (U)	—	—	—
MD21-98-0515	21-10842	71.5–72.5	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0443	21-10843	4–5	Soil	—	2.2 (U)	—	—	2.2 (U)	—	—	—
MD21-98-0445	21-10843	14–15	Qbt3	1 (U)	2 (U)	—	—	2 (U)	—	—	—
MD21-98-0444	21-10843	24–25	Qbt3	1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0446	21-10843	34–35	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0447	21-10843	44–45	Qbt3	1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0448	21-10843	54–55	Qbt3	1.1 (U)	2.2 (U)	—	—	2.2 (U)	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Selenium	Silver	Sodium	Strontium	Thallium	Uranium	Vanadium	Zinc
Soil Background Value				**1.52**	**1**	**915**	**N.A.**	**0.73**	**1.82**	**39.6**	**48.8**
Qbt2,3,4 Background Value				**0.3**	**1**	**2770**	**N.A.**	**1.1**	**2.40**	**17**	**63.5**
Sediment Background Value				**0.3**	**1**	**1470**	**N.A.**	**0.73**	**2.22**	**19.7**	**60.2**
Industrial Soil Screening Level				**5680**	**5680**	**n/a**	**1.0E+5**	**74.9**	**200**	**7950**	**1.0E+5**
MD21-98-0453	21-10843	64–65	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0516	21-10843	72.5–75	Qbt3	1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0517[J]	21-10843	72.5–75	Qbt3	1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0454	21-10844	2.5–5	Qbt3	1 (U)	2 (U)	—	—	2 (U)	—	—	—
MD21-98-0456	21-10844	12.5–15	Qbt3	1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0455	21-10844	24–25	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0457	21-10844	34–35	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0458	21-10844	44–45	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0459	21-10844	54–55	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0464	21-10844	64–65	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0465[J]	21-10844	74–75	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0519	21-10844	74–75	Qbt3	1 (U)	2 (U)	—	—	2 (U)	—	—	—
MD21-98-0468	21-10845	4–5	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0470	21-10845	14–15	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0469	21-10845	24–25	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0471	21-10845	34–35	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0472	21-10845	44–45	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0473	21-10845	54–55	Qbt3	1.1 (U)	2.2 (U)	—	—	2.2 (U)	—	—	—

Table 3.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Selenium	Silver	Sodium	Strontium	Thallium	Uranium	Vanadium	Zinc
Soil Background Value				**1.52**	**1**	**915**	**N.A.**	**0.73**	**1.82**	**39.6**	**48.8**
Qbt2,3,4 Background Value				**0.3**	**1**	**2770**	**N.A.**	**1.1**	**2.40**	**17**	**63.5**
Sediment Background Value				**0.3**	**1**	**1470**	**N.A.**	**0.73**	**2.22**	**19.7**	**60.2**
Industrial Soil Screening Level				**5680**	**5680**	**n/a**	**1.0E+5**	**74.9**	**200**	**7950**	**1.0E+5**
MD21-98-0520	21-10845	64–65	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—
MD21-98-0521	21-10845	74–75	Qbt3	1.1 (U)	2.1 (U)	—	—	2.1 (U)	—	—	—

Note: Values are in mg/kg.

[a] From "Inorganic and Radionuclide Background Data for Soil, Sediment and Bandelier Tuff at Los Alamos National Laboratory" (LANL 1998, 59730).

[b] From New Mexico Environment Department, "Technical Background Document for Development of Soil Screening Levels, Revision 2.0" (NMED 2004, 85615), unless otherwise noted.

[c] Calculated from New Mexico Environment Department, "Technical Background Document for Development of Soil Screening Levels, Revision 2.0" (NMED 2004, 85615) using inputs from Eq. 7 (p. 15) and Table C-1.

[d] n/a = Not applicable.

[e] — indicates result was not detected, does not exceed the background values, or was not analyzed.

[f] "U" indicates a nondetected result for which the detection limit is greater than background.

[g] "J" indicates a result with an estimated value.

[h] "UJ" indicates result is not detected; detection limit is estimated.

[i] N.A. = Not available.

[j] Field duplicate.

Table 3.4-3
Frequency of Organic Chemicals Detected

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range* (mg/kg)	Frequency of Detects
Acenaphthene	Soil	70	1	[0.33 to 0.46]	1/70
Anthracene	Soil	70	1	[0.33] to 0.88	1/70
Benz(a)anthracene	Soil	70	2	[0.33] to 0.66	2/70
Benzo(a)anthracene	Sediment	9	1	[0.34 to 0.46]	1/9
Benzo(a)pyrene	Soil	70	2	[0.33] to 0.81	2/70
Benzo(b)fluoranthene	Soil	70	3	[0.33] to 0.61	3/70
Benzo(g,h,i)perylene	Soil	70	1	[0.33] to 0.62	1/70
Benzo(k)fluoranthene	Soil	70	1	[0.33] to 0.72	1/70
Chrysene	Soil	70	2	[0.33] to 0.73	2/70
Chrysene	Sediment	9	1	[0.34 to 0.46]	1/9
3,3'-Dichlorobenzidine	Sediment	9	1	[0.34 to 0.46]	1/9
Diethylphthalate	Soil	70	1	[0.33] to 8.1	1/70
Di-n-butylphthalate	Qbt3	62	3	[0.33] to 0.44	3/62
Fluoranthene	Soil	70	3	[0.33] to 2.9	3/70
Fluoranthene	Sediment	9	1	[0.34] to 1.4	1/9
Fluorene	Soil	70	1	[0.33 to 0.46]	1/70
Indeno(1,2,3-cd)pyrene	Soil	70	1	[0.33] to 0.56	1/70
Phenanthrene	Soil	70	3	[0.33] to 2.9	3/70
Phenanthrene	Sediment	9	1	[0.34] to 1.5	1/9
Pyrene	Soil	70	3	[0.33] to 1.8	3/70
Pyrene	Sediment	9	1	[0.34] to 0.99	1/9

*Brackets indicate detection limits for nondetected results.

Table 3.4-4
Organic Chemicals Detected

Sample ID	Location ID	Depth (ft)	Media	Acenaphthene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene
Industrial Soil Screening Level[a]				3.48E+4	2.64E+5	23.4	2.34	23.4	3.13E+4[b]	234	2340
AAA7526	21-01865	0.25–0.5	Sediment	—[c]	—	—	—	—	—	—	—
AAB9752	21-02061	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9765	21-02074	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB9772	21-02081	0–0.5	Soil	0.45	0.88	0.66	0.81	0.61	0.62	0.72	0.73
AAB9790	21-02099	0–0.5	Soil	—	—	—	—	0.44	—	—	—
AAB7285	21-02571	0.25–0.5	Sediment	—	—	0.44	—	—	—	—	0.45
AAB9889	21-02578	0–0.5	Soil	—	—	0.42	0.47	0.43	—	—	0.4
MD21-98-0435	21-10842	14–15	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0436	21-10842	44–45	Qbt3	—	—	—	—	—	—	—	—
MD21-98-0437	21-10842	49–50	Qbt3	—	—	—	—	—	—	—	—

Table 3.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	3,3'-Dichlorobenzidine	Diethylphthalate	Di-n-butylphthalate	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Phenanthrene	Pyrene
Industrial Soil Screening Level				42.6	1.0E+5	6.84E+4	2.44E+4	2.94E+4	23.4	2.05E+4	3.13E+4
AAA7526	21-01865	0.25–0.5	Sediment	0.36	—	—	—	—	—	—	—
AAB9752	21-02061	0–0.5	Soil	—	—	—	0.74	—	—	0.65	0.54
AAB9765	21-02074	0–0.5	Soil	—	8.1	—	—	—	—	—	—
AAB9772	21-02081	0–0.5	Soil	—	—	—	2.9	0.42	0.56	2.9	1.8
AAB9790	21-02099	0–0.5	Soil	—	—	—	—	—	—	—	—
AAB7285	21-02571	0.25–0.5	Sediment	—	—	—	1.4	—	—	1.5 (J)[d]	0.99 (J)
AAB9889	21-02578	0–0.5	Soil	—	—	—	1.3	—	—	1.3	0.98
MD21-98-0435	21-10842	14–15	Qbt3	—	—	0.36	—	—	—	—	—
MD21-98-0436	21-10842	44–45	Qbt3	—	—	0.38	—	—	—	—	—
MD21-98-0437	21-10842	49–50	Qbt3	—	—	0.44	—	—	—	—	—

Note: Values are in mg/kg.

[a] From New Mexico Environment Department, "Technical Background Document for Development of Soil Screening Levels, Revision 2.0" (NMED 2004, 85615), unless otherwise noted.

[b] Based on pyrene as a surrogate chemical.

[c] — = Result was not detected or was not analyzed.

[d] "J" indicates a result with an estimated value.

Table 3.4-5
Frequency of Radionuclides Detected Above Background/Fallout Values

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above Background Value
Americium-241	Soil	80	7	[-0.4599] to 0.84	0.013	7/80
Americium-241	Sediment	2	0	[0.01 to 0.06]	0.04	0/2
Americium-241	Qbt3	66	6	[-0.0108] to 0.046	n/a[b]	6/66
Cesium-134	Soil	27	0	[-0.075 to 0.083]	N.A.[c]	0/27
Cesium-134	Sediment	2	0	[-0.004 to 0.044]	N.A.	0/2
Cesium-134	Qbt3	66	0	[-0.068 to 0.086]	n/a	0/66
Cesium-137	Soil	59	50	[-0.012] to 2.779	1.65	7/59
Cesium-137	Sediment	7	7	0.212 to 0.5228	0.9	0/7
Cesium-137	Qbt3	66	0	[-0.061 to 0.16]	n/a	0/66
Cobalt-60	Soil	27	0	[-0.136 to 0.074]	N.A.	0/27
Cobalt-60	Sediment	2	0	[-0.003 to 0.008]	N.A.	0/2
Cobalt-60	Qbt3	66	0	[-0.072 to 0.092]	n/a	0/66
Europium-152	Soil	27	0	[-0.27 to 0.11]	N.A.	0/27
Europium-152	Sediment	2	0	[-0.06 to –0.017]	N.A.	0/2
Europium-152	Qbt3	66	0	[-0.17 to 0.22]	n/a	0/66
Plutonium-238	Soil	76	30	[-0.001] to 0.066	0.023	7/76
Plutonium-238	Sediment	9	2	[-0.0004] to 2.516	0.006	2/9
Plutonium-238	Qbt3	66	1	[-0.0145] to 0.0291	n/a	1/66
Plutonium-239	Soil	76	67	[-0.0006] to 3.095	0.054	61/76
Plutonium-239	Sediment	9	9	0.0226 to 4.136	0.068	7/9
Plutonium-239	Qbt3	66	7	[-0.0065] to 0.291	n/a	7/66
Radium-223	Soil	1	1	3.82 to 3.82	N.A.	1/1
Radium-223	Qbt3	1	1	2.3 to 2.3	n/a	1/1
Radon-219	Soil	4	4	0.762 to 3.85	N.A.	4/4
Ruthenium-106	Soil	27	0	[-0.38 to 0.75]	N.A.	0/27
Ruthenium-106	Sediment	2	0	[-0.18 to 0.05]	N.A.	0/2
Ruthenium-106	Qbt3	66	0	[-0.77 to 0.45]	n/a	0/66
Sodium-22	Soil	27	0	[-0.086 to 0.089]	N.A.	0/27
Sodium-22	Sediment	2	0	[0.006 to 0.011]	N.A.	0/2
Sodium-22	Qbt3	66	0	[-0.118 to 0.072]	n/a	0/66
Strontium-90	Soil	77	14	[-0.3] to 2.96	1.31	3/77
Strontium-90	Sediment	9	4	[0.04] to 0.86	1.04	0/9
Strontium-90	Qbt3	66	0	[-0.27 to 0.47]	n/a	0/66
Thorium-227	Soil	3	3	0.503 to 4.41	N.A.	3/3
Thorium-227	Qbt3	1	1	2.33 to 2.33	n/a	1/1
Thorium-228	Soil	5	1	1.43 to [5.569]	2.28	0/5

Table 3.4-5 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above Background Value
Thorium-230	Soil	1	1	1.3 to 1.3	2.29	0/1
Thorium-232	Soil	1	1	1.3 to 1.3	2.33	0/1
Tritium	Soil	90	90	0.063 to 8.11	n/a	90/90
Tritium	Sediment	9	8	[0.006] to 0.257	0.093	5/9
Tritium	Qbt3	66	63	[0.01] to 2.37	n/a	63/66
Uranium-234	Soil	28	28	0.549 to 17.9	2.59	2/28
Uranium-234	Sediment	2	2	0.978 to 1.249	2.59	0/2
Uranium-234	Qbt3	66	66	0.575 to 22.5	1.98	13/66
Uranium-235	Soil	58	39	[0.022] to 1.45	0.2	11/58
Uranium-235	Sediment	2	2	0.073 to 0.083	0.2	0/2
Uranium-235	Qbt3	66	66	0.0232 to 1.229	0.09	15/66
Uranium-238	Soil	28	28	0.433 to 1.7	2.29	0/28
Uranium-238	Sediment	2	2	0.799 to 0.802	2.29	0/2
Uranium-238	Qbt3	66	66	0.579 to 1.129	1.93	0/66

[a] Brackets indicate detection limits for nondetected results.

[b] n/a = Not applicable.

[c] N.A. = Not available.

Table 3.4-6
Radionuclides Detected Above Background/Fallout Values

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Radium-223[a]	Radon-219[a]	Strontium-90	Thorium-227[a]	Tritium[b]	Uranium-234	Uranium-235
Soil Background Value[c]				**0.013**	**1.65**	**0.023**	**0.054**	**N.A.[d]**	**N.A.**	**1.31**	**N.A.**	**n/a[e]**	**2.59**	**0.2**
Qbt2,3,4 Background Value[c]				**n/a**	**n/a**	**n/a**	**n/a**	**N.A.**	**N.A.**	**n/a**	**N.A.**	**n/a**	**1.98**	**0.09**
Sediment Background Value[c]				**0.040**	**0.90**	**0.006**	**0.068**	**N.A.**	**N.A.**	**1.04**	**N.A.**	**0.093**	**2.59**	**0.2**
Industrial Screening Action Level[f]				**140**	**19.7**	**176**	**159**	**N.A.**	**N.A.**	**1615**	**N.A.**	**15140**	**1087**	**73.1**
MD21-01-0492	21-01001	0–0.5	Soil	—[g]	—	—	—	—	—	—	—	1.59	—	—
MD21-01-0493	21-01001	0–0.5	Soil	—	—	—	—	—	—	—	—	8.11	—	—
AAA0396	21-01177	0–0.08	Soil	—	—	—	1.84	—	—	—	—	0.456	—	—
AAA0191	21-01178	0–0.08	Soil	—	—	0.044	0.664	—	—	—	—	0.7	—	—
AAA0192	21-01178	0–0.5	Soil	—	—	—	0.593	—	—	—	—	0.989	—	—
AAA0395	21-01183	0–0.08	Soil	0.131	—	0.024	2.686	—	—	—	—	0.189	—	—
AAA0193	21-01184	0–0.08	Soil	0.105	—	—	1.268	—	—	—	—	0.711	—	—
AAA0194	21-01184	0–0.5	Soil	0.031	—	—	0.603	—	—	—	—	0.9	—	—
AAA0391	21-01191	0–0.08	Soil	—	—	0.03	2.348	—	—	—	—	0.278	—	—
AAA0195	21-01192	0–0.08	Soil	0.267	—	0.037	3.095	—	—	—	—	0.711	—	—
AAA0196	21-01192	0–0.5	Soil	—	—	—	0.815	—	—	—	—	0.922	—	—
AAA0197	21-01193	0–0.08	Soil	—	—	—	0.185	—	—	—	—	0.833	—	—
AAA0198	21-01193	0–0.5	Soil	—	—	—	—	—	—	—	—	1.389	—	—
AAA0199[h]	21-01193	0–0.08	Soil	—	—	—	0.069	—	—	—	—	0.856	—	—
AAA7519	21-01863	0–0.25	Soil	—	—	—	0.168	—	—	—	—	0.433	—	—
AAA7520	21-01863	0.25–0.5	Soil	—	—	—	0.082	—	—	—	—	0.243	—	—
AAA7521	21-01863	0.5–1	Soil	—	—	—	0.149	—	—	—	—	0.181	—	—
AAA7522	21-01864	0–0.25	Soil	—	—	—	0.126	—	—	—	—	0.672	—	—
AAA7523	21-01864	0.25–0.5	Soil	—	—	—	0.110	—	—	1.61	—	0.502	—	—
AAA7524	21-01864	0.5–1	Soil	—	—	—	0.147	—	—	2.63	—	0.081	—	—
AAA7525	21-01865	0–0.25	Sediment	—	—	0.022	0.371	—	—	—	—	0.171	—	—

Table 3.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Radium-223[a]	Radon-219[a]	Strontium-90	Thorium-227[a]	Tritium[b]	Uranium-234	Uranium-235
Soil Background Value				**0.013**	**1.65**	**0.023**	**0.054**	**N.A.**	**N.A.**	**1.31**	**N.A.**	**n/a**	**2.59**	**0.2**
Qbt2,3,4 Background Value				**n/a**	**n/a**	**n/a**	**n/a**	**N.A.**	**N.A.**	**n/a**	**N.A.**	**n/a**	**1.98**	**0.09**
Sediment Background Value				**0.040**	**0.90**	**0.006**	**0.068**	**N.A.**	**N.A.**	**1.04**	**N.A.**	**0.093**	**2.59**	**0.2**
Industrial Soil Screening Level				**140**	**19.7**	**176**	**159**	**N.A.**	**N.A.**	**1615**	**N.A.**	**15140**	**1087**	**73.1**
AAA7526	21-01865	0.25–0.5	Sediment	—	—	—	0.232	—	—	—	—	—	—	—
AAA7527	21-01865	0.5–1	Sediment	—	—	2.516	4.136	—	—	—	—	—	—	—
AAB9750	21-02059	0–0.5	Soil	—	—	—	1.48	—	—	—	—	0.618	—	—
AAB9751	21-02060	0–0.5	Soil	—	—	—	0.152	—	—	—	—	0.381	—	—
AAB9752	21-02061	0–0.5	Soil	—	—	—	0.272	—	—	—	—	0.256	—	—
AAB9753	21-02062	0–0.5	Soil	—	—	—	0.164	—	—	—	—	0.858	—	—
AAB9754	21-02063	0–0.5	Soil	—	1.66	—	1.45	—	—	—	—	1.104	—	—
AAB9755	21-02064	0–0.5	Soil	—	2.779	—	2.696	—	—	—	—	1.310	—	—
AAB9756	21-02065	0–0.5	Soil	—	—	—	1.168	—	—	—	—	1.022	—	0.243
AAB9757	21-02066	0–0.5	Soil	—	—	—	1.557	—	—	—	—	0.413	—	—
AAB9758	21-02067	0–0.5	Soil	—	—	—	0.218	—	—	—	—	0.112	—	—
AAB9759	21-02068	0–0.5	Soil	—	—	—	1.244	—	—	—	—	0.209	—	0.204
AAB9760	21-02069	0–0.25	Soil	—	—	—	1.734	—	—	—	—	0.750	—	—
AAB9761	21-02070	0–0.5	Soil	—	—	—	0.449	—	—	—	—	0.120	—	—
AAB9762	21-02071	0–0.5	Soil	—	—	—	1.896	—	—	—	—	0.635	—	—
AAB9763	21-02072	0–0.5	Soil	—	—	—	—	—	—	—	—	0.375	—	—
AAB9764	21-02073	0–0.5	Soil	—	—	—	0.302	—	—	—	—	0.264	—	—
AAB9765	21-02074	0–0.5	Soil	—	—	—	0.826	—	—	—	—	0.441	—	—
AAB9766	21-02075	0–0.5	Soil	—	—	—	0.639	—	—	—	—	0.328	—	—
AAB9767	21-02076	0–0.5	Soil	—	—	—	0.793	—	—	—	—	0.315	—	—
AAB9768	21-02077	0–0.5	Soil	—	—	—	—	—	—	2.96	—	0.271	—	—

Table 3.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Radium-223[a]	Radon-219[a]	Strontium-90	Thorium-227[a]	Tritium[b]	Uranium-234	Uranium-235
Soil Background Value				**0.013**	**1.65**	**0.023**	**0.054**	**N.A.**	**N.A.**	**1.31**	**N.A.**	**n/a**	**2.59**	**0.2**
Qbt2,3,4 Background Value				**n/a**	**n/a**	**n/a**	**n/a**	**N.A.**	**N.A.**	**n/a**	**N.A.**	**n/a**	**1.98**	**0.09**
Sediment Background Value				**0.040**	**0.90**	**0.006**	**0.068**	**N.A.**	**N.A.**	**1.04**	**N.A.**	**0.093**	**2.59**	**0.2**
Industrial Soil Screening Level				**140**	**19.7**	**176**	**159**	**N.A.**	**N.A.**	**1615**	**N.A.**	**15140**	**1087**	**73.1**
AAB9769	21-02078	0–0.5	Soil	—	—	—	0.144	—	—	—	—	0.163	—	—
AAB9803[h]	21-02078	0–0.5	Soil	—	—	—	0.107	—	—	—	—	0.200	—	—
AAB9770	21-02079	0–0.5	Soil	—	—	—	0.804	—	—	—	—	0.191	—	—
AAB9771	21-02080	0–0.5	Soil	—	—	—	0.180	—	—	—	—	0.277	—	—
AAB9772	21-02081	0–0.5	Soil	—	—	—	0.342	—	—	—	—	0.252	—	—
AAB9773	21-02082	0–0.5	Soil	—	—	—	0.237	—	—	—	—	0.392	—	0.211
AAB9774	21-02083	0–0.5	Soil	—	—	—	0.154	—	—	—	—	1.810	—	—
MD21-01-0434	21-02083	0–0.5	Soil	—	—	—	—	—	—	—	—	7.08	—	—
MD21-01-0490[h]	21-02083	0–0.5	Soil	—	—	—	—	—	—	—	—	5.81	—	—
AAB9775	21-02084	0–0.5	Soil	—	—	—	0.223	—	—	—	—	0.285	—	—
AAB9776	21-02085	0–0.5	Soil	0.255	—	0.028	0.793	—	—	—	—	1.491	—	—
AAB9777	21-02086	0–0.5	Soil	—	—	—	0.124	—	—	—	—	0.376	—	0.346
AAB9778	21-02087	0–0.5	Soil	—	—	—	—	—	—	—	—	0.243	—	—
AAB9779	21-02088	0–0.5	Soil	—	—	—	0.118	—	—	—	—	0.639	—	0.243
AAB9780	21-02089	0–0.5	Soil	—	—	0.025	0.183	—	—	—	—	0.733	—	0.332
AAB9781	21-02090	0–0.25	Soil	—	—	—	0.247	—	—	—	—	0.191	—	0.278
AAB9782	21-02091	0–0.5	Soil	—	—	—	0.209	—	—	—	—	0.396	—	—
AAB9783	21-02092	0–0.5	Soil	—	—	—	0.181	—	—	—	—	0.271	—	—
AAB9784	21-02093	0–0.5	Soil	0.634	—	—	0.502	—	—	—	—	0.284	—	—
AAB9785	21-02094	0–0.5	Soil	—	—	—	0.181	—	—	—	—	0.296	—	0.343
AAB9786	21-02095	0–0.5	Soil	—	—	—	—	—	—	—	—	0.281	—	—
AAB9787	21-02096	0–0.5	Soil	—	—	—	—	—	—	—	—	0.417	—	—

Table 3.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Radium-223[a]	Radon-219[a]	Strontium-90	Thorium-227[a]	Tritium[b]	Uranium-234	Uranium-235
Soil Background Value				**0.013**	**1.65**	**0.023**	**0.054**	**N.A.**	**N.A.**	**1.31**	**N.A.**	**n/a**	**2.59**	**0.2**
Qbt2,3,4 Background Value				**n/a**	**n/a**	**n/a**	**n/a**	**N.A.**	**N.A.**	**n/a**	**N.A.**	**n/a**	**1.98**	**0.09**
Sediment Background Value				**0.040**	**0.90**	**0.006**	**0.068**	**N.A.**	**N.A.**	**1.04**	**N.A.**	**0.093**	**2.59**	**0.2**
Industrial Soil Screening Level				**140**	**19.7**	**176**	**159**	**N.A.**	**N.A.**	**1615**	**N.A.**	**15140**	**1087**	**73.1**
AAB9788	21-02097	0–0.5	Soil	—	—	—	0.288	—	—	—	—	0.189	—	—
AAB9789	21-02098	0–0.5	Soil	—	—	—	0.195	—	—	—	—	0.270	—	—
AAB9790	21-02099	0–0.5	Soil	—	—	—	0.639	—	—	—	—	3.246	—	—
MD21-01-0435	21-02099	0–0.5	Soil	—	—	—	—	—	—	—	—	2.42	—	—
AAB9791	21-02100	0–0.5	Soil	—	—	—	—	—	—	—	—	0.302	—	—
AAB9792	21-02101	0–0.5	Soil	—	—	—	0.325	—	—	—	—	0.992	—	—
MD21-01-0436	21-02101	0–0.5	Soil	—	—	—	—	—	—	—	—	1.83	—	—
AAB9793	21-02102	0–0.5	Soil	—	—	—	0.214	—	—	—	—	0.430	—	0.225
AAB9794	21-02103	0–0.5	Soil	—	—	0.066	—	—	—	—	—	0.071	—	—
AAB9802[h]	21-02103	0–0.5	Soil	—	—	—	—	—	—	—	—	0.403	—	—
AAB9795	21-02104	0–0.5	Soil	—	—	—	—	—	—	—	—	0.091	—	—
AAB9796	21-02105	0–0.42	Soil	—	—	—	0.179	—	—	—	—	0.251	—	—
AAB9797	21-02106	0–0.5	Soil	—	—	—	—	—	—	—	—	0.214	—	—
AAB9798	21-02107	0–0.5	Soil	—	—	—	—	—	—	—	—	0.333	—	—
AAB7281	21-02570	0–0.25	Sediment	—	—	—	0.207	—	—	—	—	0.129	—	—
AAB7282	21-02570	0.25–0.5	Sediment	—	—	—	0.119	—	—	—	—	0.126	—	—
AAB7283	21-02570	0.5–1	Sediment	—	—	—	—	—	—	—	—	0.257	—	—
AAB7284	21-02571	0–0.25	Sediment	—	—	—	0.247	—	—	—	—	0.099	—	—
AAB7285	21-02571	0.25–0.5	Sediment	—	—	—	0.234	—	—	—	—	—	—	—
AAB9891	21-02576	0–0.5	Soil	—	—	—	—	—	—	—	—	0.336	—	—
AAB9888	21-02577	0–0.5	Soil	—	—	—	—	—	—	—	—	0.405	—	—
AAB9889	21-02578	0–0.5	Soil	—	—	—	—	—	—	—	—	0.403	—	—

Table 3.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Radium-223[a]	Radon-219[a]	Strontium-90	Thorium-227[a]	Tritium[b]	Uranium-234	Uranium-235
Soil Background Value				**0.013**	**1.65**	**0.023**	**0.054**	**N.A.**	**N.A.**	**1.31**	**N.A.**	**n/a**	**2.59**	**0.2**
Qbt2,3,4 Background Value				**n/a**	**n/a**	**n/a**	**n/a**	**N.A.**	**N.A.**	**n/a**	**N.A.**	**n/a**	**1.98**	**0.09**
Sediment Background Value				**0.040**	**0.90**	**0.006**	**0.068**	**N.A.**	**N.A.**	**1.04**	**N.A.**	**0.093**	**2.59**	**0.2**
Industrial Soil Screening Level				**140**	**19.7**	**176**	**159**	**N.A.**	**N.A.**	**1615**	**N.A.**	**15140**	**1087**	**73.1**
AAB9890	21-02579	0–0.5	Soil	—	—	—	—	—	—	—	—	0.422	—	—
AAC0135	21-02594	0–0.5	Soil	—	—	—	0.070	—	—	—	—	0.938	—	—
AAC0136	21-02595	0–0.5	Soil	—	—	—	0.064	—	—	—	—	2.479	—	—
AAC0137	21-02596	0–0.5	Soil	—	—	—	0.238	—	—	—	—	0.590	—	—
AAC0138	21-02597	0–0.5	Soil	—	—	—	0.15	—	—	—	—	1.239	—	—
AAC0139	21-02598	0–0.5	Soil	—	—	—	0.078	—	—	—	—	1.530	—	—
AAC0140	21-02599	0–0.5	Soil	—	—	—	0.066	—	—	—	—	0.215	—	—
AAC0144[h]	21-02599	0–0.5	Soil	—	—	—	0.069	—	—	—	—	0.235	—	—
MD21-98-0394	21-10838	0–5	Qbt3	0.036	—	—	0.072	—	—	—	—	0.73	11.49	0.565
MD21-98-0392	21-10838	14–15	Qbt3	—	—	—	—	—	—	—	—	—	2.96	0.163
MD21-98-0395	21-10838	24–25	Qbt3	—	—	—	—	—	—	—	—	0.54	—	—
MD21-98-0393	21-10838	34–35	Qbt3	0.046	—	—	0.291	—	—	—	—	0.45	—	—
MD21-98-0397	21-10838	44–45	Qbt3	—	—	—	—	—	—	—	—	0.35	—	—
MD21-98-0507	21-10838	54–55	Qbt3	—	—	—	—	—	—	—	—	0.41	6.93	0.347
MD21-98-0396	21-10838	64–65	Qbt3	—	—	—	—	—	—	—	—	0.09	2.57	0.142
MD21-98-0506	21-10838	74–75	Qbt3	—	—	—	—	—	—	—	—	0.06	—	—
MD21-98-0508	21-10839	2–3	Qbt3	—	—	—	—	—	—	—	—	0.4	2.19	0.107
MD21-98-0402	21-10839	14–15	Qbt3	—	—	—	—	—	—	—	—	0.19	3.8	0.188
MD21-98-0403	21-10839	24–25	Qbt3	—	—	—	—	—	—	—	—	0.31	—	0.105
MD21-98-0405	21-10839	34–35	Qbt3	—	—	—	—	—	—	—	—	0.24	—	—
MD21-98-0406	21-10839	44–45	Qbt3	—	—	—	—	—	—	—	—	0.25	—	—
MD21-98-0509	21-10839	51.5–52.5	Qbt3	—	—	—	—	—	—	—	—	0.47	2.67	0.14

Table 3.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Radium-223[a]	Radon-219[a]	Strontium-90	Thorium-227[a]	Tritium[b]	Uranium-234	Uranium-235
Soil Background Value				**0.013**	**1.65**	**0.023**	**0.054**	**N.A.**	**N.A.**	**1.31**	**N.A.**	**n/a**	**2.59**	**0.2**
Qbt2,3,4 Background Value				**n/a**	**n/a**	**n/a**	**n/a**	**N.A.**	**N.A.**	**n/a**	**N.A.**	**n/a**	**1.98**	**0.09**
Sediment Background Value				**0.040**	**0.90**	**0.006**	**0.068**	**N.A.**	**N.A.**	**1.04**	**N.A.**	**0.093**	**2.59**	**0.2**
Industrial Soil Screening Level				**140**	**19.7**	**176**	**159**	**N.A.**	**N.A.**	**1615**	**N.A.**	**15140**	**1087**	**73.1**
MD21-98-0404	21-10839	59–60	Qbt3	—	—	—	—	—	—	—	—	0.55	2.86	0.183
MD21-98-0407	21-10839	74–75	Qbt3	—	—	—	—	—	—	—	—	0.17	—	0.096
MD21-98-0412	21-10840	4–5	Qbt3	—	—	—	—	—	—	—	—	0.97	—	—
MD21-98-0414	21-10840	11.5–12.5	Qbt3	—	—	—	—	—	—	—	—	0.32	2.67	0.128
MD21-98-0413	21-10840	21.5–22.5	Qbt3	—	—	—	—	—	—	—	—	0.34	—	—
MD21-98-0415	21-10840	34–35	Qbt3	—	—	—	—	—	—	—	—	0.2	—	—
MD21-98-0417	21-10840	44–45	Qbt3	—	—	—	—	—	—	—	—	0.11	—	—
MD21-98-0416	21-10840	46.5–47.5	Qbt3	—	—	—	—	—	—	—	—	0.12	—	—
MD21-98-0422	21-10840	64–65	Qbt3	—	—	—	—	—	—	—	—	0.12	—	—
MD21-98-0511	21-10840	74–75	Qbt3	—	—	—	—	—	—	—	—	0.17	—	—
MD21-98-0423	21-10841	4–5	Qbt3	—	—	—	—	—	—	—	—	0.64	—	—
MD21-98-0425	21-10841	11.5–12.5	Qbt3	—	—	—	—	—	—	—	—	0.99	2.01	0.107
MD21-98-0424	21-10841	24–25	Qbt3	—	—	—	—	—	—	—	—	1.85	—	—
MD21-98-0426	21-10841	34–35	Qbt3	—	—	—	—	—	—	—	—	2.37	—	—
MD21-98-0428	21-10841	44–45	Qbt3	0.033	—	—	—	—	—	—	—	1.25	—	—
MD21-98-0513	21-10841	54–55	Qbt3	0.04	—	—	—	2.3	—	—	2.33	2	—	—
MD21-98-0427	21-10841	56.5–57.5	Qbt3	—	—	—	—	—	—	—	—	1.84	—	—
MD21-98-0512	21-10841	74–75	Qbt3	—	—	—	—	—	—	—	—	0.95	—	—
MD21-98-0433	21-10842	4–5	Qbt3	—	—	—	—	—	—	—	—	0.35	—	—
MD21-98-0435	21-10842	14–15	Qbt3	—	—	—	—	—	—	—	—	0.14	—	—
MD21-98-0434	21-10842	24–25	Qbt3	0.029	—	—	—	—	—	—	—	0.1	—	—
MD21-98-0438	21-10842	26.5–27.5	Qbt3	0.029	—	—	—	—	—	—	—	0.07	—	—

Table 3.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Radium-223[a]	Radon-219[a]	Strontium-90	Thorium-227[a]	Tritium[b]	Uranium-234	Uranium-235
Soil Background Value				**0.013**	**1.65**	**0.023**	**0.054**	**N.A.**	**N.A.**	**1.31**	**N.A.**	**n/a**	**2.59**	**0.2**
Qbt2,3,4 Background Value				**n/a**	**n/a**	**n/a**	**n/a**	**N.A.**	**N.A.**	**n/a**	**N.A.**	**n/a**	**1.98**	**0.09**
Sediment Background Value				**0.040**	**0.90**	**0.006**	**0.068**	**N.A.**	**N.A.**	**1.04**	**N.A.**	**0.093**	**2.59**	**0.2**
Industrial Soil Screening Level				**140**	**19.7**	**176**	**159**	**N.A.**	**N.A.**	**1615**	**N.A.**	**15140**	**1087**	**73.1**
MD21-98-0436	21-10842	44–45	Qbt3	—	—	—	—	—	—	—	—	0.15	—	—
MD21-98-0437	21-10842	49–50	Qbt3	—	—	—	—	—	—	—	—	0.4	—	—
MD21-98-0515	21-10842	71.5–72.5	Qbt3	—	—	—	—	—	—	—	—	0.19	—	—
MD21-98-0443	21-10843	4–5	Soil	—	—	—	—	—	—	—	—	1.54	—	—
MD21-98-0445	21-10843	14–15	Qbt3	—	—	—	—	—	—	—	—	0.2	—	—
MD21-98-0444	21-10843	24–25	Qbt3	—	—	—	—	—	—	—	—	0.31	—	—
MD21-98-0446	21-10843	34–35	Qbt3	—	—	—	—	—	—	—	—	0.42	—	—
MD21-98-0447	21-10843	44–45	Qbt3	—	—	—	—	—	—	—	—	0.29	—	—
MD21-98-0448	21-10843	54–55	Qbt3	—	—	—	—	—	—	—	—	0.52	—	—
MD21-98-0453	21-10843	64–65	Qbt3	—	—	—	—	—	—	—	—	0.18	—	—
MD21-98-0516	21-10843	72.5–75	Qbt3	—	—	—	—	—	—	—	—	0.09	—	—
MD21-98-0517[h]	21-10843	72.5–75	Qbt3	—	—	—	—	—	—	—	—	0.1	—	—
MD21-98-0454	21-10844	2.5–5	Qbt3	—	—	—	—	—	—	—	—	0.11	—	—
MD21-98-0456	21-10844	12.5–15	Qbt3	—	—	0.029	—	—	—	—	—	0.15	—	—
MD21-98-0455	21-10844	24–25	Qbt3	—	—	—	—	—	—	—	—	0.38	—	—
MD21-98-0457	21-10844	34–35	Qbt3	—	—	—	—	—	—	—	—	0.45	—	—
MD21-98-0458	21-10844	44–45	Qbt3	—	—	—	—	—	—	—	—	0.36	—	—
MD21-98-0459	21-10844	54–55	Qbt3	—	—	—	—	—	—	—	—	0.25	—	—
MD21-98-0464	21-10844	64–65	Qbt3	—	—	—	—	—	—	—	—	0.32	—	—
MD21-98-0465[h]	21-10844	74–75	Qbt3	—	—	—	—	—	—	—	—	0.33	—	—
MD21-98-0519	21-10844	74–75	Qbt3	—	—	—	—	—	—	—	—	0.4	—	—
MD21-98-0468	21-10845	4–5	Qbt3	—	—	—	0.07	—	—	—	—	0.84	3.02	0.244

Table 3.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Radium-223[a]	Radon-219[a]	Strontium-90	Thorium-227[a]	Tritium[b]	Uranium-234	Uranium-235
Soil Background Value				**0.013**	**1.65**	**0.023**	**0.054**	**N.A.**	**N.A.**	**1.31**	**N.A.**	**n/a**	**2.59**	**0.2**
Qbt2,3,4 Background Value				**n/a**	**n/a**	**n/a**	**n/a**	**N.A.**	**N.A.**	**n/a**	**N.A.**	**n/a**	**1.98**	**0.09**
Sediment Background Value				**0.040**	**0.90**	**0.006**	**0.068**	**N.A.**	**N.A.**	**1.04**	**N.A.**	**0.093**	**2.59**	**0.2**
Industrial Soil Screening Level				**140**	**19.7**	**176**	**159**	**N.A.**	**N.A.**	**1615**	**N.A.**	**15140**	**1087**	**73.1**
MD21-98-0470	21-10845	14–15	Qbt3	—	—	—	—	—	—	—	—	0.24	—	—
MD21-98-0472	21-10845	44–45	Qbt3	—	—	—	—	—	—	—	—	0.09	—	—
MD21-98-0473	21-10845	54–55	Qbt3	—	—	—	—	—	—	—	—	0.16	—	—
MD21-98-0520	21-10845	64–65	Qbt3	—	—	—	—	—	—	—	—	0.15	—	—
MD21-98-0521	21-10845	74–75	Qbt3	—	—	—	—	—	—	—	—	0.11	—	—
MD21-98-0492	21-10855	0–0.5	Soil	—	2.56	—	—	—	—	—	—	—	—	—
MD21-98-0484	21-10857	0–0.5	Soil	0.84	—	—	—	—	—	—	—	—	—	—
MD21-98-0485	21-10858	0–0.5	Soil	—	—	—	—	—	—	—	—	—	6.87	0.272
MD21-98-0500	21-10864	6–8	Qbt3	—	—	—	0.067	—	—	—	—	0.31	—	—
MD21-98-0501	21-10865	6–8	Qbt3	—	—	—	0.057	—	—	—	—	0.3	—	—
MD21-98-0502	21-10866	5–8	Qbt3	—	—	—	0.051	—	—	—	—	0.93	6.68	0.317
MD21-98-0503	21-10867	5–8	Qbt3	—	—	—	0.23	—	—	—	—	0.72	22.5	1.229
MD21-01-0494	21-11404	3–3.5	Soil	—	—	—	—	—	—	—	—	0.337	—	—
MD21-01-0495[h]	21-11404	3–3.5	Soil	—	—	—	—	—	—	—	—	0.356	—	—
MD21-01-0496	21-11406	5–5	Soil	—	0.094	—	—	—	0.762	—	—	0.948	17.9	1.45
MD21-01-0497	21-11407	4–4	Soil	—	—	—	—	—	—	—	—	0.467	—	—
MD21-01-0498	21-11408	5–5.5	Soil	—	—	—	—	—	—	—	—	0.495	—	—
MD21-01-0499	21-11409	7–7	Soil	—	—	—	—	—	—	—	—	0.139	—	—
MD21-01-0500[h]	21-11409	7–7	Soil	—	—	—	—	—	—	—	—	0.141	—	—
MD21-01-0501	21-11411	7–7	Soil	—	0.215	—	—	—	0.815	—	0.503	0.371	—	—

Table 3.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Radium-223[a]	Radon-219[a]	Strontium-90	Thorium-227[a]	Tritium[b]	Uranium-234	Uranium-235
Soil Background Value				**0.013**	**1.65**	**0.023**	**0.054**	**N.A.**	**N.A.**	**1.31**	**N.A.**	**n/a**	**2.59**	**0.2**
Qbt2,3,4 Background Value				**n/a**	**n/a**	**n/a**	**n/a**	**N.A.**	**N.A.**	**n/a**	**N.A.**	**n/a**	**1.98**	**0.09**
Sediment Background Value				**0.040**	**0.90**	**0.006**	**0.068**	**N.A.**	**N.A.**	**1.04**	**N.A.**	**0.093**	**2.59**	**0.2**
Industrial Soil Screening Level				**140**	**19.7**	**176**	**159**	**N.A.**	**N.A.**	**1615**	**N.A.**	**15140**	**1087**	**73.1**
MD21-01-0502	21-11412	7–7	Soil	—	0.657	—	—	3.82	3.85	—	4.41	0.063	—	—
MD21-01-0503	21-11413	7–7	Soil	—	0.051	—	—	—	0.82	—	1.33	0.632	—	—

Note: Values are in pCi/g.

[a] Radium-223, radon-219, and thorium-227 are reported because they are progeny of actinium-227, a known contaminant released at the site.

[b] Although there is a soil background value for tritium (0.76 pCi/mL), it is not used for comparisons in this dataset. Not enough information is available to convert all of the earlier tritium results in soil to the correct units for background value comparisons. The sediment background value is in units of pCi/g and therefore comparison of detections in sediment to background value is performed.

[c] From "Inorganic and Radionuclide Background Data for Soil, Sediment and Bandelier Tuff at Los Alamos National Laboratory" (LANL 1998, 59730).

[d] N.A.= No available.

[e] n/a = Not applicable.

[f] Calculated using the dose-based computer model RESRAD 6.21 and a radiation dose limit of 15 mrem/yr.

[g] — Indicates result was not detected, does not exceed the background/fallout value, or was not analyzed.

[h] Field duplicate.

Table 3.4-7
Borehole Moisture Content Analyses

Depth (ft)	BH 1	BH 2	BH 3	BH 4	BH 5	BH 6	BH 7	BH 8	West Absorption Bed		East Absorption Bed	
	% Moisture	% Moisture	% Moisture	% Moisture	% Moisture	% Moisture	% Moisture	% Moisture	21-10864	21-10865	21-10866	21-10867
3	—[a]	3	—	—	—	—	—	—	—	—	—	—
5	—	—	8	4	5	10	5	5	—	—	—	—
8	—	—	—	—	—	—	—	—	4	4	6	6
12.5	—	—	5	1	—	2	—	—	—	—	—	—
15	0	2	—	—	4	2	5	5	—	—	—	—
22.5	—	—	6	—	—	—	—	—	—	—	—	—
25	4	5	—	4	3	4	3	5	—	—	—	—
27.5	—	—	—	—	3	—	—	—	—	—	—	—
35	5	5	6	5		6	6	6	—	—	—	—
45	6	6	7	5	6	4	5	6	—	—	—	—
47.5	—	—	7	—	—	—	—	—	—	—	—	—
50	—	—	—	—	10	—	—	—	—	—	—	—
52.5	—	8	—	—	—	—	—	—	—	—	—	—
55	**16**[b]	—	—	10	—	**9**[b]	5	8	—	—	—	—
57.5	—	—	—	**9**[b]	—	—	—	—	—	—	—	—
65	6	—	7	—	—	5	5	6	—	—	—	—
72.5	—	—	—	—	5	—	—	—	—	—	—	—
75	6	**6**[b]	6	5	—	4	5	6	—	—	—	—

[a] — = Not analyzed.

[b] Boldfaced values are associated with samples from clay-rich fractures or interbeds.

Table 3.4-8
Frequency of Organic Chemicals Detected in Pore-Gas Samples

Analyte	Number of Analyses	Number of Detects	Concentration Range* (ppbv)
Ethylbenzene	24	3	[0.5] to 18
Trimethylbenzene[1,3,5-]	24	2	[0.5] to 17
Toluene	24	22	0.62 to 480
Chloroform	24	7	[0.5] to 6.5
Benzene	24	10	[0.5 to 5.4]
Trichloroethane[1,1,1-]	24	16	[0.52] to 24
Chloromethane	24	1	[1.2 to 14]
Dichlorodifluoromethane	24	9	0.54 to [5.4]
Trichloro-1,2,2-trifluoroethane[1,1,2-]	24	6	[0.52 to 5.4]
Trichloroethene	24	11	[0.5] to 29
Xylene[1,2-]	24	8	[0.5] to 29
Trimethylbenzene[1,2,4-]	24	12	[0.5] to 63
Xylene[1,3-]+Xylene[1,4-]	24	15	[0.5] to 59

*Brackets indicate detection limits for nondetected results.

Table 3.4-9
Organic Chemicals Detected in Pore-Gas Samples

Sample ID	Location ID	Depth (ft)	Analyte	Sample Concentration (ppbv)
MD21-98-0398	21-10838	25–25	1,1,1-Trichloroethane	7
MD21-98-0398	21-10838	25–25	Chloromethane	6.7
MD21-98-0398	21-10838	25–25	Toluene	4.6
MD21-98-0398	21-10838	25–25	1,3-Xylene+1,4-Xylene	2.7
MD21-98-0399	21-10838	55–55	1,1,1-Trichloroethane	24
MD21-98-0399	21-10838	55–55	Toluene	6.4
MD21-98-0399	21-10838	55–55	1,2,4-Trimethylbenzene	2.7
MD21-98-0399	21-10838	55–55	1,2-Xylene	2
MD21-98-0399	21-10838	55–55	1,3-Xylene+1,4-Xylene	5.3
MD21-98-0400	21-10838	75–75	1,1,1-Trichloroethane	6.7
MD21-98-0400	21-10838	75–75	Trichloroethene	1.7
MD21-98-0400	21-10838	75–75	Benzene	0.66
MD21-98-0400	21-10838	75–75	Toluene	2.3
MD21-98-0400	21-10838	75–75	1,2,4-Trimethylbenzene	0.75
MD21-98-0400	21-10838	75–75	1,2-Xylene	0.62
MD21-98-0400	21-10838	75–75	1,3-Xylene+1,4-Xylene	1.6
MD21-98-0408	21-10839	25–25	1,1,1-Trichloroethane	18
MD21-98-0408	21-10839	25–25	Trichloroethene	2.7
MD21-98-0408	21-10839	25–25	Toluene	3.7
MD21-98-0409	21-10839	55–55	1,1,2-Trichloro-1,2,2-trifluoroethane	1.4
MD21-98-0409	21-10839	55–55	1,1,1-Trichloroethane	21
MD21-98-0409	21-10839	55–55	Toluene	1.4
MD21-98-0410	21-10839	75–75	1,1,1-Trichloroethane	6.9
MD21-98-0410	21-10839	75–75	Benzene	1.1
MD21-98-0410	21-10839	75–75	Dichlorodifluoromethane	1
MD21-98-0410	21-10839	75–75	Ethylbenzene	18
MD21-98-0410	21-10839	75–75	1,2,4-Trimethylbenzene	63
MD21-98-0410	21-10839	75–75	1,3,5-Trimethylbenzene	17
MD21-98-0410	21-10839	75–75	1,2-Xylene	29
MD21-98-0410	21-10839	75–75	1,3-Xylene+1,4-Xylene	59
MD21-98-0418	21-10840	25–25	Benzene	1.5
MD21-98-0418	21-10840	25–25	Dichlorodifluoromethane	0.58
MD21-98-0418	21-10840	25–25	Ethylbenzene	0.58
MD21-98-0418	21-10840	25–25	Toluene	4.4
MD21-98-0418	21-10840	25–25	1,2,4-Trimethylbenzene	0.9
MD21-98-0418	21-10840	25–25	1,2-Xylene	0.78

Table 3.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Analyte	Sample Concentration (ppbv)
MD21-98-0418	21-10840	25–25	1,3-Xylene+1,4-Xylene	2
MD21-98-0419	21-10840	55–55	1,1,1-Trichloroethane	6.3
MD21-98-0419	21-10840	55–55	Toluene	1
MD21-98-0420	21-10840	75–75	1,1,1-Trichloroethane	3.1
MD21-98-0420	21-10840	75–75	Trichloroethene	4.5
MD21-98-0420	21-10840	75–75	Toluene	1.6
MD21-98-0429	21-10841	25–25	1,1,2-Trichloro-1,2,2-trifluoroethane	0.83
MD21-98-0429	21-10841	25–25	1,1,1-Trichloroethane	13
MD21-98-0429	21-10841	25–25	Dichlorodifluoromethane	0.6
MD21-98-0429	21-10841	25–25	Toluene	0.62
MD21-98-0430	21-10841	55–55	1,1,1-Trichloroethane	17
MD21-98-0430	21-10841	55–55	Toluene	1.9
MD21-98-0431	21-10841	75–75	1,1,1-Trichloroethane	4.4
MD21-98-0439	21-10842	25–25	1,1,1-Trichloroethane	0.97
MD21-98-0439	21-10842	25–25	Dichlorodifluoromethane	0.54
MD21-98-0439	21-10842	25–25	Toluene	2.6
MD21-98-0439	21-10842	25–25	1,3-Xylene+1,4-Xylene	1
MD21-98-0440	21-10842	55–55	1,1,1-Trichloroethane	5.4
MD21-98-0440	21-10842	55–55	Benzene	2.4
MD21-98-0440	21-10842	55–55	Dichlorodifluoromethane	0.59
MD21-98-0440	21-10842	55–55	Ethylbenzene	3.3
MD21-98-0440	21-10842	55–55	Toluene	11
MD21-98-0440	21-10842	55–55	1,2,4-Trimethylbenzene	14
MD21-98-0440	21-10842	55–55	1,3,5-Trimethylbenzene	3.4
MD21-98-0440	21-10842	55–55	1,2-Xylene	6.2
MD21-98-0440	21-10842	55–55	1,3-Xylene+1,4-Xylene	14
MD21-98-0441	21-10842	75–75	Toluene	5.3
MD21-98-0441	21-10842	75–75	1,1,1-Trichloroethane	14
MD21-98-0441	21-10842	75–75	1,2,4-Trimethylbenzene	3.7
MD21-98-0441	21-10842	75–75	1,3-Xylene+1,4-Xylene	2.8
MD21-98-0449	21-10843	25–25	Toluene	160
MD21-98-0449	21-10843	25–25	Trichloroethene	3.4
MD21-98-0449	21-10843	25–25	1,3-Xylene+1,4-Xylene	4
MD21-98-0450	21-10843	55–55	Toluene	39
MD21-98-0450	21-10843	55–55	1,1,2-Trichloro-1,2,2-trifluoroethane	1.3
MD21-98-0450	21-10843	55–55	Benzene	1.1
MD21-98-0450	21-10843	55–55	Chloroform	1.4
MD21-98-0450	21-10843	55–55	Dichlorodifluoromethane	0.55

Table 3.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Analyte	Sample Concentration (ppbv)
MD21-98-0450	21-10843	55–55	1,2,4-Trimethylbenzene	1.7
MD21-98-0450	21-10843	55–55	1,2-Xylene	0.81
MD21-98-0450	21-10843	55–55	1,3-Xylene+1,4-Xylene	1.7
MD21-98-0451	21-10843	75–75	Toluene	39
MD21-98-0451	21-10843	75–75	1,1,2-Trichloro-1,2,2-trifluoroethane	2.2
MD21-98-0451	21-10843	75–75	1,1,1-Trichloroethane	0.57
MD21-98-0451	21-10843	75–75	Trichloroethene	26
MD21-98-0451	21-10843	75–75	Benzene	0.75
MD21-98-0451	21-10843	75–75	Chloroform	2.5
MD21-98-0451	21-10843	75–75	Dichlorodifluoromethane	0.55
MD21-98-0451	21-10843	75–75	1,2,4-Trimethylbenzene	1.4
MD21-98-0451	21-10843	75–75	1,2-Xylene	0.58
MD21-98-0451	21-10843	75–75	1,3-Xylene+1,4-Xylene	1.2
MD21-98-0460	21-10844	25–25	Toluene	49
MD21-98-0460	21-10844	25–25	Trichloroethene	5.2
MD21-98-0460	21-10844	25–25	Benzene	1.4
MD21-98-0460	21-10844	25–25	Chloroform	1.4
MD21-98-0460	21-10844	25–25	Dichlorodifluoromethane	0.58
MD21-98-0460	21-10844	25–25	1,2,4-Trimethylbenzene	1.5
MD21-98-0460	21-10844	25–25	1,2-Xylene	0.73
MD21-98-0460	21-10844	25–25	1,3-Xylene+1,4-Xylene	1.6
MD21-98-0461	21-10844	55–55	Toluene	19
MD21-98-0461	21-10844	55–55	1,1,2-Trichloro-1,2,2-trifluoroethane	1.5
MD21-98-0461	21-10844	55–55	Benzene	0.67
MD21-98-0461	21-10844	55–55	Chloroform	2
MD21-98-0461	21-10844	55–55	Trichloroethene	17
MD21-98-0461	21-10844	55–55	1,2,4-Trimethylbenzene	1.2
MD21-98-0461	21-10844	55–55	1,3-Xylene+1,4-Xylene	0.96
MD21-98-0462	21-10844	75–75	Toluene	42
MD21-98-0462	21-10844	75–75	1,1,2-Trichloro-1,2,2-trifluoroethane	2.4
MD21-98-0462	21-10844	75–75	1,1,1-Trichloroethane	0.7
MD21-98-0462	21-10844	75–75	Benzene	1.2
MD21-98-0462	21-10844	75–75	Chloroform	3.2
MD21-98-0462	21-10844	75–75	Dichlorodifluoromethane	0.62
MD21-98-0462	21-10844	75–75	Trichloroethene	29
MD21-98-0462	21-10844	75–75	1,2,4-Trimethylbenzene	0.97
MD21-98-0462	21-10844	75–75	1,3-Xylene+1,4-Xylene	1
MD21-98-0474	21-10845	25–25	Toluene	86

Table 3.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Analyte	Sample Concentration (ppbv)
MD21-98-0474	21-10845	25–25	Benzene	2.8
MD21-98-0474	21-10845	25–25	Chloroform	3.2
MD21-98-0474	21-10845	25–25	Trichloroethene	4.1
MD21-98-0474	21-10845	25–25	1,2,4-Trimethylbenzene	1.7
MD21-98-0474	21-10845	25–25	1,3-Xylene+1,4-Xylene	2
MD21-98-0475	21-10845	55–55	Toluene	480
MD21-98-0475	21-10845	55–55	Trichloroethene	17
MD21-98-0476	21-10845	75–75	Toluene	220
MD21-98-0476	21-10845	75–75	Chloroform	6.5
MD21-98-0476	21-10845	75–75	Trichloroethene	27
MD21-98-0477*	21-10845	75–75	Toluene	240
MD21-98-0477*	21-10845	75–75	Chloroform	5.3
MD21-98-0477*	21-10845	75–75	Trichloroethene	23

*Field duplicate.

Appendix A

Acronyms and Metric Conversion Table

ACRONYMS

bgs	below ground surface
DOE	Department of Energy
DP	Delta Prime
dpm/L	disintegrations per minute per liter
ENV-RS	Environmental Stewardship Division–Remediation Services
EPA	Environmental Protection Agency
ERDB	Environmental Restoration Data Base
HIR	historical investigation report
LAL	lower acceptance level
Laboratory	Los Alamos National Laboratory
LANL	Los Alamos National Laboratory
LASL	Los Alamos Scientific Laboratory
MDA	material disposal area
MDL	method detection limit
NMED	New Mexico Environment Department
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PQL	practical quantitation limit
ppbv	parts per billion by volume
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RPF	Records Processing Facility
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TA	technical area
VOC	volatile organic compound

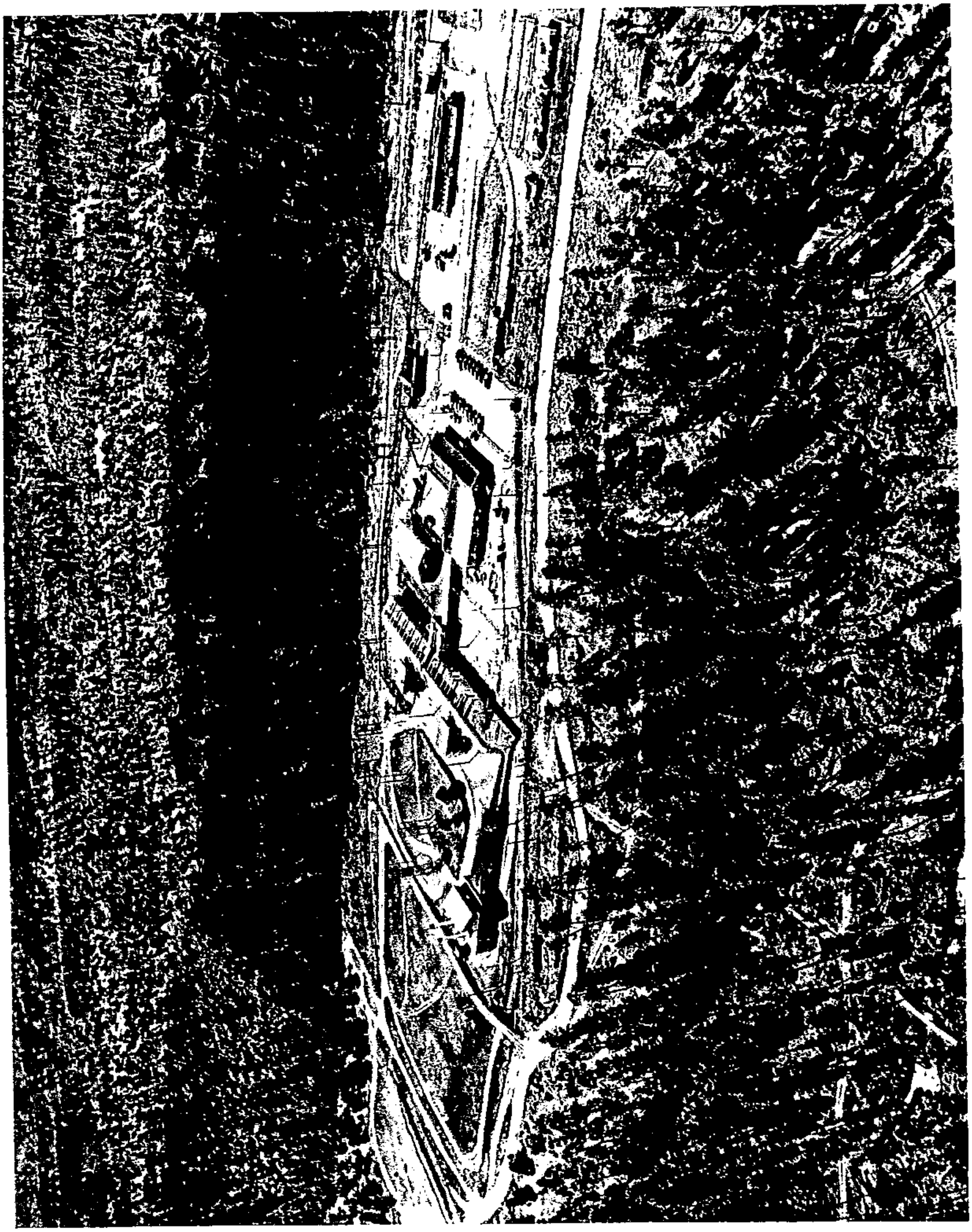
METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain US Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (μm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (μg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

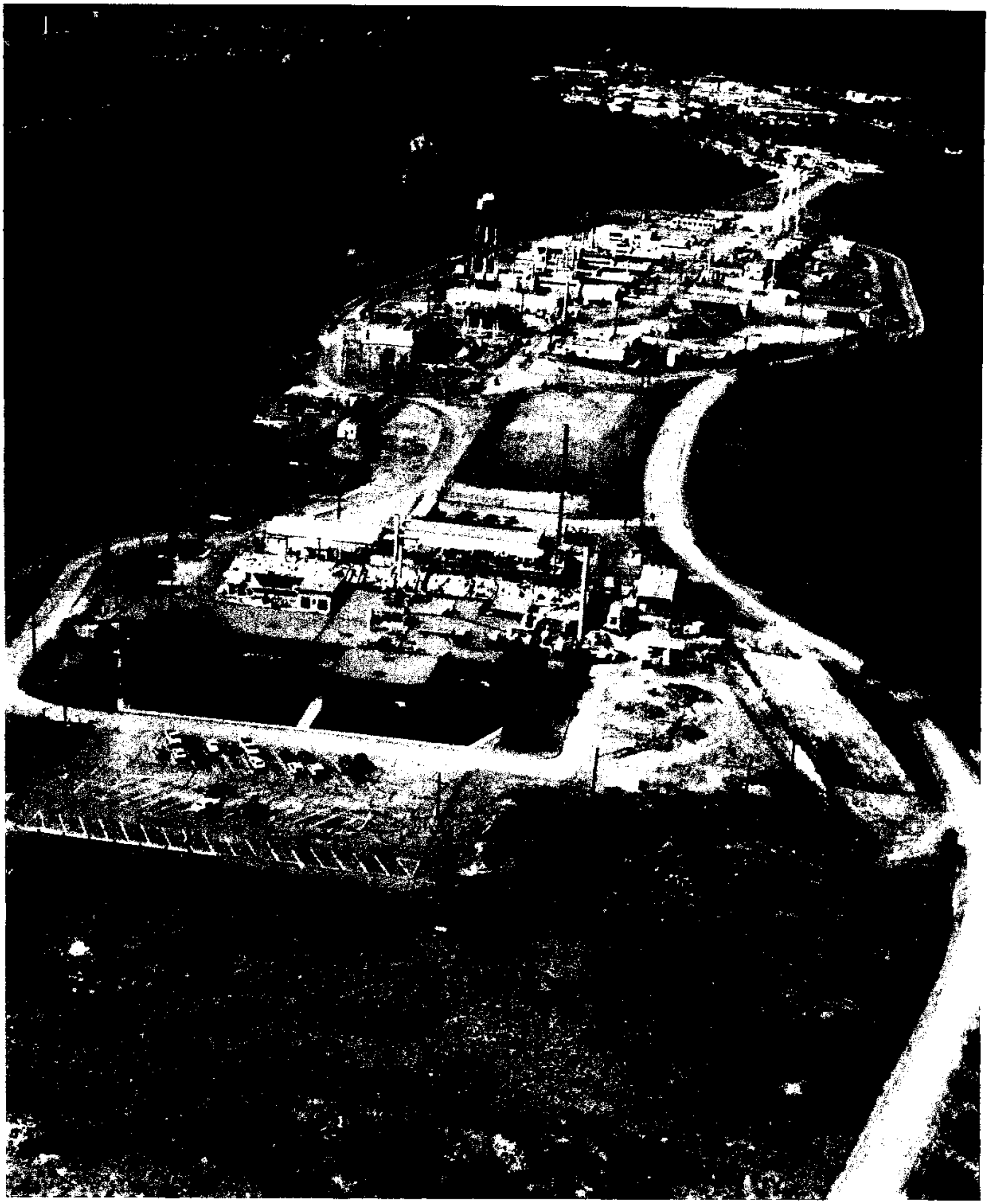
Appendix B

Site Photographs

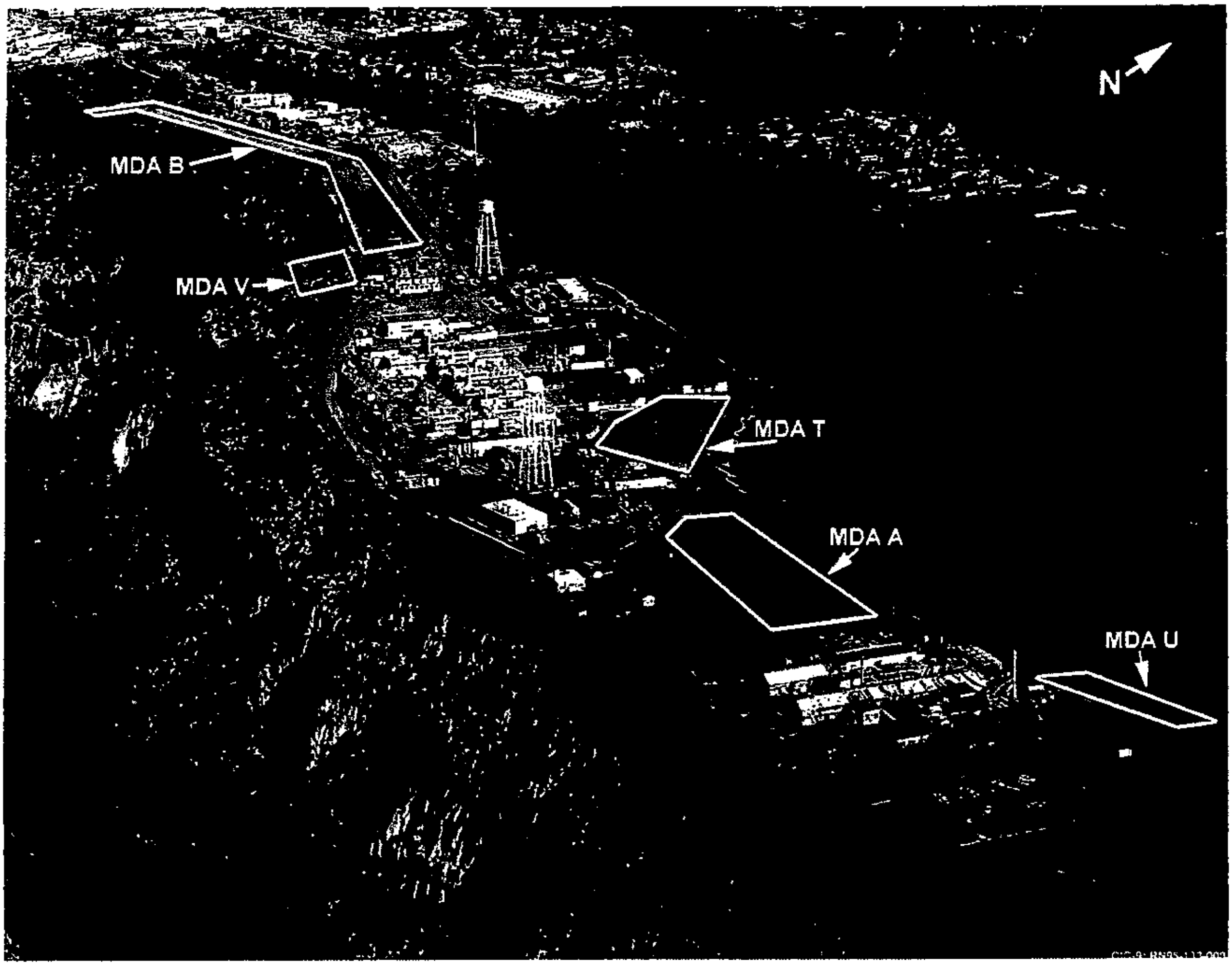
Photograph 1. Aerial view of TA-21 and DP Mesa, taken December 4, 1946. View is to the south.



Photograph 2. 1959 view of DP East, looking north. MDA U is visible just beyond the tops of the trees, south of the filter building (21-153)



Photograph 3. View of TA-21, between 1985 and 1990, looking west. MDA U is the vacant, rectangular fenced area on the right side of the photograph.

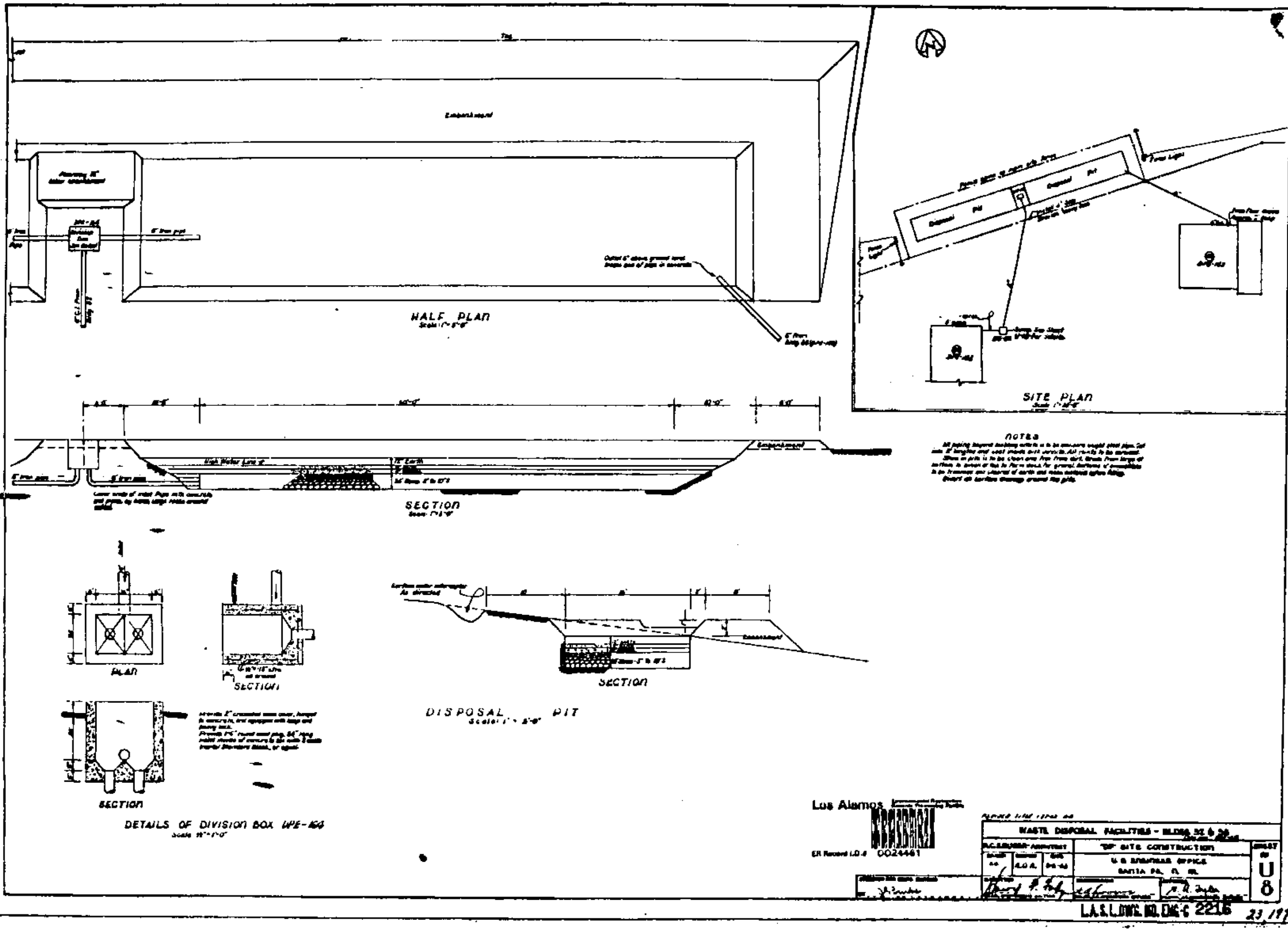


Photograph 4. 1995 view of MDA U and other TA-21 MDAs

Photograph 5. View of current site conditions at MDA U, taken from the west fence looking northeast (July 15, 2004).

Appendix C

Engineering Plan for MDA U Absorption Beds


HALF PLAN
Embankment
SECTION
SITE PLAN
NOTES
DISPOSAL PIT
SECTION
PLAN
SECTION
SECTION
DETAILS OF DIVISION BOX
Los Alamos
ER Record I.D.# 0024461
WASTE DISPOSAL FACILITIES
"OP" SITE CONSTRUCTION
U S ENGINEER OFFICE
SANTA FE, N. M.
U
8
L.A.S.L. DWG. NO. ENG-C 2216
23/197

Appendix D

MDA U Analytical Data
(CD on inside back cover of this report)

TARGET PAGE

This target page represents media that was not scanned. The original media can be obtained through the Records Processing Facility.

ER ID # 87454

RECORD TYPE: CA

DATE: NOVEMBER 2004

SYMBOL: LA-UR-04-7247
ER2004-0570

SUBJECT: HISTORICAL INVESTIGATION REPORT FOR MATERIAL DISPOSAL AREA U, SOLID WASTE MANAGEMENT UNIT 21-017(a)-99, AT TECHNICAL AREA 21

APPENDIX D

1075

Appendix E

RFI Borehole Logs

LOS ALAMOS NATIONAL LABORATORY
MDA U, PRS 21-017 a,b,c RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA U-1, 21-10838	TA/OU: TA-21	
TOTAL DEPTH: 75 feet bgs	START DATE: September 22, 1998	END DATE: September 25, 1998
DRILLING EQ/METHOD: Hollow Stem Auger	SAMPLING EQ/METHOD: Split Spoon	
DRILLING COMPANY: ICF Kaiser	BOREHOLE ORIENTATION: Vertical	
DRILLER: Elmer Alcon	SITE GEOLOGIST: Tom Benson	

Depth (ft)	Core Run (amt. recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
0				Fill: Brown tuff fill material with organics.		
	0.5/2.5		No Detectable Activity (NDA)	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		
5	1.25/2.5	MD21-98-0394 Core (4-5 ft)				
	1.8/2.5		NDA			
10	2.5/2.5		NDA			
	2.5/2.5		NDA			
15	2.5/2.5	[illegible] 15ft)	NDA			
	2.5/2.5		NDA			
20	2.5/2.5		NDA			
	2.5/2.5		NDA			
25	2.5/2.5	MD21-98-0395 Core (24-25 ft) MD21-98-0398 Soil Gas (25 ft)	NDA			
	2.5/2.5		NDA			
30	2.5/2.5		NDA			
	2.5/2.5		NDA			
35	2.5/2.5	MD21-98-0393 Core (34-35 ft)	NDA			
	2.5/2.5		NDA			
40	2.5/2.5		NDA			
	2.5/2.5		NDA			2-5mm brown clay filled fracture (41-42ft)
45	2.5/2.5	MD21-98-0397 Core (44-45 ft)	NDA			
	2.5/2.5		NDA			
50	2.5/2.5		NDA			
	2.5/2.5		NDA			2-5mm brown clay filled fracture (53-55ft)
55	2.5/2.5	MD21-98-0507 Core (54-55 ft) MD21-98-0399 Soil Gas (55 ft)	NDA			
	2.5/2.5		NDA			2-5mm brown clay filled fracture (55-57ft)
60	2.5/2.5		NDA			
	2.5/2.5		NDA			2-5mm brown clay filled fracture (60-62ft)
55	2.5/2.5	MD21-98-0396 Core (64-65 ft)	NDA			
	2.5/2.5		NDA			
70	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0506 Core (74-75 ft) MD21-98-0400 Soil Gas (75ft)	NDA			
75						

LOS ALAMOS NATIONAL LABORATORY
MDA U, PRS 21-017 a,b,c RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA U-2, 21-10839	TA/OU:TA-21	Page 1 of 1
TOTAL DEPTH:75 feet bgs	START DATE: September 28, 1998	END DATE:September 30, 1998
DRILLING EQ/METHOD:Hollow Stem Auger	SAMPLING EQ/METHOD:Split Spoon	
DRILLING COMPANY: IOF Kaiser	BOREHOLE ORIENTATION:Vertical	
DRILLER: Elmer Alcon	SITE GEOLOGIST: Tom Benson	

Core Run (amt.-recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results
1.5/2.5	MD21-98-0508 Core (2-3 ft)	193.66 beta/gamma(b/g)
0.5/2.5		No Detectable Activity (NDA)
1.5/2.5		NDA
2.5/2.5		NDA
[illegible]		[illegible]
2.5/2.5	MD21-98-0402 Core (14-15ft)	NDA
2.5/2.5		72.55 b/g
2.5/2.5		134.55 b/g
2.5/2.5	MD21-98-0403 Core (24-25 ft)	51.55 b/g
2.5/2.5	MD21-98-0408 Soil Gas (25 ft)	NDA
2.5/2.5		NDA
2.5/2.5		108.55 b/g
2.5/2.5		NDA
2.5/2.5	MD21-98-0405 Core (34-35 ft)	NDA
2.5/2.5		NDA
2.5/2.5		NDA
2.5/2.5		NDA
[illegible]	MD21-98-0406 Core (44-45 ft)	[illegible]
2.5/2.5		NDA
2.5/2.5	MD21-98-0509 Core (51.5-52.5 ft)	23.55 b/g
2.5/2.5		NDA
2.5/2.5	MD21-98-0409 Soil Gas (55 ft)	NDA
2.5/2.5		NDA
2.5/2.5	MD21-98-0404 Core (59-60 ft)	178.55 b/g
2.0/2.5		NDA
2.0/2.5		NDA
2.0/2.5		NDA
2.0/2.5	MD21-98-0407 Core (74-75 ft)	NDA
2.0/2.5	MD21-98-0410 Soil Gas (75ft)	NDA

Lithology

- Topsoil: Brown topsoil with organics.
- Fill: Grey tuff fill material
- Cobbles and boulders: Absorption bed materials.
- QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%

Notes

- 2-5mm brown clay interbeds(60-62ft)
- 2-5mm brown clay interbeds(68-75ft)

LOS ALAMOS NATIONAL LABORATORY
MDA U, PRS 21-017 a,b,c RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA U-3, 21-10840	TA/OU:TA-21	Page 1 of 1
TOTAL DEPTH:75 feet bgs	START DATE: September 30, 1998	END DATE:October 2, 1998
DRILLING EQ/METHOD:Hollow Stem Auger	SAMPLING EQ/METHOD:Split Spoon	
DRILLING COMPANY: IOF Kaiser	BOREHOLE ORIENTATION:Vertical	
DRILLER: Elmer Alcon	SITE GEOLOGIST: Tom Benson	

Core Run (amt.-recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results
2.0/2.5		No Detectable Activity (NDA)
2.5/2.5	[illegible] ft)	110.0 beta/gamma(b/g)
1.0/2.5		NDA
0.12/2.5		NDA
[illegible]	MD21-98-0414 Core (11.5-[illegible])	NDA
2.5/2.5		NDA
2.5/2.5		NDA
2.5/2.5		NDA
2.5/2.5	MD21-98-0413 Core (21.5-22.5 ft)	127.0 b/g
2.5/2.5	MD21-98-0418 Soil Gas (25 ft)	NDA
2.5/2.5		NDA
2.5/2.5		NDA
2.5/2.5		NDA
2.5/2.5	MD21-98-0415 Core (34-35 ft)	24.23 b/g
2.0/2.5		NDA
2.5/2.5		NDA
2.5/2.5		NDA
[illegible]	MD21-98-0417 Core (44-[illegible])	NDA
2.5/2.5	MD21-98-0416 Core (46.5-47.5 ft)	NDA
2.5/2.5		NDA
2.5/2.5		NDA
2.5/2.5	MD21-98-0419 Soil Gas (55 ft)	NDA
2.5/2.5		NDA
2.0/2.5		NDA
2.0/2.5		NDA
1.7/2.5	MD21-98-0422 Core (64-65 ft)	59.23 b/g
1.7/2.5		NDA
2.0/2.5		NDA
2.0/2.5	MD21-98-0511 Core (74-75 ft) MD21-98-0420 Soil Gas (75ft)	NDA

Lithology

- Topsoil: Brown topsoil with organics.
- Fill: Gray tuff fill material.
- Cobbles and boulders: Absorption bed materials.
- QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.

Notes

2-5mm brown clay interbeds(53-55ft)

LOS ALAMOS NATIONAL LABORATORY
MDA U, PRS 21-017 a,b,c RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA U-4, 21-10841	TA/OU: TA-21	Page 1 of 1
TOTAL DEPTH: 75 feet bgs	START DATE: October 5, 1998	END DATE: October 5, 1998
DRILLING EQ/METHOD: Hollow Stem Auger	SAMPLING EQ/METHOD: Split Spoon	
DRILLING COMPANY: [illegible]	BOREHOLE ORIENTATION: [illegible]	
DRILLER: Elmer Alcon	SITE GEOLOGIST: Tom Benson	

Depth (ft)	Core Run (amt. recov./amt. attempt.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
0	1.8/2.5		No Detectable Activity (NDA)	Topsoil: Brown topsoil with organics.		
5	2.0/2.5	MD21-98-0423 Core (4-5 ft)	NDA	Fill: Gray tuff fill material.		
	2.0/2.5		NDA	Fill: Brown silty fill material.		
10	0/2.5		NDA	Cobbles and boulders.: Absorption bed material.		
	2.5/2.5	MD21-98-0425 Core (11.5-12.5 ft)	0.98 cpm alpha (a)	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		
15	2.5/2.5		NDA			
	2.5/2.5		NDA			
20	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0424 Core (24-25 ft)	NDA			
25	2.5/2.5	MD21-98-0429 Soil Gas (25 ft)	NDA			
	2.0/2.5		NDA			
30	2.5/2.5		NDA			
	2.5/2.5		NDA			
35	2.5/2.5	MD21-98-0426 Core (34-35 ft)	NDA			
	2.5/2.5		NDA			
40	2.5/2.5		NDA			
	2.0/2.5		NDA			
45	2.0/2.5	MD21-98-0428 Core (44-45 ft)	NDA			
	2.5/2.5		NDA			
50	2.0/2.5		NDA			
	2.5/2.5	MD21-98-0513 Core (54-55 ft)	NDA			
55	2.0/2.5	MD21-98-0430 Soil Gas (55 ft)	NDA			2-5mm brown silty clay interbeds(55-62ft)
	2.0/2.5	MD21-98-0427 Core (56.5-57.5 ft)	NDA			
60	2.0/2.5		NDA			
	2.0/2.5		NDA			
65	2.0/2.5		NDA			
	1.8/2.5		NDA			
70	1.8/2.5		NDA			
	1.7/2.5	MD21-98-0512 Core (74-75 ft); MD21-98-0431 Soil Gas (75ft)	NDA			
75						

LOS ALAMOS NATIONAL LABORATORY
MDA U, PRS 21-017 a,b,c RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA U-5, 21-10842	TA/OU: TA-21	Page 1 of 1
TOTAL DEPTH: 75 feet bgs	START DATE: October 6, 1998	END DATE: October 7, 1998
DRILLING EQ/METHOD: Hollow Stem Auger	SAMPLING EQ/METHOD: Split Spoon	
[illegible]	[illegible]	
DRILLER: Elmer Alcon	SITE GEOLOGIST: Tom Benson	

Depth (ft)	Core Run (amt. recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Notes
0	1.8/2.5		No Detectable Activity (NDA)	Topsoil: Brown topsoil with organics.	
5	1.8/2.5	MD21-98-0433 Core (4-5 ft)	18.37 cpm beta/gamma (b/g)	Fill: Gray tuff fill material.	
	1.8/2.5		NDA	Cobbles and boulders.: Absorption bed material.	
10	0/2.5		NDA	QBT3: Grey poorly to non-welded tuff fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.	
	2.0/2.5		NDA		
15	1.8/2.5	MD21-98-0435 Core (14-15ft)	17.37 cpm b/g		
	2.5/2.5		NDA		
20	2.5/2.5	MD21-98-0434 Core (24-25 ft)	NDA		2-5mm brown silty clay interbeds(20-21ft)
	1.8/2.5		NDA		
25	1.8/2.5	MD21-98-0439 Soil Gas (25 ft)	NDA		
	2.0/2.5	MD21-98-0438 Core (26.5-27.5 ft)	24.52 cpm b/g		
30	2.0/2.5		NDA		2-5mm brown silty clay interbeds(30-32.5ft)
	2.5/2.5		NDA		
35	2.0/2.5		NDA		
	2.2/2.5		NDA		
40	2.0/2.5		NDA		
	2.0/2.5		NDA		
45	2.0/2.5	MD21-98-0436 Core (44-45 ft)	NDA		
	1.8/2.5		NDA		
50	2.0/2.5	MD21-98-0437 Core (49-50 ft)	58.52 cpm b/g		
	2.0/2.5		NDA		
55	2.2/2.5	MD21-98-0440 Soil Gas (55 ft)	NDA		No recovery, pushed boulder in tip of spoon (55-62.5 ft).
	0/2.5		NDA		
60	0/2.5		NDA		
	0/2.5		NDA		
65	2.0/2.5		NDA		
	2.0/2.5		NDA		
70	2.2/2.5	MD21-98-0515 Core (71.5-72.5 ft)	NDA		
75	2.2/2.5	MD21-98-0481 Soil Gas (75ft)	96.52 cpm b/g		

LOS ALAMOS NATIONAL LABORATORY
MDA U, PRS 21-017 a,b,c RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA U-6, 21-10843	TA/OU:TA-21	Page 1 of 1
TOTAL DEPTH:75 feet bgs	START DATE: October 13, 1998	END DATE:October 14, 1998
DRILLING EQ/METHOD:Hollow Stem Auger	SAMPLING EQ/METHOD:Split Spoon	
DRILLING CONTRACTOR: [illegible]	BOREHOLE ORIENTATION:Vertical	
DRILLER: Elmer Alcon	SITE GEOLOGIST: Tom Benson	

Depth (ft)	Core Run (amt. recov./amt. attempt.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
0	2.0/2.5		No Detectable Activity (NDA)	Topsoil: Brown topsoil with organics.		
5	2.5/2.5	MD21-98-0443 Core (4-5 ft)	NDA	Fill: Gray tuff fill material.		
	2.5/2.5		NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		
10	2.5/2.5		NDA			
	2.5/2.5		NDA			
15	2.5/2.5	MD21-98-0445 Core (14-15ft)	NDA			
	2.5/2.5		NDA			
20	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0444 Core (24-25 ft)	NDA			Moderately welded (20-22.5ft)
25	2.5/2.5	MD21-98-0449 Soil Gas (25 ft)	NDA			
	2.5/2.5		NDA			
30	2.5/2.5		NDA			
	2.5/2.5		NDA			
35	2.5/2.5	MD21-98-0446 Core (34-35 ft)	NDA			
	2.5/2.5		NDA			
40	2.5/2.5		NDA			
	2.5/2.5		NDA			
45	2.5/2.5	MD21-98-0447 Core (44-45 ft)	NDA			
	2.5/2.5		NDA			
50	2.5/2.5	MD21-98-0448 Core (54-55 ft)	NDA			
	2.5/2.5		NDA			2-5mm fracture with iron staining (52.5-55 ft)
55	2.5/2.5	MD21-98-0450 Soil Gas (55 ft)	NDA			
	2.5/2.5		NDA			
60	2.5/2.5		NDA			
	2.5/2.5		NDA			
65	2.5/2.5	MD21-98-0453 Core (64-65 ft)	NDA			
	2.5/2.5		NDA			
70	2.5/2.5	MD21-98-0516/0517 Core (72.5-75ft)	NDA			10-20mm powdery ash lens (70-72.5 ft)
	2.5/2.5	MD21-98-0451 Soil Gas (75ft)	NDA			
75						

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MDA U, PRS 21-017 a,b,c RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA U-7, 21-10844	TA/OU:TA-21 — Page 1 of 1
TOTAL DEPTH:75 feet bgs	START DATE: October 14, 1998 — END DATE:October 15, 1998
DRILLING EQ/METHOD:Hollow Stem Auger	SAMPLING EQ/METHOD:Split Spoon
DRILLING COMPANY: [illegible]	[illegible]
DRILLER: Stanley Johnson	SITE GEOLOGIST: Tom Benson

Depth (ft)	Core Run (amt.–recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
0	2.5/2.5		No Detectable Activity (NDA)	Topsoil: Brown topsoil with organics.		
5	2.5/2.5	MD21-98-0454 Core (4-5 ft)	NDA	Fill: Gray tuff fill material		Asphalt material
	2.5/2.5		NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		
10	2.5/2.5		NDA			2-5mm oxidized fracture (10-10.5 ft)
	[illegible]		[illegible]			
15	2.5/2.5	MD21-98-0456 Core (14-15ft)	NDA			2-5mm clay-filled fractures (15-20ft)
	2.5/2.5		NDA			
20	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0455 Core (24-25 ft)	NDA			
25	2.5/2.5	MD21-98-0460 Soil Gas (25 ft)	NDA			
	2.5/2.5		NDA			
30	2.5/2.5		NDA			
	2.5/2.5		NDA			
35	2.5/2.5	MD21-98-0457 Core (34-35 ft)	NDA			
	2.5/2.5		NDA			2-5mm oxidized clay-filled fracture (37.5-47.5 ft)
40	2.5/2.5		NDA			
	2.5/2.5		NDA			
45	2.5/2.5	MD21-98-0458 Core (44-45 ft)	NDA			
	2.5/2.5		NDA			
50	2.5/2.5	MD21-98-0459 Core (54-55 ft)	NDA			
	2.5/2.5		NDA			
55	2.5/2.5	MD21-98-0461 Soil Gas (55 ft)	NDA			
	2.5/2.5		NDA			
60	2.5/2.5		NDA			
	2.5/2.5		NDA			
65	2.5/2.5	MD21-98-0464 Core (64-65 ft)	NDA			
	2.5/2.5		NDA			
70	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0519/0465 Core (74-75ft) MD21-98-0462 Soil Gas (75ft)	NDA			
75						

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ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA U-8, 21-10845	TA/OU: TA-21	Page 1 of 1
TOTAL DEPTH: 75 feet bgs	START DATE: October 19, 1998	END DATE: October 19, 1998
DRILLING EQ/METHOD: Hollow Stem Auger	SAMPLING EQ/METHOD: Split Spoon	
DRILLING COMPANY: Stewart Bros. Drilling Company	BOREHOLE ORIENTATION: Vertical	
DRILLER: Stanley Johnson	SITE GEOLOGIST: Tom Benson	

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75

Core Run (amt.—recov./amt. attemp.)	Analytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
2.5/2.5		No Detectable Activity (NDA)	Topsoil: Brown topsoil with organics.		
2.5/2.5	MD21-98-0468 Core (4-5 ft)	NDA	Fill: Gray-brown tuff fill material.		
2.5/2.5		NDA	QBT3: Brown weathered tuff, clay-silt, fractures.		
2.5/2.5		NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		2-5mm clay-filled fracture (7.5-10 ft)
2.5/2.5		NDA			
2.5/2.5	MD21-98-0470 Core (14-15ft)	NDA			
2.5/2.5		NDA			2-5mm clay-filled fracture (16 ft)
2.5/2.5		NDA			
2.5/2.5	MD21-98-0469 Core (24-25 ft)	NDA			
2.5/2.5	MD21-98-0474 Soil Gas (25 ft)	NDA			
2.5/2.5		NDA			
2.5/2.5		NDA			
2.5/2.5		NDA			
2.5/2.5	MD21-98-0471 Core (34-35 ft)	NDA			2-5mm oxidized fracture (35-42.5ft)
2.5/2.5		NDA			
2.5/2.5		NDA			
2.5/2.5		NDA			
2.5/2.5	MD21-98-0472 Core (44-45 ft)	NDA			
2.5/2.5		NDA			
2.5/2.5	MD21-98-0473 Core (54-55 ft)	NDA			
2.5/2.5		NDA			
2.5/2.5	MD21-98-0475 Soil Gas (55 ft)	NDA			
2.5/2.5		NDA			
2.5/2.5		NDA			
2.5/2.5		NDA			
2.5/2.5	MD21-98-0520 Core (64-65 ft)	NDA			
2.5/2.5		NDA			
2.5/2.5	MD21-98-0521 Core (74-75ft)	NDA			
2.5/2.5	MD21-98-0476/0477 Soil Gas (75ft)	NDA			

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