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TA21

Date: July 1, 2005
Refer to: ER2005-0418

Mr. James Bearzi
NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

RECEIVED JUL 2005 Hazardous Bureau

SUBJECT: SUBMITTAL OF TWO ADDITIONAL ELECTRONIC DOCUMENTS REQUESTED BY THE NEW MEXICO ENVIRONMENT DEPARTMENT

Dear Mr. Bearzi:

Enclosed are two CDs each with electronic files of four documents requested by the New Mexico Environment Department (NMED). Three Material Disposal Area U documents including the investigation work plan, the historical investigation report, and response to the notice of disapproval. These documents were requested by email on June 21, 2005. The documents were inadvertently left off the original list requested by NMED. In a letter dated June 23, 2005, NMED requested an electronic file of the Airport Landfill Phase II Remedy Design Work Plan to be received within 10 days. This submittal fulfills the requirement in Section XI.A of the Consent Order and subsequent NMED requests to provide an electronic copies of all work plans and reports to NMED.

If you have questions, please contact Saundra Martinez at (505) 665-6771 (saundra@lanl.gov) or Phil Noll at (505) 667-7940 (pdn@lanl.gov).

Sincerely,

David McInroy, Deputy Program Director
Environmental Remediation & Surveillance
Los Alamos National Laboratory

Sincerely,

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

10849

SM/jv/bw

Enclosure: 1) Two CDs each with electronic files of four documents

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Date: June 22, 2005
Refer To: ER2005-0393

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

SUBJECT: SUPPLEMENTAL RESPONSE TO THE NOTICE OF DISAPPROVAL FOR THE INVESTIGATION WORK PLAN FOR SOLID WASTE MANAGEMENT UNIT 21-017(a)-99, MATERIAL DISPOSAL AREA U, AT TECHNICAL AREA 21

Dear Mr. Bearzi:

Los Alamos National Laboratory (LANL) received the New Mexico Environment Department's Notice of Disapproval (NOD) of the "Investigation Work Plan for Material Disposal Area U, Solid Waste Management Unit 21-017(a)-99, at Technical Area 21." on February 4, 2005 and responded to the NOD in a letter with attachment dated March 5, 2005. The approval with modifications for this work plan was received from NMED on March 21, 2005. Recently it was noted that one of the NOD comments was inadvertently omitted from LANL's NOD response. The omitted comment, NMED specific comment Number 4, Item 9, states

> *Section IX.B.2.d, Soil Rock, and Sediment Sample Field Screening of the proposed Consent Order states that "The primary screening methods to be used shall include: 1) visual examination; 2) headspace vapor screening for VOCs; 3) metals screening using X-ray fluorescence (XRF). Additional screening for site- or release-specific characteristics such as pH, HE, or for other specific compounds using field test kits shall be conducted where appropriate." The permittees do not include a justification as to why XRF is not included in the field screening methods. The Permittees must include XRF in their field screening procedures.*

LANL is not proposing the use of X-ray fluorescence (XRF) for field screening of metals at Material Disposal Area (MDA) U because we do not believe it will provide usable results for guiding drilling activities at the site. Most of the metals historically detected in MDA U samples are within the range of twice background, particularly in the subsurface. The best detection limits achievable by XRF are typically significantly higher than the concentrations of metals historically seen at MDA U. Exceptions to this include copper, zinc, and lead, the maximum concentrations of which are within the same order

of magnitude as the optimal detection limits afforded by field XRF analysis. The vertical extent of these metals has already been established using fixed laboratory analytical data. No inorganic chemicals have been detected above background values at the total depth (75 ft below ground surface [bgs]) of historical boreholes. The deepest detection of a metal at MDA U (mercury, 0.16 mg/kg at approximately 57 ft bgs) is more than two orders of magnitude below typical XRF detection limit.

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

Sincerely,

David McInroy, Deputy Project Director
Environmental Remediation and Surveillance
Los Alamos National Laboratory

Sincerely,

David Gregory, Federal Project Director
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LA-UR-04-7267
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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CD included with this document

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Prepared by
Environmental Stewardship Division–Remediation Services

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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

Responsible project leader:

Printed Name	Signature	Title	Organization	Date
Becky Coel-Roback		Project Leader	ENV-RS	

Responsible UC representative:

Printed Name	Signature	Title	Organization	Date
David McInroy		Deputy Project Director	ENV-RS	

Responsible DOE representative:

Printed Name	Signature	Title	Organization	Date
David Gregory		Federal Project Director	DOE-LASO	

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 polycyclic aromatic 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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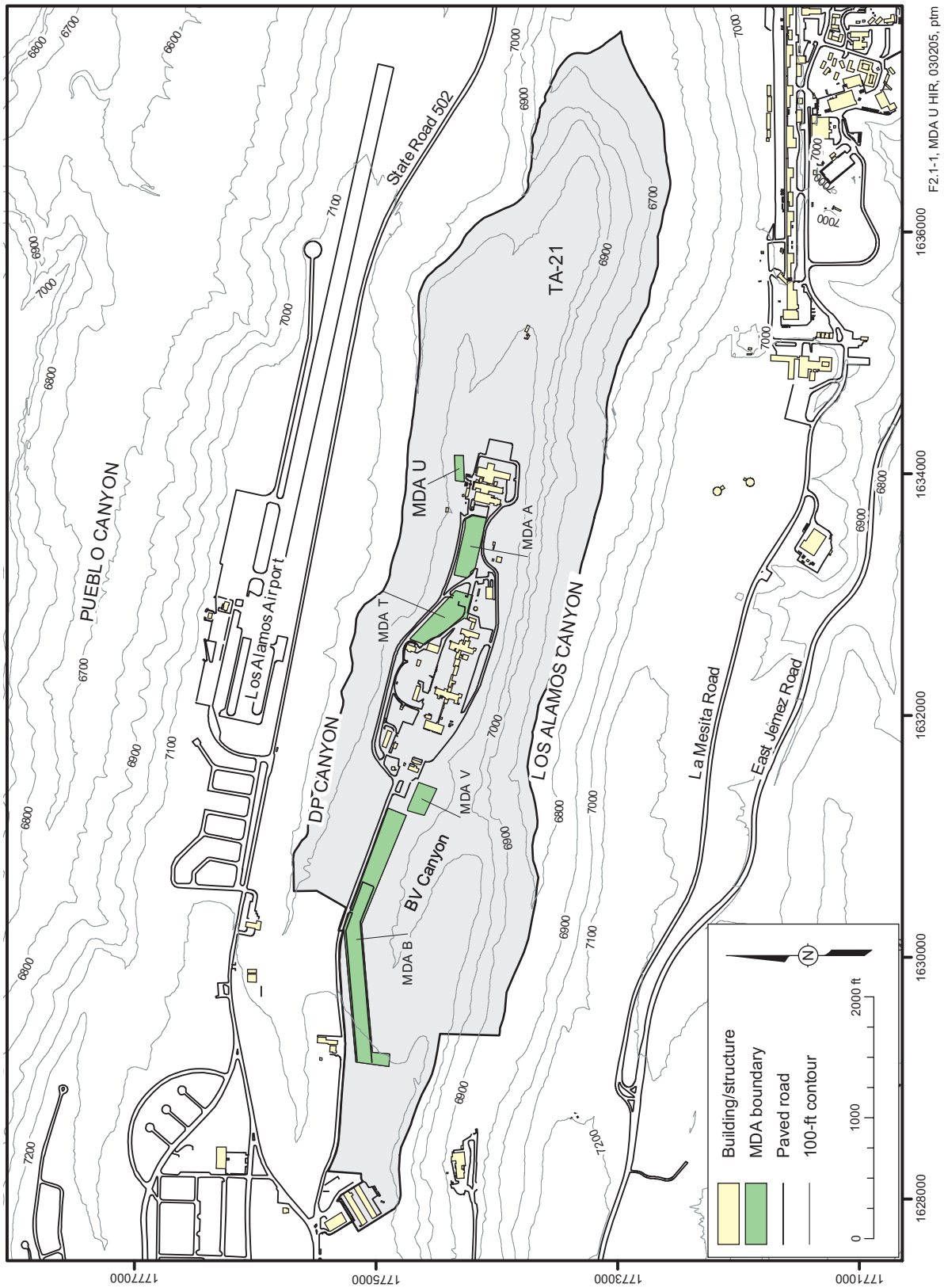


Figure 2.1-1. Material disposal areas in TA-21

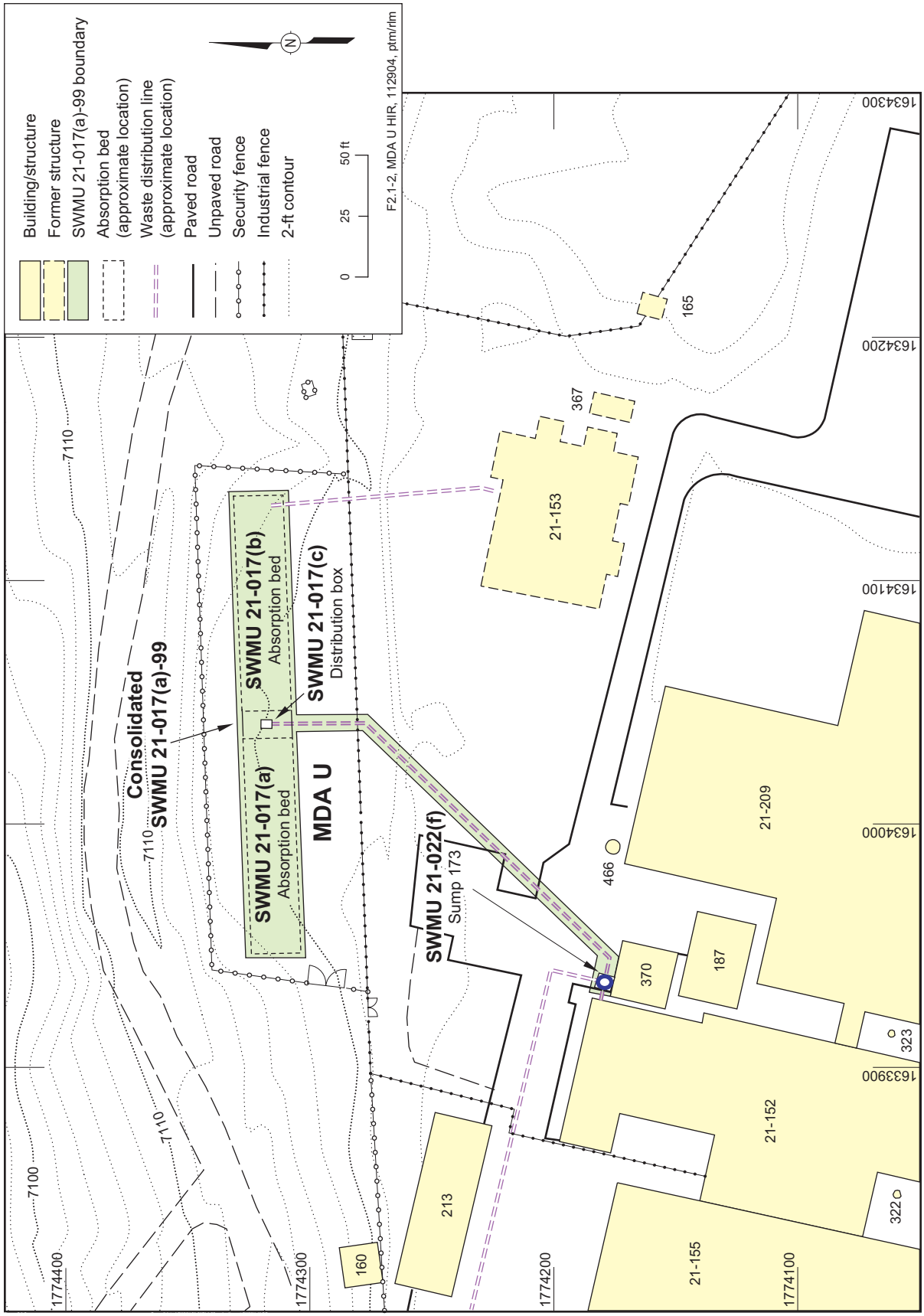


Figure 2.1-2. Consolidated SWMU 21-017(a)-99

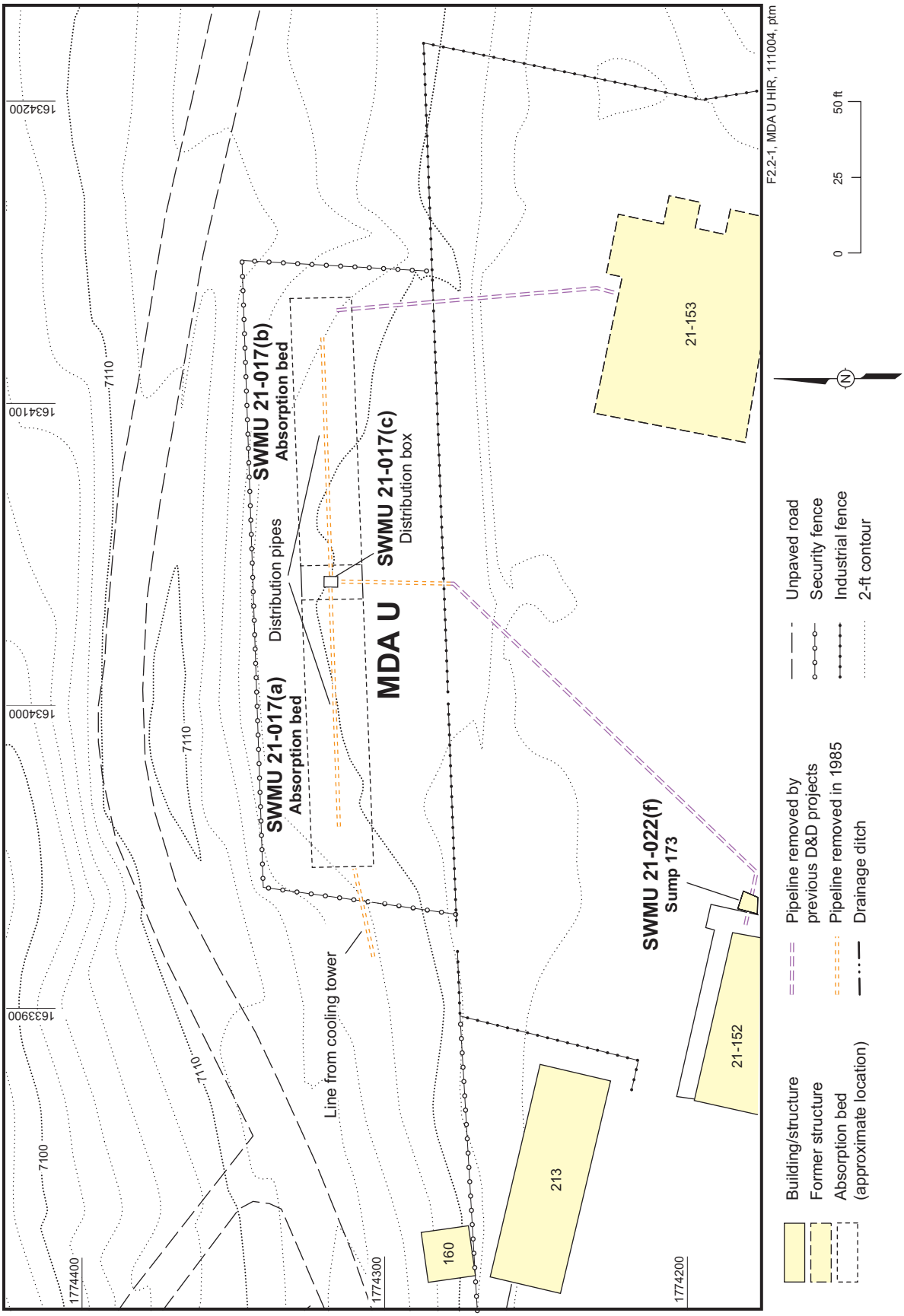
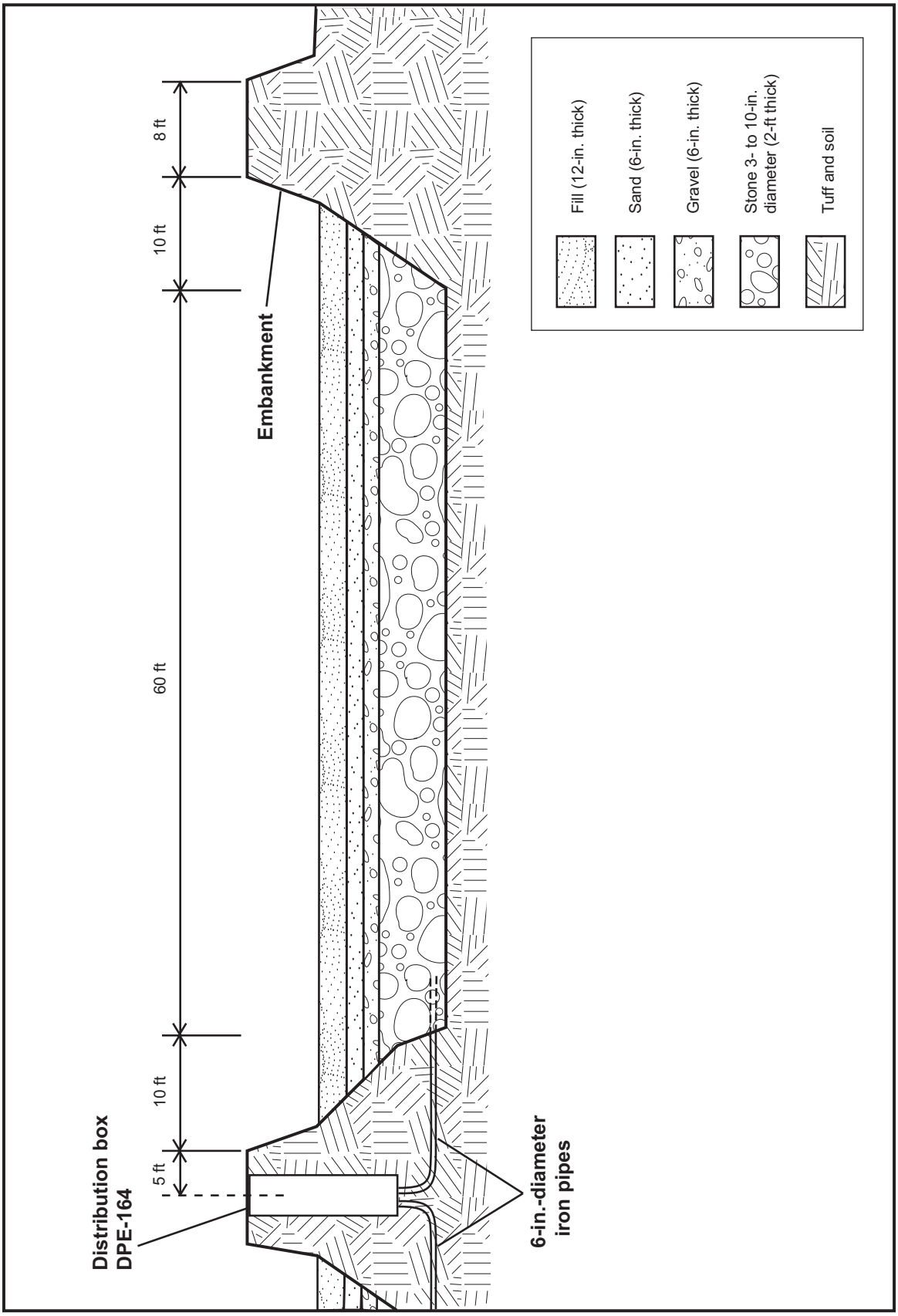
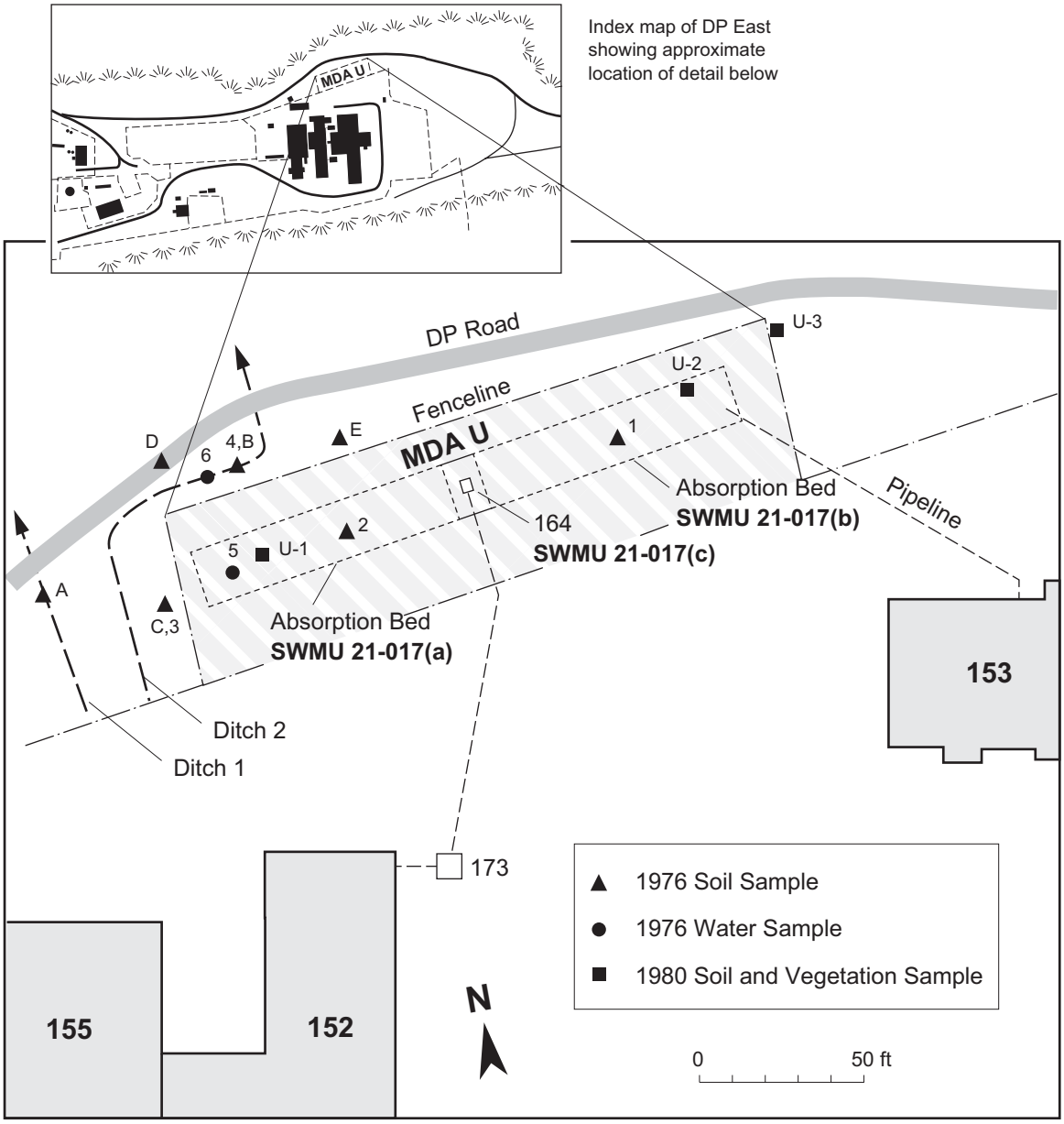


Figure 2.2-1. 1985 stabilization activities at MDA U



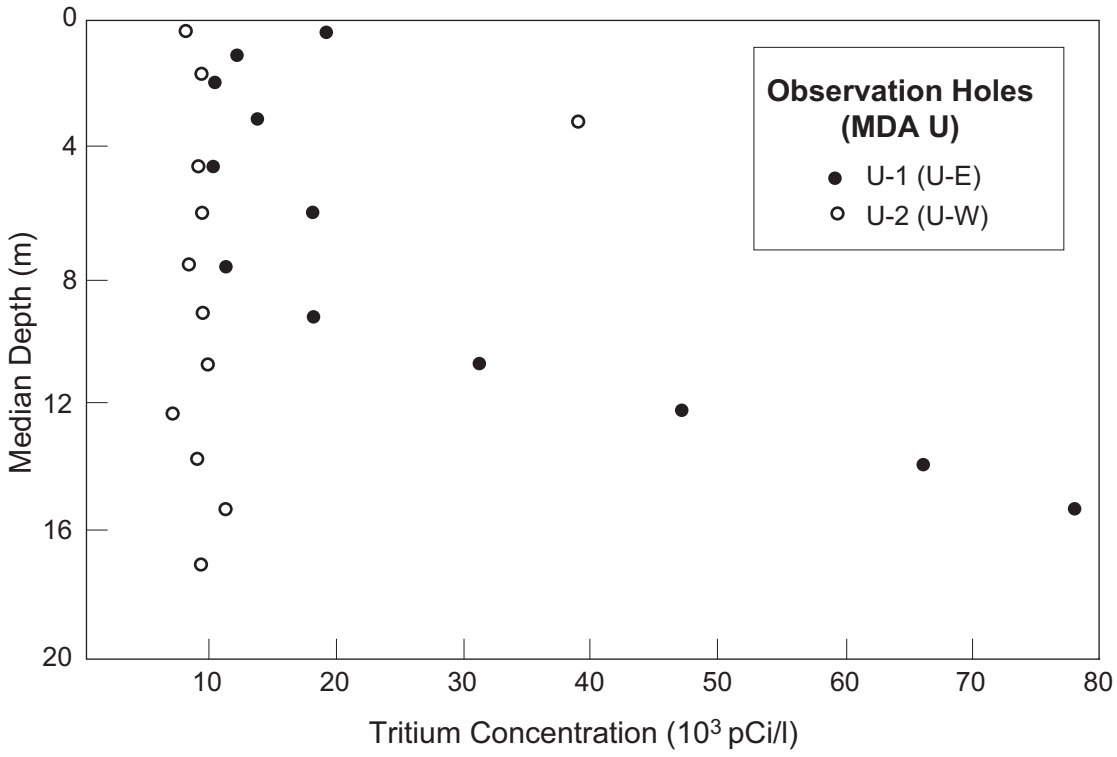
Source: LASL ENG-C2216 6/6/45; modified for F2.2-3/MDA U RFI/011203/rlm; modified for F2.3-1, MDA U HIR, 110804, ptm

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



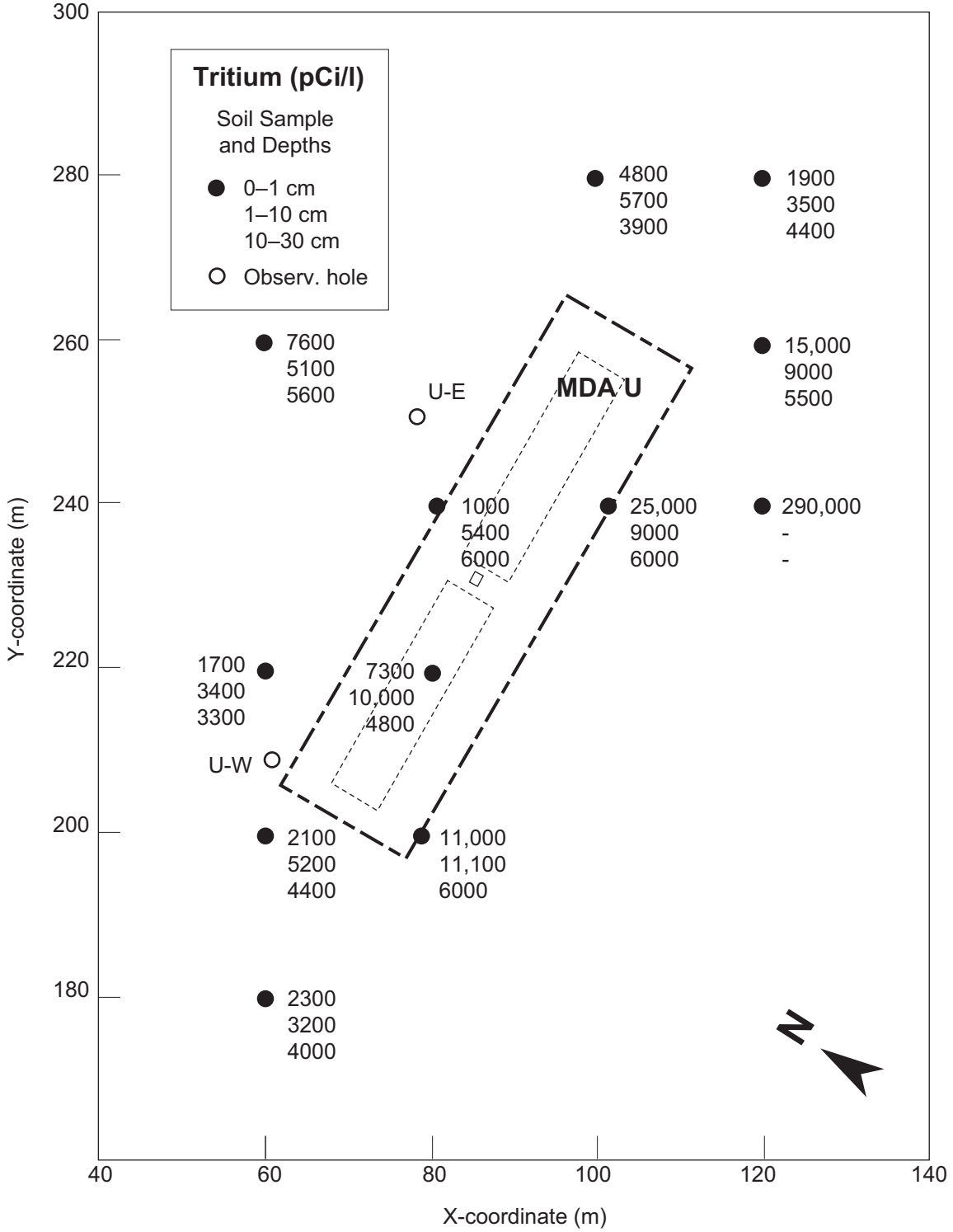
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-1, p. 16-207); modified for F3.1-1, MDA U HIR, 112804, ptm

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



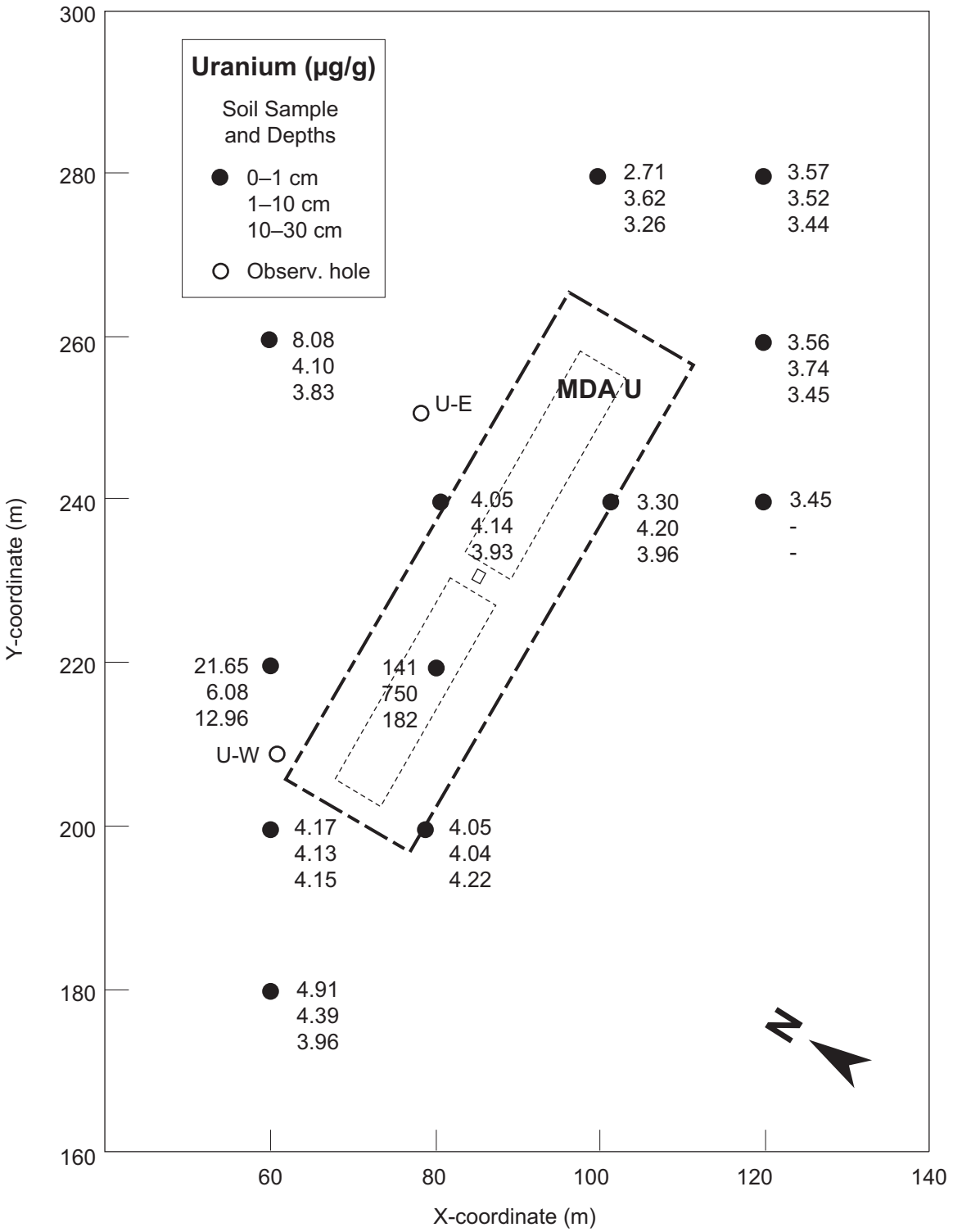
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-9, p. 16-215)
F3.1-2, MDA U HIR, 112804, ptm/rlm

Figure 3.1-2. 1983 borehole investigation tritium results



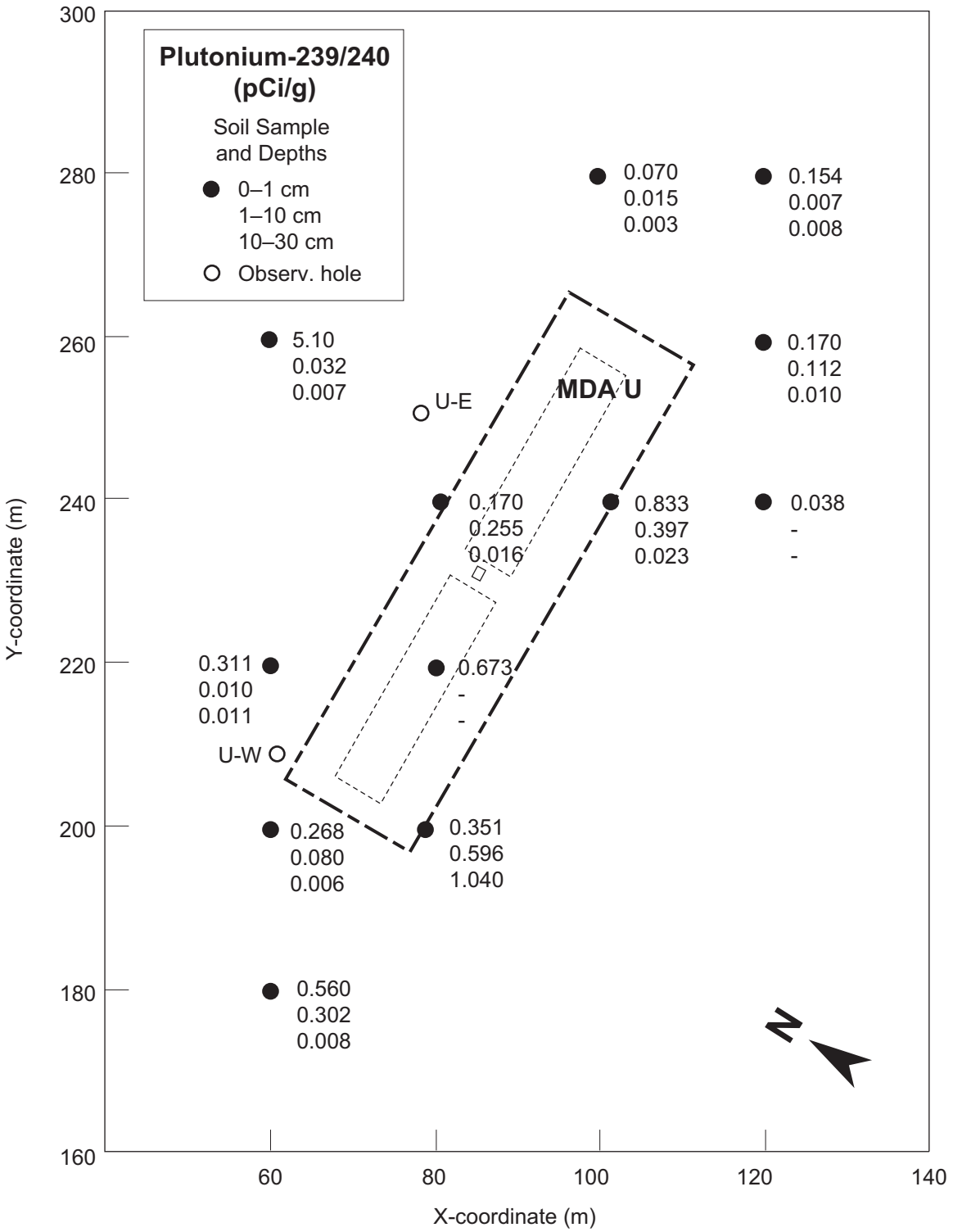
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-2, p. 16-208) modified for F3.1-3, MDA U HIR, 112804, ptm/rlm

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



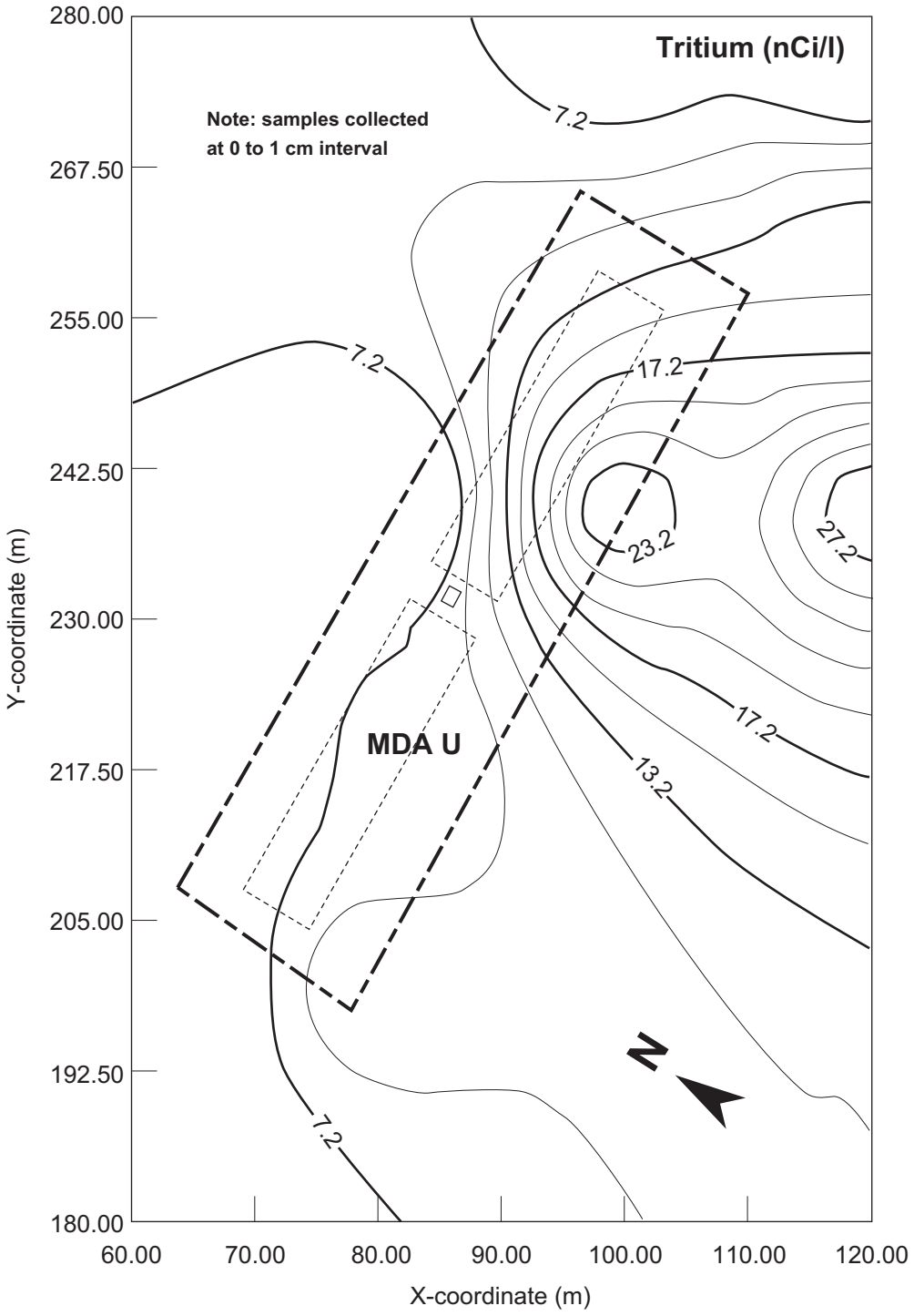
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-3, p. 16-209) modified for F3.1-4, MDA U HIR, 112804, ptm/rlm

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



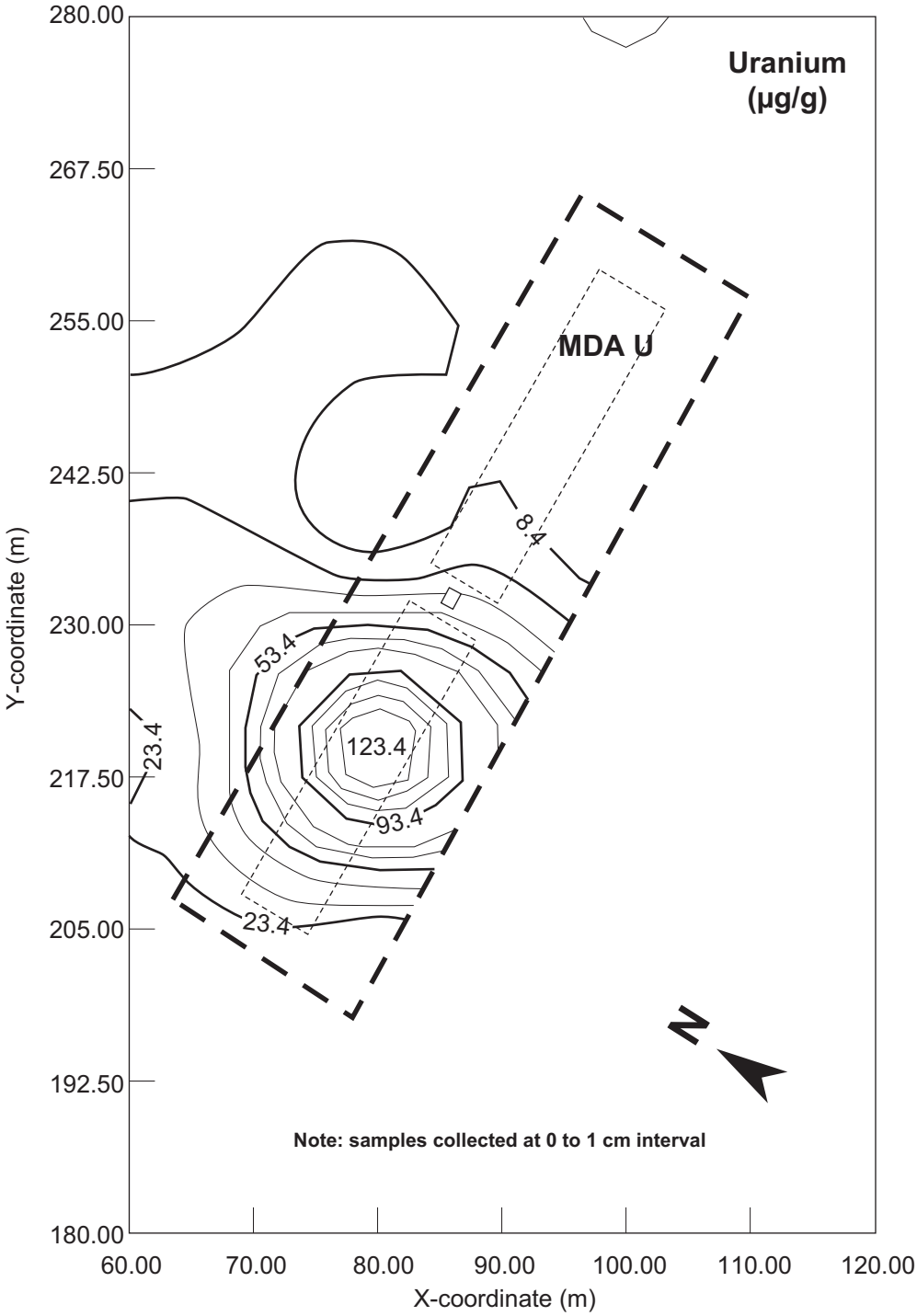
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-4, p. 16-210) modified for F3.1-5, MDA U HIR, 112804, ptm/rlm

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



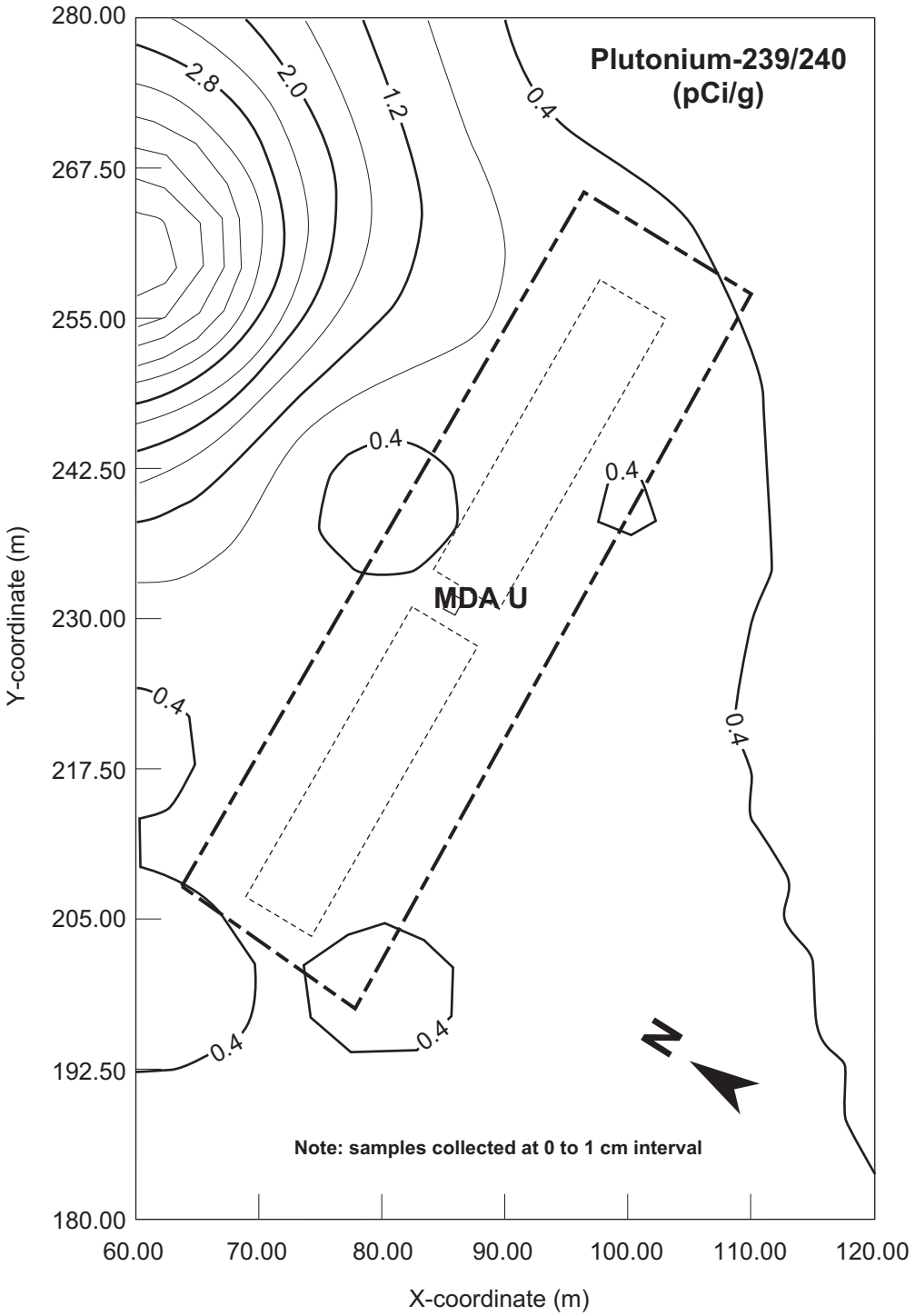
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-5, p. 16-211) modified for F3.1-6, MDA U HIR, 111004, ptm

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



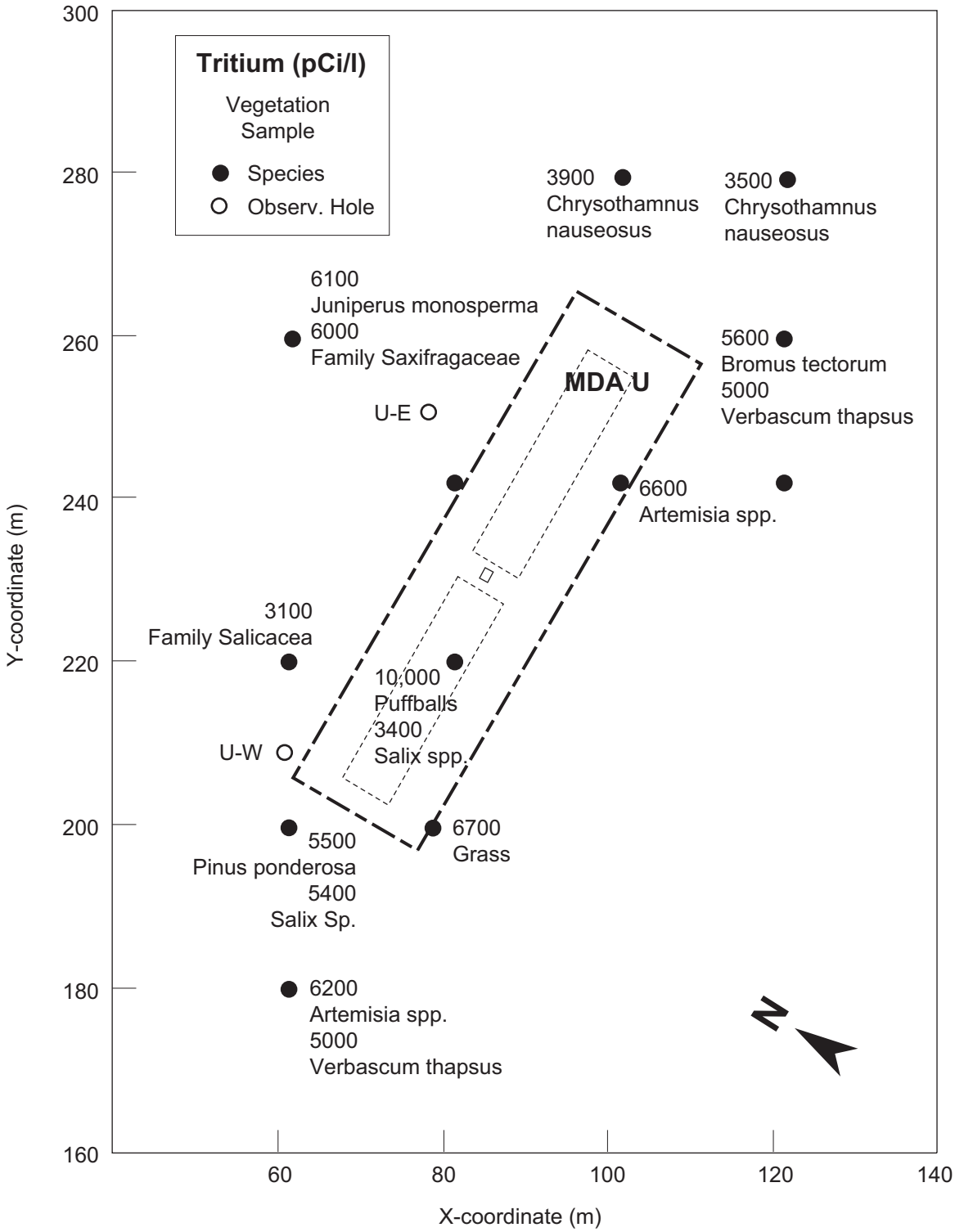
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-6, p. 16-212) modified for F3.1-7, MDA U HIR, 112804, ptm/rlm

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

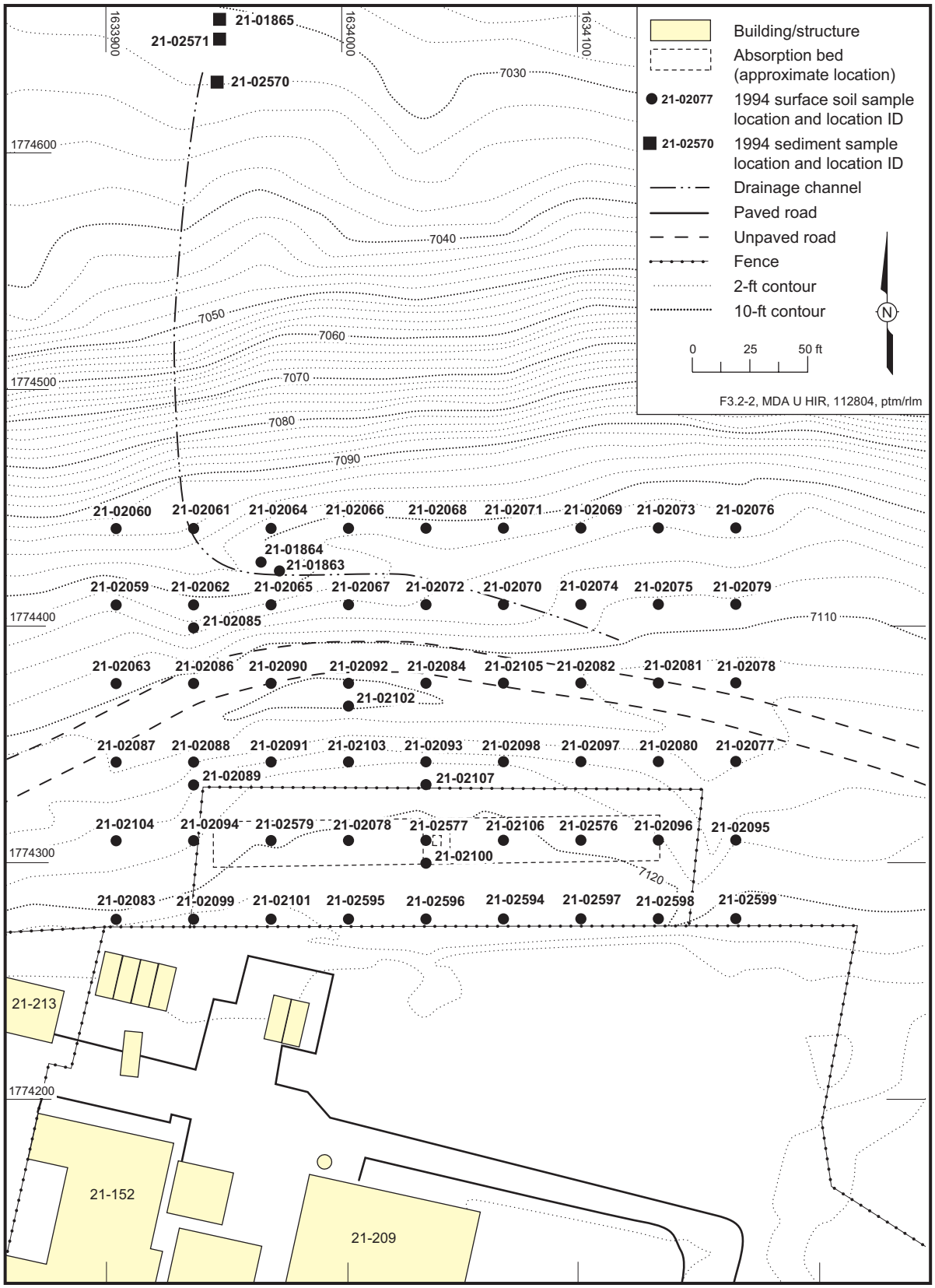


Figure 3.2-2. Locations for 1994 surface soil and sediment samples

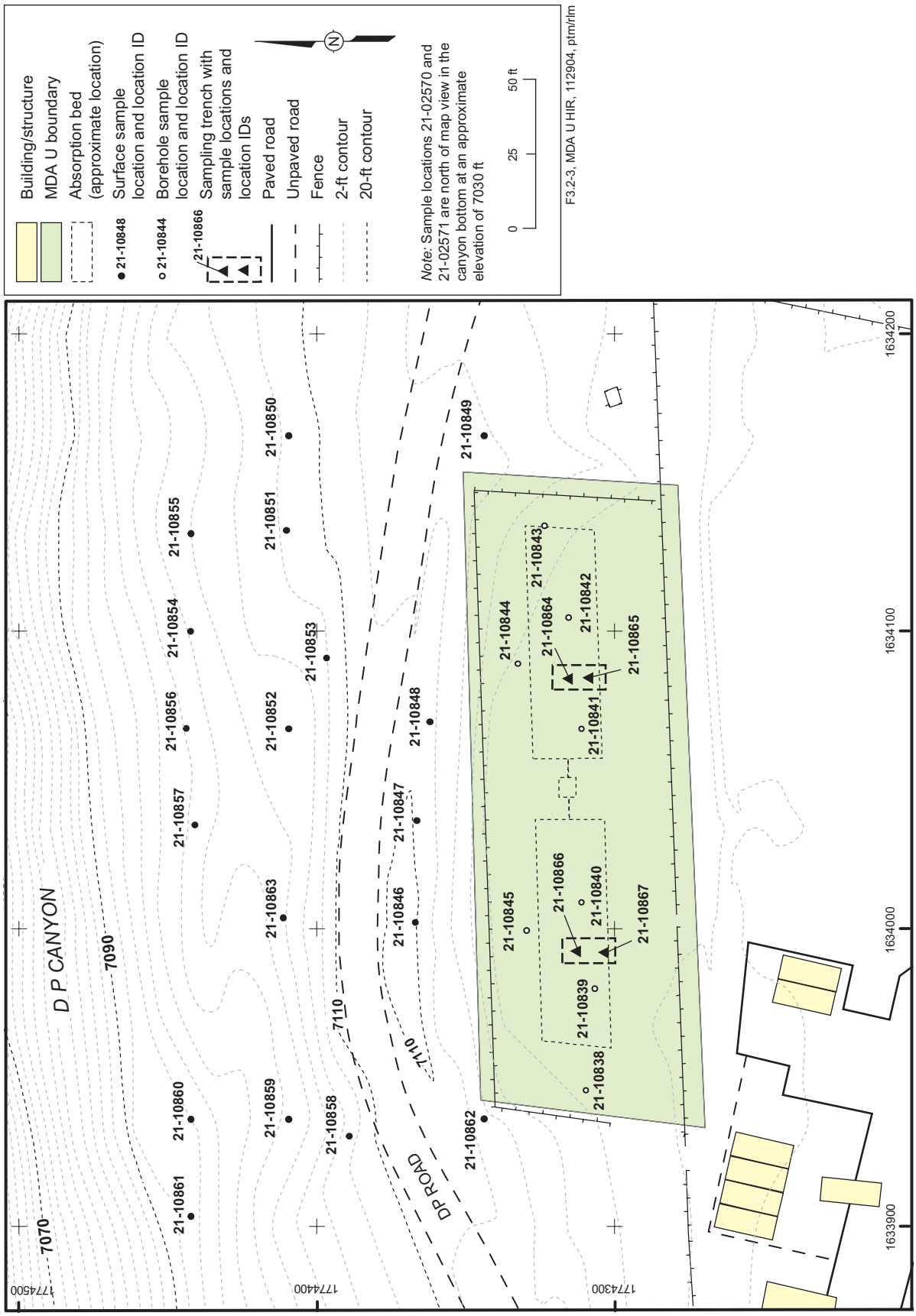


Figure 3.2-3. Locations for 1998 absorption bed, surface, and subsurface sampling

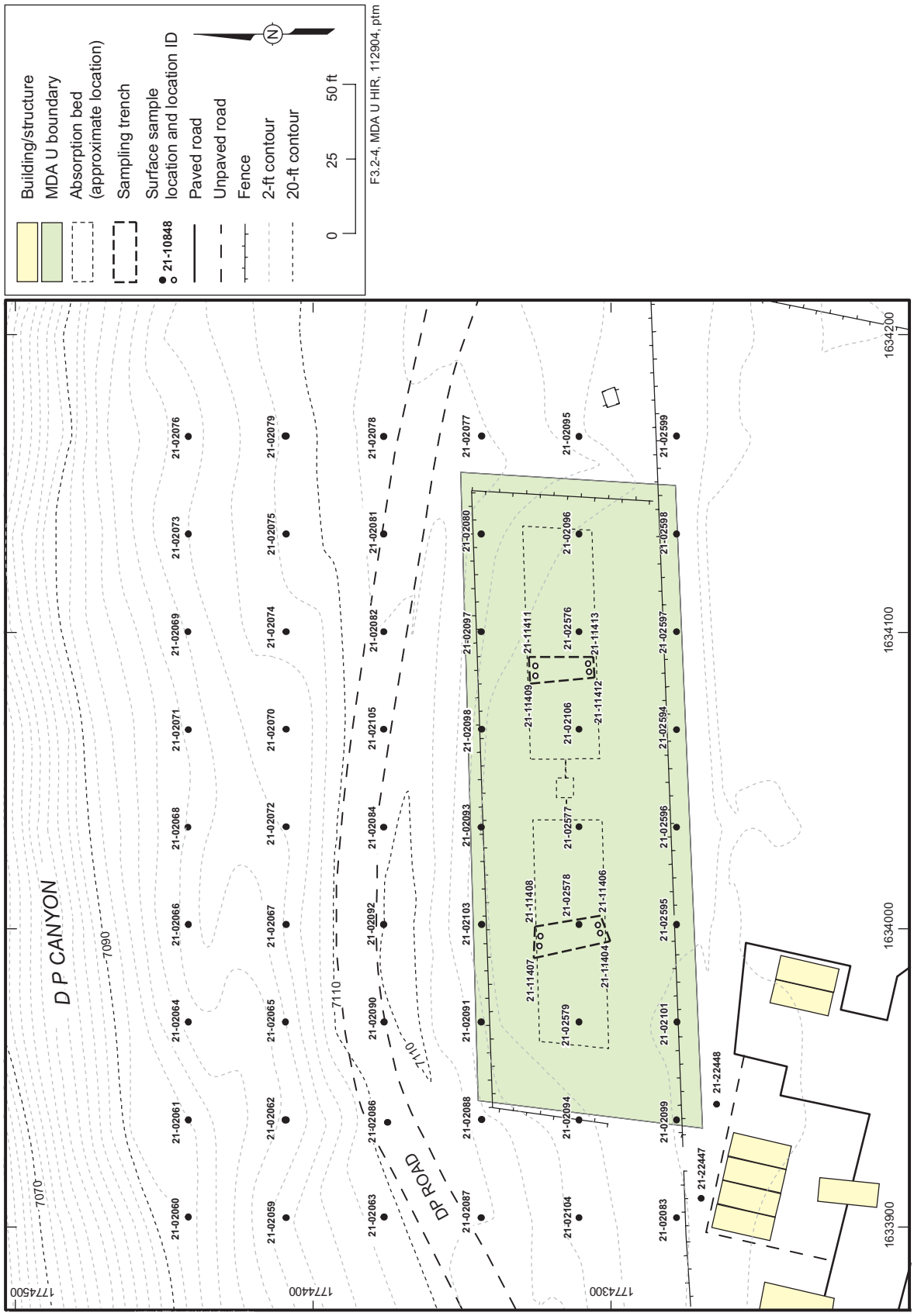


Figure 3.2-4. Locations for 2001 absorption bed and surface soil sampling

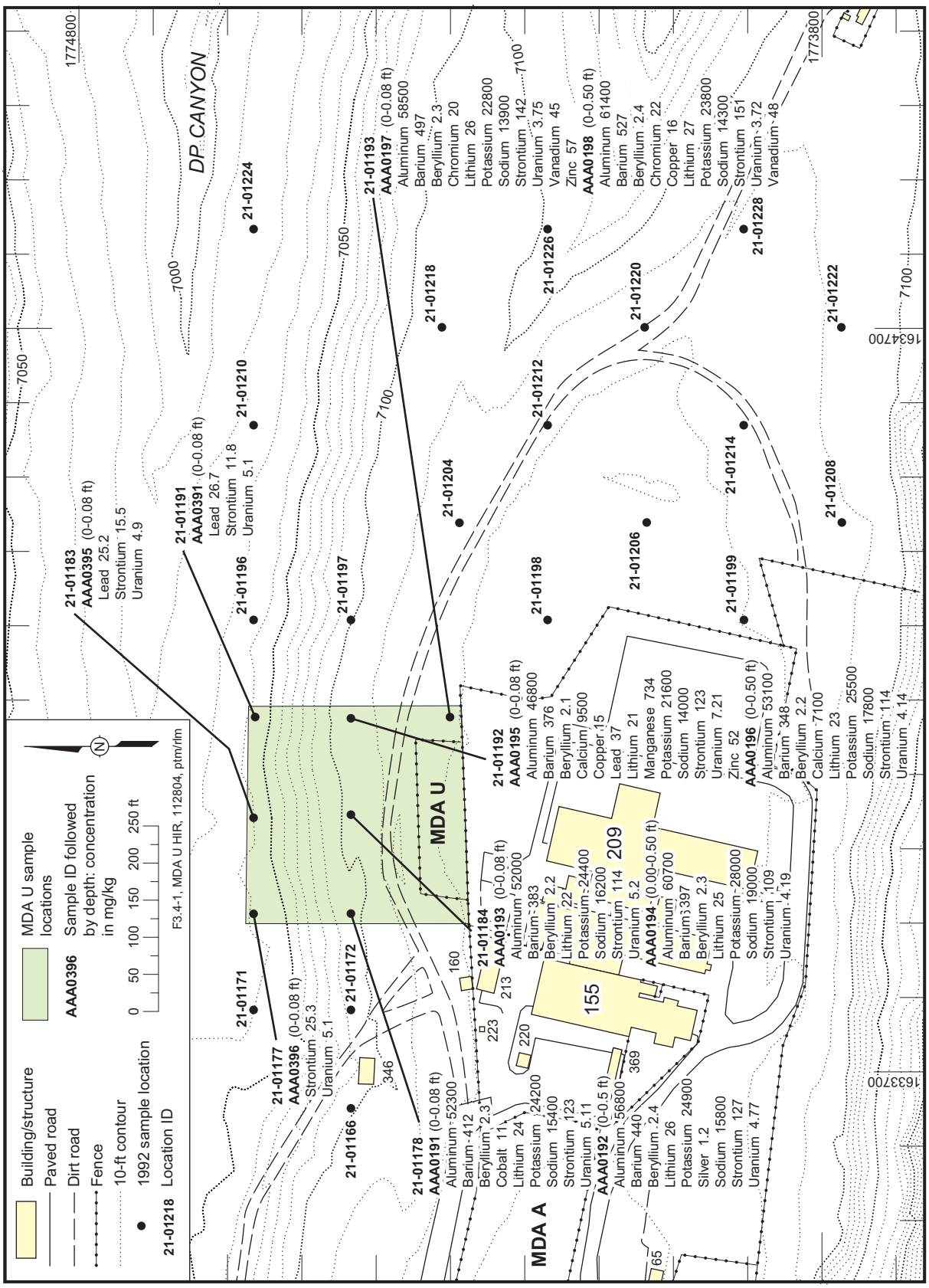
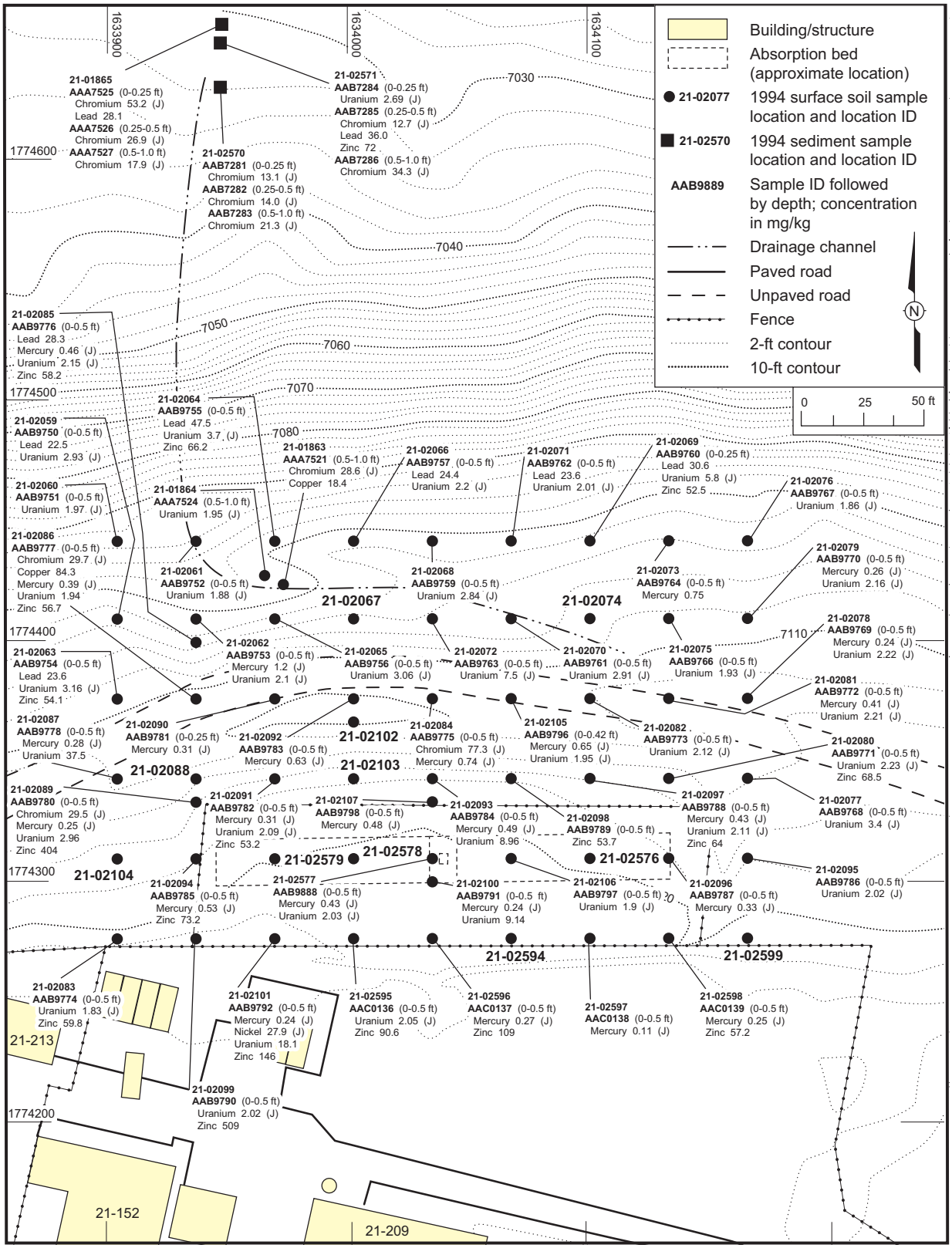


Figure 3.4-1. Inorganic chemicals above background values in 1992 surface samples



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

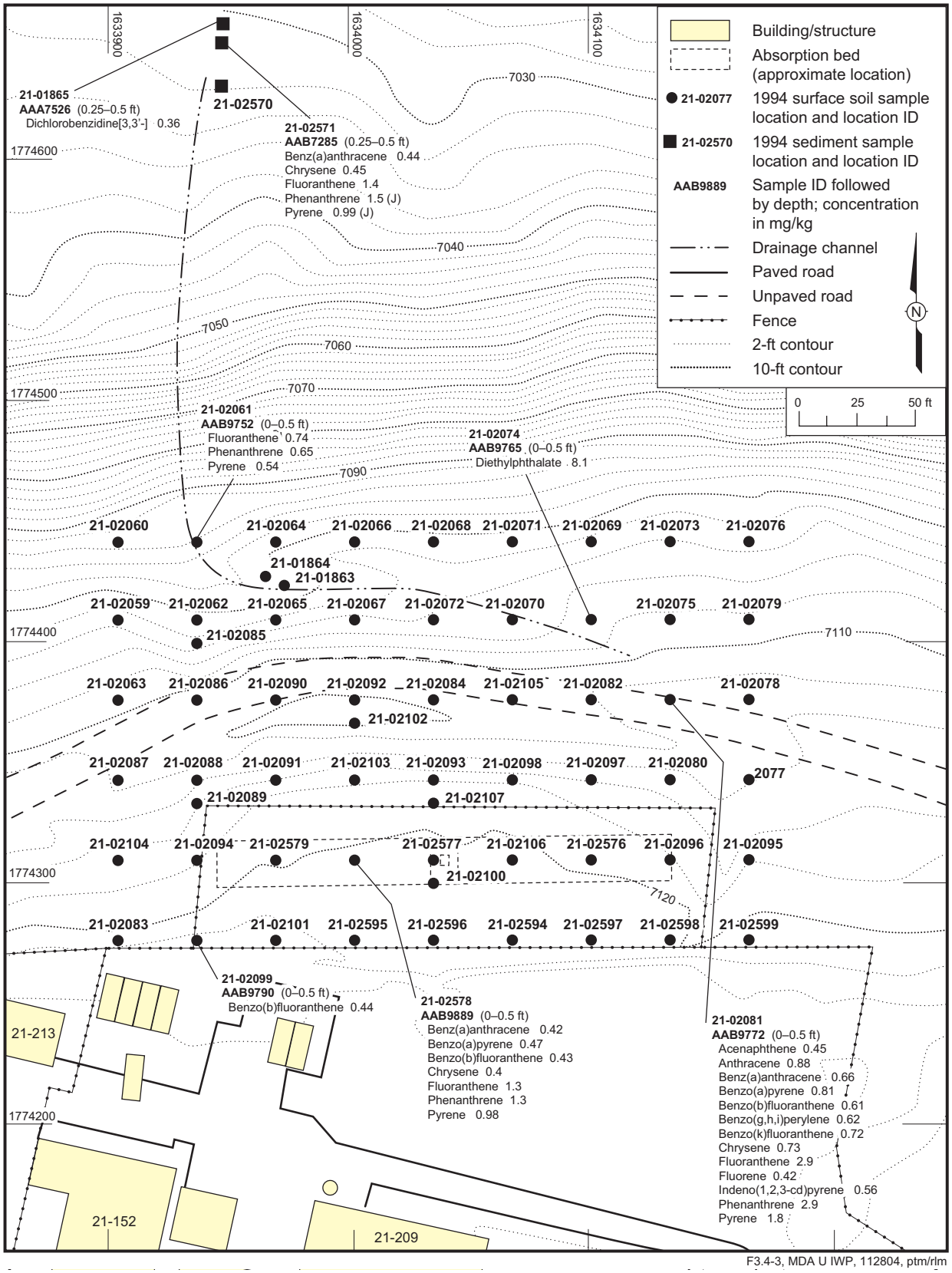


Figure 3.4-3. Organic chemicals detected in 1994 surface soil and sediment samples

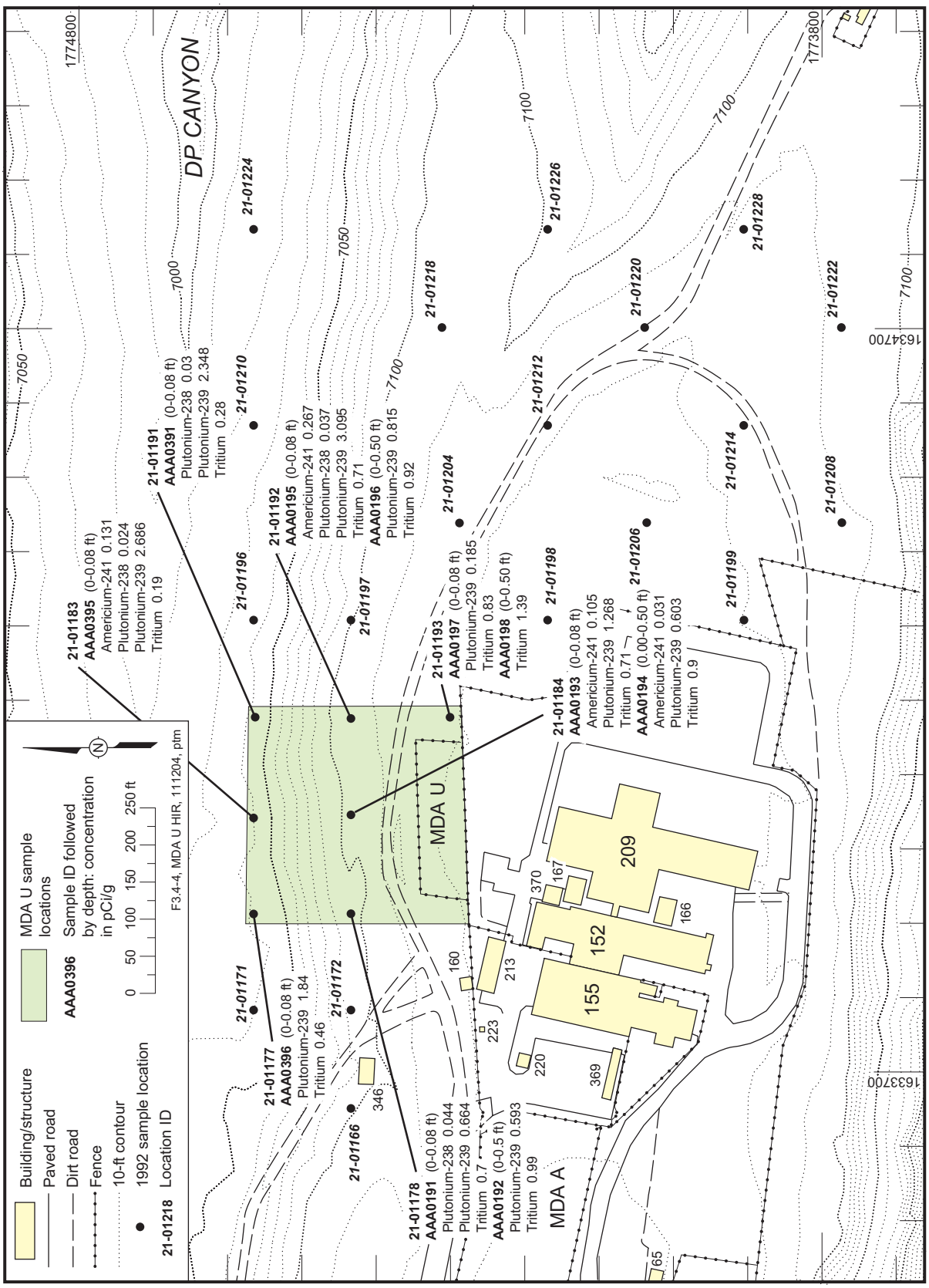
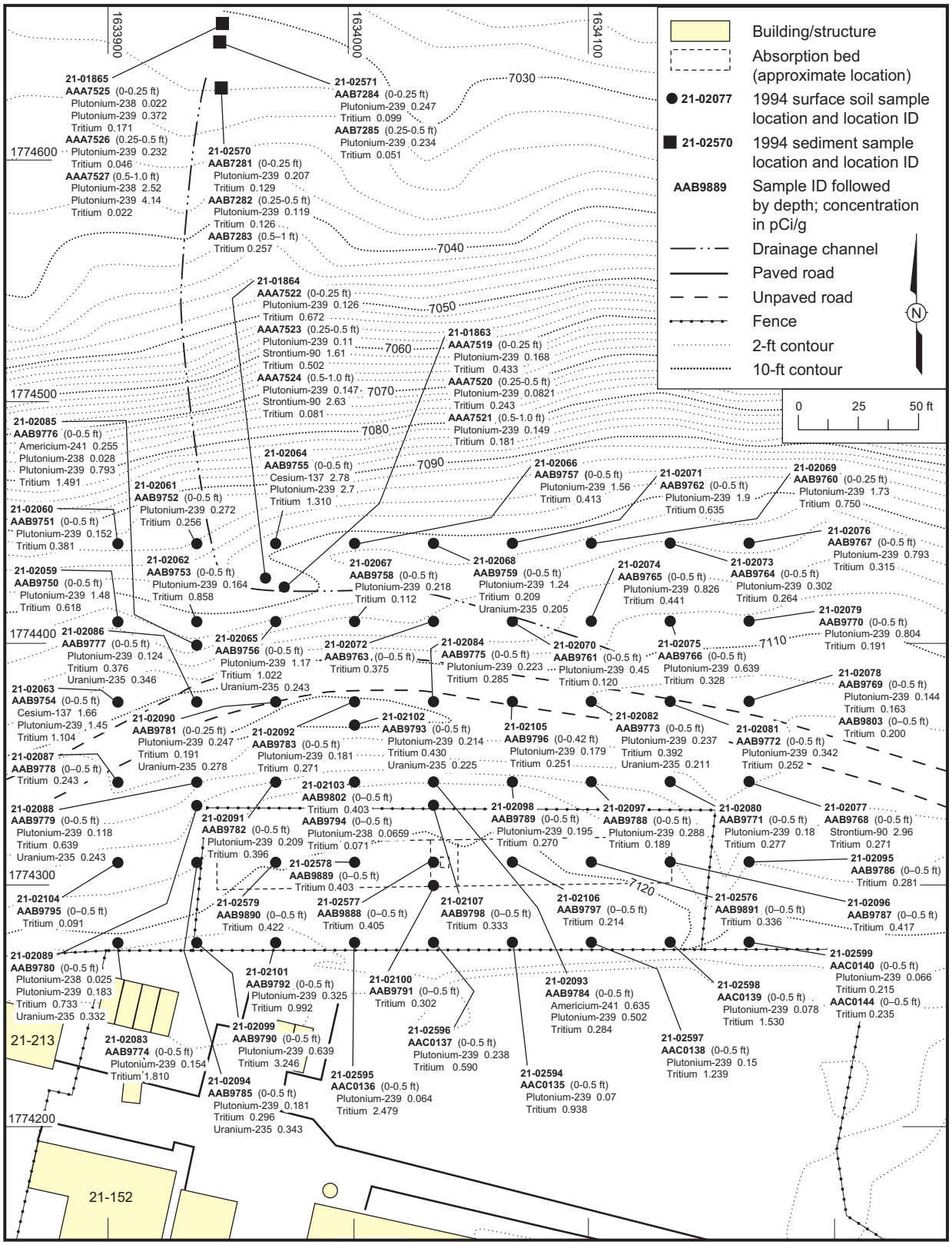


Figure 3.4-4. Radionuclides above background values in 1992 surface samples



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

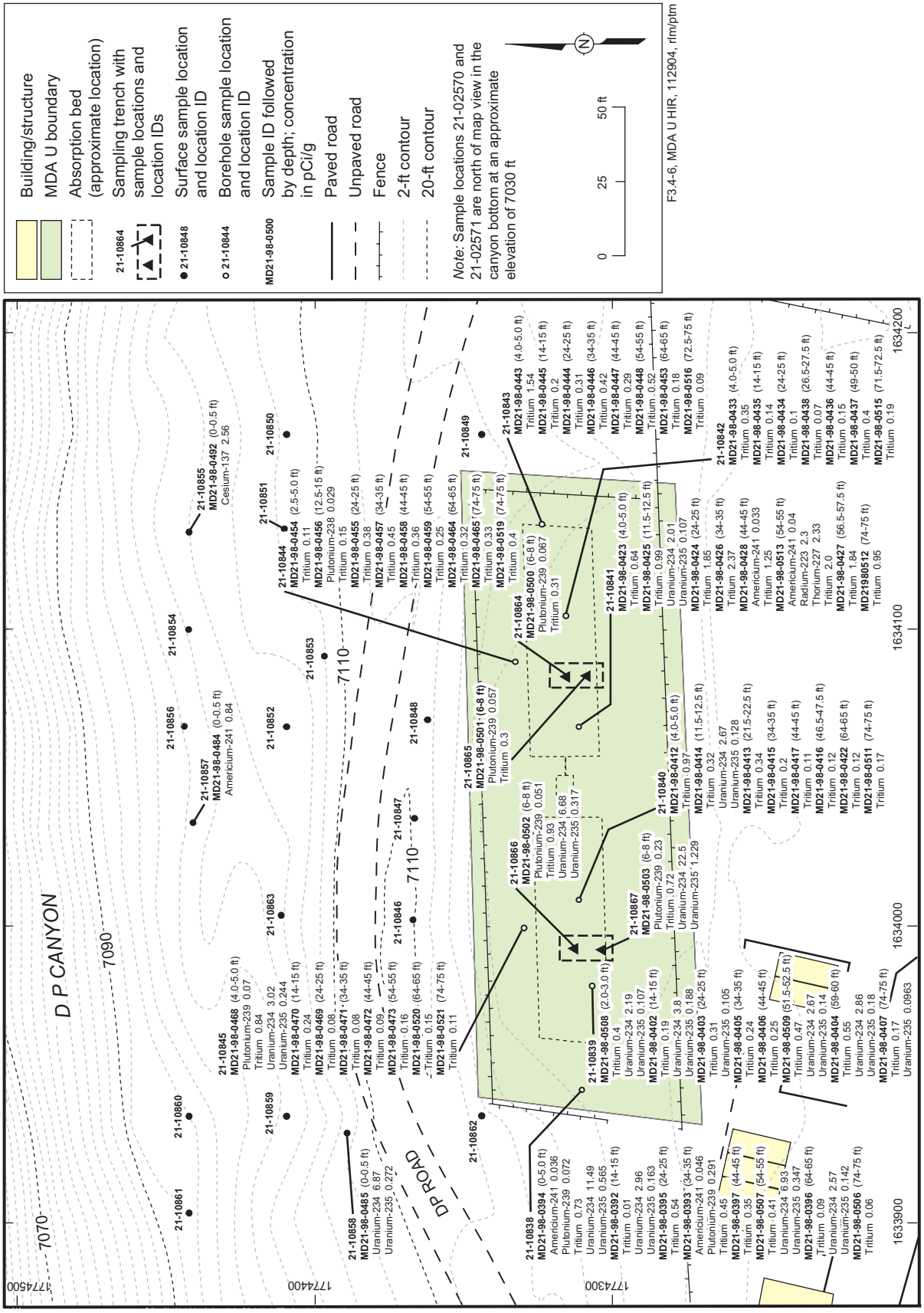


Figure 3.4-6. Radionuclides detected above background values/fallout values in 1998 surface and subsurface samples

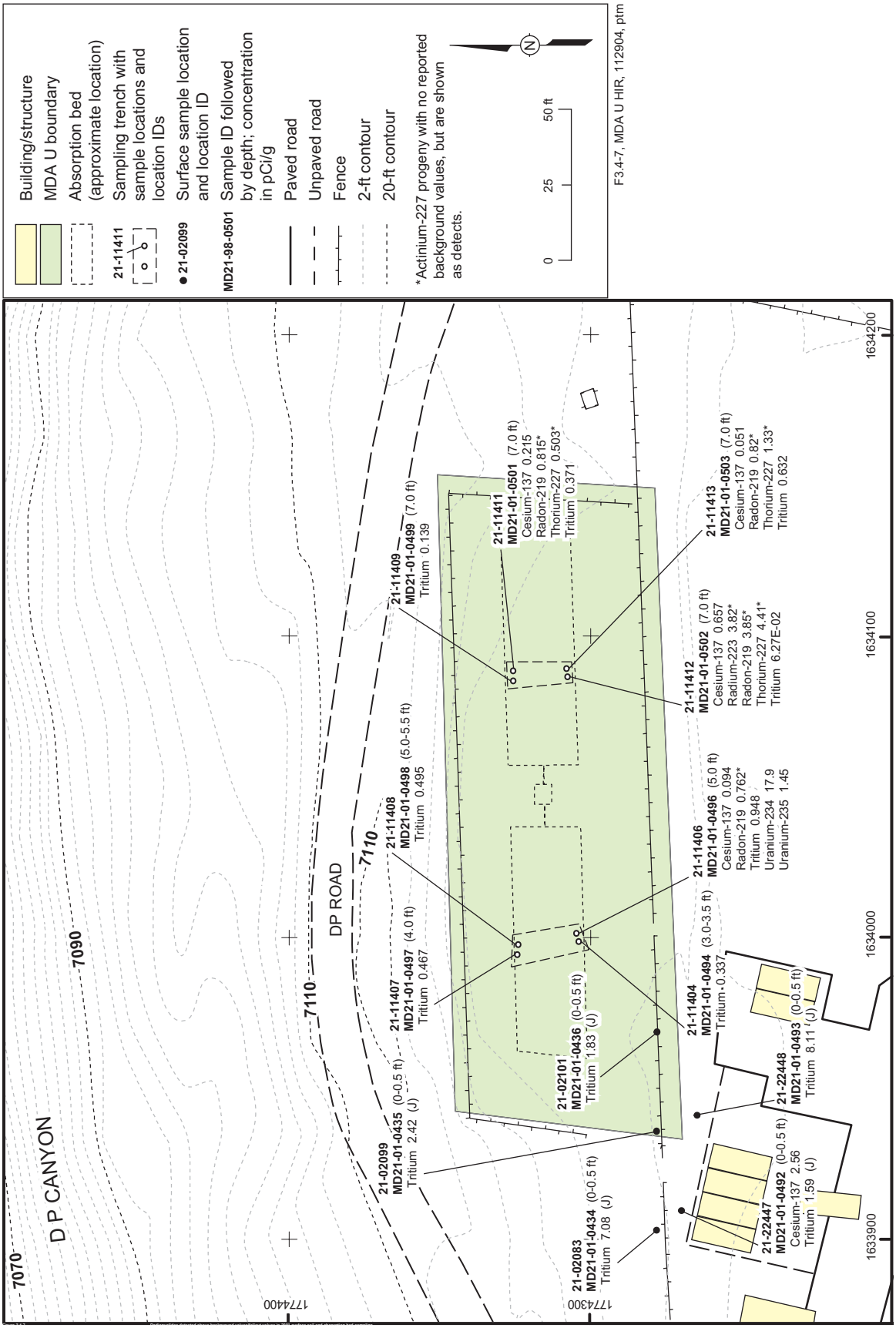


Figure 3.4-7. Radionuclides detected above background values/fallout values in 2001 surface soil and absorption bed sampling

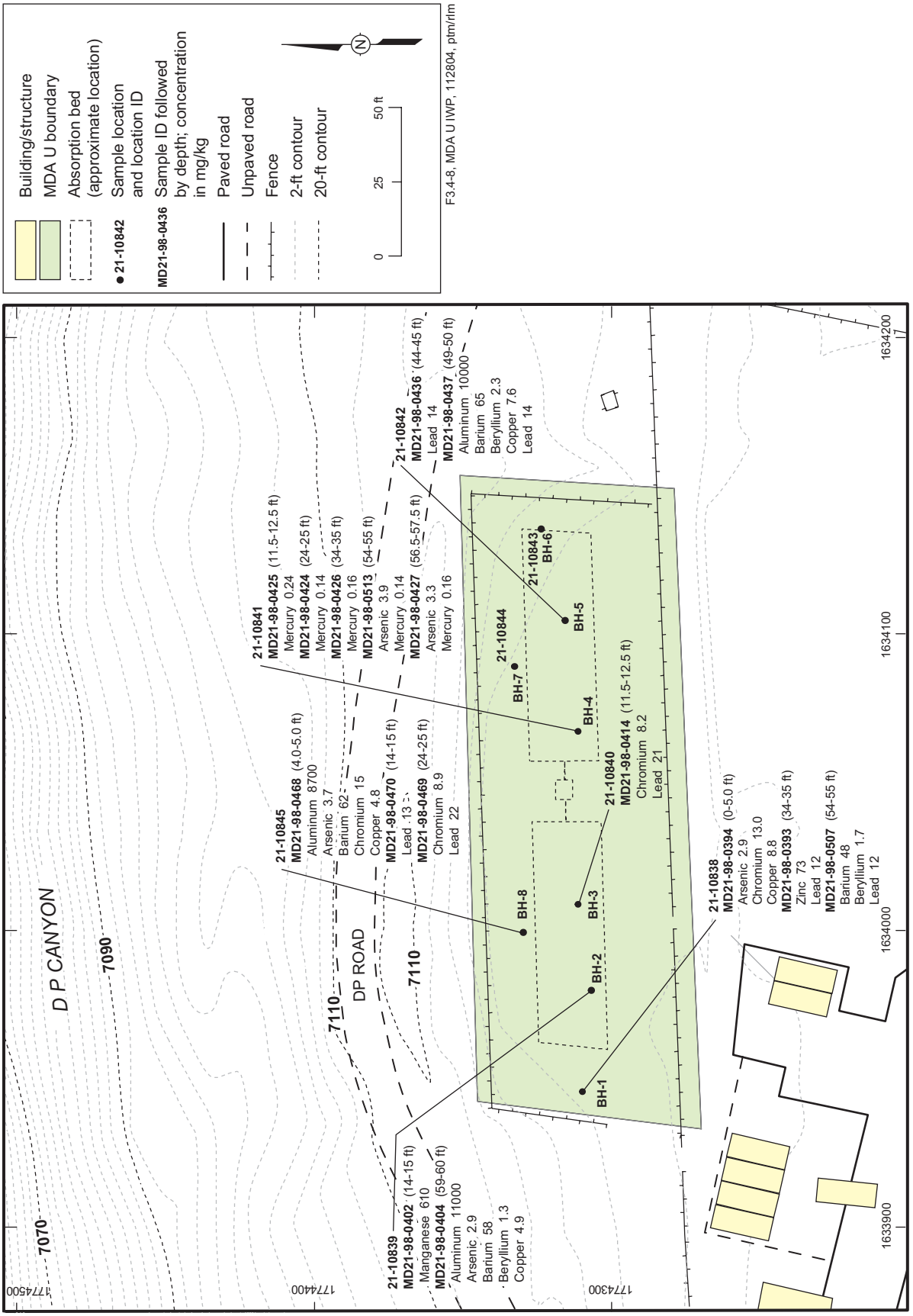


Figure 3.4-8. Inorganic chemicals above background values in 1998 borehole samples

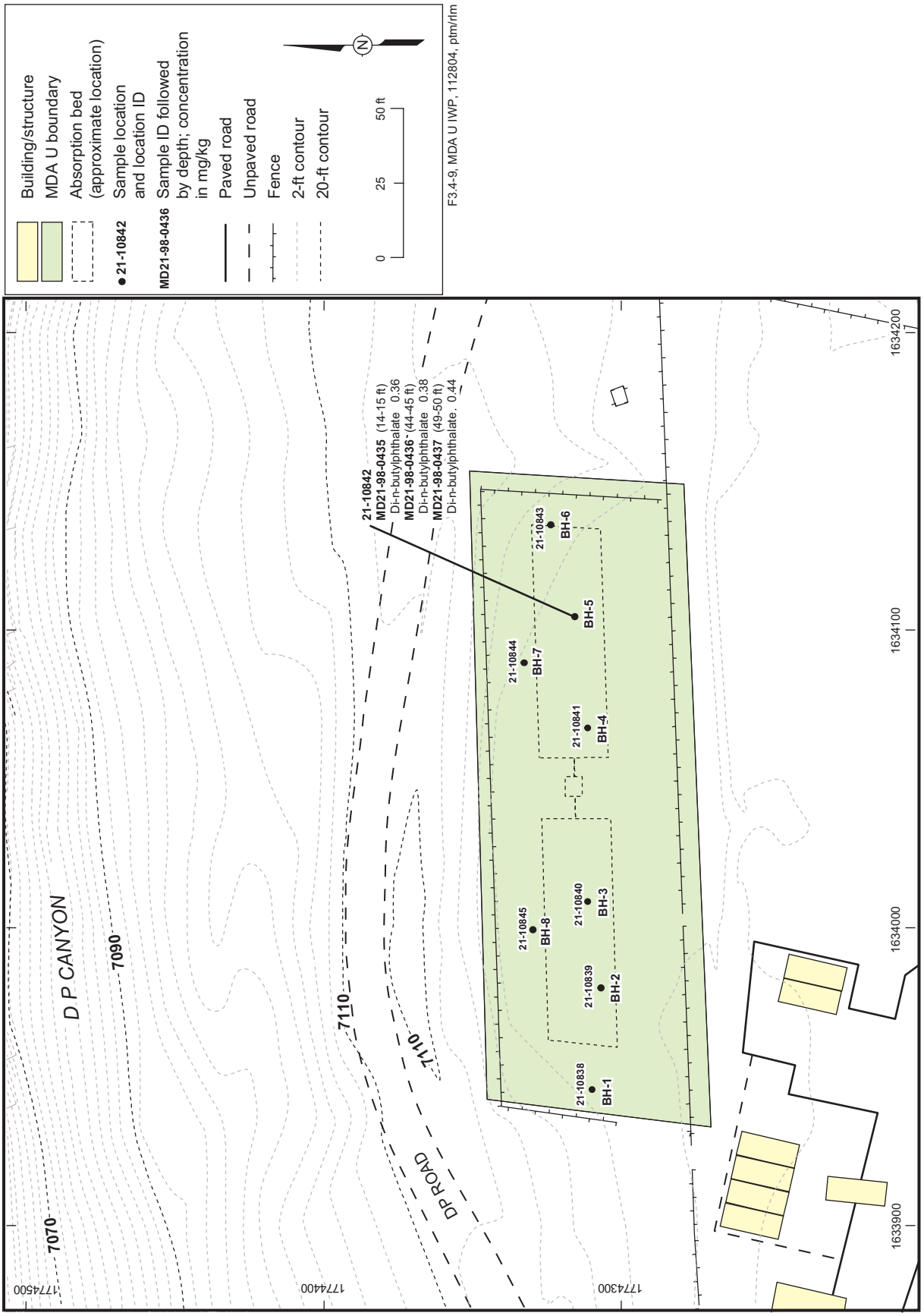


Figure 3.4-9. Organic chemicals detected in 1998 borehole samples

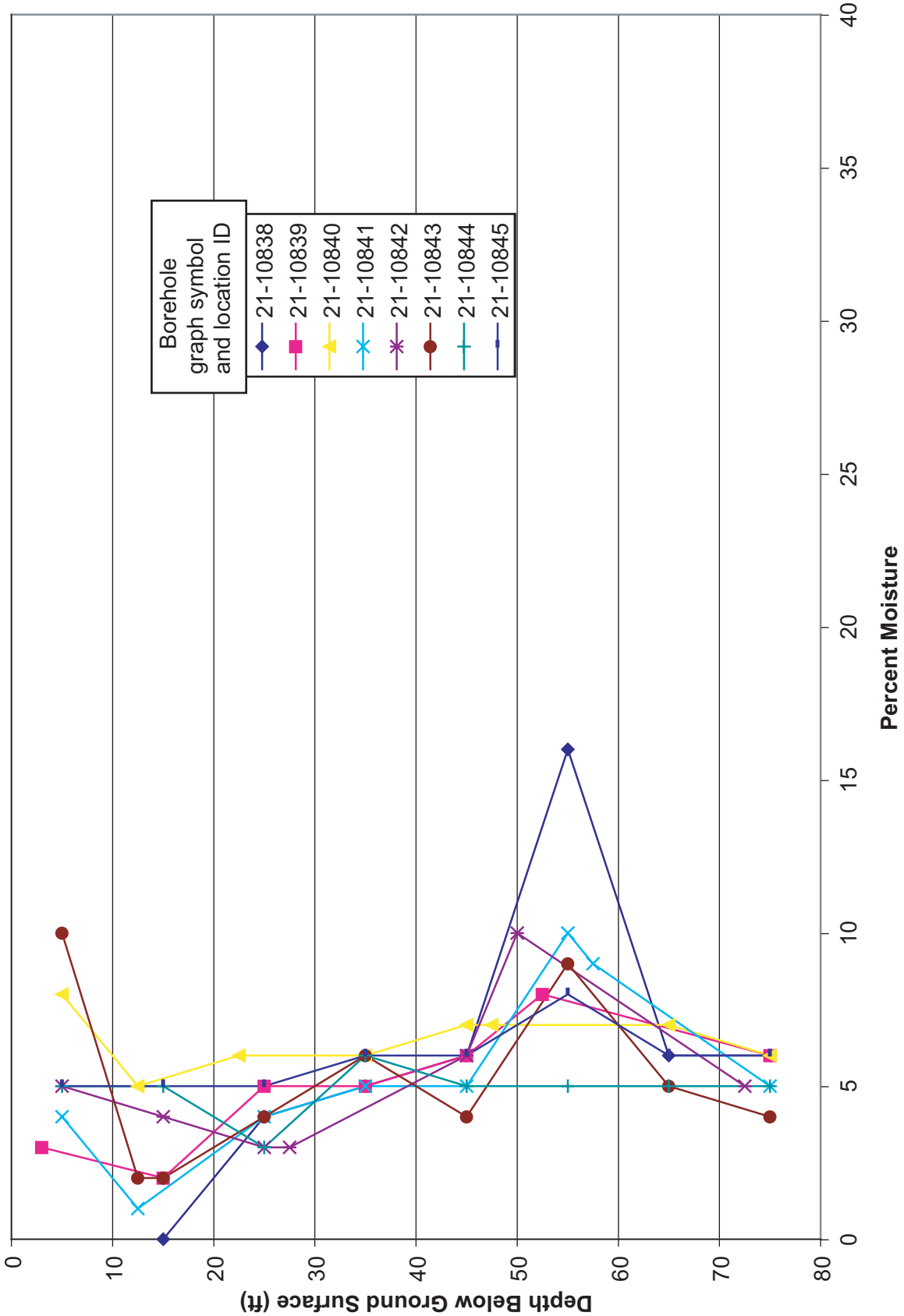


Figure 3.4-10. MDA U moisture profiles from 1998 borehole investigations

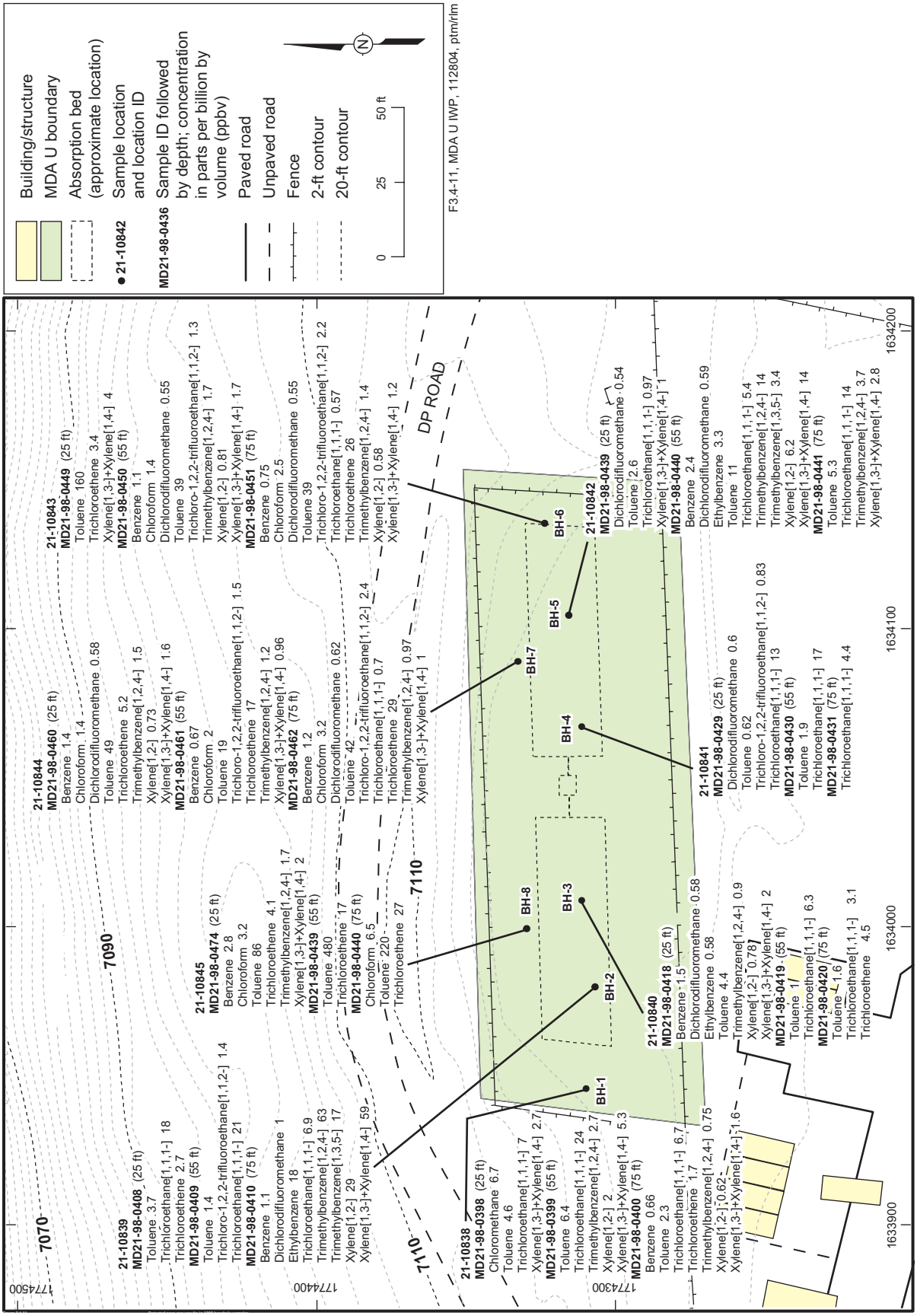


Figure 3.4-11. Detected pore-gas results in 1998 borehole samples

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[j]	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.**[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**
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[1]	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[1]	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[J]	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.

Response to the "Notice of Disapproval for the Investigation Work Plan for Solid Waste Management Unit 21-017(a)-99, Material Disposal Area U, at Technical Area 21 Los Alamos National Laboratory (LANL), EPA ID #NM0890010515 HWB-LANL-04-015" Dated January 28, 2005

INTRODUCTION

This submittal is the response by Los Alamos National Laboratory (LANL or the Laboratory) to the "Notice of Disapproval for the Investigation Work Plan for Solid Waste Management Unit 21-017(a)-99, Material Disposal Area U, at Technical Area 21," issued by the New Mexico Environment Department (NMED) Hazardous Waste Bureau on January 28, 2005, and received by LANL on February 4, 2005. The Investigation Work Plan for Material Disposal Area U, Solid Waste Management Unit 21-017(a)-99, at Technical Area 21 (LA-UR-04-7268, 87454) was submitted by LANL to NMED in November 2004.

To facilitate review of these responses, NMED's comments are included verbatim in italics. The comments are divided into general and specific categories as presented by NMED. LANL's responses follow each NMED comment.

GENERAL COMMENTS

NMED Comment

1. *Figure 2.1-1 in the Historical Investigation Report (HIR) is incorrectly labeled. All MDA boundaries should be in green and buildings/structures in yellow. The figure shows all MDAs in yellow except MDA V. The Permittees must ensure the legend corresponds to the figure.*

LANL Response

1. LANL has revised Figure 2.1-1 from the historical investigation report (HIR) for MDA U to ensure that the legend corresponds to the figure. Two replacement pages showing the revised figure are provided with this response.

NMED Comment

2. *There are a handful of items listed in Section 8.0, References that are not included in the Reference Set for TA-21. NMED cannot adequately evaluate the work plan without reviewing the references provided throughout the report. The Permittees must supply these references to the NMED for review. A list of these references is attached.*

LANL Response

2. LANL has included four of the six missing references (Benson 2004, 87383; LANL 1995, 54320; Francis 1996, 76137; and Walker 1981, 06277) along with the MDA A TA-21 reference set update, which will be delivered to NMED in early March 2005. Christensen 1973 (00940) was already included in the existing TA-21 reference set. The remaining reference (LANL 2004, 87454) is the HIR for Material Disposal Area U, which was submitted to NMED on November 30, 2004, along with the MDA U work plan, which has the same ER ID number (87454).

SPECIFIC COMMENTS

1. Section 2.1, Operational History, page 3, paragraph 1

NMED Comment 1, Part 1

The Permittees must provide more information regarding the trench that was dug in 1985. There is no map showing the location of the excavation and no explanation as to why records at TA-54 only show that 3000 ft^3 of material was taken for disposal at Area G. The Permittees must explain where the remaining 5000 ft^3 of material is located.

LANL Response to Comment 1, Part 1

LANL has conducted a thorough search of existing records and has determined that further documentation and data concerning the 1985 excavation effort do not exist. The best available information has been presented comprehensively in the HIR and summarized in the work plan. As discussed in Section 3.2 of the HIR for MDA U, LANL has assumed that the referenced trenches were installed along the centerline of the east and west absorption beds. This is consistent with the identified objective of the 1985 excavation activity, which was to remove the subsurface pipelines and distribution box located along the centerline of the MDA U absorption beds. However, any figure representing the 1985 trench location would be speculation.

As indicated in Section 2.1 of the work plan, material above the pipelines was excavated, stockpiled, and used to backfill the pipeline trench. The best available information indicates that the remaining 5000 ft^3 of excavated material were returned to the site.

NMED Comment 1, Part 2

Figure 2.1.2 does not show the distribution lines from all buildings that contributed waste to MDA U. The Permittees must include on a figure the location of the distribution line from the cooling tower at Building 21-155 to the MDA U western absorption bed and explain if the line is part of this investigation.

LANL Response to Comment 1, Part 2

Figure 2.1-2, as presented in the work plan, shows the best available information regarding the former location of the distribution line from the cooling tower associated with Building 21-155. This undocumented line, which ran into the west end of the western MDA U absorption bed, was discovered during the 1985 excavation activities. Although this former distribution line is not part of SWMU 21-017(a)-99 and is not specifically addressed in the investigation work plan for MDA U, borehole location 21-10838, drilled and sampled in 1998, falls in the immediate area of the former line (see work plan figure 4.2-1). This location had trace concentrations of tritium and organic chemicals in soil vapor at the total depth of 75 ft below ground surface (bgs). Metals, which are commonly associated with cooling tower effluent, were detected to a depth of 55 ft bgs at concentrations just above background values.

2. Section 2.5.1.2, Pre-RFI Subsurface Sampling, page 7

NMED Comment

Based on the information provided on page 5 , Section 2.4, MDA U Waste Inventory, Christenson (Christenson 1973, 0440.1) suggests that the primary contaminant at MDA U is Polonium-210 followed closely by actinium-227. The Permittees must explain why these constituents were not analyzed in the 1983 subsurface sampling event.

LANL Response

The following radionuclide data are provided for informational purposes only. No information has been found to indicate why samples from the 1983 subsurface investigation were not analyzed for polonium-210 and actinium-227. Polonium-210 has a half-life of 138 days, and is unlikely to have been a significant concern in 1983, by which time 40 half-lives had passed. Presently, polonium-210 has undergone nearly 100 half-lives since operational discharges from Buildings 21-152 and 21-153 ceased in 1968, and has decayed to undetectable levels. Therefore, it is not included in the current analytical suite prescribed in the work plan for MDA U. LANL has analyzed and evaluated actinium-227 progeny activity levels in investigations conducted since the inception of the RCRA corrective action process at MDA U. In addition, the MDA U work plan prescribes alpha spectroscopy analysis for all samples specifically to define the extent of actinium-227 progeny at MDA U.

3. Section 4.2, Subsurface Investigations, page 14, paragraph 3

NMED Comment

The Permittees must also state that if the Qbt2 unit is not reached by the estimated 120 ft bgs, the borehole will be drilled until the appropriate depth (20 ft into Qbt2) is attained. As a reminder, in accordance with Section X.B.2.b.i, Drilling, of the proposed Consent Order, the boreholes must be drilled 25 feet past the last detected contamination based on field screening, laboratory analyses, and/or previous investigations at the site.

LANL Response

LANL explicitly states in Section 4.2 (page 14, paragraph 3) of the work plan for MDA U that the boreholes will be advanced 20 ft into unit 2 of the Tshirege Member of the Bandelier Tuff. LANL will ensure that all boreholes are advanced at least 20 ft into Qbt 2, regardless of total depth of the borehole. LANL will also ensure that all boreholes will be drilled to a minimum total depth 25 ft beyond the deepest interval from which a sample containing a detectable level of a contaminant was collected, based on the field screening methods prescribed in the work plan.

4. Table 4.0-1, Crosswalk between NMED Proposed Consent Order (September 2004) and LANL Response for Investigation Activities at MDA U, pages 53-58

NMED Comment 4, Item 3

NMED does not agree with the justifications provided by the Permittees for this item. Boreholes proposed to the Cerro Toledo interval in the MDA A &T work plans are not suitable for assessing the conditions beneath MDA U. The eight boreholes drilled in 1998 to 75 ft, did not determine lateral or vertical extent of contamination based on the analytical results provided in various figures and tables in this work plan (i.e. Figure 2.5-6). Based on information provided in the HIR, the Permittees identified soil and vegetation contamination outside the MDA U fenceline in 1980 and 1984. Also, the extent of the fractured/clay interbed zone has not been defined and is a potential contaminant migration pathway. Based on this information, the Permittees must complete the additional boreholes at the locations identified by NMED (see attached map) to determine lateral and vertical extent of contamination. If contamination is found in any of the boreholes, the Permittees must use a 'step-out' approach to determine lateral extent of contamination.

LANL Response to Comment 4, Item 3

LANL acknowledges that the extent of contamination has not been determined. The four boreholes prescribed by the MDA U work plan are positioned to address the remaining data issues at the site. Specifically, these boreholes

- bound the lateral extent of mercury contamination to the south, which has already been defined to the north, east, and west (borehole 1);
- penetrate the fractured/clay interbed zone and provide data addressing contaminant migration along this potential pathway (boreholes 1, 2, and 3);
- define lateral extent of actinium-227 contamination, which is believed to be confined to the eastern absorption bed and the interbed zone (boreholes 1, 2, and 3);
- define lateral extent of tritium contamination identified at shallower depths (boreholes 1, 2, and 3);
- define extent of uranium contamination that remains undefined to the west of the site and possibly vertically (boreholes 1 and 4);
- define the vertical extent of low-level (<1 pCi/g) tritium contamination identified at a depth of 75 ft (borehole 4);
- define the extent of mercury contamination at depth (borehole 4); and
- support the characterization of a subsurface vapor plume should the presence of such a plume be verified (boreholes 1, 2, 3 and 4).

If contamination is detected in any of the four boreholes described in the MDA U work plan, the additional boreholes proposed by NMED will not allow further definition of the lateral extent of contamination because they are all roughly the same distance away from the source (i.e., the absorption beds). However, implementation of a step-out approach will enable full definition of the extent of contamination at MDA U. LANL proposes to implement the step-out approach in the field by using field screening data to determine if the four boreholes prescribed in the MDA U work plan effectively bound the extent of contamination. If screening data indicate the need for supplemental data, additional boreholes will be sited accordingly. Additionally, if analytical laboratory results

indicate that the extent of contamination at MDA U has not been defined, additional sampling will be conducted. This step-out approach, coupled with the approach of drilling and sampling all boreholes to a minimum total depth of 25 ft beyond the deepest detectable contamination (see LANL response to specific comment 3), will ensure that the extent of contamination is adequately determined. Therefore, LANL does not agree that the five additional boreholes as recommended by NMED in the notice of disapproval are appropriate. (Note that application of the step-out approach may yield more boreholes than are currently prescribed by the Consent Order without the five additional boreholes recommended by NMED.)

The 1980 and 1984 investigations referenced by NMED were conducted prior to the inception of the RCRA corrective action process; the results were presented for informational purposes only and have not been used to support any site decisions. LANL has conducted extensive investigations under Module VIII in the areas outside the MDA U fence. These investigations effectively defined the nature and extent of contamination in the surface associated with MDA U, and are discussed in the HIR and work plan for MDA U. The MDA U work plan requires the collection of additional surface samples at all borehole locations, three of which are positioned outside the MDA U fence. Sample results from these locations will effectively address any remaining concerns regarding surface contamination resulting from activities at MDA U.

NMED Comment 4, Item 6

In accordance with Section IV.C.2.f.vi of the proposed Consent Order, the Permittees must submit for review and written approval a work plan to collect subsurface vapor samples.

LANL Response to Comment 4, Item 6

The MDA U work plan describes subsurface vapor sampling. Section 2.6 of the work plan identifies vapor phase data as an explicit data need and objective of the MDA U investigation. Section 4.2.1 identifies organic-vapor field screening as an explicit investigation activity and prescribes the collection of organic-vapor field-screening samples from every 10-ft interval of all boreholes drilled during the investigation. Section 4.2.6 identifies subsurface pore gas sampling for both organic vapors and tritium as an explicit investigation activity and prescribes the frequency and target depths of pore-gas sample collection. Section 4.2.6 further defines the pore-gas data collection activities that will be conducted in the event that air-rotary drilling will be required to install the boreholes. Section 4.2.6 establishes that the initial pore-gas data collected during the investigation prescribed in the MDA U work plan will form the basis of a decision regarding a vapor phase monitoring well installation. Section 5.2 defines the field methods that will be implemented for collecting organic-vapor screening data. Section 5.4 defines the methods that will be implemented during pore-gas sample collection and analysis, and outlines the quality assurance/quality control protocols that will be used to control the quality of pore-gas data. This section also explicitly prescribes the submittal of any required pore-gas monitoring well designs to NMED for their review and approval. Finally, Section 6 explicitly requires the development and submittal of a monitoring plan to NMED for review and approval in the event that a subsurface vapor plume is identified through the implementation of the MDA U work plan.

NMED Comment 4, Item 13

Section 2.4, MDA U Waste Inventory, states that, "Known documentation does not provide any information on the constituents, types, or volumes of non-radioactive waste discharged to MDA U." Based on this statement, NMED recommends that the Permittees select their most contaminated

sample based on field screening results and complete a full analytical suite, as described in Section IV.C.2.f.iv of the Consent Order, on the selected sample. If dioxins, furans, and HE are not detected in the sample, NMED may not require the Permittees to include them in the remainder of the analyses.

LANL Response to Comment 4, Item 13

LANL agrees with the recommendation to select the most contaminated sample based on field screening results and to complete a full analytical suite on the selected sample, as described in Section IV.C.2.f.iv of the Consent Order. If screening results do not indicate contamination, historical data will be used to choose the sample likely to represent the most contaminated area of the site.

Because of scheduling issues associated with analytical turnaround and hold times, the process for determining whether site samples need additional analysis will require a planned and coordinated effort. LANL proposes to proceed with drilling and sample collection activities following standard practices; however, in addition to collecting sample aliquots for the analytical suite prescribed in the MDA U work plan, LANL will also collect additional aliquots for possible dioxins, furans, and HE analysis from all sample intervals. These additional aliquots will be stored under chain-of-custody and in accordance with analytical method requirements while the selected sample undergoes quick-turnaround analysis for dioxins, furans, and HE. The data from the selected sample will be transmitted to NMED, via fax, for their review. Based on NMED's review, the stored aliquots may or may not be submitted for laboratory analysis of dioxins, furans, and HE.

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November 2004
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Investigation Work Plan for Material Disposal Area U, Solid Waste Management Unit 21-017(a)-99, at Technical Area 21

Los Alamos
NATIONAL LABORATORY
EST. 1943

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Environmental Stewardship Division–Remediation Services

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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:

Printed Name	Signature	Title	Organization	Date
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Printed Name	Signature	Title	Organization	Date
David Gregory	for	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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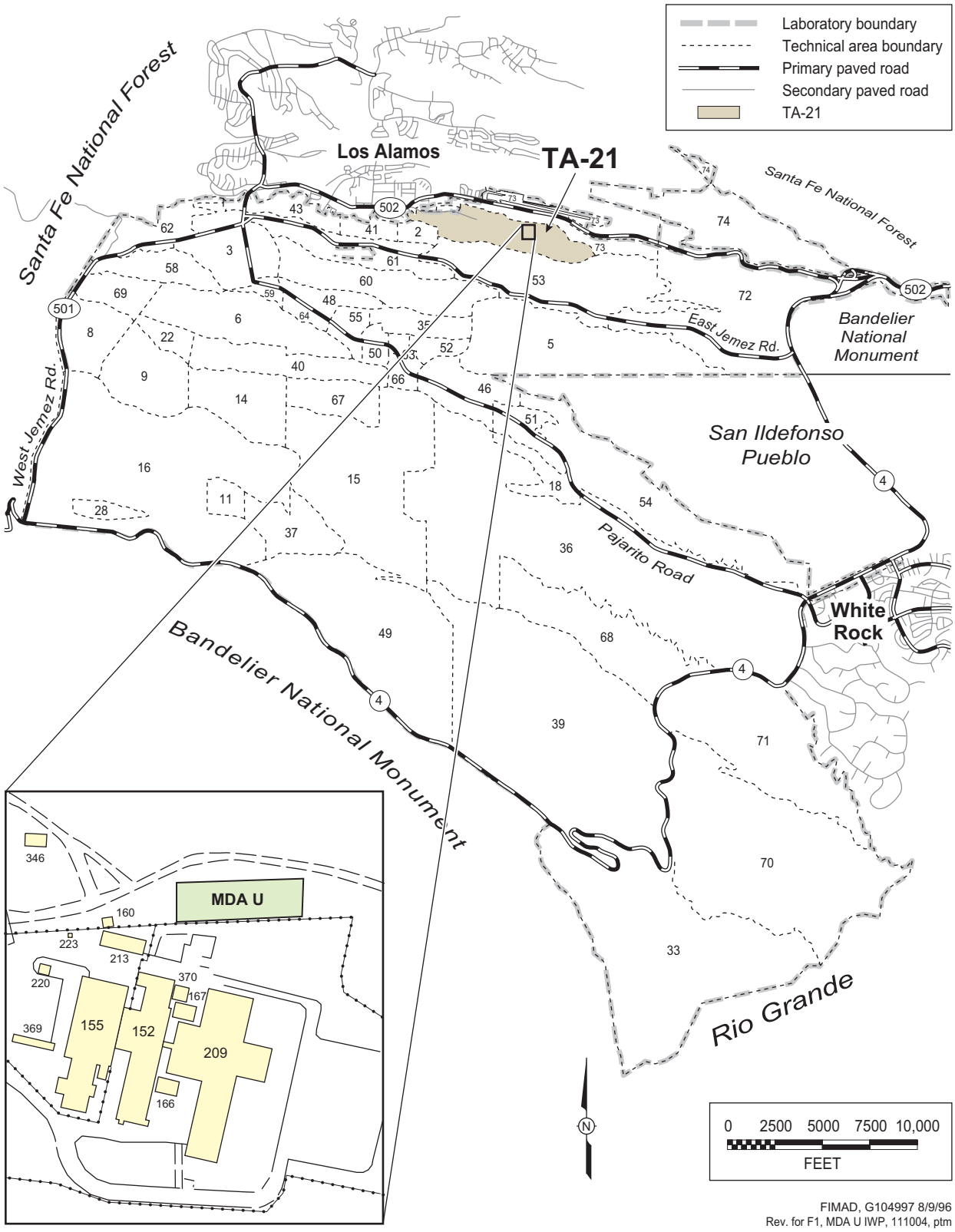


Figure 1.1-1. Location of MDA U in TA-21 with respect to Laboratory technical areas and surrounding land holdings

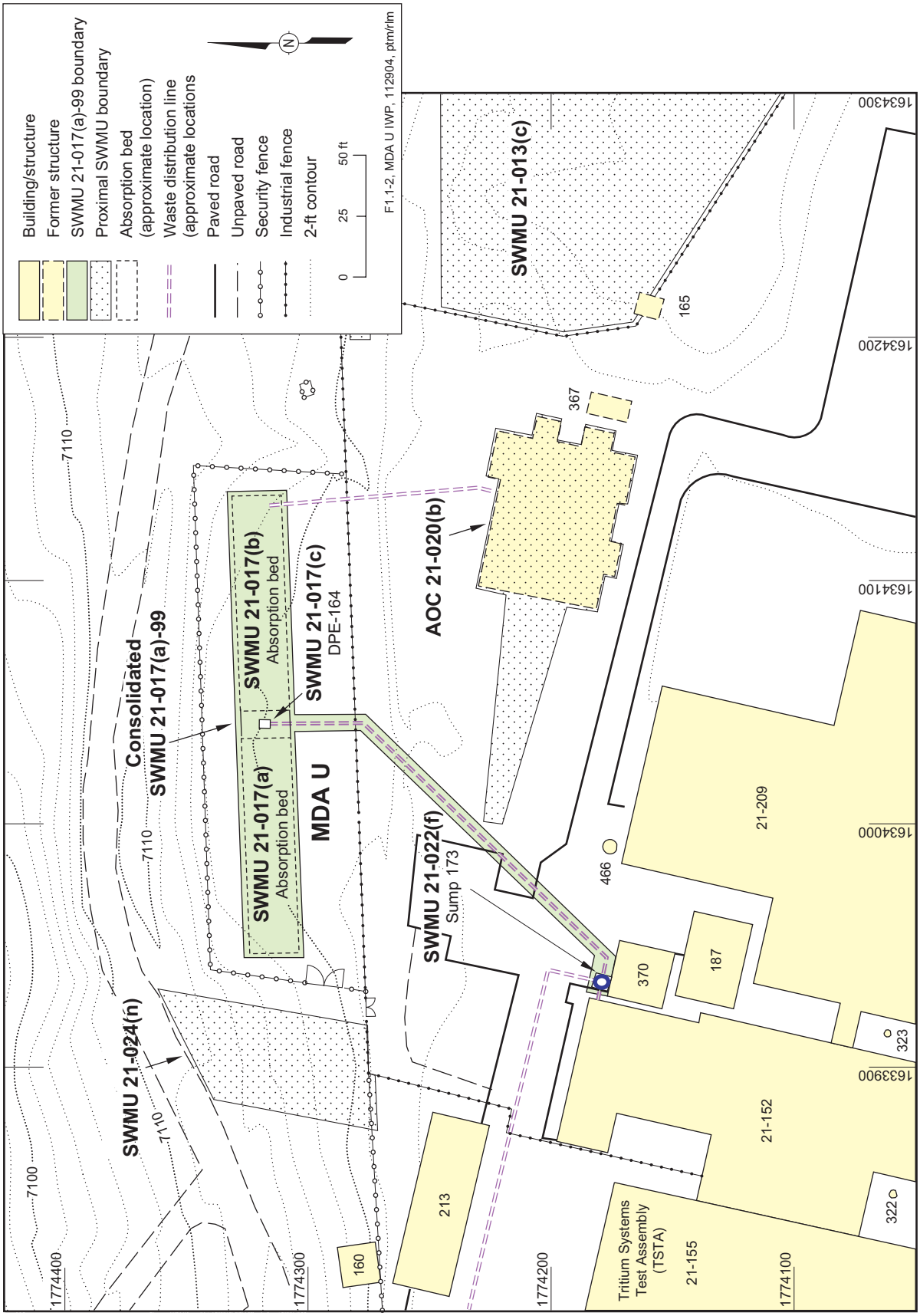
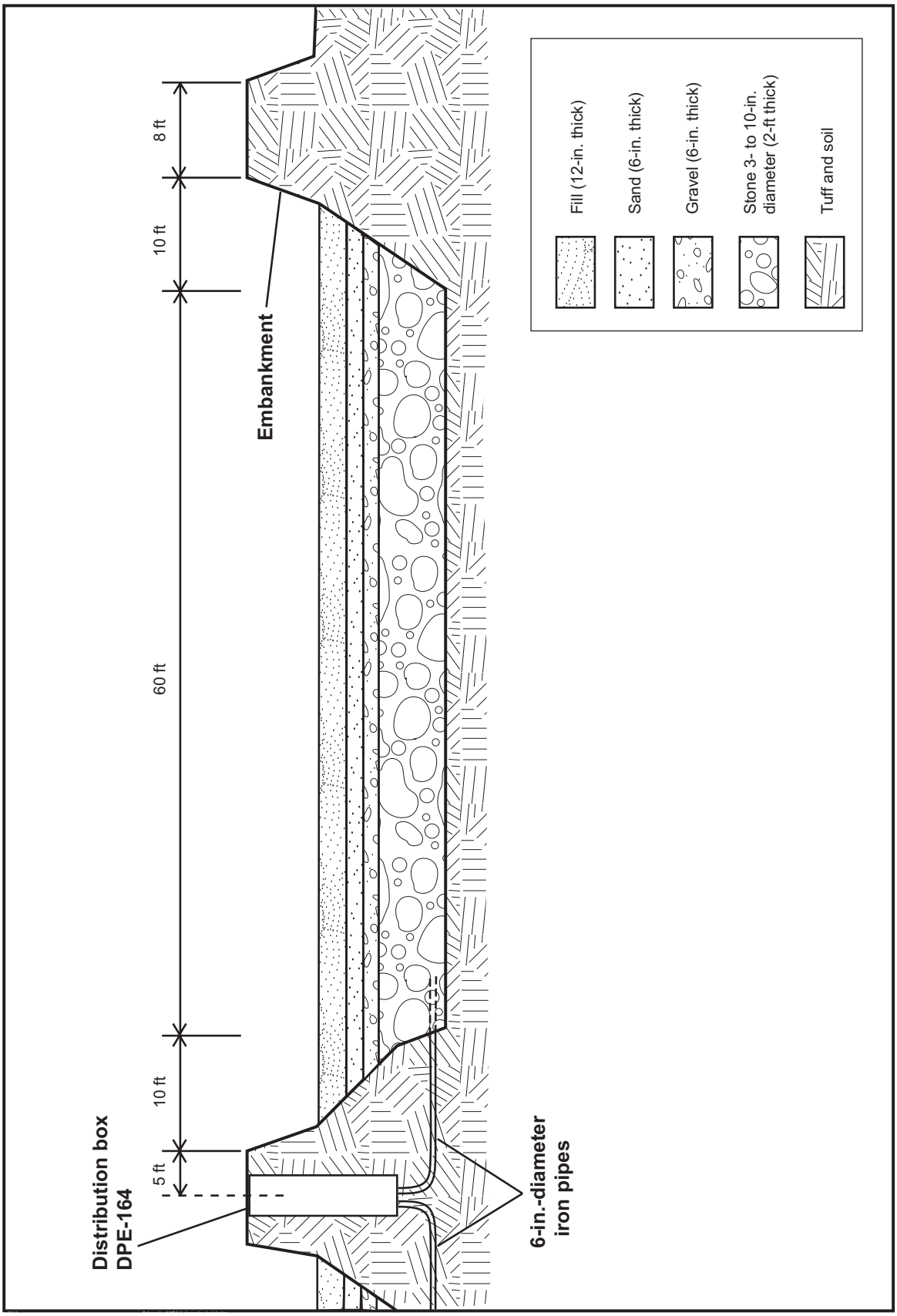


Figure 1.1-2. Site map of MDA U [consolidated SWMU 21-018(a)-99] and adjacent SWMUs/AOCs



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

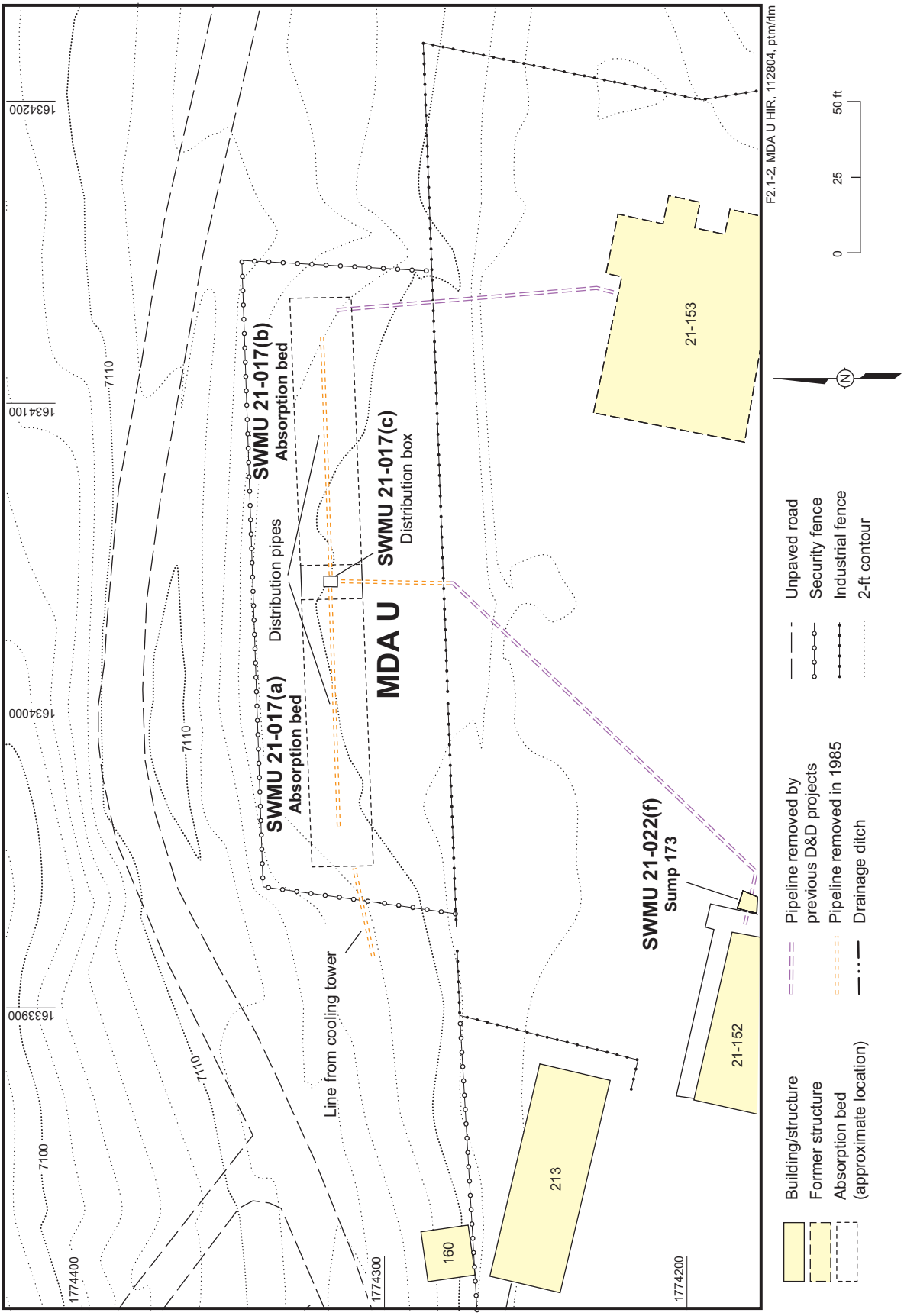


Figure 2.1-2. MDA U pipeline removal schematic

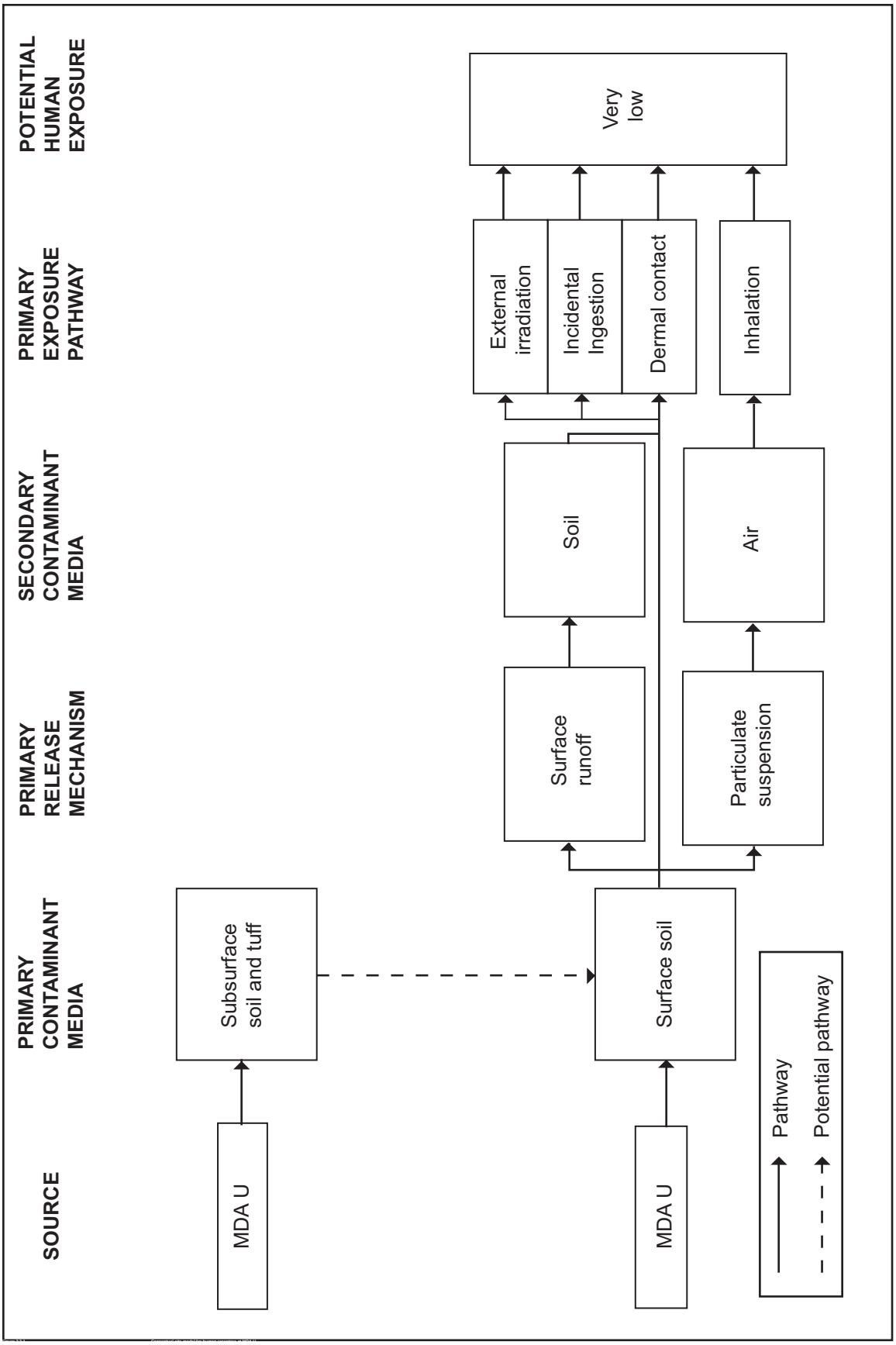


Figure 2.3-1. Conceptual site model for human receptors at MDA U

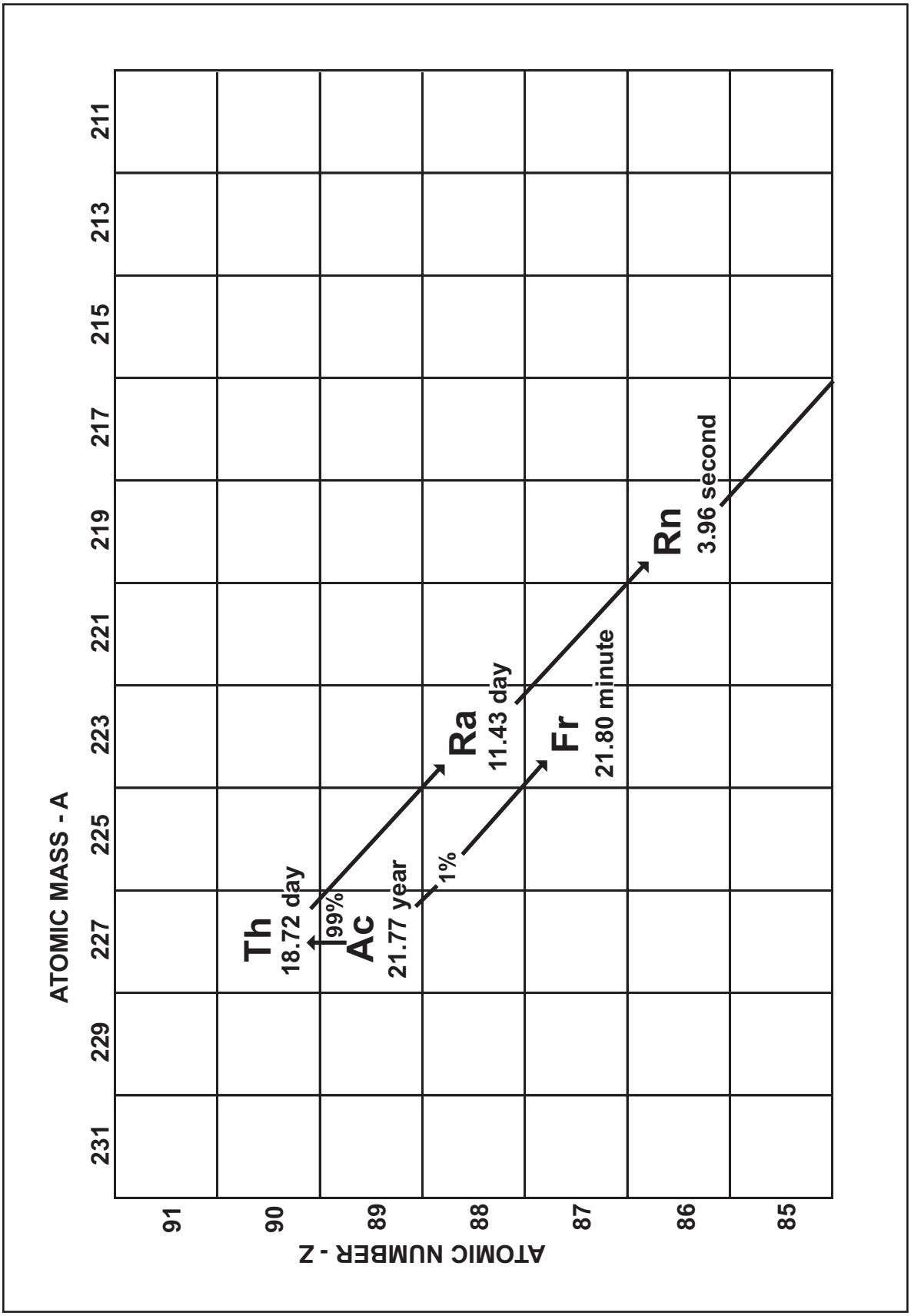


Figure 2.4-1. Decay scheme for actinium-227

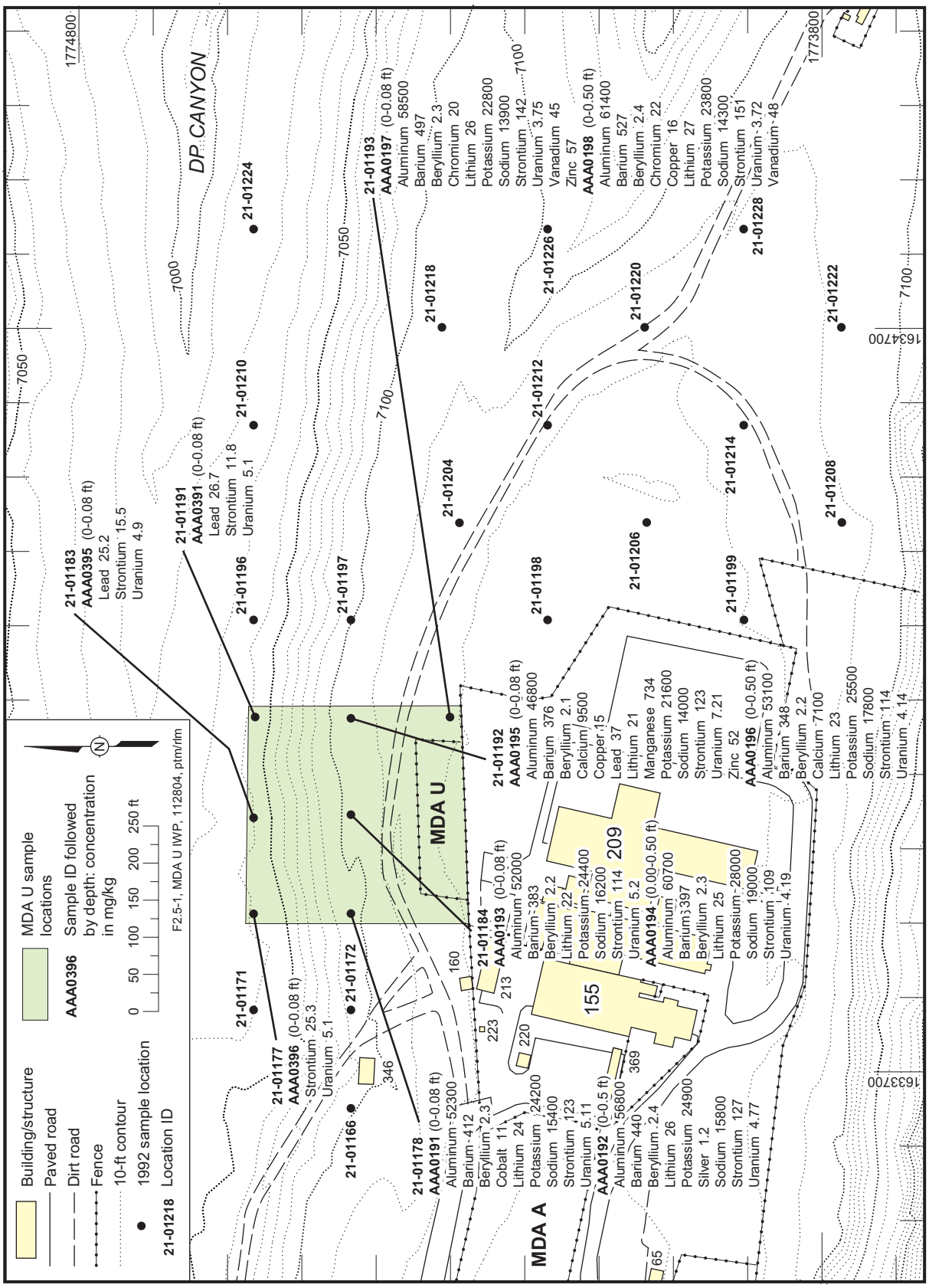


Figure 2.5-1. Inorganic chemicals above background values in 1992 surface samples

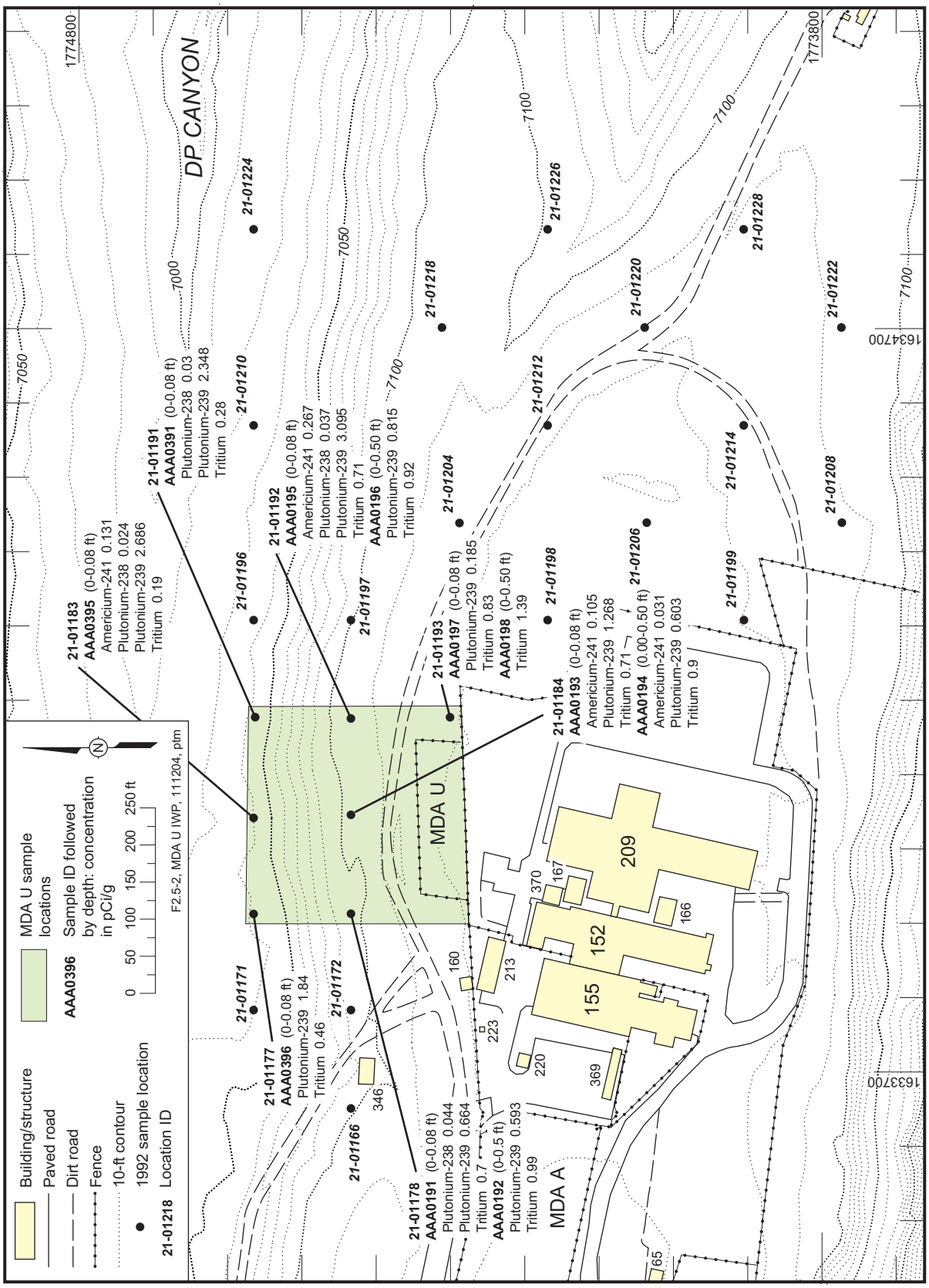
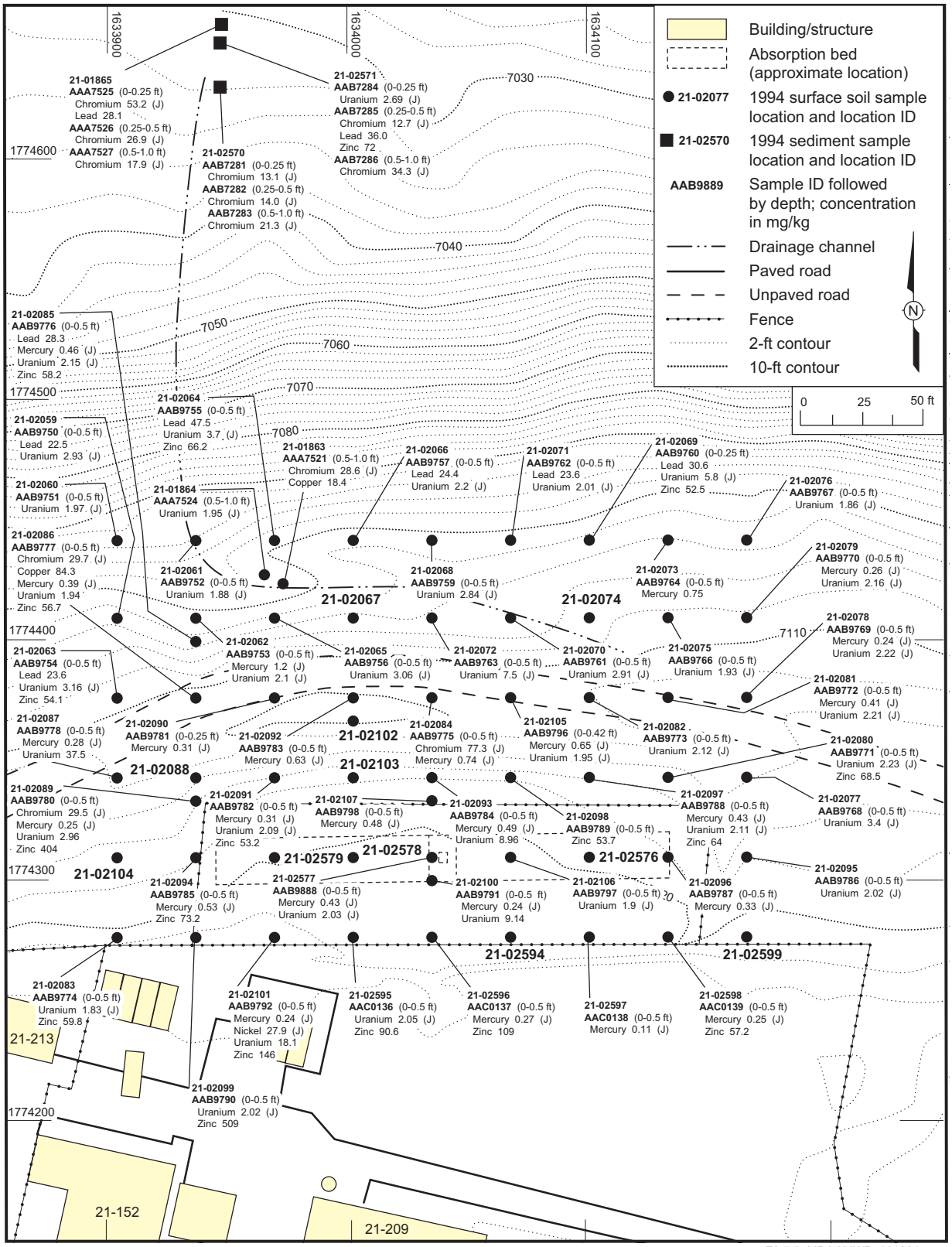
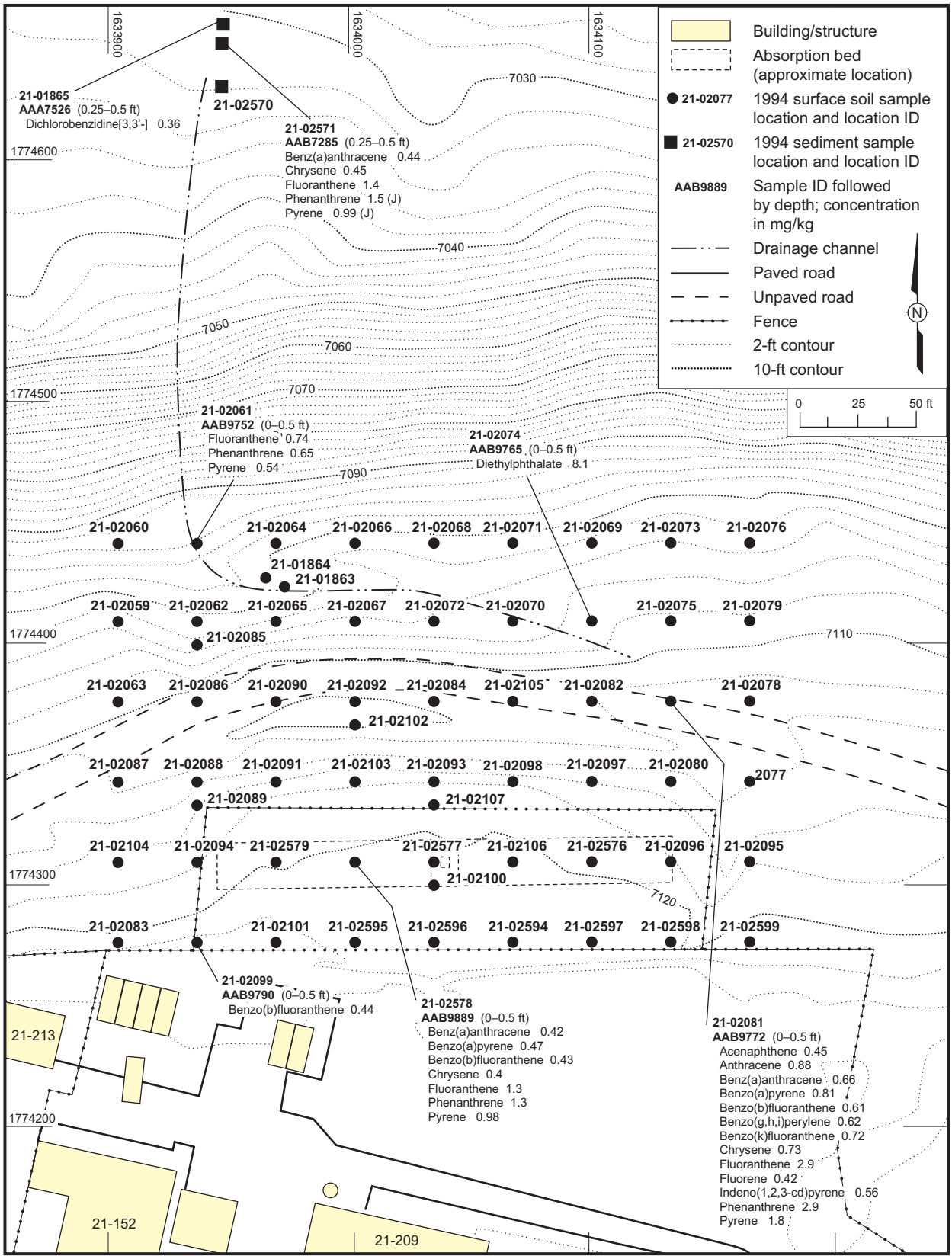


Figure 2.5-2. Radionuclides above background values in 1992 surface samples



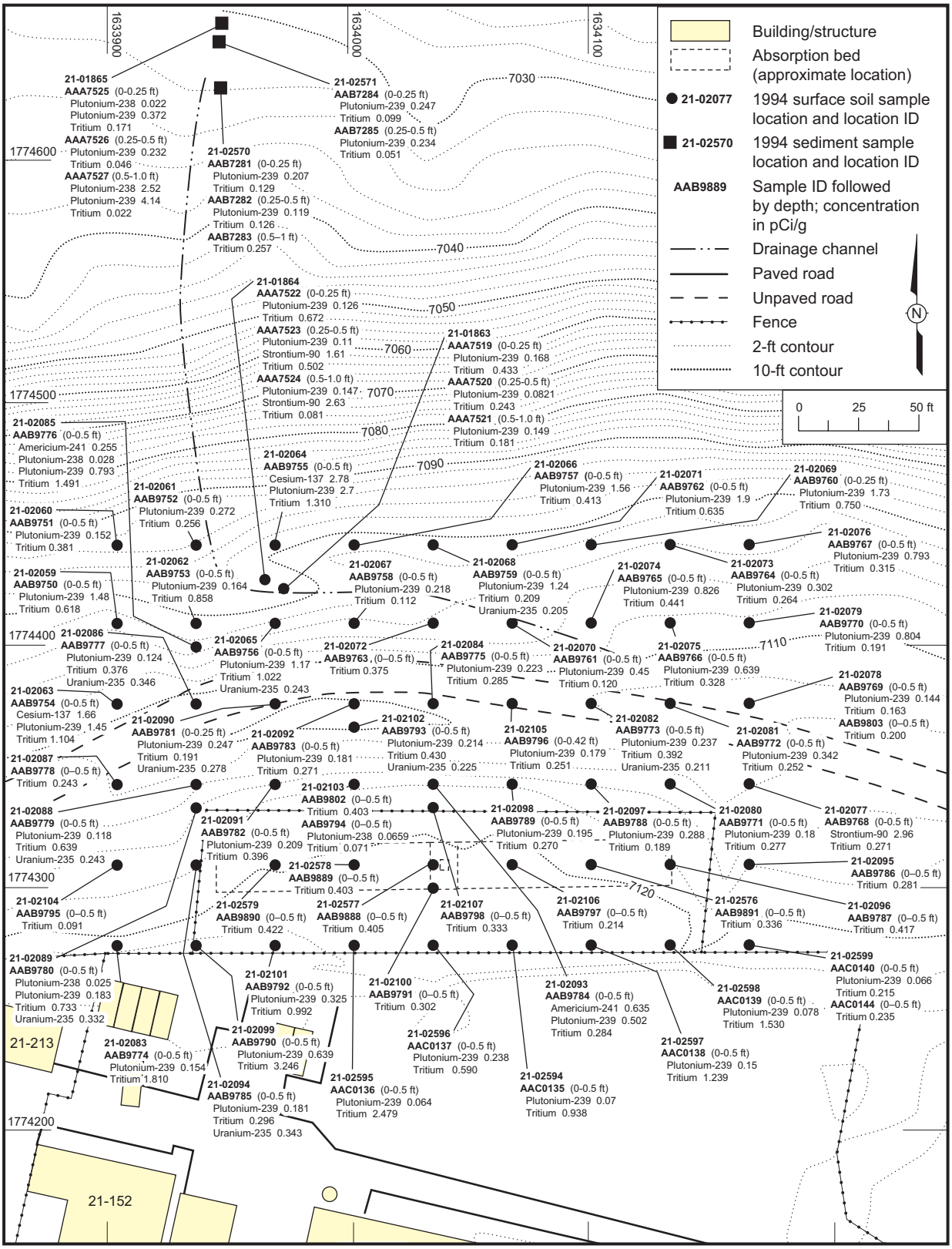
F2.5-3, MDA U IWP, 111004, ptm

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

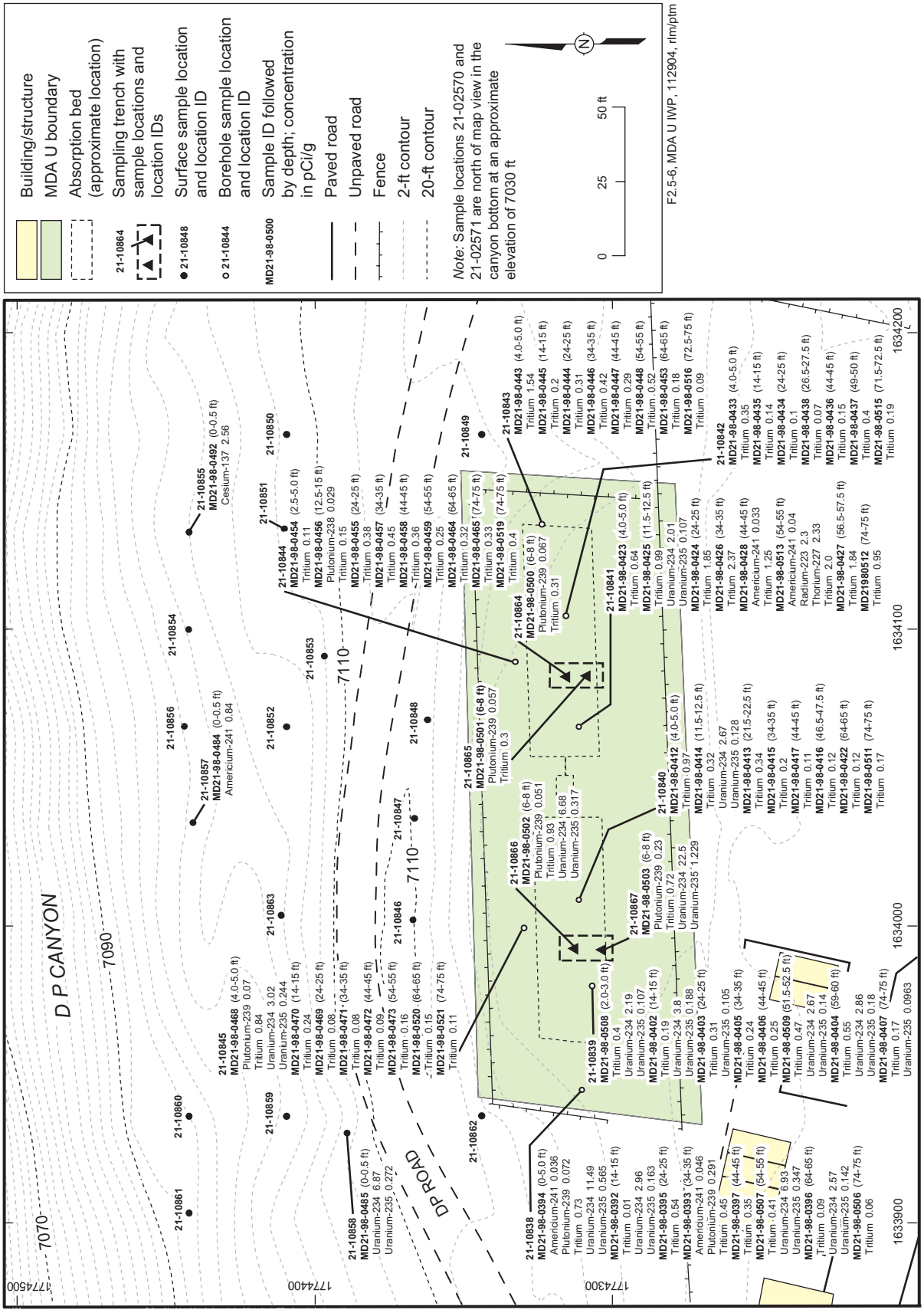


Figure 2.5-6. Radionuclides detected above background values/fallout values in 1998 surface and subsurface samples

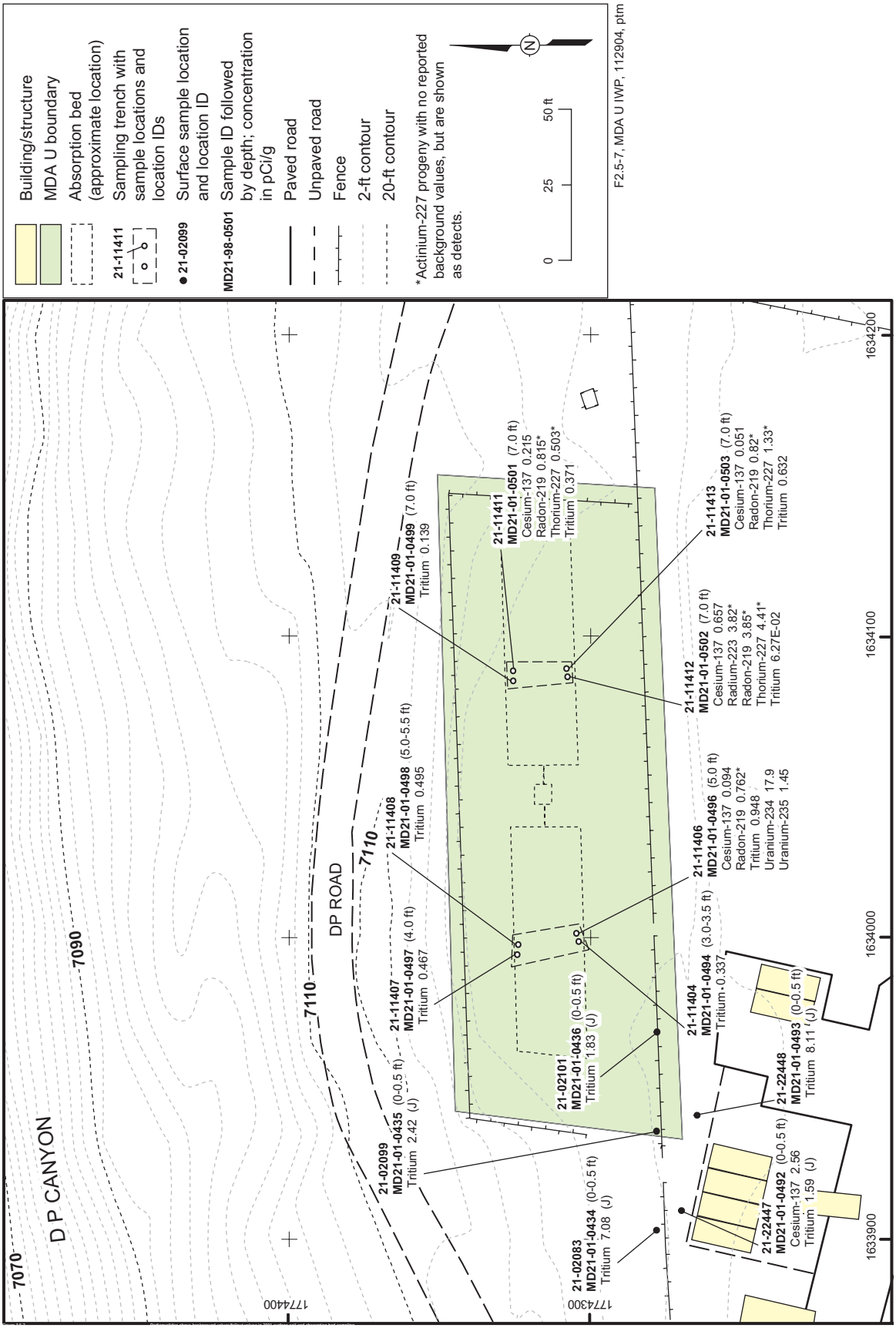


Figure 2.5-7. Radionuclides detected above background values/fallout values in 2001 surface soil and absorption bed sampling

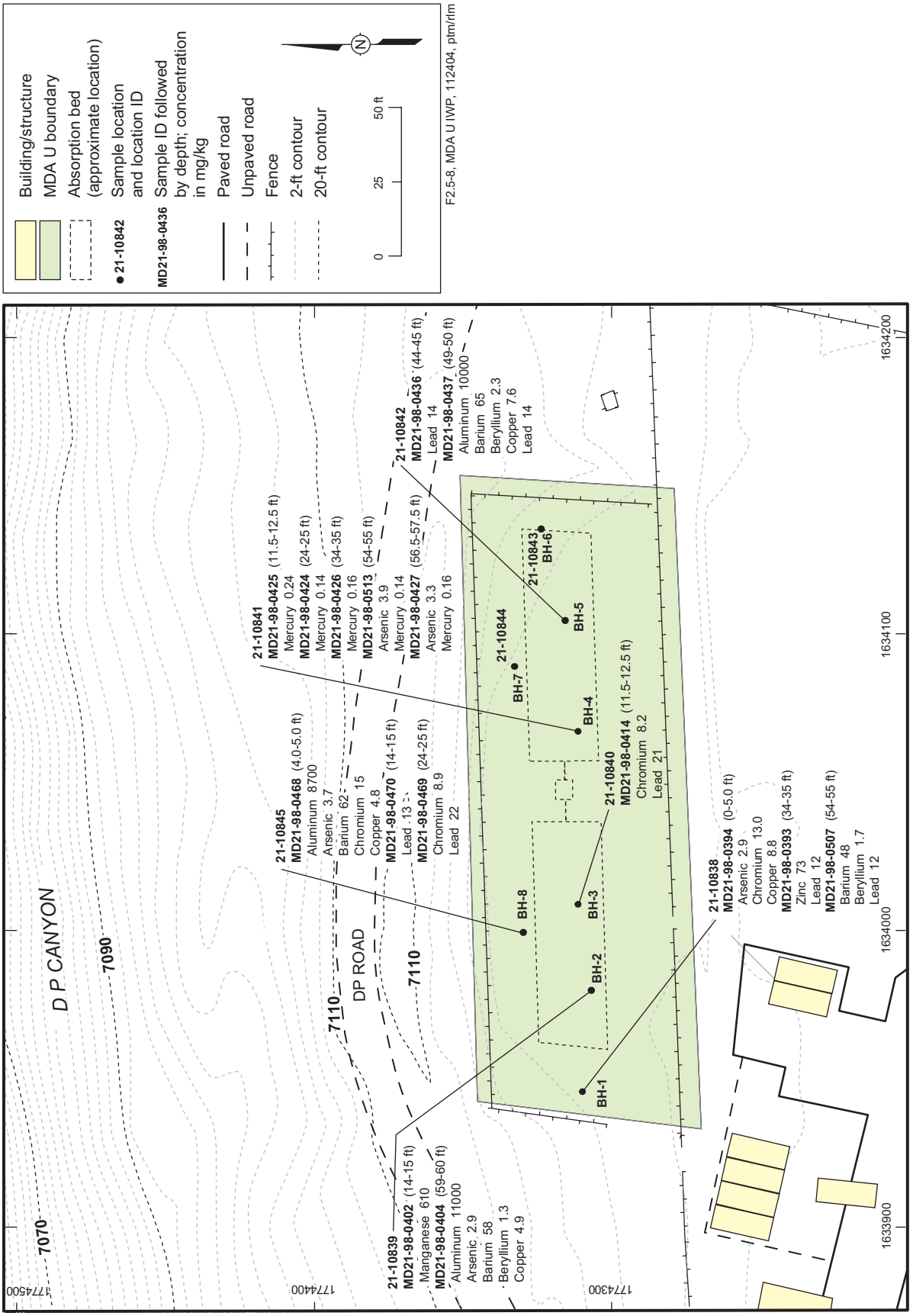


Figure 2.5-8. Inorganic chemicals above background values in 1998 borehole samples

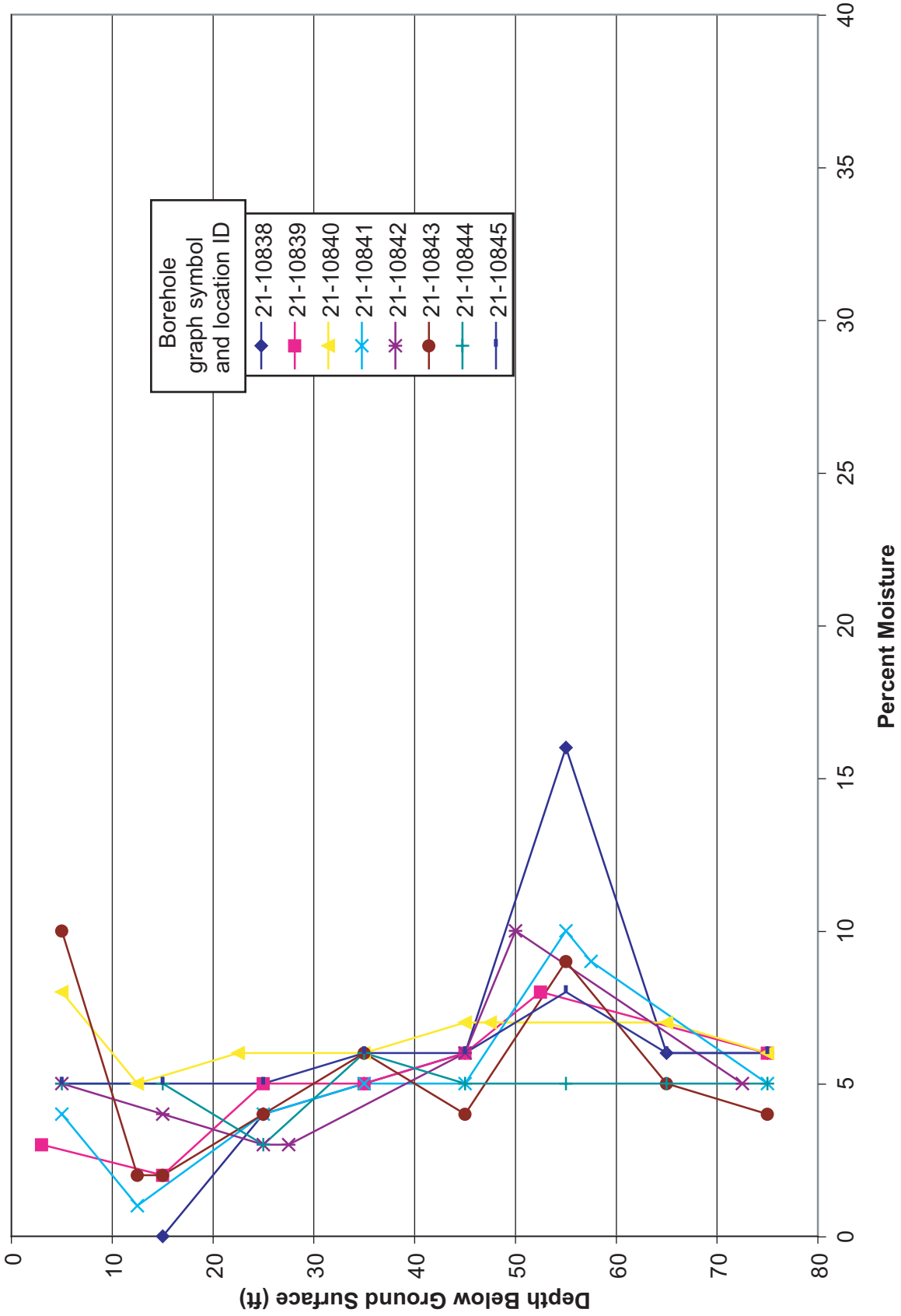


Figure 2.5-9. MDA U moisture profiles from 1998 borehole investigations

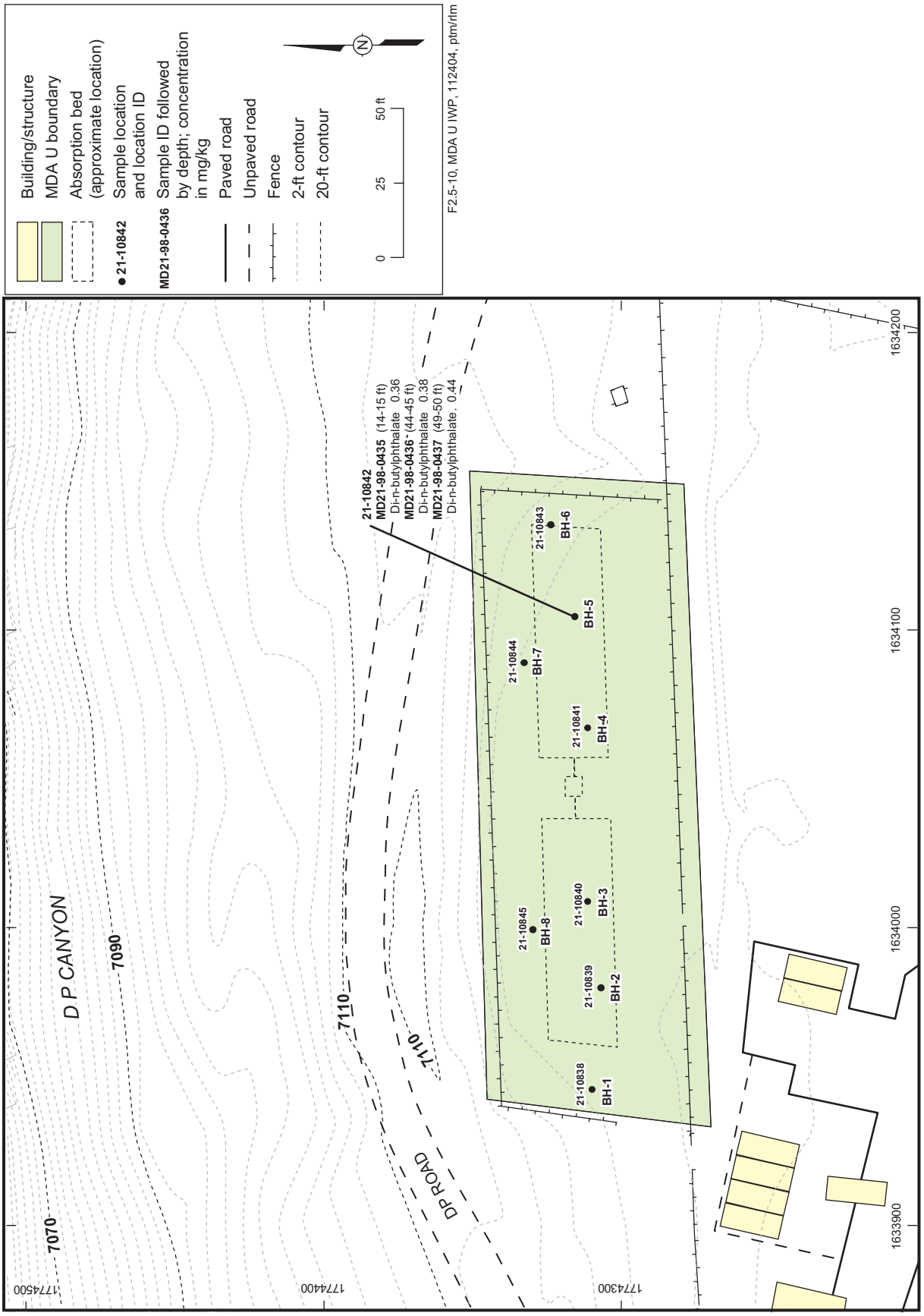


Figure 2.5-10. Organic chemicals detected in 1998 borehole samples

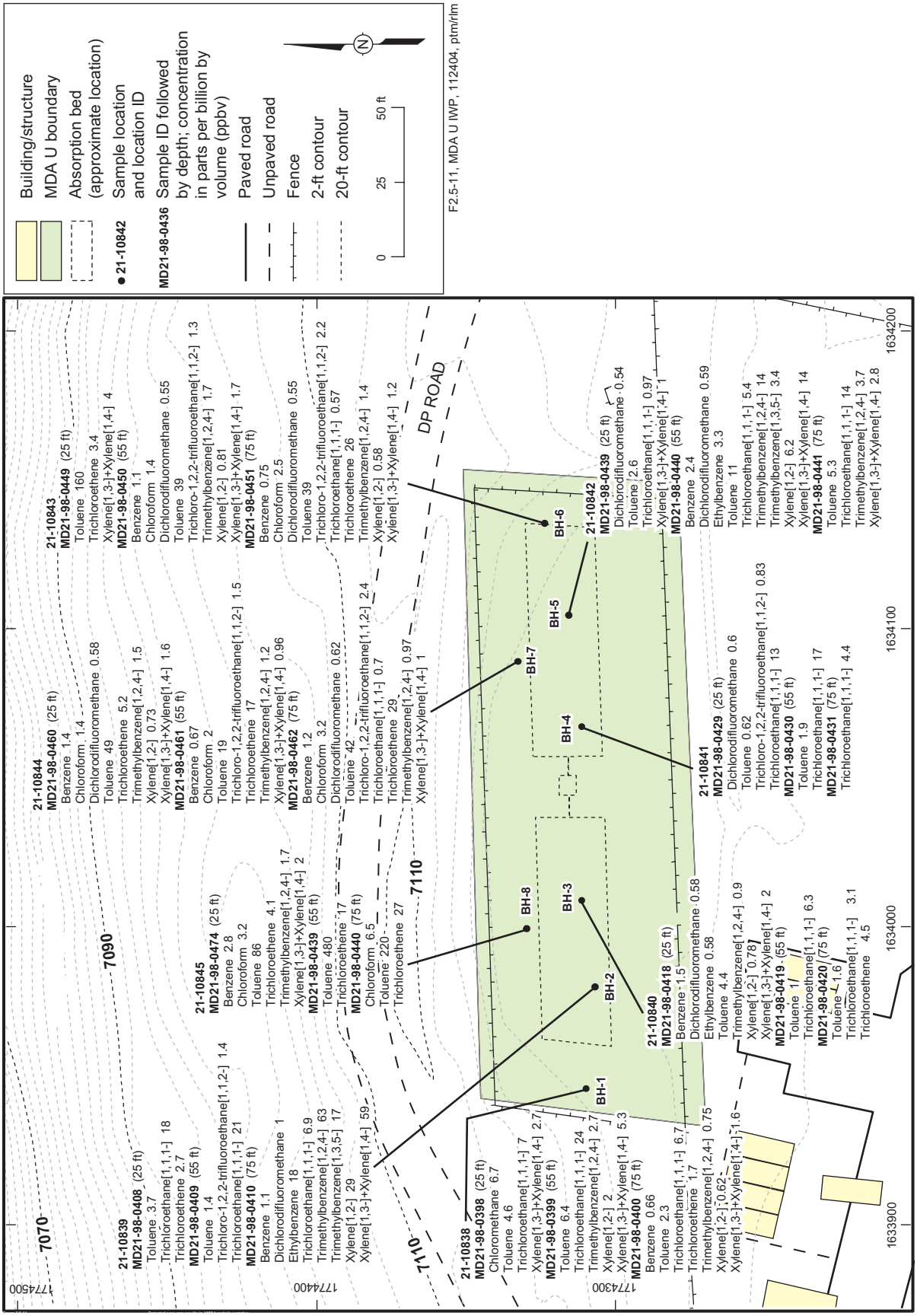


Figure 2.5-11 . Detected pore-gas results in 1998 borehole samples

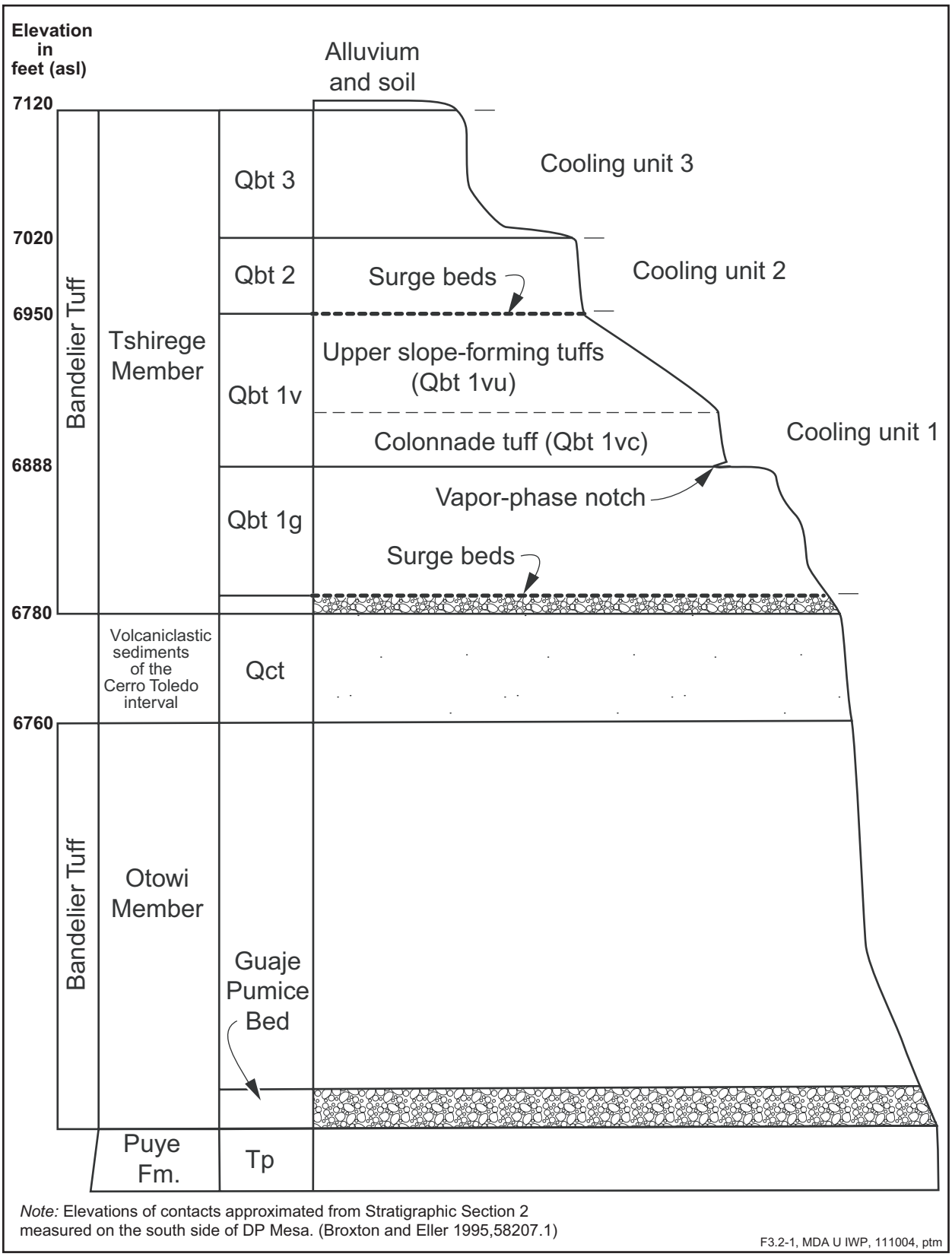
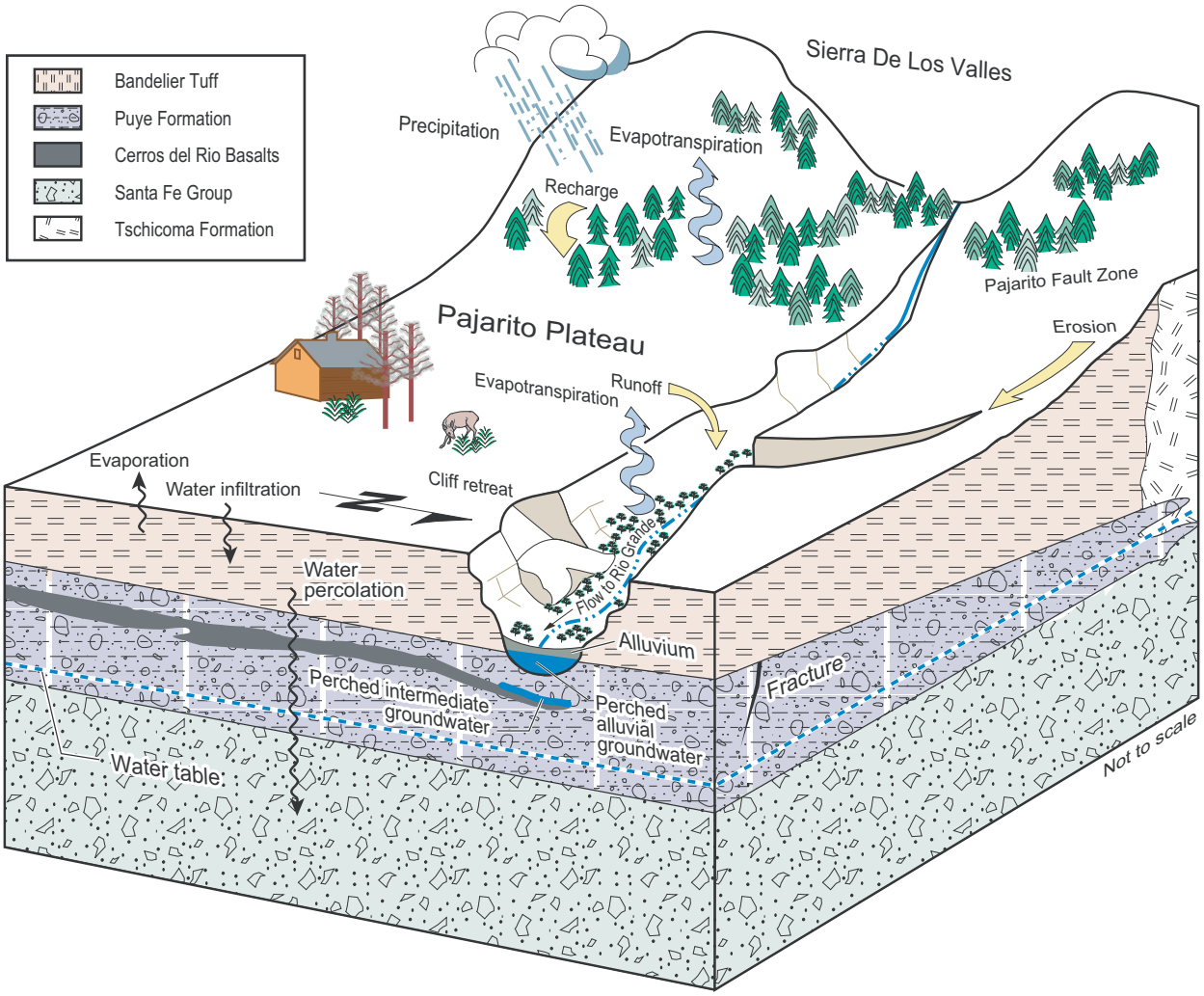


Figure 3.2-1. Generalized stratigraphy under MDA U



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

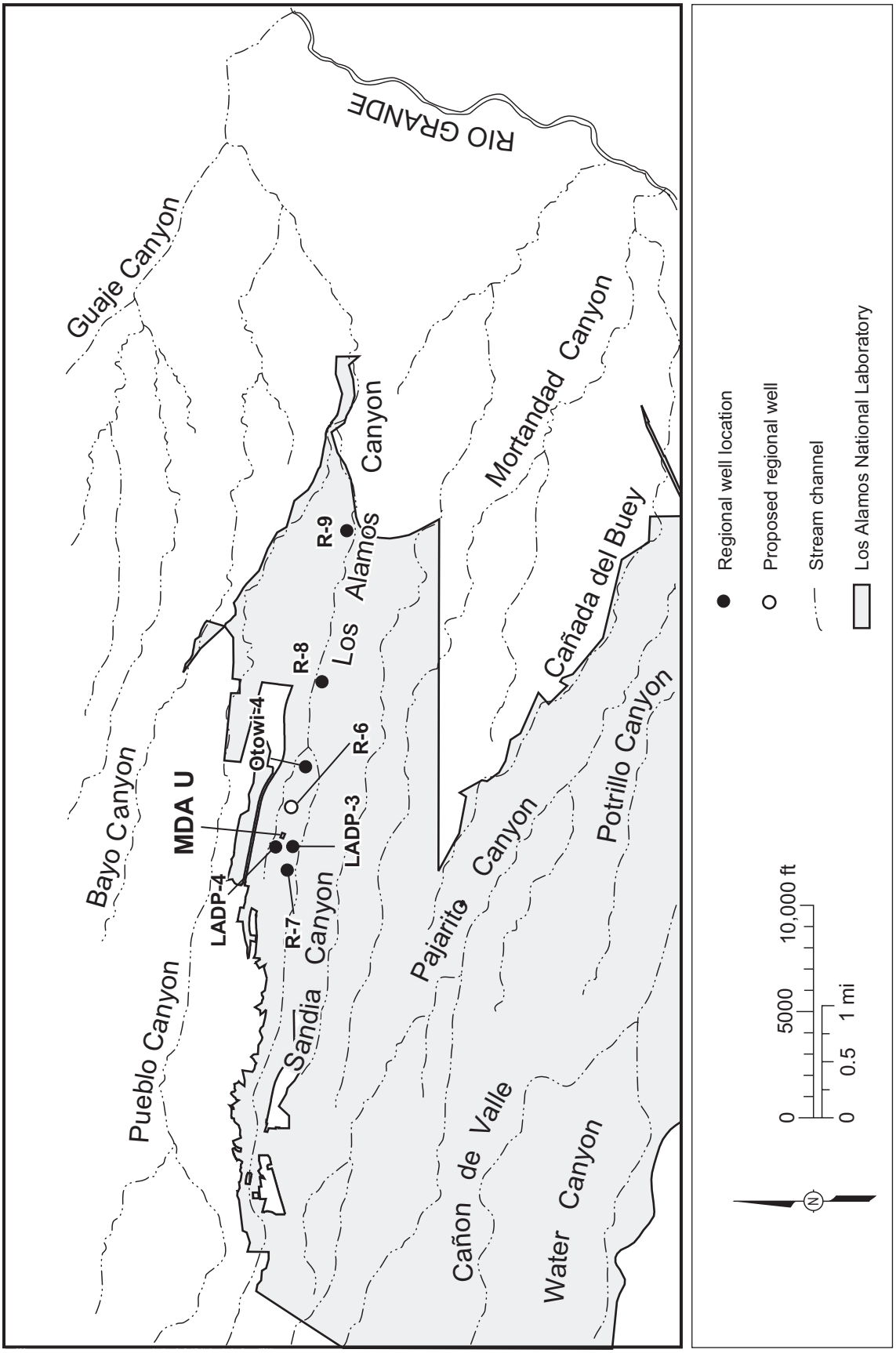


Figure 3.2-3. Locations of wells drilled to the regional aquifer near MDA U

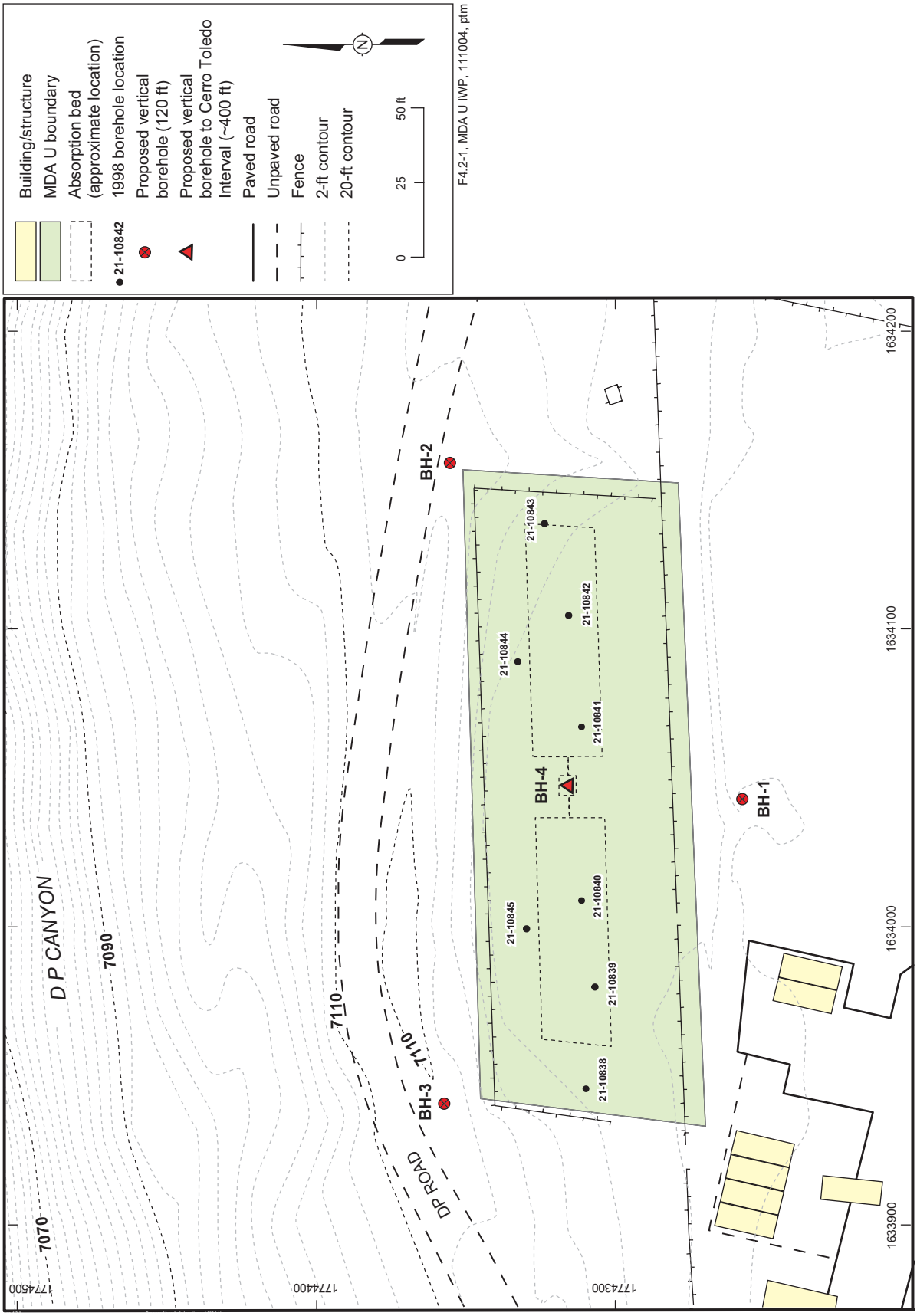


Figure 4.2-1. Proposed borehole locations at MDA U

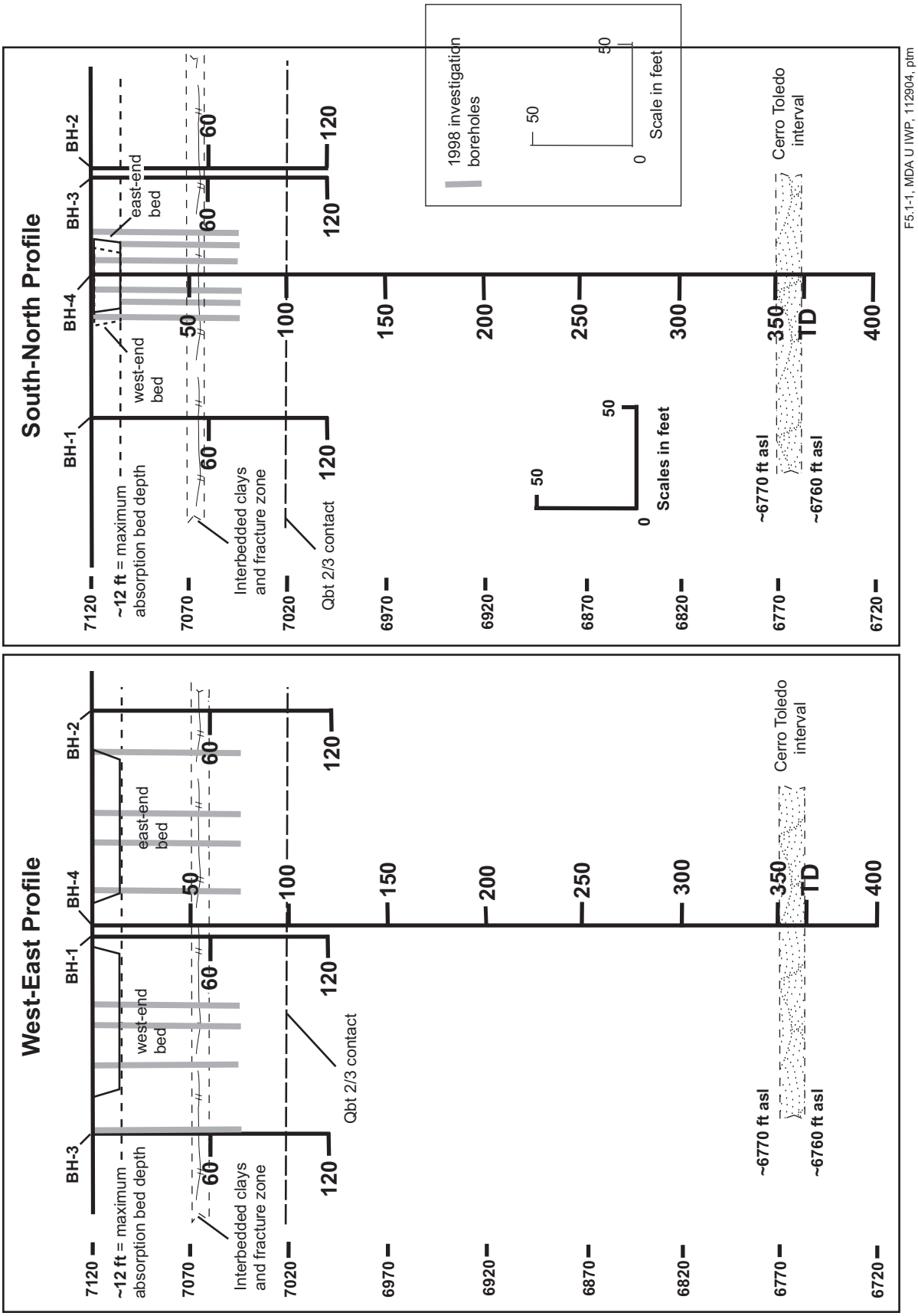


Figure 5.1-1. East-west and north-south profiles of the four proposed boreholes at MDA U

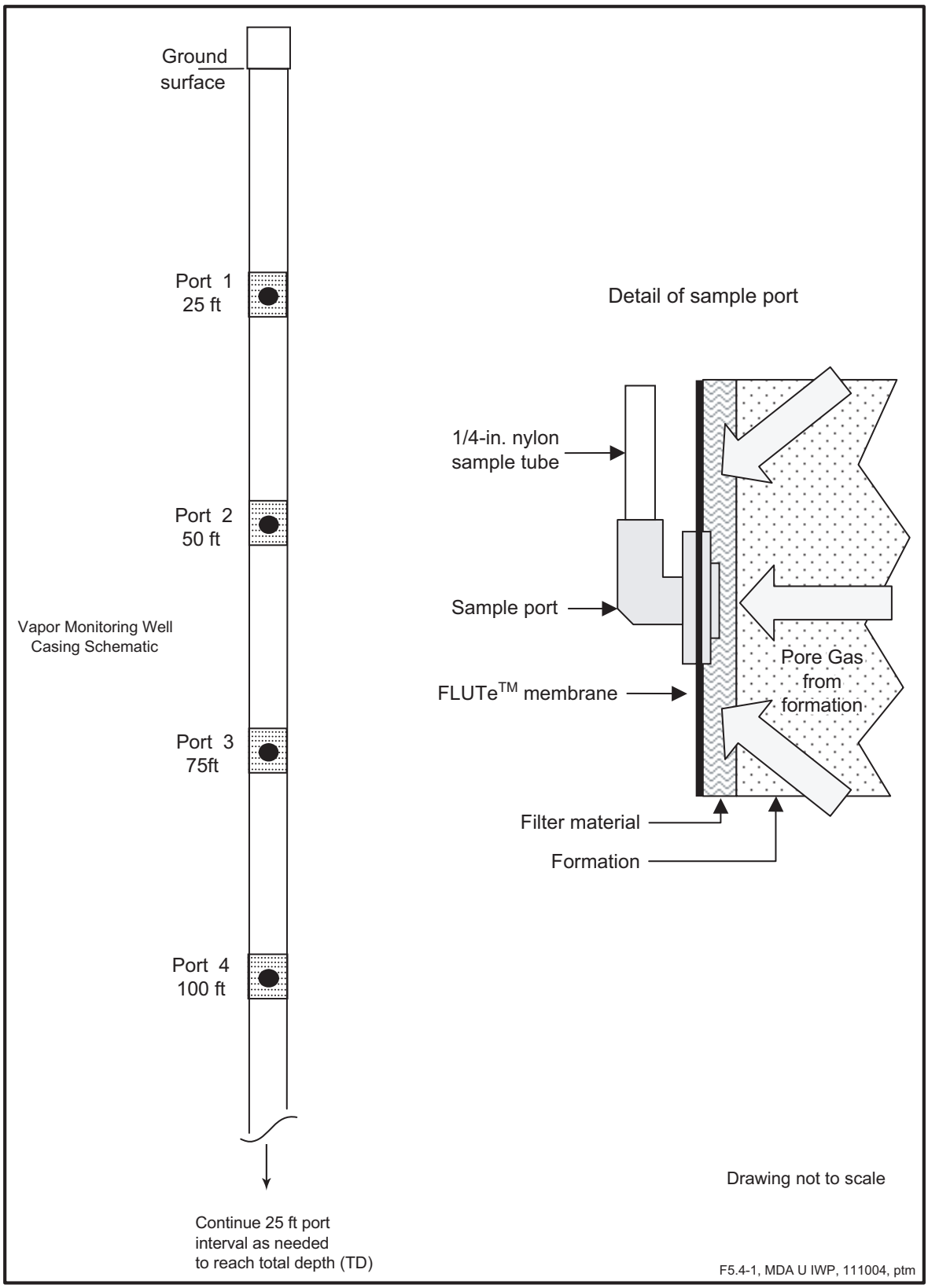


Figure 5.4-1. General diagram for construction of a vapor-monitoring borehole

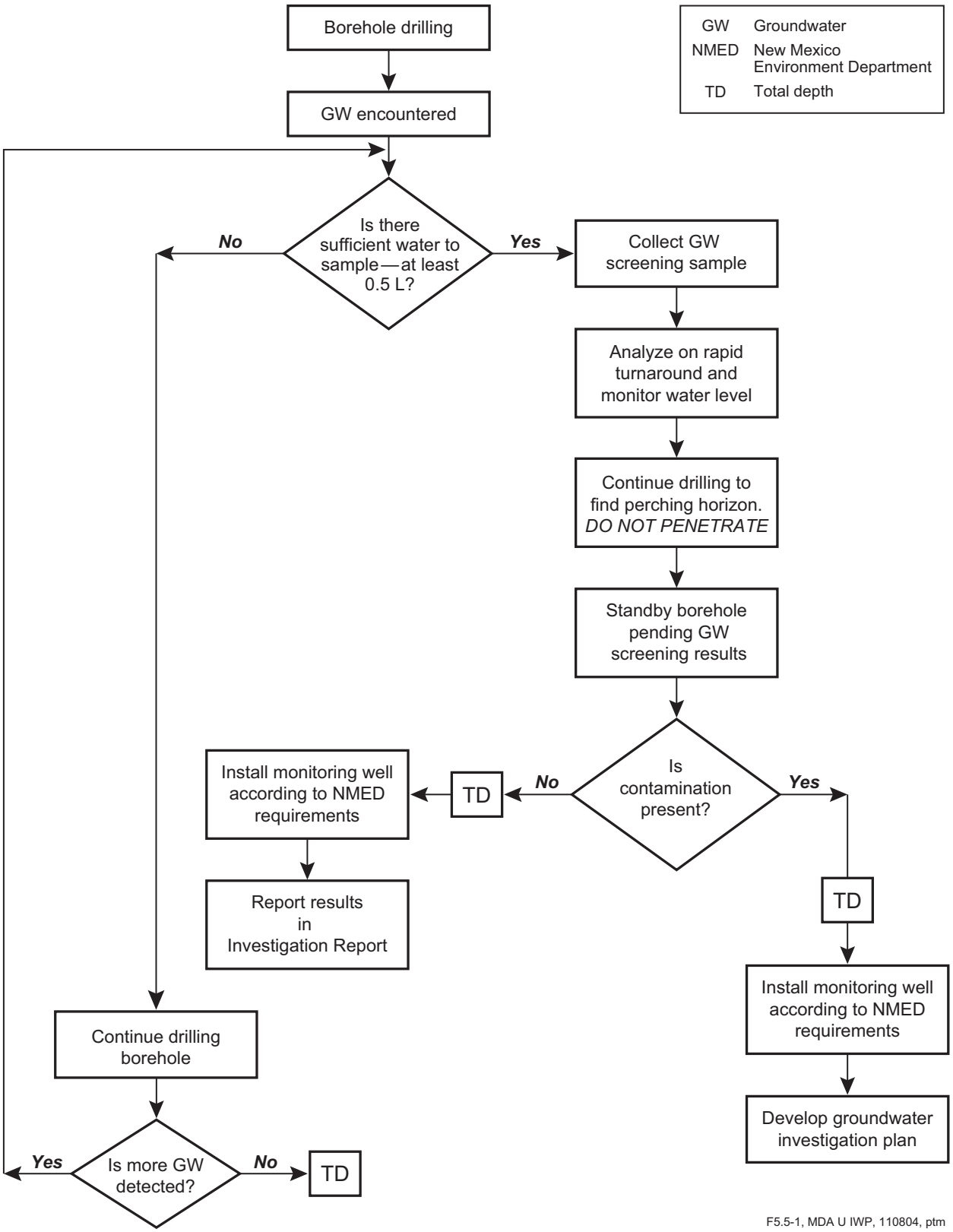


Figure 5.5-1. MDA U perched groundwater flow chart

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, *leachin*g, 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 *sampl*e.

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)—*Mediu*m-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 *ris*k-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.

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

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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 polycyclic aromatic 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.

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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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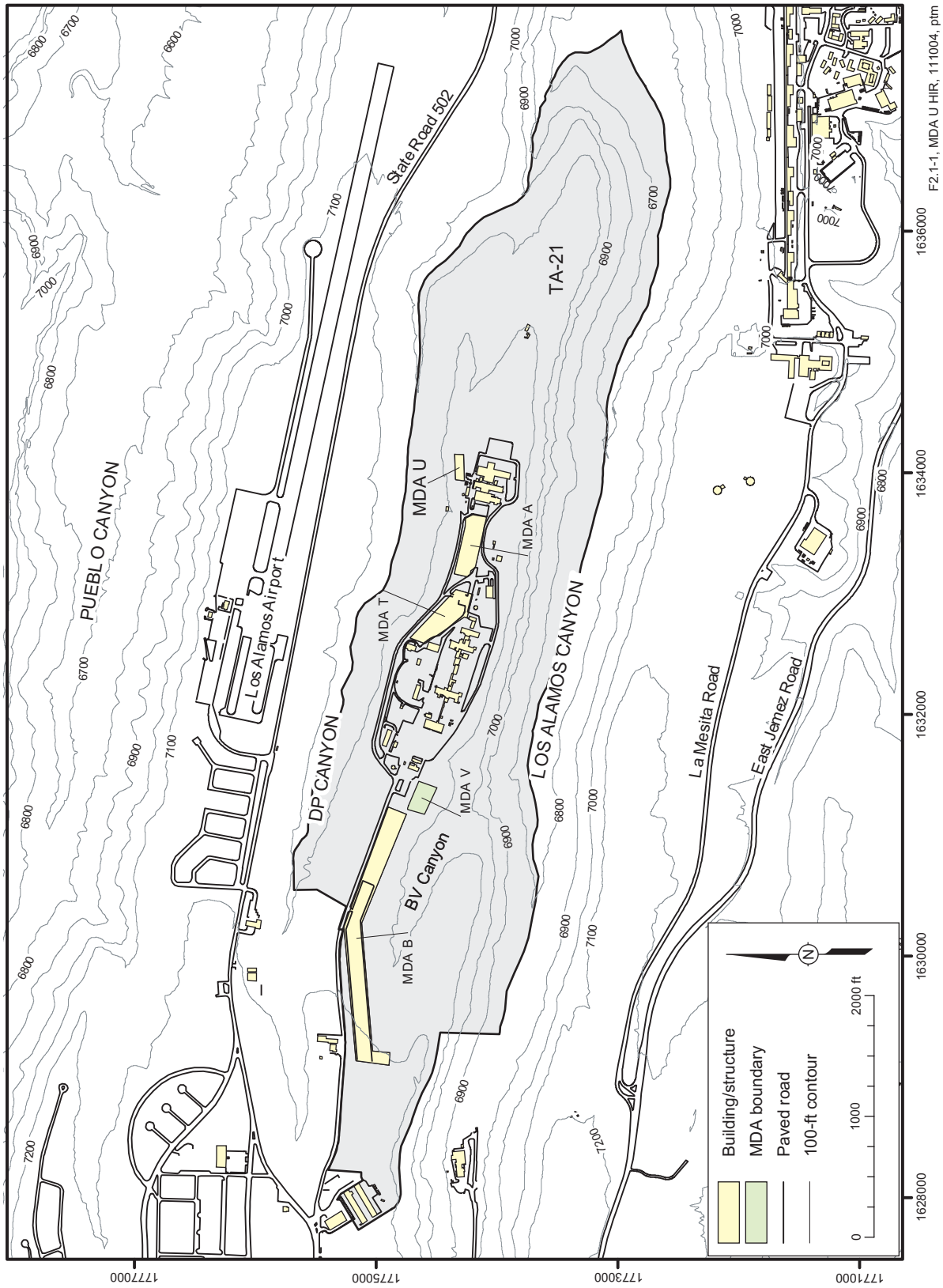


Figure 2.1-1. Material disposal areas in TA-21

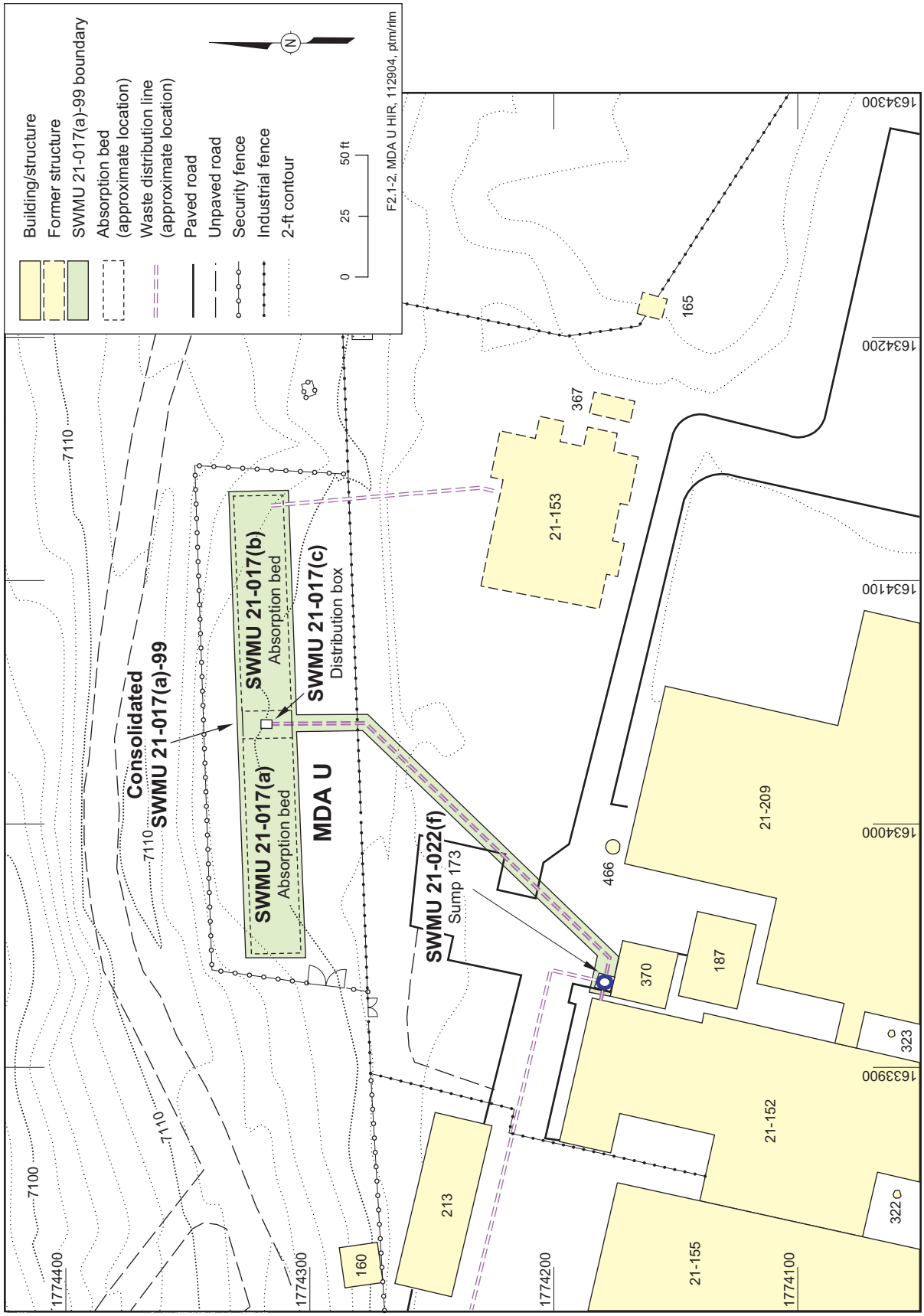


Figure 2.1-2. Consolidated SWMU 21-017(a)-99

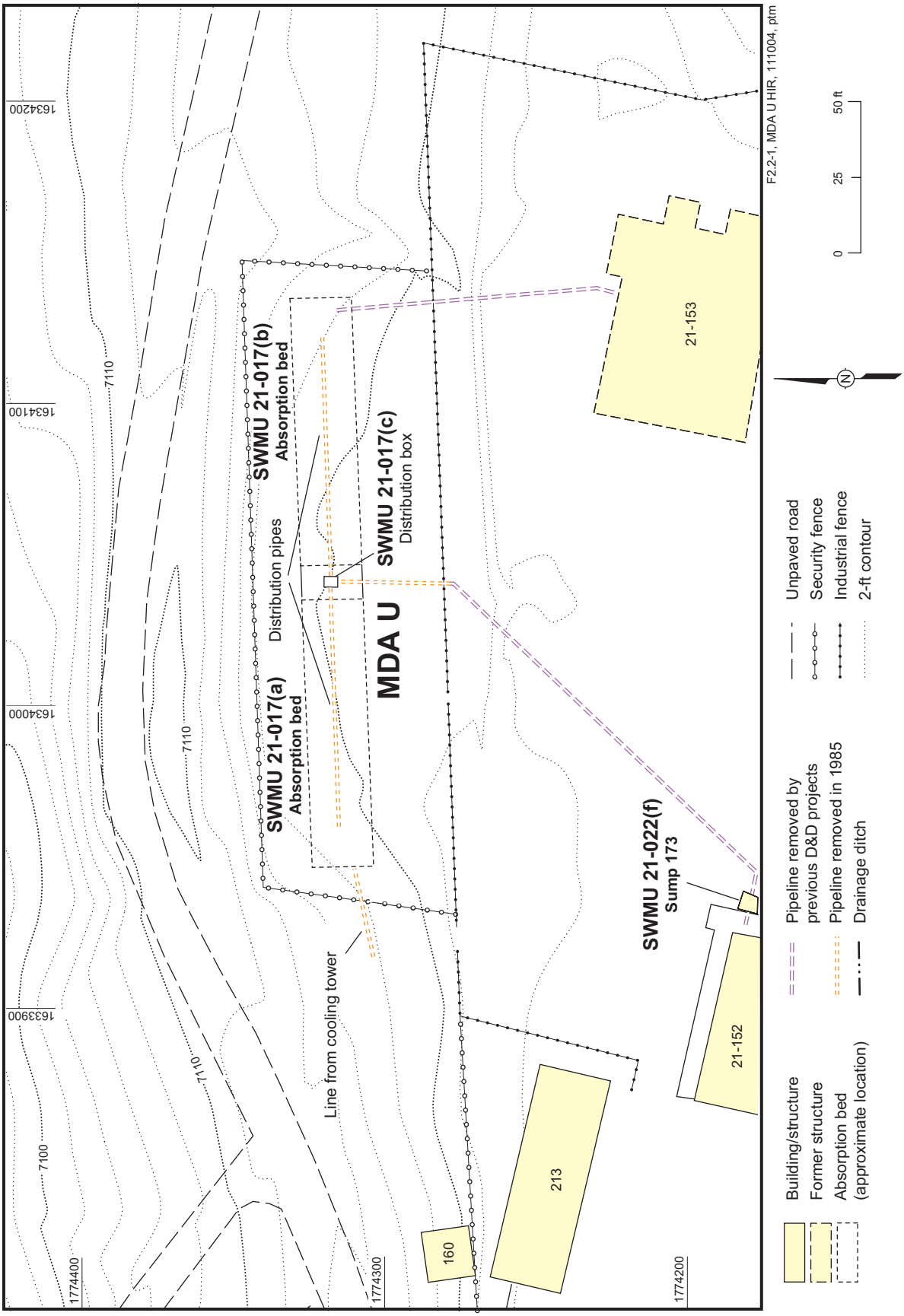
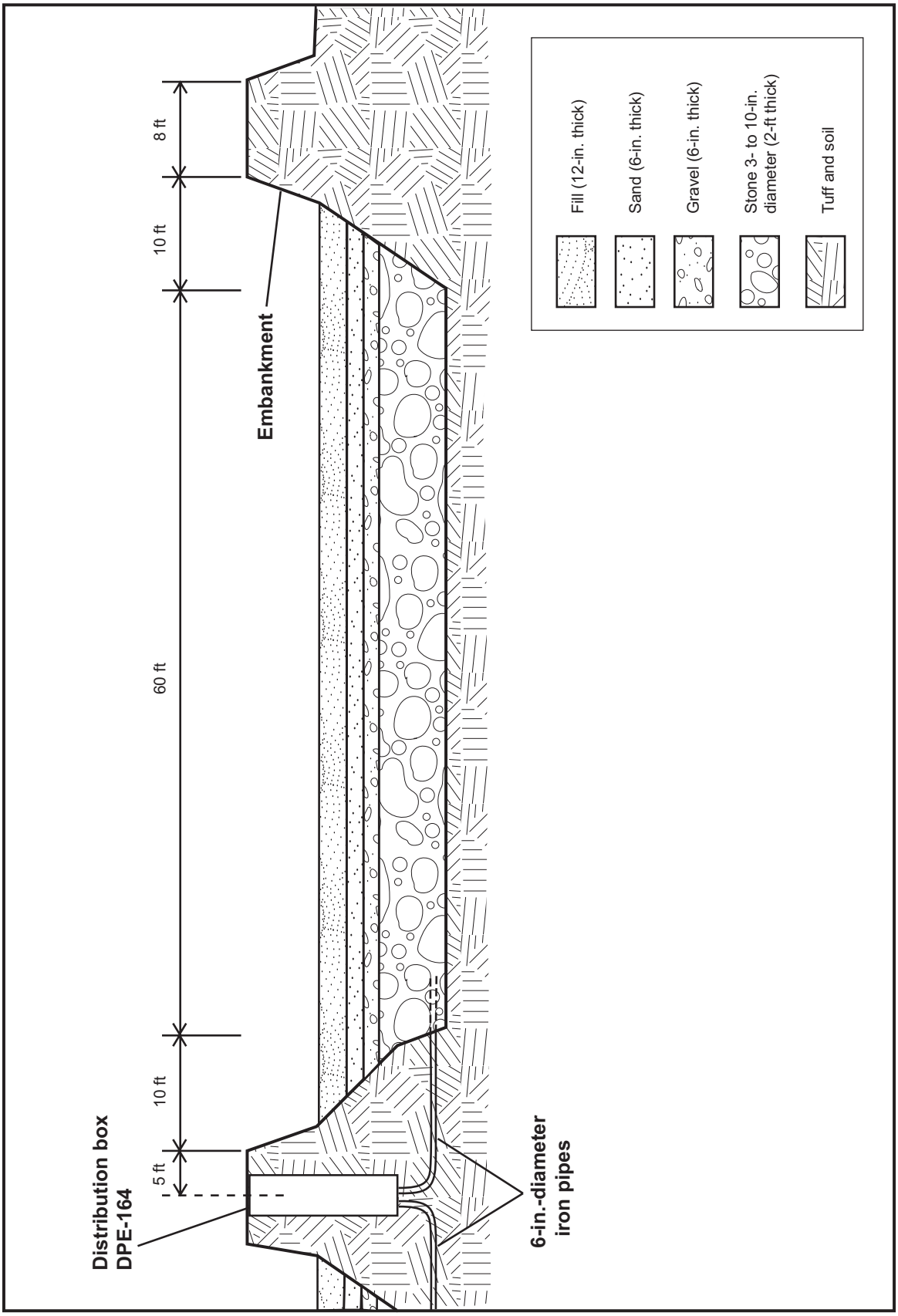
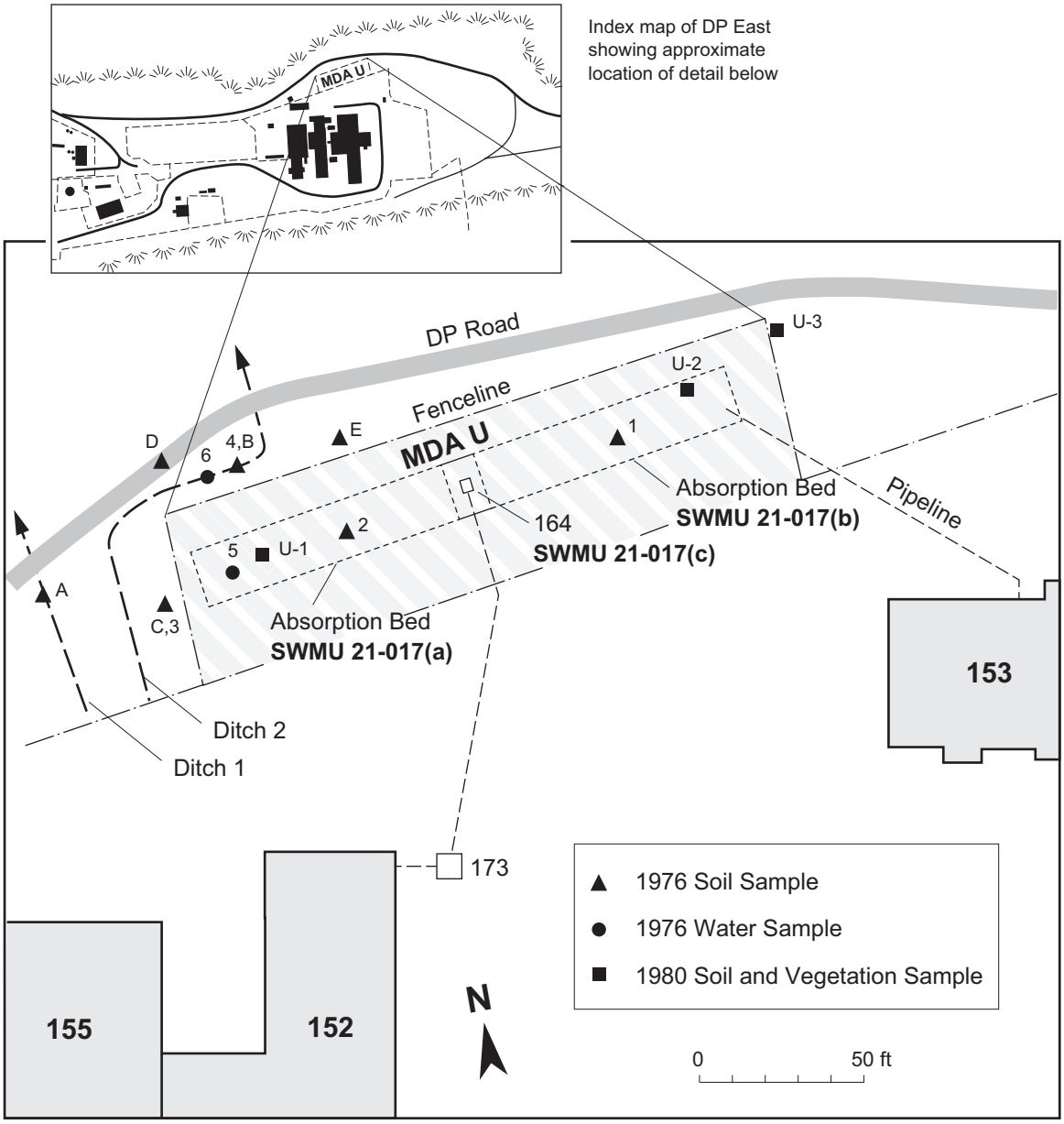


Figure 2.2-1. 1985 stabilization activities at MDA U



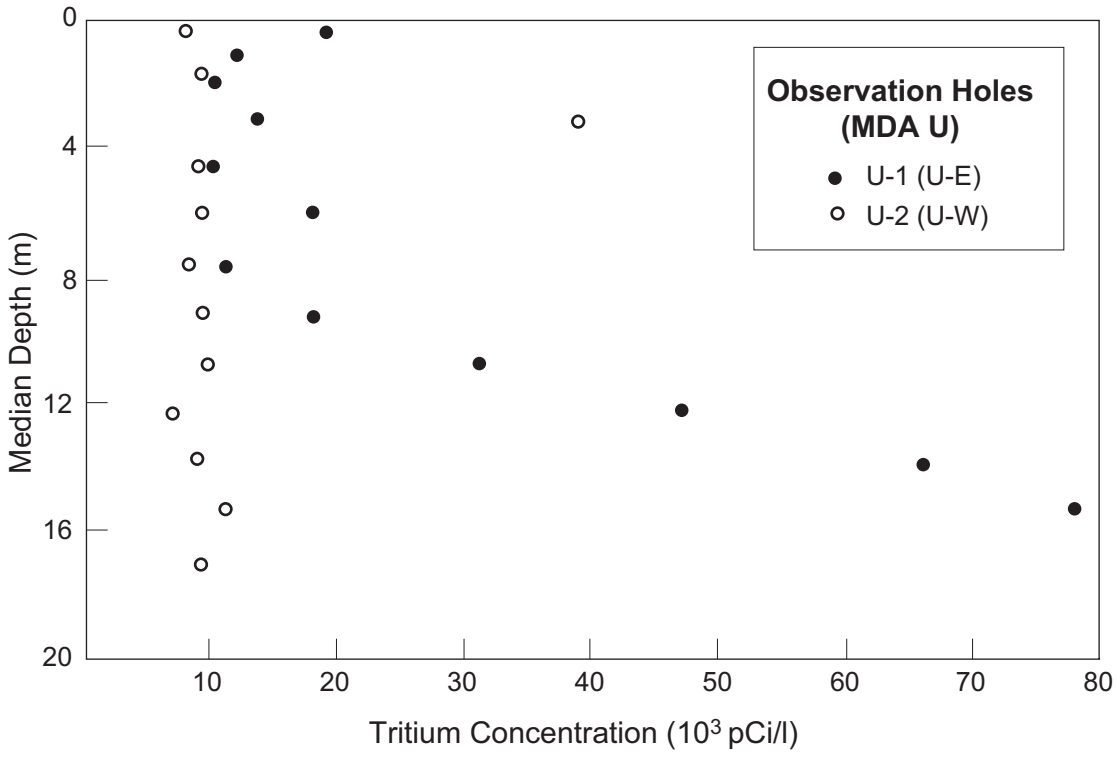
Source: LASL ENG-C2216 6/6/45; modified for F2.2-3/MDA U RFI/011203/rlm; modified for F2.3-1, MDA U HIR, 110804, ptm

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

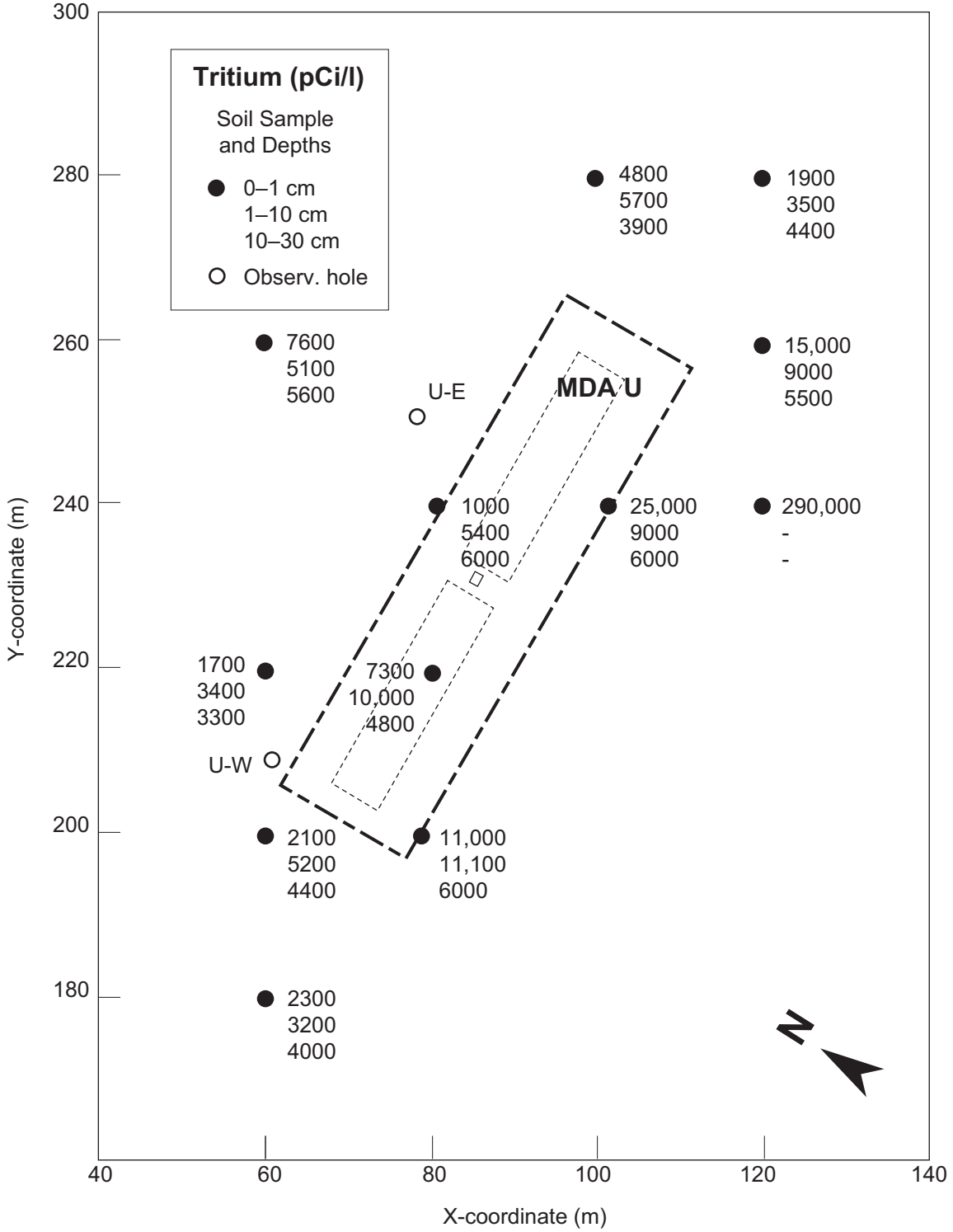


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Figure 3.1-3. 1984 MDA U tritium data for soils

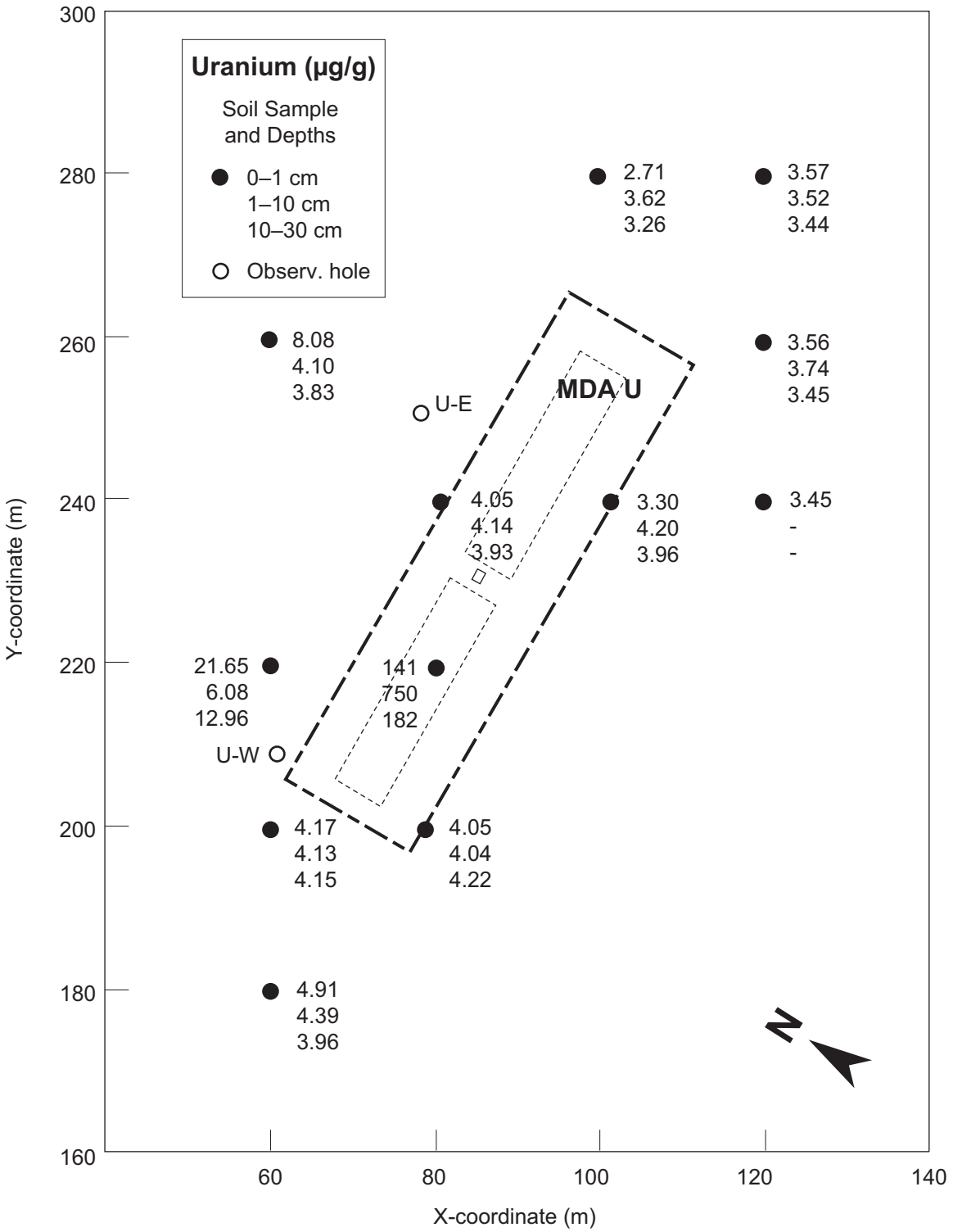

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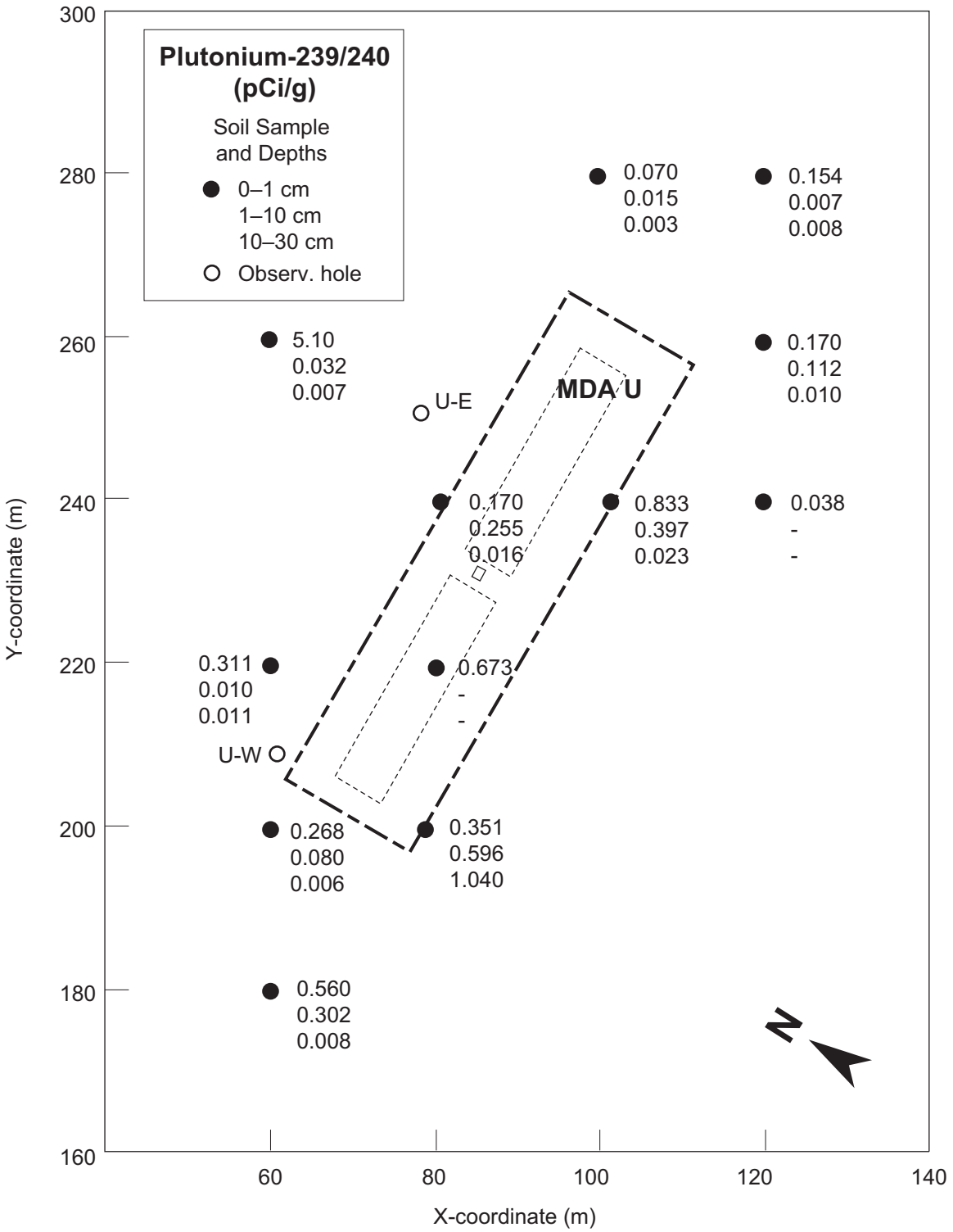
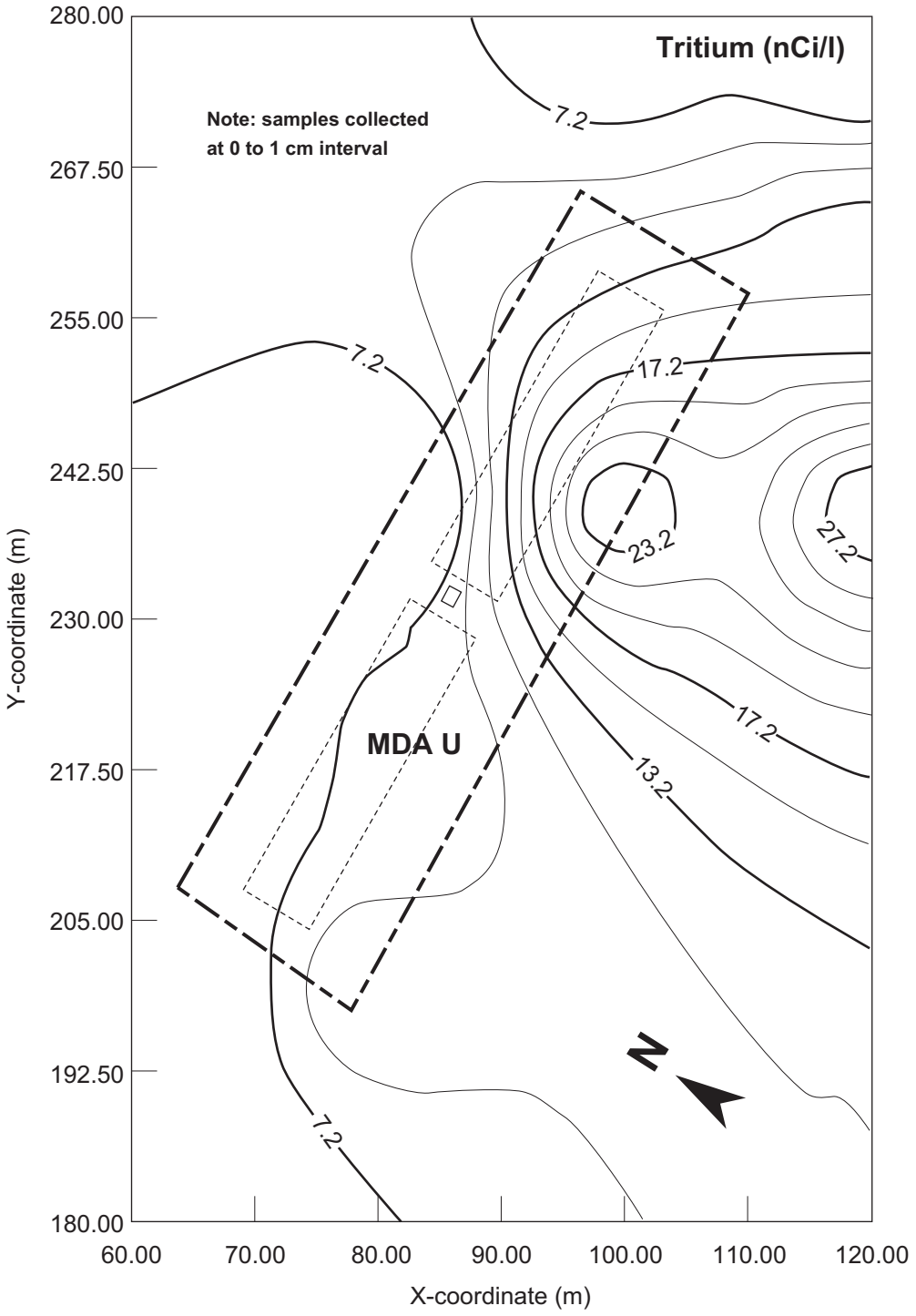
Figure 3.1-4. 1984 MDA U uranium data for soils



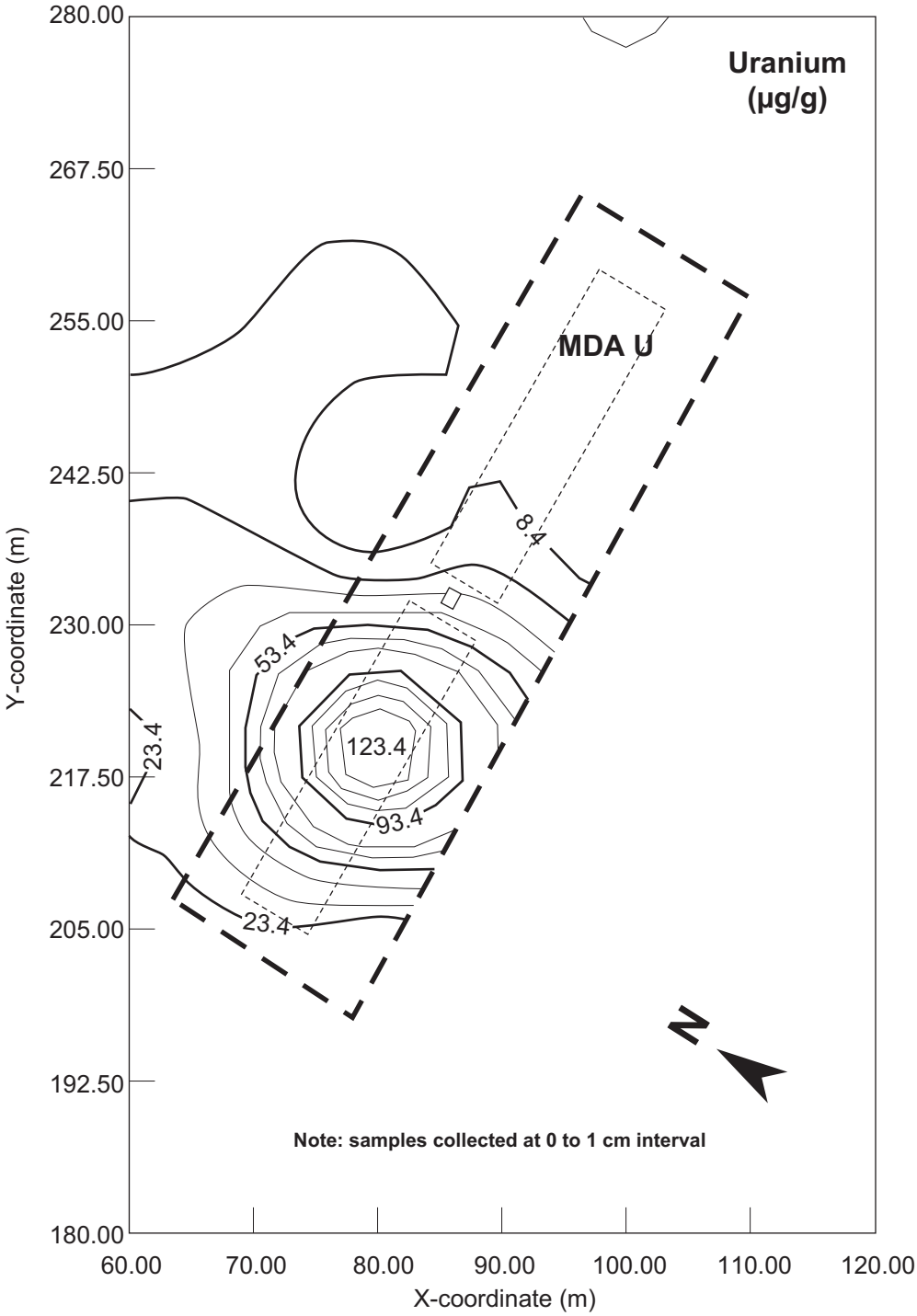
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-4, p. 16-210) modified for F3.1-5, MDA U HIR, 112804, ptm/rlm

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



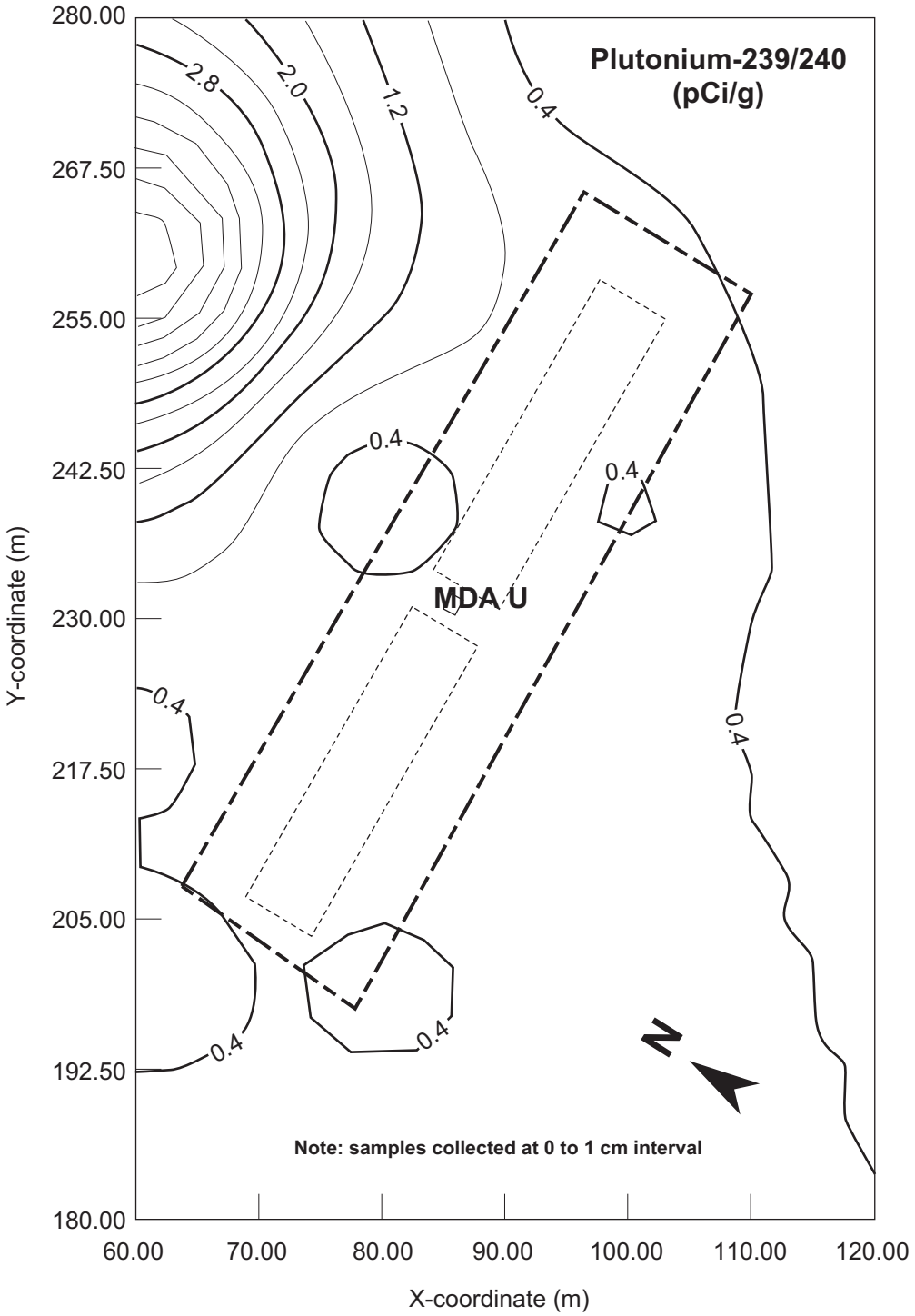
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-5, p. 16-211) modified for F3.1-6, MDA U HIR, 111004, ptm

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



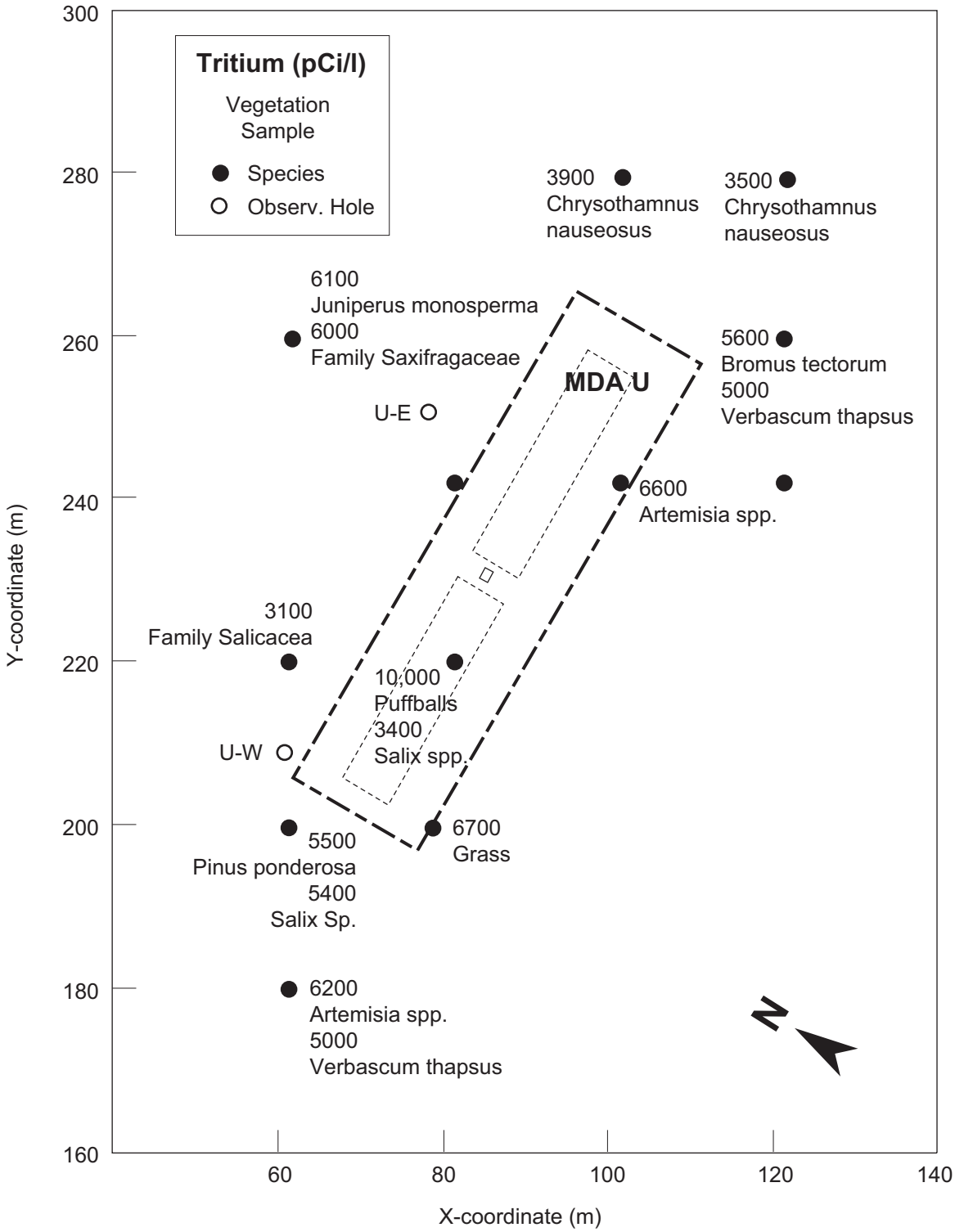
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529, Figure 16.6-6, p. 16-212) modified for F3.1-7, MDA U HIR, 112804, ptm/rlm

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

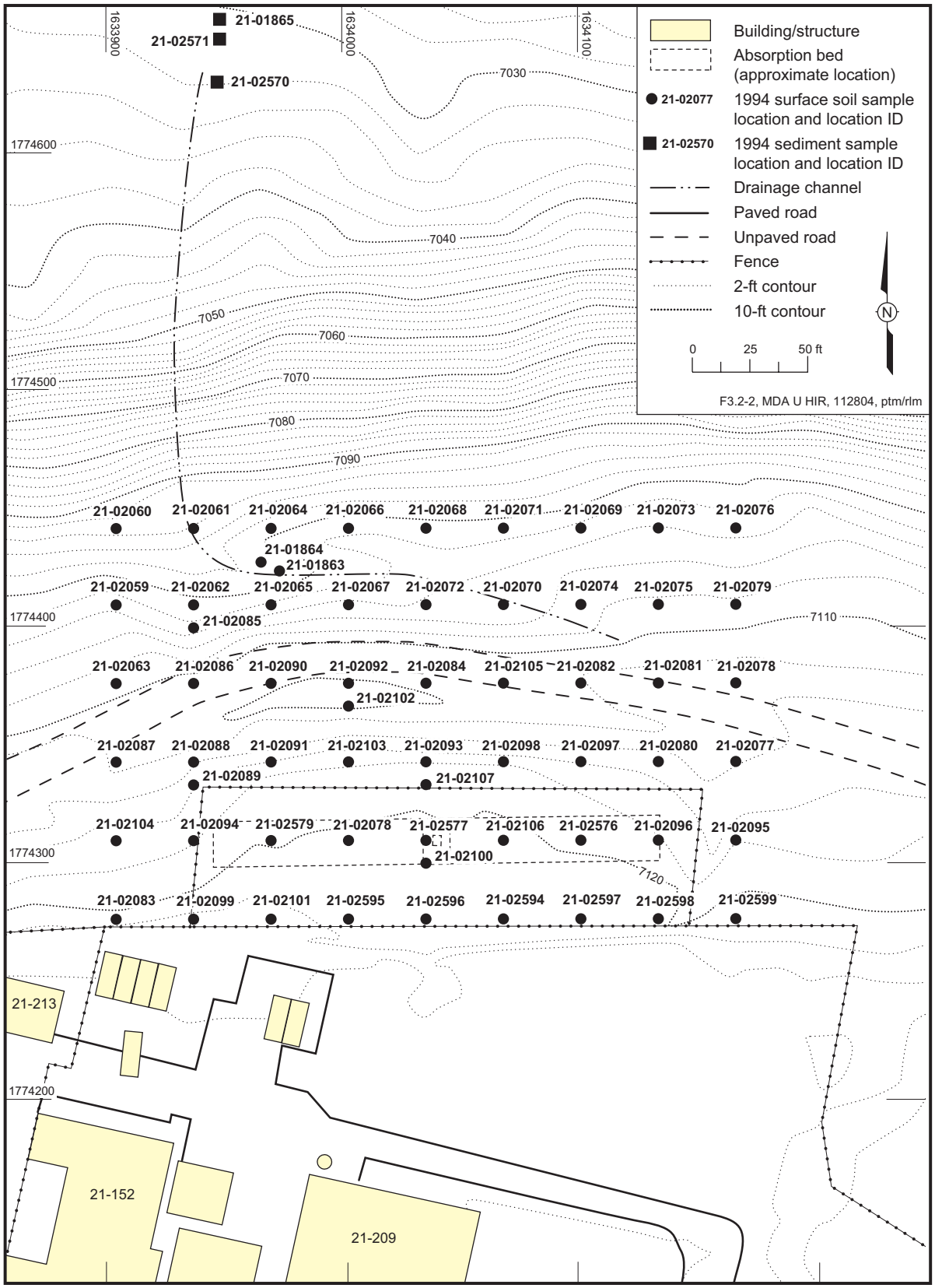


Figure 3.2-2. Locations for 1994 surface soil and sediment samples

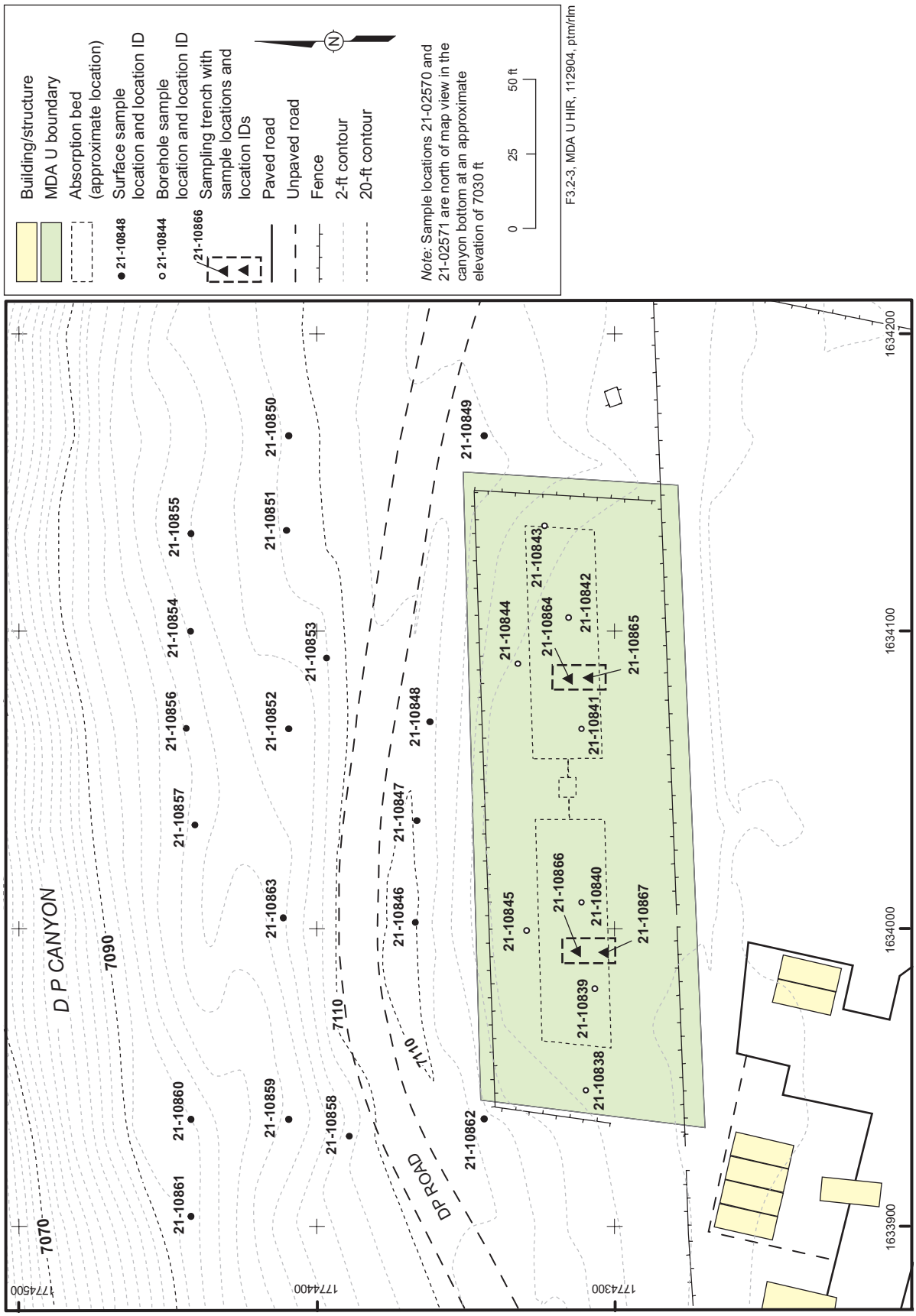


Figure 3.2-3. Locations for 1998 absorption bed, surface, and subsurface sampling

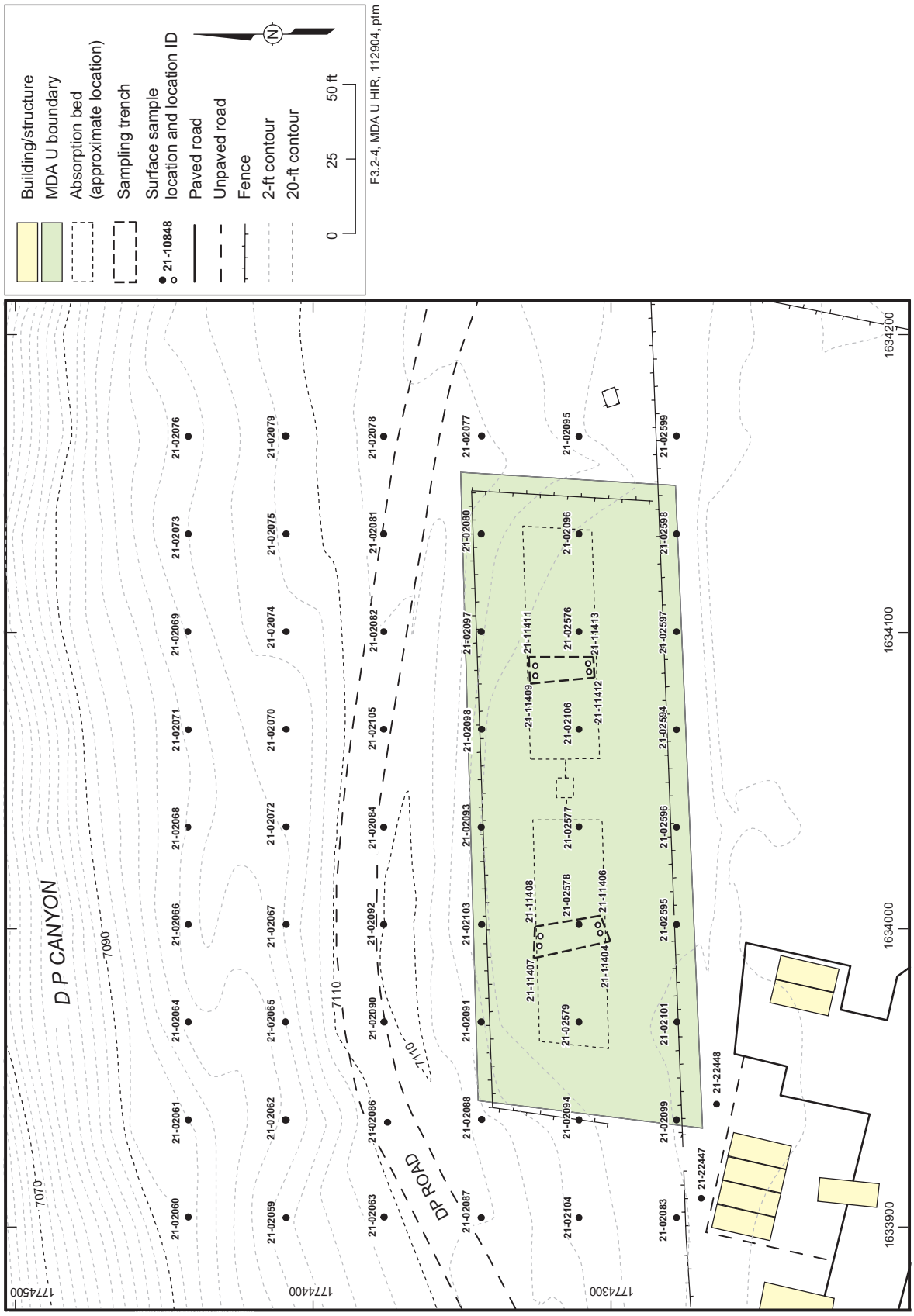


Figure 3.2-4. Locations for 2001 absorption bed and surface soil sampling

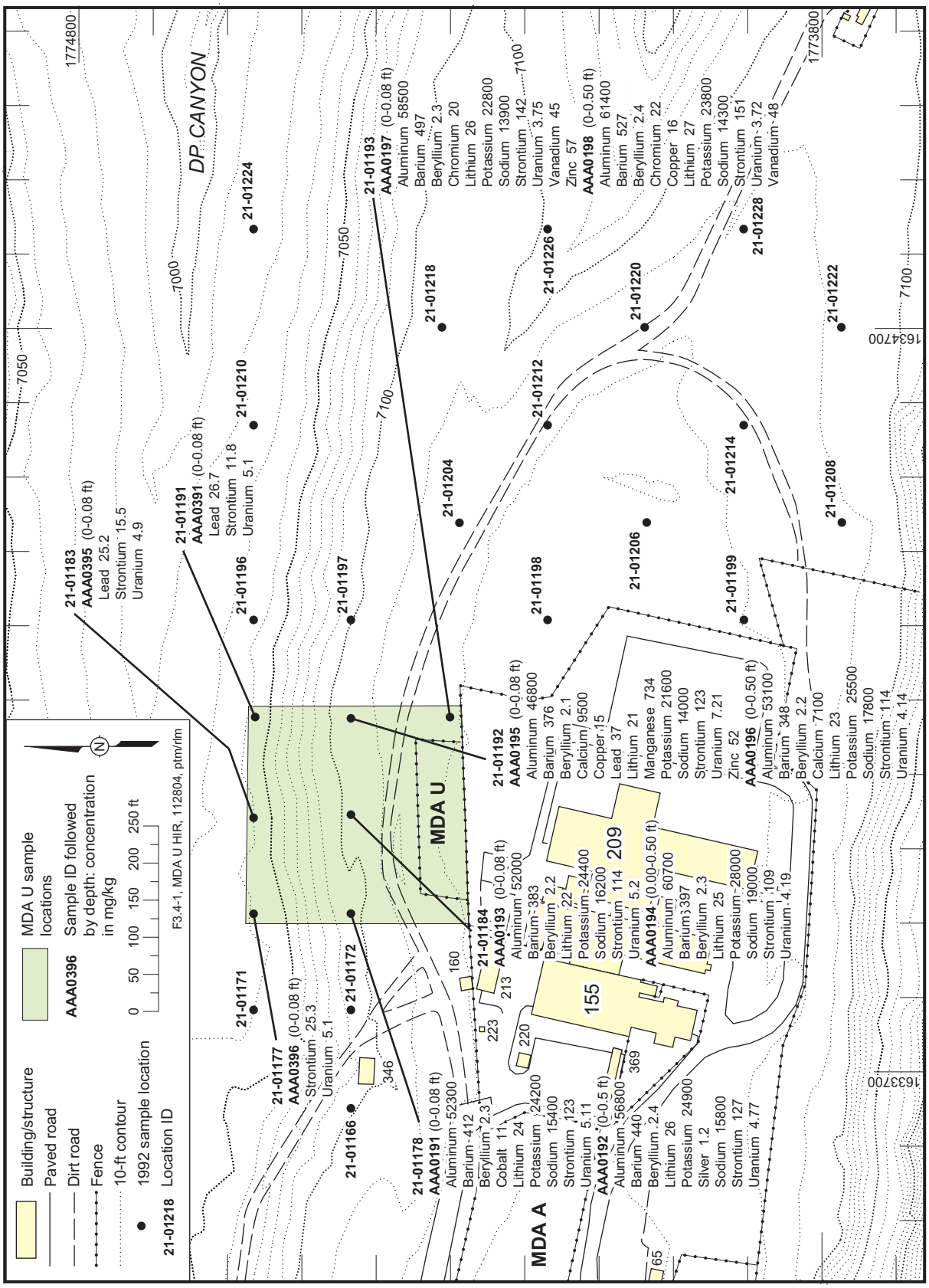
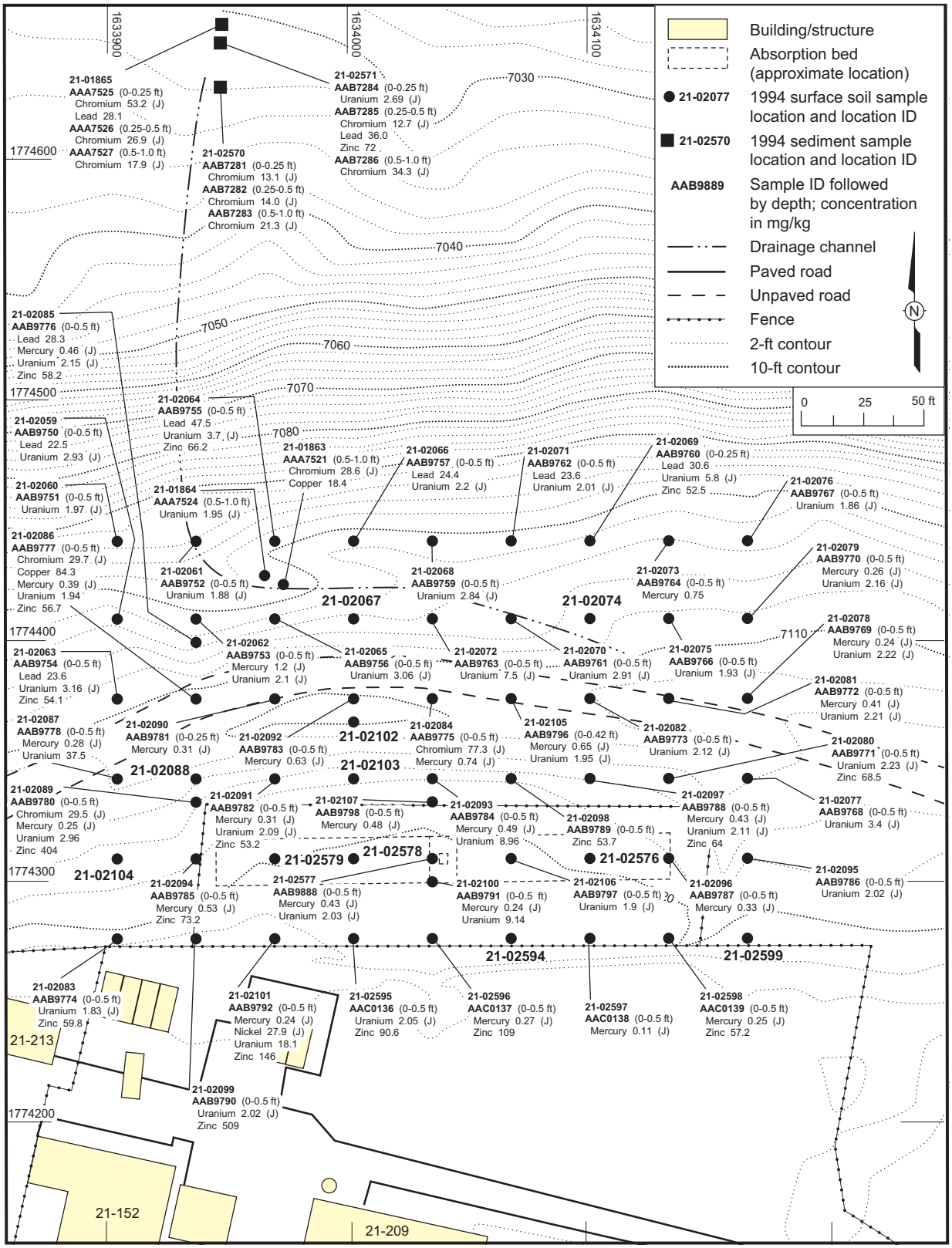


Figure 3.4-1. Inorganic chemicals above background values in 1992 surface samples



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

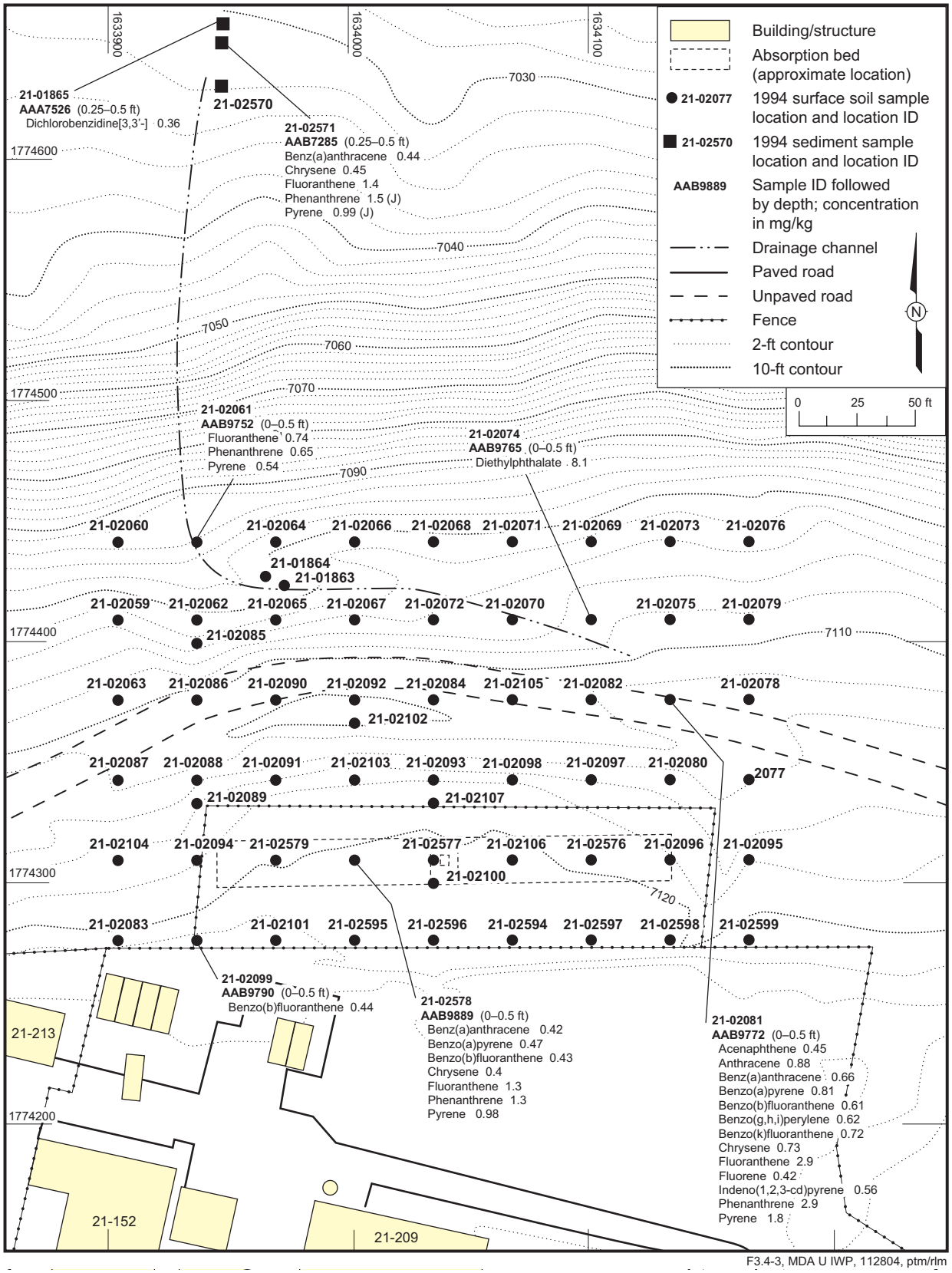


Figure 3.4-3. Organic chemicals detected in 1994 surface soil and sediment samples

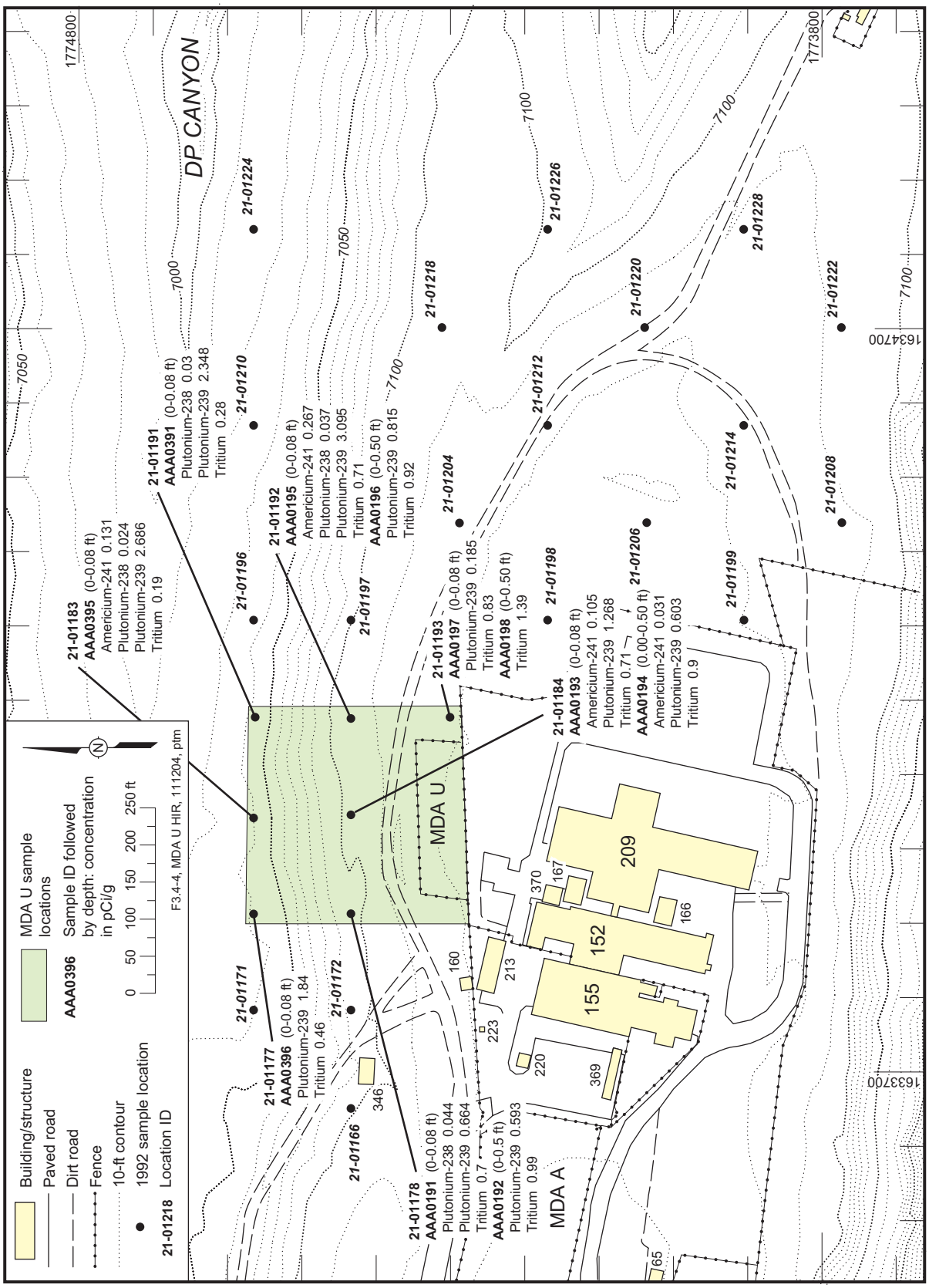
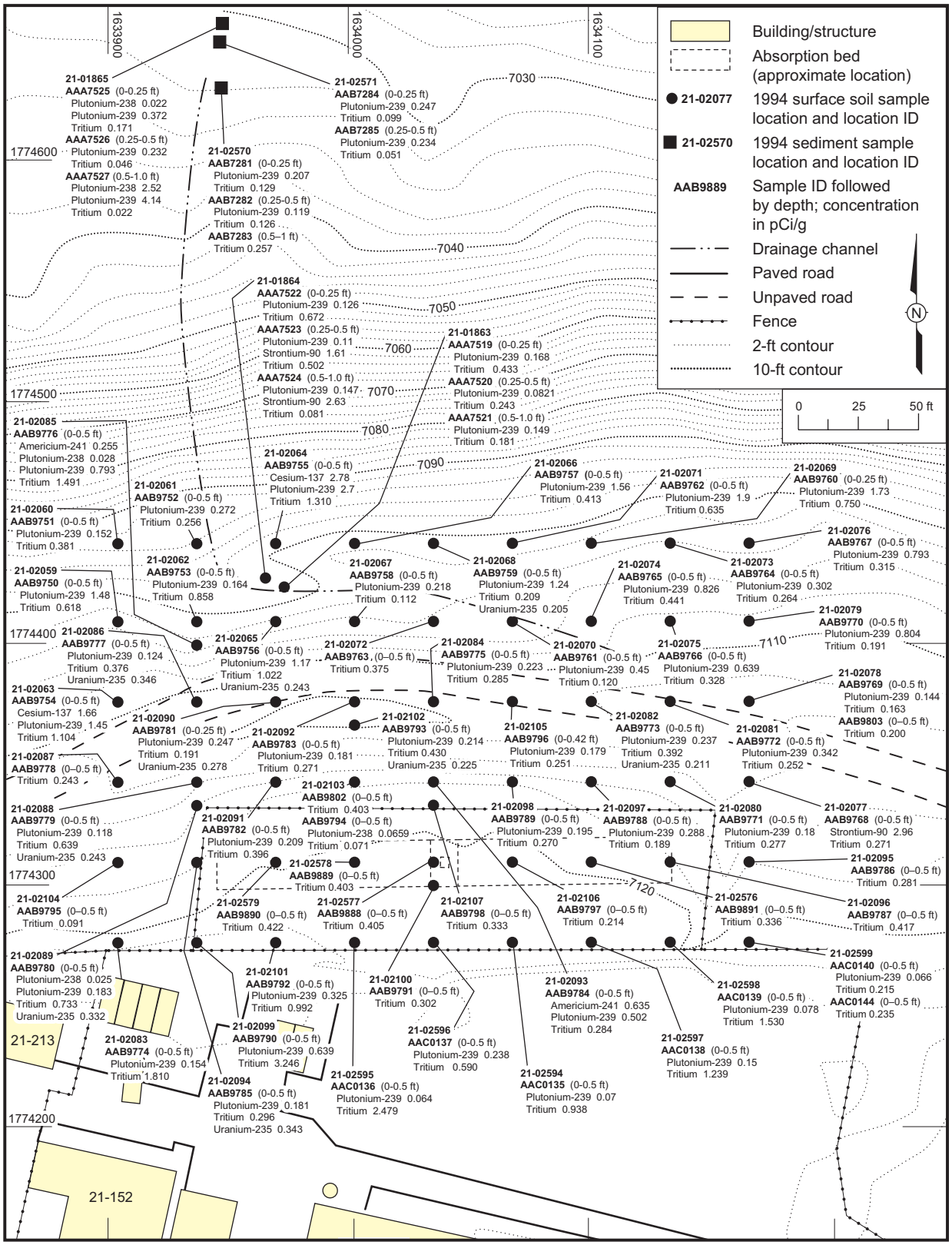


Figure 3.4-4. Radionuclides above background values in 1992 surface samples



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

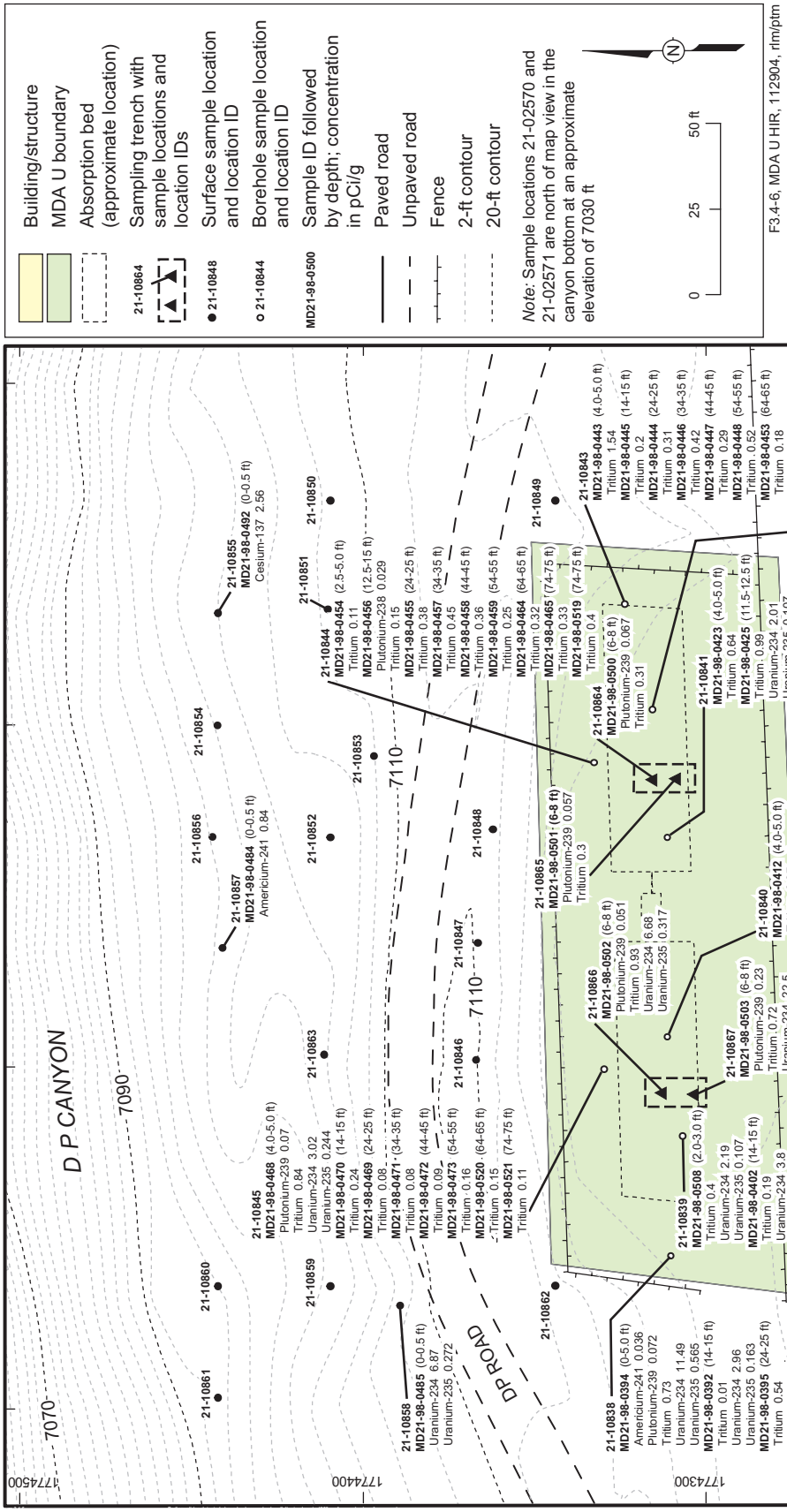


Figure 3.4-6. Radionuclides detected above background values/fallout values in 1998 surface and subsurface samples

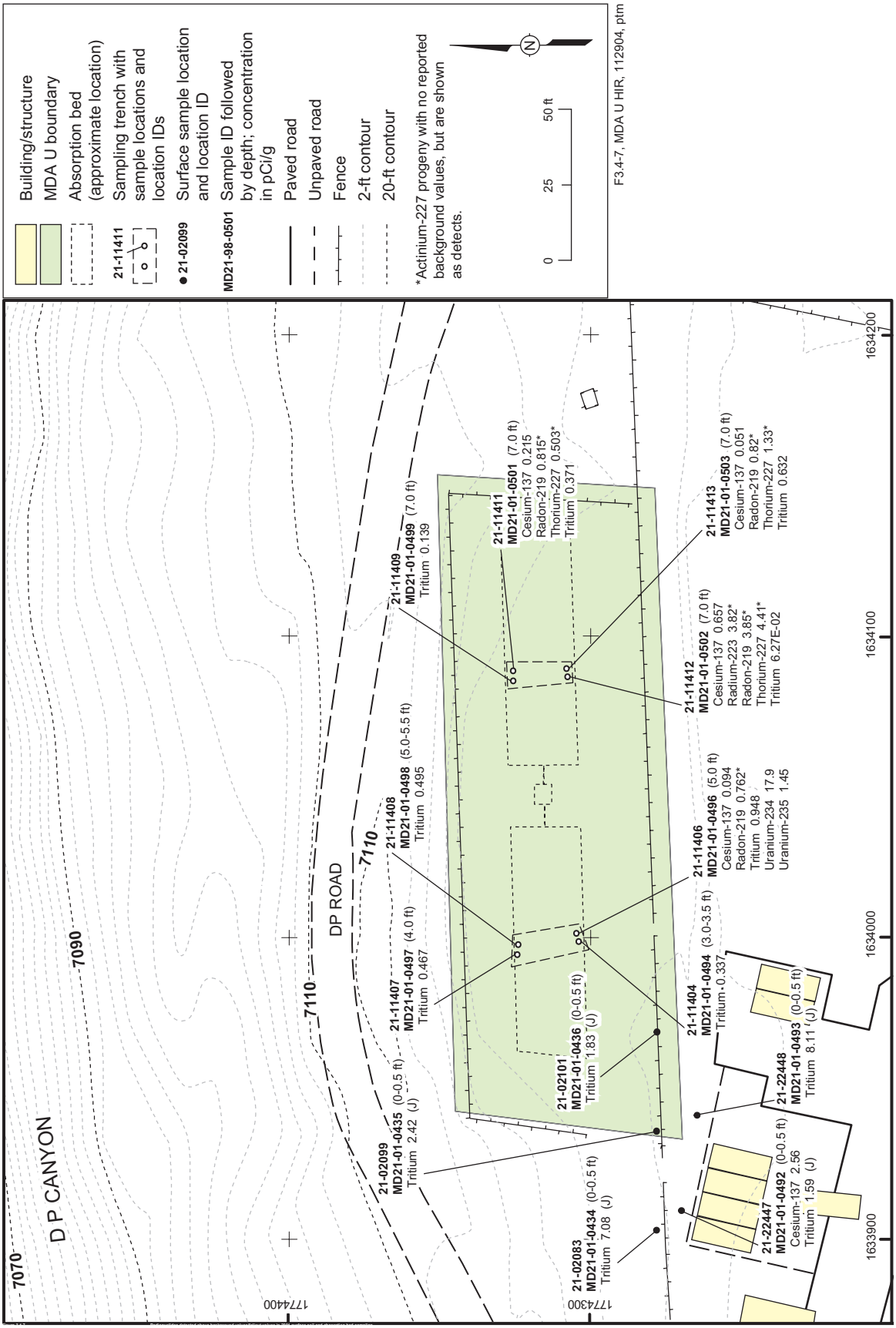


Figure 3.4-7. Radionuclides detected above background values/fallout values in 2001 surface soil and absorption bed sampling

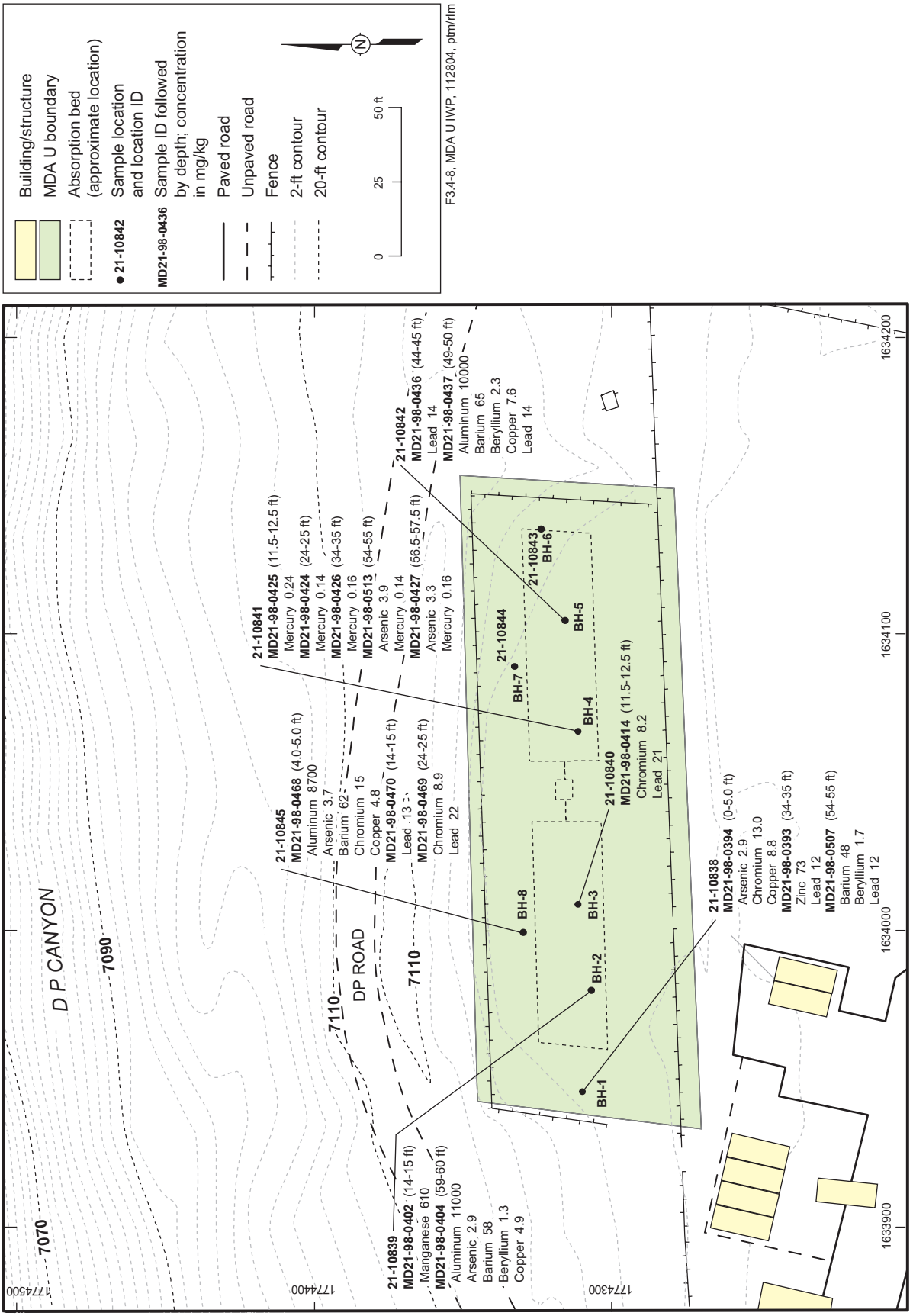


Figure 3.4-8. Inorganic chemicals above background values in 1998 borehole samples

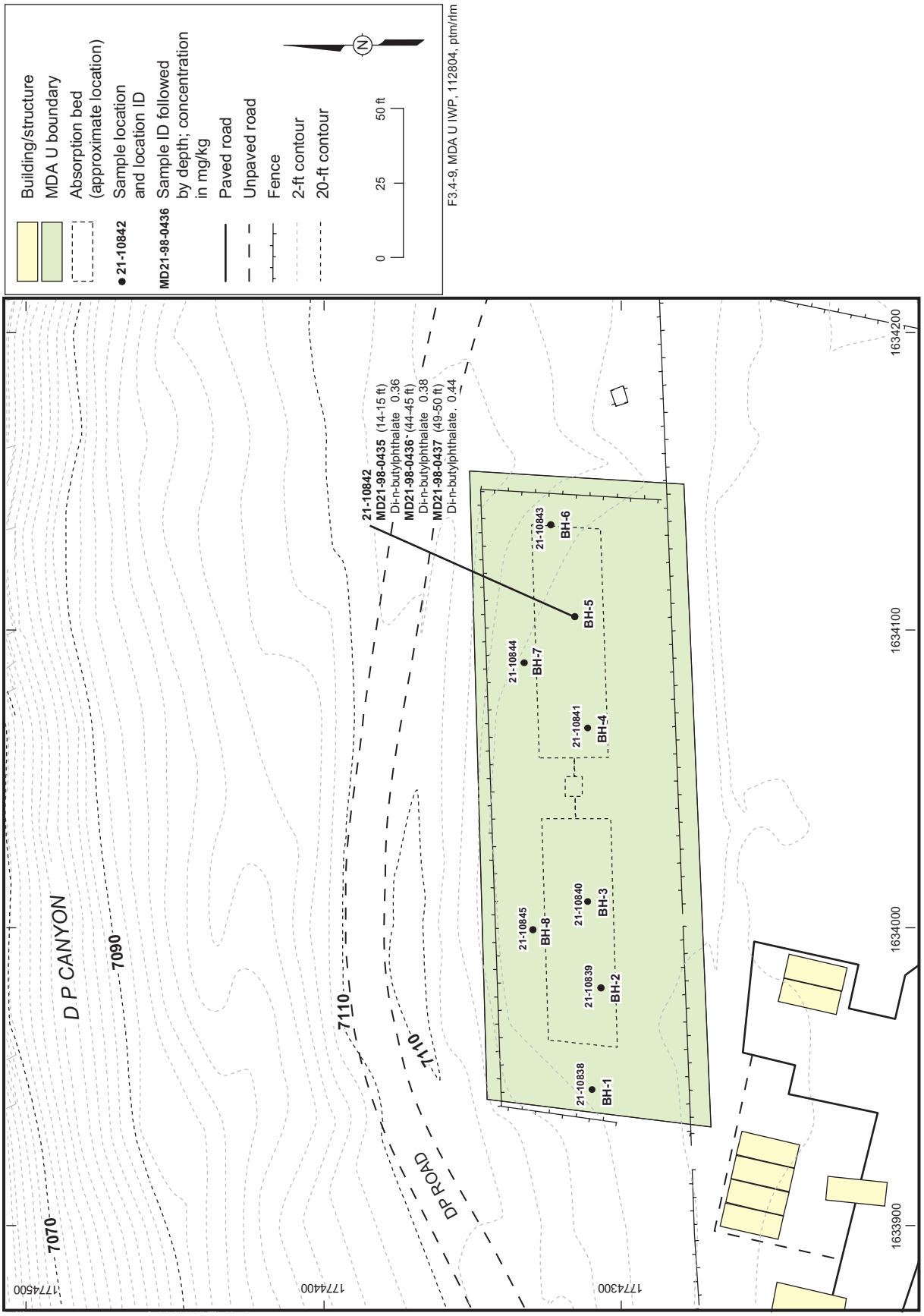


Figure 3.4-9. Organic chemicals detected in 1998 borehole samples

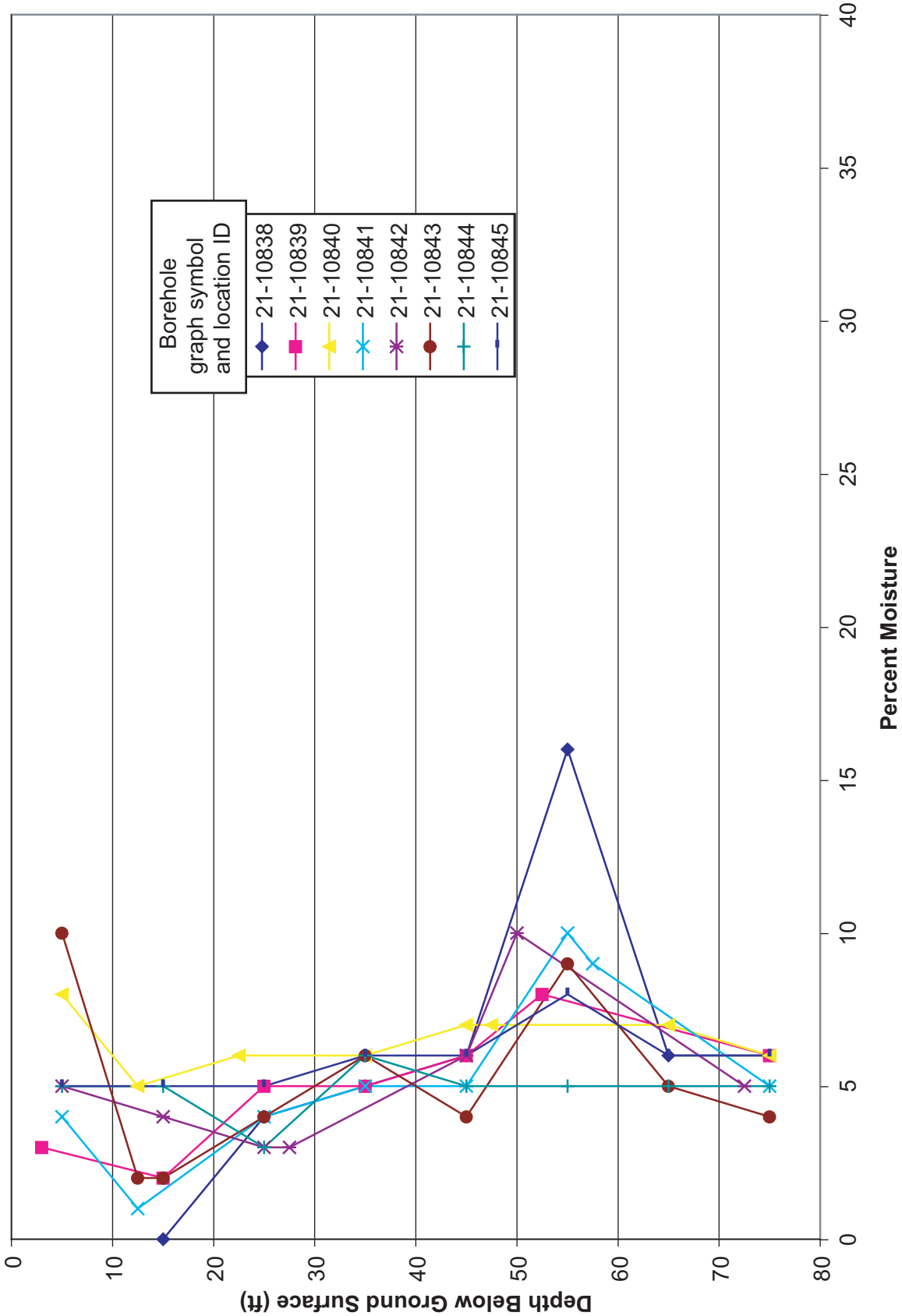


Figure 3.4-10. MDA U moisture profiles from 1998 borehole investigations

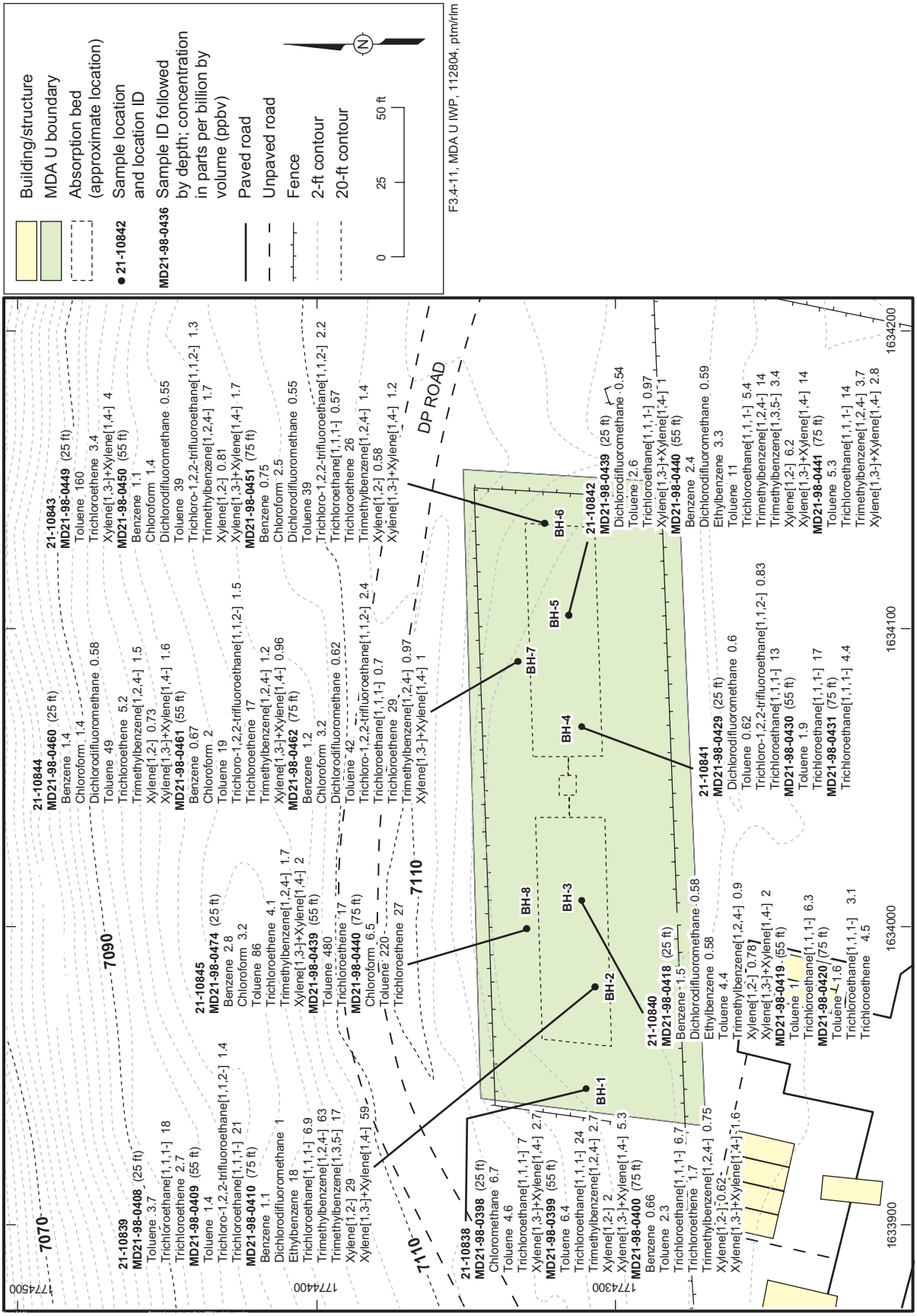


Figure 3.4-11. Detected pore-gas results in 1998 borehole samples

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[j]	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.**[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**
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[1]	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[1]	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[J]	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

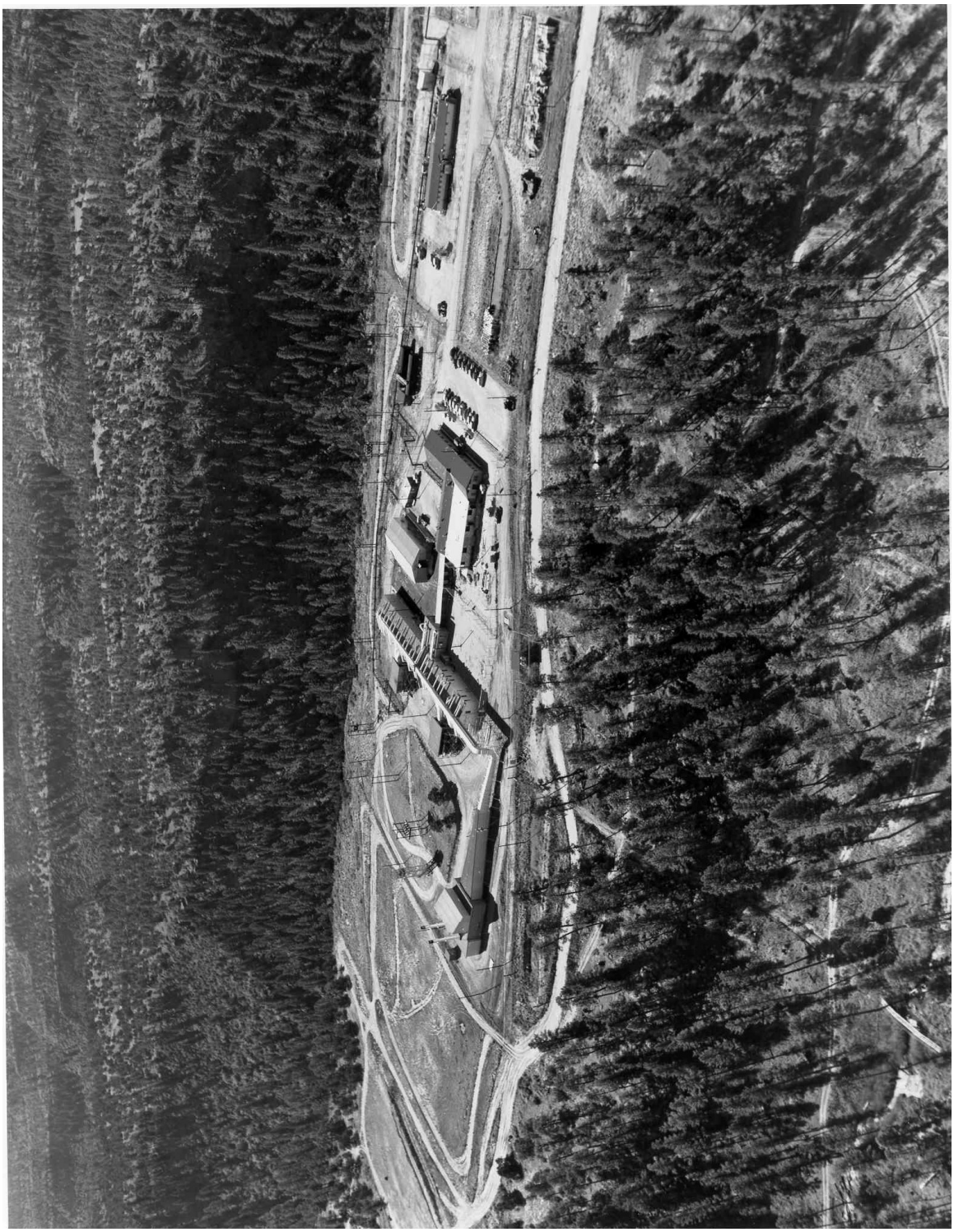
METRIC CONVERSION TABLE

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

Appendix D

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

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 | Page 1 of 1

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	MD21-98-0392 Core (14-15ft)	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			2-5mm brown clay filled fracture (41-42ft)
	2.5/2.5		NDA			
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			2-5mm brown clay filled fracture (60-62ft)
	2.5/2.5		NDA			
65	2.5/2.5	MD21-98-0396 Core (64-65 ft)	NDA			
	2.5/2.5		NDA			
70	2.5/2.5	MD21-98-0506 Core (74-75 ft)	NDA			
	2.5/2.5	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: 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	1.5/2.5	MD21-98-0508 Core (2-3 ft)	193.66 beta/gamma(b/g)	Topsoil: Brown topsoil with organics.		
5	0.5/2.5		No Detectable Activity (NDA)	Fill: Gray tuff fill material.		
	1.5/2.5		NDA	Cobbles and boulders: Absorption bed materials.		
10	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%		
	2.5/2.5		NDA			
15	2.5/2.5	MD21-98-0402 Core (14-15ft)	NDA			
	2.5/2.5		72.55 b/g			
20	2.5/2.5		134.55 b/g			
	2.5/2.5	MD21-98-0403 Core (24-25 ft)	51.55 b/g			
25	2.5/2.5	MD21-98-0408 Soil Gas (25 ft)	NDA			
	2.5/2.5		NDA			
30	2.5/2.5		108.55 b/g			
	2.5/2.5		NDA			
35	2.5/2.5	MD21-98-0405 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	MD21-98-0406 Core (44-45 ft)	NDA			
	2.5/2.5		NDA			
50	2.5/2.5	MD21-98-0509 Core (51.5-52.5 ft)	23.55 b/g			
	2.5/2.5		NDA			
55	2.5/2.5	MD21-98-0409 Soil Gas (55 ft)	NDA			
	2.5/2.5		NDA			
60	2.5/2.5	MD21-98-0404 Core (59-60 ft)	178.55 b/g			2-5mm brown clay interbeds(60-62ft)
	2.0/2.5		NDA			
65	2.0/2.5		NDA			
	2.0/2.5		NDA			2-5mm brown clay interbeds(68-75ft)
70	2.0/2.5	MD21-98-0407 Core (74-75 ft)	NDA			
	2.0/2.5	MD21-98-0410 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-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: 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	2.0/2.5		No Detectable Activity (NDA)	Topsoil: Brown topsoil with organics.		
5	2.5/2.5	MD21-98-0412 Core (4-5 ft)	113.5 beta/gamma(b/g)	Fill: Gray tuff fill material.		
	1.0/2.5		NDA	Cobbles and boulders: Absorption bed materials.		
10	0.12/2.5		NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		
	2.5/2.5	MD21-98-0414 Core (11.5-12.5ft)	NDA			
15	2.5/2.5		NDA			
	2.5/2.5		NDA			
20	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0413 Core (21.5-22.5 ft)	127.0 b/g			
25	2.5/2.5	MD21-98-0418 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	MD21-98-0415 Core (34-35 ft)	24.23 b/g			
	2.0/2.5		NDA			
40	2.5/2.5		NDA			
	2.5/2.5		NDA			
45	2.5/2.5	MD21-98-0417 Core (44-45 ft)	NDA			
	2.5/2.5	MD21-98-0416 Core (46.5-47.5 ft)	NDA			
50	2.5/2.5		NDA			
	2.5/2.5		NDA			
55	2.5/2.5	MD21-98-0419 Soil Gas (55 ft)	NDA			2-5mm brown clay interbeds(53-55ft)
	2.5/2.5		NDA			
60	2.0/2.5		NDA			
	2.0/2.5		NDA			
65	1.7/2.5	MD21-98-0422 Core (64-65 ft)	59.23 b/g			
	1.7/2.5		NDA			
70	2.0/2.5		NDA			
	2.0/2.5	MD21-98-0511 Core (74-75 ft) MD21-98-0420 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-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: 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	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 (11.5-12.5ft)	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	MD21-98-0512 Core (74-75 ft)	NDA			
	1.7/2.5	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

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	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			
	2.2/2.5	MD21-98-0441 Soil Gas (75ft)	96.52 cpm b/g			
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-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 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	2.0/2.5		No Detectable Activity (NDA)	Topsoil: Brown topsoil with organics.		
				Fill: Gray tuff fill material.		
5	2.5/2.5	MD21-98-0443 Core (4-5 ft)	NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		
	2.5/2.5		NDA			
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			Moderately welded (20-22.5ft)
	2.5/2.5	MD21-98-0444 Core (24-25 ft)	NDA			
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						

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-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: Stewart Bros. Drilling Company BOREHOLE ORIENTATION:Vertical

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)
	2.5/2.5		NDA			
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			
40	2.5/2.5		NDA			2-5mm oxidized clay-filled fracture (37.5-47.5 ft)
	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)	NDA			
75	2.5/2.5	MD21-98-0462 Soil Gas (75ft)	NDA			

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-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)	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	MD21-98-0468 Core (4-5 ft)	NDA	Fill: Gray-brown tuff fill material.		
	2.5/2.5		NDA	QBT3: Brown weathered tuff, clay-silt, fractures.		2-5mm clay-filled fracture (7.5-10 ft)
10	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%.		
	2.5/2.5		NDA			
15	2.5/2.5	MD21-98-0470 Core (14-15ft)	NDA			2-5mm clay-filled fracture (16 ft)
	2.5/2.5		NDA			
20	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0469 Core (24-25 ft)	NDA			
25	2.5/2.5	MD21-98-0474 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	MD21-98-0471 Core (34-35 ft)	NDA			2-5mm oxidized fracture (35-42.5ft)
	2.5/2.5		NDA			
40	2.5/2.5		NDA			
	2.5/2.5		NDA			
45	2.5/2.5	MD21-98-0472 Core (44-45 ft)	NDA			
	2.5/2.5		NDA			
50	2.5/2.5	MD21-98-0473 Core (54-55 ft)	NDA			
	2.5/2.5		NDA			
55	2.5/2.5	MD21-98-0475 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	MD21-98-0520 Core (64-65 ft)	NDA			
	2.5/2.5		NDA			
70	2.5/2.5	MD21-98-0521 Core (74-75ft)	NDA			
	2.5/2.5	MD21-98-0476/0477 Soil Gas (75ft)	NDA			
75						

NW-ID-2004-031
Revision 0

PHASE II WORK PLAN
FOR LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILL

April 2004

Prepared for:

U. S. Department of Energy, National Nuclear Security Administration
Los Alamos Site Office
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DOCUMENT APPROVAL PAGE

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Approval Signatures

Name	Signature	Date	Title
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Robert Enz		4/12/04	U.S. Department of Energy, LASO

Revision Log

Revision	Date	Reason for Revision
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Revision 0	04/15/04	Document revised to incorporate DOE/LASO comments of 04/05/04

NW-ID-2004-031 i *April 2004*

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Appendix B. Construction Plan for LASO TA-73 Airport Landfill B-1
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1.0 INTRODUCTION

This Phase II Work Plan describes the final remedy that North Wind, Inc. (North Wind) will implement at the U.S. Department of Energy (DOE) Los Alamos Site Office (LASO) Technical Area (TA)-73 Airport Landfill and Debris Disposal Area project, henceforth referred to as the Airport Landfill project.

As described in the DOE Savannah River Operations Office "Statement of Work for the Airport Landfill" (DOE 2003), the Airport Landfill project mission consists of designing and constructing an appropriate cover over Potential Release Site (PRS) 73-001(a) Airport Landfill, and recontouring and reseeding of PRS 73-001(d), Debris Disposal Area (DDA). A detailed site description and operational history is documented in the Los Alamos National Laboratory (LANL) Voluntary Corrective Measure (VCM) Plan (LANL 2002, 74007.2). A summary is provided below in Section 1.3.

1.1 Contents of Phase II Work Plan

The contents of the Phase II Work Plan are prescribed in the New Mexico Environment Department (NMED) conditional approval letter of the VCM Plan (NMED 2003). The conditional approval letter is referenced by Section VI.L of the NMED Order of November 26, 2002 (NMED 2002). The conditional approval letter prescribes the following elements of the Phase II Work Plan:

- Detailed engineering design (Section 2.0),
- Construction or implementation details (Section 3.0),
- Vapor monitoring system design and plan (Section 4.0),
- Demonstration of cover performance over the life of the cover (Section 5.0),
- Schedule for cover maintenance (Section 6.0),
- Closure and post-closure care for the landfill once construction of the cover is complete (Section 7.0), and
- Explanation as to why certain ground water monitoring data referenced in the VCM Plan was not reported (Section 8.0).

This Phase II Work Plan is organized by sections corresponding to the above elements. For most elements, North Wind has prepared a plan that addresses the specific element and that plan is referenced in the appropriate section and attached as an appendix. For the remaining elements, descriptive text is provided to address the particular element.

1.2 Scope of Document

The Phase II Work Plan applies to the construction and post-closure care and monitoring of the earthen landfill cover at the Airport Landfill project. The construction phase is defined as the time period from mobilization to demobilization. The post-closure phase is defined as 30 years after closure (completion of construction of landfill cover).

1.3 Site Description and Background

The Airport Landfill project consists of two PRSs. PRS 73-001(a), main landfill, and PRS 73-001(d), DDA, are inactive solid waste management units and both are listed in Table A within Module VIII of LANL's

Hazardous Waste Facility Permit (LANL 1996, 57486). Both PRSs are located within TA-73 on DOE property, as shown in Figure 1.3-1. The main landfill is east of the existing airport hangars and the DDA is east of the end of the runway. Figure 1.3-2 shows the location of the PRSs in TA-73.

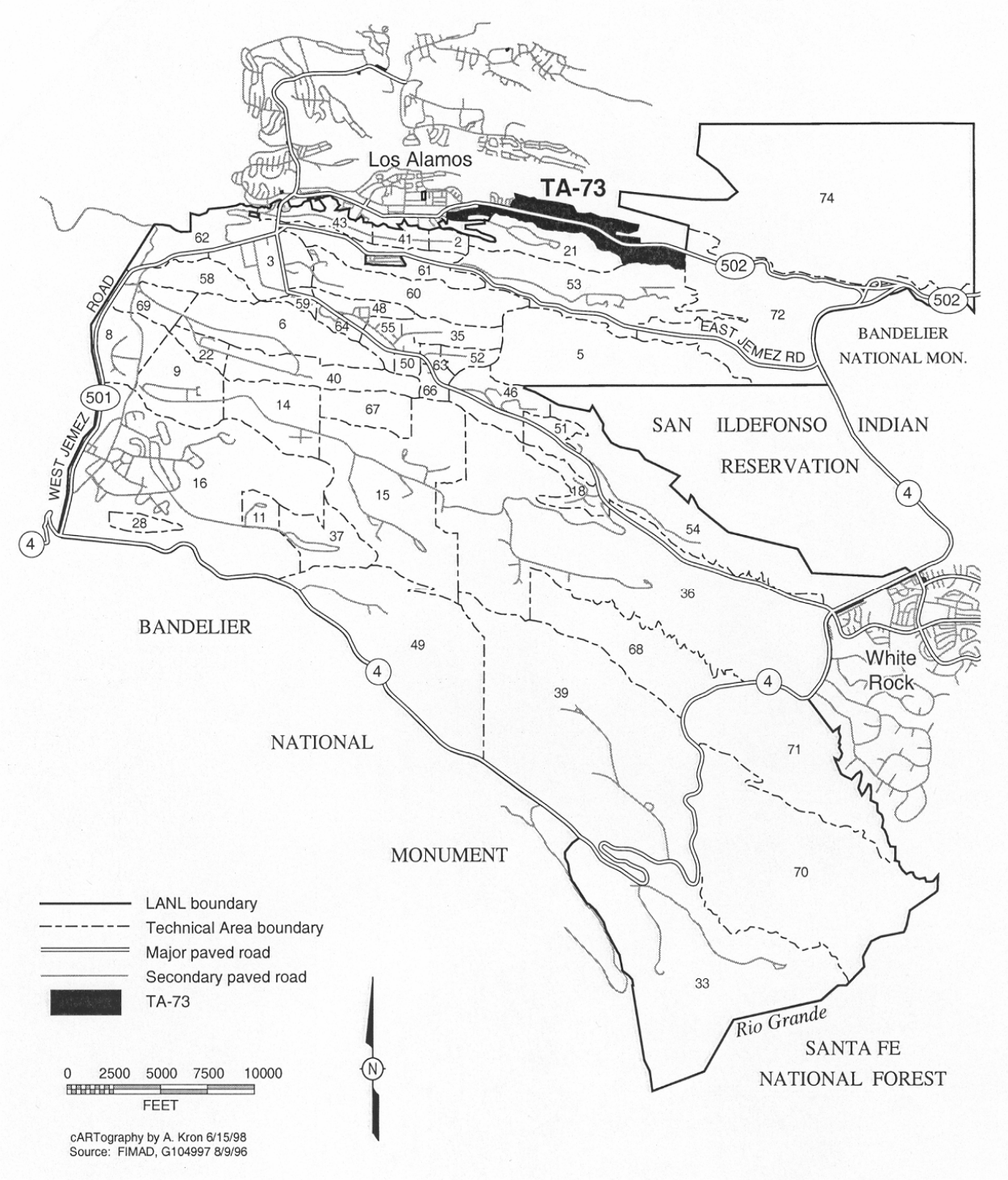

Figure 1.3-1. Location of TA-73

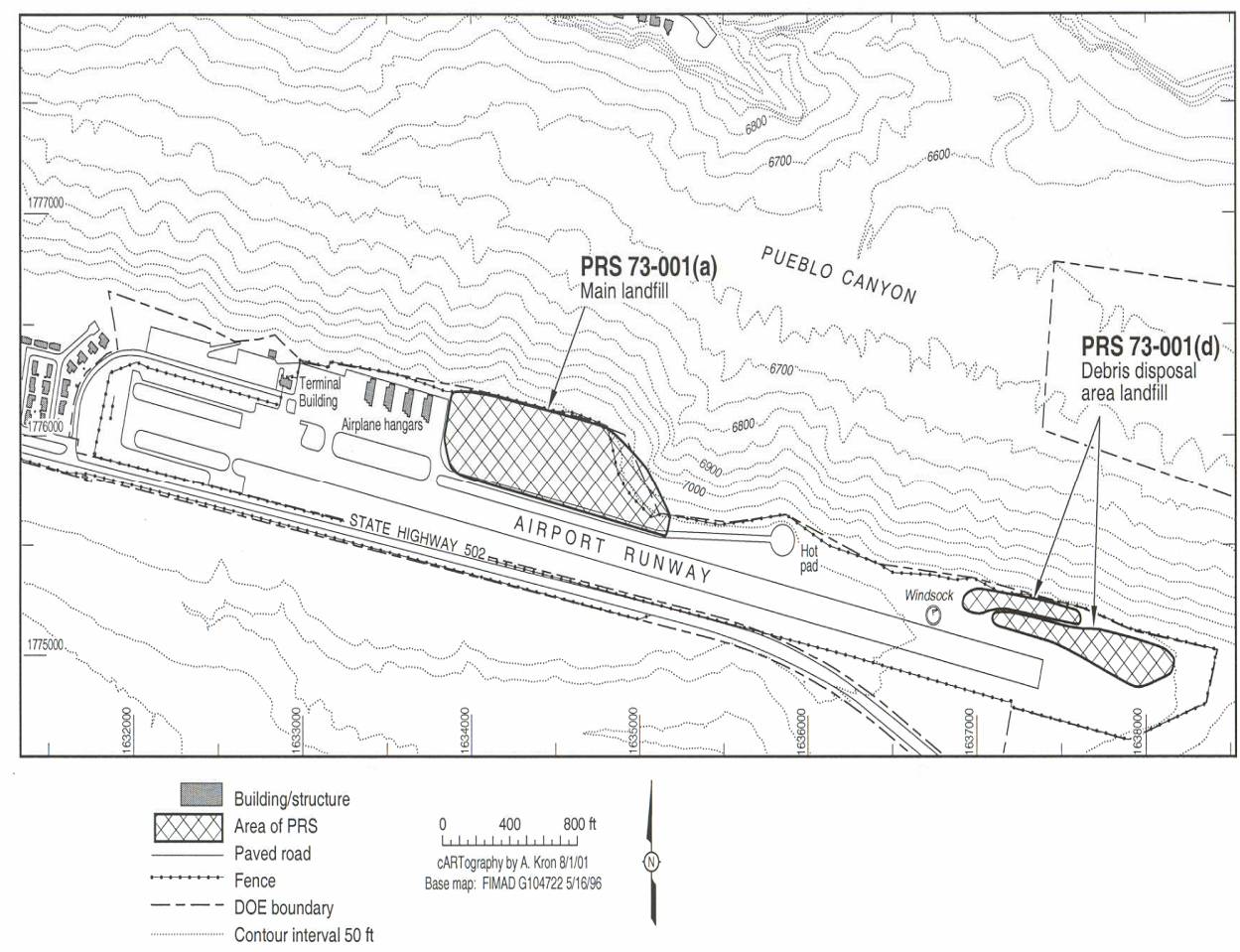

Figure 1.3-2. Location of Potential Release Sites at TA-73

In 1943, the DOE began using the hanging valley north of the airport runway as the main landfill. Garbage was collected twice a week from the Laboratory and town site and burned on the edge of the hanging valley. Heavy equipment was then used to push the burned residues and ash into whichever landfill disposal area was being used at the time. This intentional burning ceased in 1965 when Los Alamos County assumed operation of the landfill. The county continued to operate the landfill until June 30, 1973.

The DDA was used from 1984 to 1986 to bury debris excavated from the western portion of the main landfill. This material was excavated and replaced with clean fill to prepare the western portion of the landfill for the construction of airplane hangars and tie-down areas. Since the wastes placed in the DDA came from the main landfill, both areas contain similar types of debris. In 1986, the DDA landfill was covered with soil and hydroseeded.

2.0 DETAILED ENGINEERING DESIGN

The selected remedy for the Airport Landfill project has been prescribed by the New Mexico Environment Department (NMED) (NMED 2003). The cover will be a *Resource Conservation and Recovery Act* (RCRA) Subtitle D municipal landfill cover as described in *New Mexico Administrative Code* (NMAC)

20.9.1.500 (NMAC 2001). Since the TA-73 landfill is unlined, this design also meets applicable NMAC 20.4.1.600 (RCRA Subtitle C) (NMAC 2003) requirements.

The engineered design of the Airport Landfill project was performed by the team of Weston Solutions, Inc. (WESTON) and North Wind. Design elements included the Design Basis Document for LASO TA-73 Airport Landfill (DBD) (North Wind 2004c), the 60% design package, the 90% design package, and the final design package. These elements were developed sequentially as an iterative process, beginning with the DBD and will culminate with the final design package.

The following subsections describe the regulatory requirements that were used to develop the landfill cover and the draft final design package.

2.1 Regulatory Requirements

In accordance with DOE Order 5480.4, “Environmental Protection, Safety, and Health Protection Standards” (DOE 1993), federal, State of New Mexico, and Los Alamos County regulations were reviewed to identify the mandatory environmental protection, safety, and health requirements. Table 2.1-1 presents the regulatory requirements applicable to the design and closure of the landfill and the DDA

Table 2.1-1
Regulatory Requirements for Airport Landfill Closure Design

Disposal Facility Component	Federal		State of New Mexico or Los Alamos County		Minimum Regulatory Technical Requirement	Additional Design Basis
	Technical Requirement	Citation	Technical Requirement	Citation	Citation	
Layout, Earthwork and Siting Criteria	Prevent washout of waste by 100 year flood, if in 100 year flood plain	10 CFR 1022 E.O. 11988	Not to be located in floodplain, within 500 feet of wetlands, or 200 feet of watercourse	NMAC 20.9.1.300.B.1(a)	10 CFR 1022 E.O. 11988 NMAC 20.9.1.300.B.1(a)	Site is not located in floodplain. Erosion protection will be included in design.
	Not located within 200 ft. of fault	40 CFR 265.18	Not located within 200 ft. of fault	NMAC 20.9.1.300.B.1(d)	40 CFR 265.18	None
	None		Not located within at least 50 feet from the property boundaries	NMAC 20.9.1.300.B.1(i)	NMAC 20.9.1.300.B.1(i)	May need to redefine property boundary to meet this requirement or obtain a waiver from NMED.
	Protect archaeological resources and sites	43 CFR 7.8 & 7.9	Not located within historically or archaeologically significant sites	NMAC 20.9.1.300.B.1(e)	There are no known cultural resources on site, per RFI Report (LANL 1998, 63070)	Stop work if cultural resources are found
	Disturbances of archaeological resources	16 USC 469	None		None	None
	Protected species may not be disturbed for any purpose	16 USC 661 50 CFR Part 17	Not located within areas that will result in the destruction or adverse modification of critical habitat of endangered or threatened species	NMAC 20.9.1.300.B.1(k) Handbook of Species Endangered in NM	16 USC 661	Mexican spotted owl may occupy cliffs of Pueblo canyon, but not top of mesa. DOE will prepare NEPA clearances.
	None		Not in an active alluvial fan	NMAC 20.9.1.300.B.1(j)	NMAC 20.9.1.300.B.1(j)	None
	Seismic Impact Zone	40 CFR 258.14	Not located within seismic impact zones, unless containment structures are designed to resist maximum horizontal acceleration in lithified earth material	NMAC 20.9.1.300.B.1(l)	40 CFR 258.14	RCRA Subtitle D Seismic Design Guidance for Municipal Solid Waste Landfill Facilities. Design will address seismic impact.

Disposal Facility Component	Federal		State of New Mexico or Los Alamos County		Minimum Regulatory Technical Requirement	Additional Design Basis
	Technical Requirement	Citation	Technical Requirement	Citation	Citation	
Layout, Earthwork and Siting Criteria (cont.)	None		Not located within unstable area unless engineering measures are incorporated into design	NMAC 20.9.1.300.B.1(m)	NMAC 20.9.1.300.B.1(m)	USGS Earthquake Hazard Program. Engineering measures will be incorporated.
Final Cover System Geometry	Horizontal 125-ft setback from the center of the runway	14 CFR 77.25	Not located within the distance to runway set FAA requirements	NMAC 20.9.1.300.B.1(h)	14 CFR 77.25	None
	Regrading requires a maximum 7-ft horizontal:1-ft vertical (7:1) slope beyond setback	14 CFR 77.25	Side slopes shall not exceed a 25% grade (4:1), so final cover of the top portion has a gradient of 2% to 5%, and slope prevents ponding of water and erosion	NMAC 20.9.1.500.B.1(a)	14 CFR 77.25 NMAC 20.9.1.500	Slope stability calculations to support steeper side slopes
Final Cover Requirements and Construction	Notice of Construction near airport	14 CFR 77.11	Obtain written approval from LA County Building Inspector and Airport Manager prior to construction 'in or about' existing hangar or building	LAC 4-149 (Ord. No. 85-238)	14 CFR 77.11 LAC 4-149	None
	None		Obtain permit from LA County Engineer to excavate in public place	LAC 34-32	LAC 34-32	None
	None		Excavation may take place from 7:00 a.m. and 6:00 p.m. only	LAC 34-54	LAC 34-54	None
	None		Noise must not exceed 65 dBA, unless apply for special permit	LAC 18-73	LAC 18-73	Evaluate equipment to determine need for special permit
	Construction Quality Control Plan (CQCP)	40 CFR 265.19	The CQCP prescribes the minimum frequency of testing in accordance with 20.9.1 NMAC for the protective cover when used to facilitate leachate drainage	NMAC 20.9.1.300.G.2(d)	40 CFR 265.19 NMAC 20.9.1.300	Required by DOE Statement of Work (SOW)
	Must provide minimization of liquids	40 CFR 265.310	None		40 CFR 265.310	None

Disposal Facility Component	Federal		State of New Mexico or Los Alamos County		Minimum Regulatory Technical Requirement	Additional Design Basis
	Technical Requirement	Citation	Technical Requirement	Citation	Citation	
Final Cover Requirements (cont.)	Minimum maintenance	40 CFR 265.310	None		40 CFR 265.310	None
	Promote drainage and minimize erosion	40 CFR 265.310	Erosion layer consisting of a minimum of 6 inches earthen material capable of sustaining native plant growth	NMAC 20.9.1.500.B.1(a)	40 CFR 265.310 NMAC 20.9.1.500	Performance assessment and SOW requirements
	Accommodate settling and subsidence	40 CFR 265.310	None		40 CFR 265.310	Slope stability and settlement calculations
	Permeability less than natural subsoils or bottom liner	40 CFR 265.310	Infiltration layer comprised of minimum of 18 in. earthen material with saturated hydraulic conductivity less than or equal to bottom liner or natural subsoils or 1E-05 cm/sec, whichever is less	NMAC 20.9.1.500.B.1(a)	40 CFR 265.310 NMAC 20.9.1.500	Performance assessment and SOW requirements
	Preventing 25 year storm flow Collect & control 24 hr/25 year volume BMPs in Storm Water Pollution Prevention Plan (SWPPP)	40 CFR 122 40 CFR 265.301	None		40 CFR 122 40 CFR 265.301	None
Gas Collection System	Exempt from emission requirements for MSW landfills because not active after November 8, 1987	40 CFR 51, 52, and 60	Exempt from emission requirements for MSW landfills because not active after November 8, 1987	NMAC 20.2.64.7A	40 CFR 51, 52, and 60	Review existing data and develop calculations to determine need for gas venting layer
	None		Prevent the generation and lateral migration of methane gas such that gas concentration does not exceed 25% of LEL in structures and property boundary	NMAC 20.9.1.400.B.2	NMAC 20.9.1.400	Review existing data and develop calculations to determine need for gas venting layer

Disposal Facility Component	Federal		State of New Mexico or Los Alamos County		Minimum Regulatory Technical Requirement	Additional Design Basis
	Technical Requirement	Citation	Technical Requirement	Citation	Citation	
Gas Collection System (cont.)	None		Design of system indicates location and design of vents, barriers, collection piping, manifolds and other control measures	NMAC 20.9.1.300.I.1	NMAC 20.9.1.300.I.1	Review existing data and develop calculations to determine need for gas venting layer
	None		If gas disposal is proposed, the design does not interfere or conflict with site activities or required control measures; does not create or cause danger to persons or property	NMAC 20.9.1.300.I.4(a, b)	NMAC 20.9.1.300.I.4(a, b)	Review existing data and develop calculations to determine need for gas venting layer
	None		Active forced ventilation uses vents located at least one foot above the landfill surface at the location of each gas vent	NMAC 20.9.1.300.I.4(c)	NMAC 20.9.1.300.I.4(c)	Review existing data and develop calculations to determine need for gas venting layer
	None		Physical and chemical characterization of condensates or the residues which are generated and the plan for their disposal	NMAC 20.9.1.300.I.5	NMAC 20.9.1.300.I.5	Review existing data and develop calculations to determine need for gas venting layer
	None		Gas vents are sealed to assure no water infiltration	NMAC 20.9.1.500.B.1(a)	NMAC 20.9.1.500.B.1(a)	Review existing data and develop calculations to determine need for gas venting layer
Facility Surface Water Drainage and Sediment Control	Designed to minimize water contact with waste Surface features direct surface water drainage away from facility to not result in erosion	40 CFR 122	None		40 CFR 122	Applies to both landfill and DDA
	Collect and control 24 hr/25/year volume	40 CFR 265.301	Collect and control 24 hr/25/year volume	NMAC 20.9.1.400.B.5 (a,b)	40 CFR 265.301 NMAC 20.9.1.400	Applies to both landfill and DDA

Disposal Facility Component	Federal		State of New Mexico or Los Alamos County		Minimum Regulatory Technical Requirement	Additional Design Basis
	Technical Requirement	Citation	Technical Requirement	Citation	Citation	
Facility Surface Water Drainage and Sediment Control (cont.)	Meet NPDES requirements SWPPP Preventing 25 year storm flow	40 CFR 122	Run-off shall not discharge any pollutant to the waters of the State or U.S. that violates regulations (NMWQCC, CWA)	NMAC 20.9.1.400.B.5(c)	40 CFR 122 NMAC 20.9.1.400	Conveyance ditches Erosion protection Preserve natural vegetation Minimize disturbance Stockpile stabilization Silt fences
Disposal Facility Releases	Cover or manage to control wind dispersal of particulate matter	40 CFR 265.301	Excavated material must be maintained to minimize disruption of traffic and to keep dirt or dust from spreading or flying	LAC 34-46	40 CFR 265.301 LAC 34-46	Ensure windblown material does not interfere with flight line
Borrow Facilities	BMPs in SWPPP Minimal clearing for grading Detain run-off and trap sediment Surface features direct surface water drainage away from facility	40 CFR 122	None		40 CFR 122	Assume that borrow material will be purchased from vendor; therefore requirements will be responsibility of vendor
	Comply with truck height & weight restrictions during hauling Comply with Motor Carrier Safety	23 CFR 658 49 CFR 40, 325, 350, 355-399	Comply with height and weight of vehicles and loads	NMAC 18.19.8 LAC 38-668 to 673	23 CFR 658 49 CFR 40, 325, 350, 355-399 NMAC 18.19.8 LAC 38-668 to 673	None
Fire Protection	Must have fire suppression means Portable fire extinguishers	40 CFR 265.30 - .37	Provide adequate means to prevent and extinguish fires	NMAC 20.9.1.400.B.7	40 CFR 265.30 - .37 NMAC 20.9.1.400.B.7	None
Sanitary Sewer	Provide toilet and hand washing facilities for workers	29 CFR 1926	None		29 CFR 1926	Assume temporary facilities
Emergency Systems	Internal communications or alarm to instruct personnel	40 CFR 265.30 - .37	None		40 CFR 265.30 - .37	None

Disposal Facility Component	Federal		State of New Mexico or Los Alamos County		Minimum Regulatory Technical Requirement	Additional Design Basis
	Technical Requirement	Citation	Technical Requirement	Citation	Citation	
Access Roads	Maintained to support operation and maintenance	None	None		None	None
Fencing	None		Have worksites fenced or maintained in a manner to safeguard property and public	LAC 10-75	LAC 10-75	None
Security	Prevent unauthorized entry by 24 hr surveillance system, fencing, or signage	40 CFR 265.14	Prevent unauthorized access by the public	NMAC 20.9.1.400.B.4	40 CFR 265.14	None
Disposal Facility Monitoring and Contingencies	Environmental monitoring program Operational efficient releases	None	Control litter, disease vectors, and odors	NMAC 20.9.1.400.B.12	NMAC 20.9.1.400.B.12	None
	Subsidence Changes in facility and site parameters which may affect long term performance	None	None		None	None
	Include surface soil, air, surface water, subsurface soil and water	None	None		None	None
	Environmental monitoring shall consist of effluent monitoring and environmental surveillance	None	None		None	None
Surface Water Monitoring	Per SWPPP Run-on/run-off system Wind dispersal control system	40 CFR 265.303	None		40 CFR 265.303	No surface water at the site.

Disposal Facility Component	Federal		State of New Mexico or Los Alamos County		Minimum Regulatory Technical Requirement	Additional Design Basis
	Technical Requirement	Citation	Technical Requirement	Citation	Citation	
Air Release Monitoring	None		Implement a routine methane monitoring program to ensure that the levels do not exceed 25% LEL	NMAC 20.9.1.400.B.3	NMAC 20.9.1.400.B.3	Review existing data and develop calculations to determine need for gas venting layer and monitoring system
	None		Minimum frequency of methane gas monitoring is quarterly	NMAC 20.9.1.400.B.3	NMAC 20.9.1.400.B.3	Review existing data and develop calculations to determine need for gas venting layer and monitoring system
	None		Air emission limits for oil burning equipment in excess of 250 BTU/hr	NMAC 20.2.18	NMAC 20.2.18	None
	None		Emissions from stationary combustion and diesel burning equipment	NMAC 20.2.61	NMAC 20.2.61	None
	Cover or manage to control wind dispersal of particulate matter	40 CFR 265.301	None		40 CFR 265.301	Ensure windblown material does not interfere with flight line
Post Closure Monitoring/Ground Water Protection	Begin after closure for 30 yrs Maintain effectiveness of final cover, including run-on/run-off	40 CFR 265.117 40 CFR 265.310	Maintain final cover, maintain and operate methane and ground water monitoring systems	NMAC 20.9.1.500.B.2	40 CFR 265.117 40 CFR 265.310 NMAC 20.9.1.500.B.2	None
	None		Post closure care is 30 years	NMAC 20.9.1.500.B.2	NMAC 20.9.1.500.B.2	None
	Closure and post-closure plans are required	40 CFR 265.112, 118	Closure and post-closure plans are required	NMAC 20.9.1.500.A.7	40 CFR 265.112, 118 NMAC 20.9.1.500	None
	Certification of closure report within 60 days of closure	40 CFR 265.115	None		40 CFR 265.115	None

Disposal Facility Component	Federal		State of New Mexico or Los Alamos County		Minimum Regulatory Technical Requirement	Additional Design Basis
	Technical Requirement	**Citation**	**Technical Requirement**	**Citation**	**Citation**	
	Complete closure activities within 180 days	40 CFR 265.113	Complete closure activities within 180 days	NMAC 20.9.1.500.B.1(e)	40 CFR 265.311 NMAC 20.9.1.500	None
	GW must be protected GW monitoring program	40 CFR 265.92 - 99	None		40 CFR 265.92 - 99	None
Long Term Surveillance and Maintenance	See post closure requirements	None	None		None	Assume that long-term surveillance period is for 30 years
	Evaluate vegetation	None	None		None	Per SOW

Note: DOE Order 5480.4 (DOE 1993) is incorporated by reference. O 5480.4 requirements include 1) specify and provide requirements for the application of the mandatory environmental protection, safety, and health (ES&H) standards applicable to all DOE and DOE contractor operations, 2) provide listing of reference ES&H standards, and 3) identify the sources of the mandatory and reference ES&H standards.

CFR = *Code of Federal Regulations*
NMAC = *New Mexico Administrative Code*
USC = *United States Code*
LAC = *Los Alamos County Code*

2.2 Draft Final Design

The draft final design package includes specifications, drawings, and engineering calculations, and is included as Appendix A. Final design specifications and drawings will be generated upon NMED review of the draft final design package, and represents the final specifications directing construction of the landfill cover.

3.0 CONSTRUCTION OR IMPLEMENTATION DETAILS

The Construction Plan for LASO TA-73 Airport Landfill (North Wind 2004a) is attached as Appendix B and describes methods and protocols that North Wind will use to manage construction activities at the Airport Landfill project. The Construction Plan summarizes planned construction activities and shows how specific construction activities will be completed in accordance with final design specifications and drawings.

The Construction Plan provides construction management protocol including key personnel responsibilities, reporting requirements, and a detailed construction schedule. The Construction Plan also provides a detailed description of construction activities which include:

- Procurement of materials and services;
- Mobilization activities which include assembling construction documents, conducting a construction readiness assessment, building access roads, installing temporary field trailers, initial surveying of the DDA and main landfill, mobilizing heavy equipment to the site, and locating underground utilities;
- Site preparation activities which include installing perimeter fencing, installing storm water run-off and erosion controls, abandoning existing monitoring wells within the footprint of the main landfill, and abandoning and/or relocating existing utilities;
- Construction of the DDA which includes a pre-construction survey, rough regrading, adding topsoil as needed to bring final topsoil to 12 inches over the entire DDA footprint, and surveying the final grade;
- Construction of the east and north slope of the main landfill which includes salvaging existing soil for use as subgrade, a pre-excavation survey, relocating existing municipal landfill waste, establishing the subgrade, adding the infiltration layer, adding geotextile and rock armor (riprap) over the slopes, and a survey of the final grade;
- Relocating waste and backfilling at the southeast corner of the main landfill;
- Construction of the approved cover over the main landfill which includes establishing the subgrade using salvaged soil, and placement of the low-permeability infiltration layer and topsoil;
- Acceptance testing of the various emplaced cover components (e.g., subgrade, infiltration layer, topsoil);
- Revegetation of the DDA and main landfill;
- DOE inspection and acceptance; and
- Demobilization.

The Construction plan also provides meetings and inspections criteria; quality controls; health and safety controls; operation, maintenance, and monitoring requirements; and training and certification requirements.

Quality control (QC) of constructed landfill components (e.g., soil cover and rock armor) is an important element of the Airport Landfill project. The Construction Quality Control Plan for LASO TA-73 Airport Landfill (CQCP) (North Wind 2004b) provides QC requirements for construction activities, including testing of offsite borrow material, emplaced cover components, and as-delivered testing of borrow material. The CQCP is attached in Appendix C.

4.0 VAPOR MONITORING SYSTEM DESIGN AND PLAN

Based on analysis of requirements shown in Table 2.1-1, it has been determined that installation of a vapor monitoring system is not applicable. The landfill was not active after November 8, 1987; federal and State law mandate that active landfills before this date are exempt from emission requirements.

Also, engineering calculations indicate that gas concentrations will not exceed 25 percent of the lower explosive limit (LEL) for methane in structures and at the property boundary. The Landfill Gas Production Summary (Engineering Calculations for LASO TA-73 Airport Landfill; Appendix A) examines the regulatory requirements for landfill gas (LFG), and estimates rates and quantities of LFG produced. The results are discussed in the context of previous methane measurements at the landfill, and of regulatory requirements for LFG and recommends:

- LFG monitoring at the landfill boundaries only in the event that enclosed structures are built nearby
- Gas collection only in the vicinity of such structures in the event that the regulatory limit is exceeded based on monitoring results

However, if future tenants build structures adjacent to, or on the main landfill, vapor monitoring systems will be required in the structure(s) to assure LEL does not exceed 25 percent.

5.0 DEMONSTRATION OF COVER PERFORMANCE

The Post-closure Care and Monitoring Plan for TA-73 Airport Landfill (PCMP) (North Wind 2004c) is attached as Appendix D and identifies post-closure care and monitoring requirements for the landfill, and describes activities to meet those requirements. The PCMP applies to operation and maintenance of the cover integrity.

The PCMP identifies regulatory requirements for post-closure care and monitoring; post-closure monitoring and maintenance methods for the cover system, storm water control system, survey benchmarks, and access roads; record-keeping and reporting requirements; and describes an inspection schedule for years one through five of the post-closure period.

6.0 SCHEDULE FOR COVER MAINTENANCE

As discussed above in Section 5.0, the schedule for cover maintenance is provided in the PCMP (Appendix D). Inspections for years one through five of the post-closure period are tentatively scheduled for the first two weeks of June each year, so that the condition of vegetation can be inspected and corrected as needed early in the growing season. All other deficiencies should be corrected at the earliest opportunity and before the end of the calendar year, in order to be completed during the reporting period.

7.0 CLOSURE AND POST-CLOSURE CARE

As discussed above in Section 5.0, methods for closure and post-closure care are proved in the PCMP (Appendix D). Monitoring for cover integrity will include inspections of the cover, and maintenance and repair of deficiencies. No frequency is specified in the requirements; however annual inspections are specified in this plan. An inspection report will be completed for each inspection. The following subsections describe inspection and maintenance tasks.

7.1 Cover System

Annual cover inspection will include site walkovers looking for and documenting erosional damage and cracks, animal burrows, subsidences, and condition of vegetation. The PCMP provides methods for repairing these conditions, if warranted.

7.2 Storm Water Control System

Annual storm water control system inspections will include all areas of the site, as described in the Storm Water Pollution Prevention Plan (SWPPP) (North Wind 2004j). Inspectors will look for evidence of, or the potential for, pollutants entering the storm water conveyance system. Discharge locations identified in the site plans will be inspected to determine whether erosion controls are effective in preventing significant impact to Pueblo Canyon.

7.3 Survey Benchmarks

Annual inspections will include locating and documenting the condition of permanent survey benchmarks annually. Benchmarks will be maintained in a clearly visible condition.

7.4 Access Roads

Annual access road inspections will include looking for and documenting subsidence, caving, cracking, severe ruts or other conditions that would limit or prevent use of the road for access by vehicles or equipment required to maintain and monitor the landfill.

8.0 VCM PLAN GROUND WATER MONITORING DATA

In the VCM Plan conditional approval letter (NMED 2003), NMED inquired as to why certain monitoring well sampling data were collected and results not reported. The comment was in regard to Section 2.3.2.1, “Monitoring Well Sampling” of the VCM Plan (LANL 2002, 74007.2) which states:

“…Therefore, the data are of little or no use when evaluating the effectiveness of the run-on controls, and the monitoring well sampling results are not presented in this plan.”

LANL’s response to the inquiry was that the above referenced data will be provided to NMED in the Phase II Work Plan. The following information provided by North Wind responds to NMED’s inquiry and is included to satisfy LANL’s commitment that the explanation will be included in the Phase II Work Plan.

“The pore water sampling from the existing monitoring wells that was attempted during the supplemental sampling campaign executed in 2001 failed to generate meaningful data. All wells were sampled in an attempt to collect pore water to verify the effectiveness of run on controls and to assess the moisture content within the landfill after two years of storm water diversion. Unfortunately, inadequate pore water was collected from any of the monitoring wells for meaningful analysis. It is believed that this is due to the ongoing drought conditions which has resulted in inadequate landfill moisture to sustain water in the

subsurface coupled with the installation of the aforementioned storm water controls to divert runoff that formerly drained onto the landfill" (Rust 2004).

9.0 SUPPORTING PROJECT DOCUMENTS

As discussed previously, this Phase II Work Plan is the primary scoping document for the Airport Landfill project. However, other plans and procedures have been prepared to direct and manage activities for both the planning and construction phases of the project. The following subsections provide a brief overview of these documents.

9.1 Project Quality Assurance Plan

The Project Quality Assurance Plan for LASO TA-73 Airport Landfill (PQAP) (North Wind 2003a) describes how North Wind will implement a quality assurance (QA) program for the Airport Landfill project that complies with the applicable requirements of DOE Order 414.1A, "Quality Assurance" (DOE 2001) and Title 10 *Code of Federal Regulations* (CFR) 830, Subpart A,§830.120, "Quality Assurance Requirements" (CFR 2003a)

The PQAP conforms to the ten QA criteria as stated in DOE Order 414.1A which include 1) program description, 2) personnel training and qualification, 3) quality improvement, 4) documents and records, 5) work processes, 6) design, 7) procurement, 8) inspection and acceptance testing, 9) management assessment, and 10) independent assessment

9.2 Health and Safety Plan

The Health and Safety Plan for LASO TA-73 Airport Landfill (HASP) (North Wind 2004d) establishes the procedures and requirements that will be used to eliminate or minimize health and safety hazards to personnel conducting construction tasks at the Airport Landfill project. The objective of the HASP is to meet the regulatory requirements of the Occupational Safety and Health Administration standard 29 CFR 1926.65 "Hazardous Waste Operations and Emergency Response" (CFR 2003b). The HASP governs all work at the project sites that is performed by North Wind, subcontractors, and any other personnel who enter the project site.

The HASP identifies anticipated site hazards and appropriate mitigation measures, exposure monitoring and sampling protocol, accident and exposure prevention, personal protective equipment, required personnel training, site control and security measures, occupational medical surveillance, key site personnel responsibilities, emergency response plan, decontamination procedures, and record-keeping requirements.

9.3 Project Management Plan

The Project Management Plan for LASO TA-73 Airport Landfill (PMP) (North Wind 2004f) describes the management structure and processes that North Wind will use to manage the Airport Landfill project. The PMP identifies key positions and associated responsibilities, availability and allocation or resources, management controls, contract administration, reporting protocol, project deliverables, a summary of the corporate QA program, and training and certification requirements. The project baseline schedule and work breakdown structure are also found in the PMP.

9.4 Storm Water Pollution Prevention Plan

The SWPPP (North Wind 2004j) has been prepared for the construction and post-construction phases of the final design remedy cover at the Airport Landfill project. The SWPPP complies with the terms of the

"Final National Pollutant Discharge Elimination System General Permit for Storm Water Discharges from Construction Activities" (FR 2003). The SWPPP also complies with applicable DOE and State of New Mexico regulations.

The primary purpose of the SWPPP is to provide a framework for reducing soil erosion and minimizing pollutants in storm water during construction of the final design remedy cover at the Airport Landfill. In addition, the SWPPP will:

- Describe construction activities, including site operators responsible for implementing and maintaining this SWPPP
- Describe existing site conditions including the body of water(s) which will receive runoff from the construction site
- Identify all potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges from the construction site
- Describe Best Management Practices (BMPs) that will be used to reduce erosion, sediment and pollutants in storm water discharge
- Provide methods for the regular inspection and maintenance of BMPs

9.5 Waste Management Plan

The Waste Management Plan for LASO TA-73 Airport Landfill (WMP) (North Wind 2004k) describes methods that North Wind will use to manage investigation-derived waste generated during execution of the Airport Landfill project. The WMP describes waste management goals, pollution prevention and waste minimization techniques, methods for managing nonhazardous waste streams and petroleum-contaminated soil, training requirements, and spill notification and reporting protocols.

9.6 Implementing Procedures

As described in the PQAP, North Wind corporate quality assurance procedures will be implemented during the Airport Landfill project. In addition, several project-specific Project Work Instructions (PWIs) have been developed. The PWIs include:

- PWI-4201-001, "Project Files" (North Wind 2003b)
- PWI-4201-002, "Field Activities Documentation" (North Wind 2003c)
- PWI-4201-003, "Document Preparation and Review" (North Wind 2004g)
- PWI-4201-004, "Readiness Assessment" (North Wind 2004h)
- PWI-4201-005, "Field Change" (North Wind 2004i)

10.0 REFERENCES

The following list includes all of the documents cited in this Phase II Work Plan. The parenthetical information following each reference provides the author, publication date, and LANL Environmental Restoration identification number (as applicable). This information is also included in the text citations and can be used to locate documents on this list.

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New Mexico Administrative Code (NMAC), November 27, 2001. New Mexico Administrative Code 20.9.1.500, "Closure and Post-closure Requirements," published by the Commission of Public Records, Administrative Law Division, Santa Fe, New Mexico. (NMAC 2001)

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North Wind, Inc. (North Wind), November 2003. "Project Quality Assurance Plan for Los Alamos Site Office TA-73 Airport Landfill," Revision 0, North Wind, Inc. document NW-ID-2003-071, Idaho Falls, Idaho. (North Wind 2003a)

North Wind, Inc. (North Wind), November 2003. "Project Work Instruction PWI-4201-001, Project Files," Revision 0, Idaho Falls, Idaho. (North Wind 2003b)

North Wind, Inc. (North Wind), November 2003. "Project Work Instruction PWI-4201-002, Field Activities Documentation," Revision 0, Idaho Falls, Idaho. (North Wind 2003c)

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North Wind, Inc. (North Wind), March 2004. “Waste Management Plan for Los Alamos Site Office TA-73 Airport Landfill,” Revision 0, North Wind, Inc. document NW-ID-2004-006, Idaho Falls, Idaho. (North Wind 2004k)

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11.0 ACRONYMS

BMP	Best Management Practice
CFR	*Code of Federal Regulations*
CQCP	Construction Quality Control Plan
DBD	Design Basis Document
DDA	Debris Disposal Area
DOE	U.S. Department of Energy
ES&H	Environmental safety and health
HASP	Health and Safety Plan
LAC	*Los Alamos County Code*
LANL	Los Alamos National Laboratory
LASO	Los Alamos Site Office
LEL	Lower explosive limit
LFG	Landfill gas
NMAC	*New Mexico Administrative Code*
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge and Elimination System
PCMP	Post-closure Care and Monitoring Plan
PMP	Project Management Plan
PQAP	Project Quality Assurance Plan
PRS	Potential Release Site
PWI	Project Work Instruction
QA	Quality assurance
QC	Quality control
RCRA	*Resource Conservation and Recovery Act*

SWPPP	Storm Water Pollution and Prevention Plan
TA	Technical Area
USC	*United States Code*
VCM	Voluntary Corrective Measure
WESTON	Weston Solutions, Inc.
WMP	Waste Management Plan

Appendix A
Final Design Package
(Specifications, Drawings, Calculations)

Appendix B
Construction Plan for LASO TA-73 Airport Landfill

Appendix C
Construction Quality Control Plan
for LASO TA-73 Airport Landfill

Appendix D
Post-closure Care and Monitoring Plan
for LASO TA-73 Airport Landfill

NW-ID-2004-016
Revision 1

CONSTRUCTION QUALITY CONTROL PLAN FOR LOS ALAMOS SITE OFFICE TA-73 AIRPORT LANDFILL

April 2004

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DOCUMENT APPROVAL PAGE

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Approval Signatures

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Revision Log

Revision	Date	Reason for Revision
Draft	02/12/04	Not applicable; first draft of document
Revision 0	03/15/04	Document revised to ensure consistency with final construction specifications. DOE-LASO had no comment on the draft of this document.
Revision 1	04/06/04	Document revised to correct minor formatting errors and add discussion of identification and mitigation of potential suspect/counterfeit items (Section 7.0)

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1.0 INTRODUCTION

This Construction Quality Control Plan (CQCP) provides the quality control (QC) requirements for construction activities at the U.S. Department of Energy (DOE) Los Alamos Site Office (LASO) Technical Area (TA)-73 Airport Landfill, henceforth referred to as the Airport Landfill project.

The CQCP provides the minimum inspection, testing (methods and frequency), materials, installation, and documentation requirements to ensure that design specifications for the Airport Landfill project are met or exceeded during construction. Protocols for reporting test results, certifying compliance with specifications and drawings, correcting construction deficiencies, and documenting such corrections are also provided.

As described in the DOE Savannah River Operations Office "Statement of Work for the Airport Landfill" (DOE 2003), the Airport Landfill project mission consists of designing and constructing an appropriate cover over Potential Release Site (PRS) 73-001(a) Airport Landfill (hereinafter referred to as the main landfill), and recontouring and reseeding of PRS 73-001(d) Debris Disposal Area (DDA). The site description and operational history is documented in the Los Alamos National Laboratory (LANL) Voluntary Corrective Measure Plan (LANL 2002, 74007.2). A brief summary is presented below in Section 1.1.

The New Mexico Environment Department (NMED) has approved the use of an engineered landfill cover that will meet or exceed applicable *Resource Conservation and Recovery Act* Subtitle C requirements (NMED 2003). The alternative cover must function efficiently and in accordance with the design parameters for the duration of the 30-year post-closure care period.

Activities for the construction of the landfill cover are detailed in the Construction Plan for LASO TA-73 Airport Landfill (North Wind 2004a). Construction activities will be completed by North Wind, Inc. (North Wind) and in general, include:

Debris Disposal Area

- Regrade to eliminate low spots and establish proper drainage
- Add topsoil as needed to bring the topsoil thickness over the entire footprint to 12 inches (in.)
- Revegetate denuded and/or disturbed areas

Main Landfill

- Excavate and relocate waste from the east and north faces of the main landfill; establish a final grade not to exceed 3H:1V slope
- Install a rock armor or other suitable material over the east and north slopes
- Install the approved cover over the flat portion of the main landfill, and revegetate

1.1 Site Description and Background

The main landfill and DDA are inactive solid waste management units and are listed in Table A within Module VIII of LANL's Hazardous Waste Facility Permit (LANL 1996, 57486). Both PRSs are located within TA-73 on DOE property, as shown in Figure 1.1-1. The main landfill is east of the existing airport hangars and the DDA is north and east of the end of the runway. Figure 1.1-2 shows the location of the PRSs in TA-73.

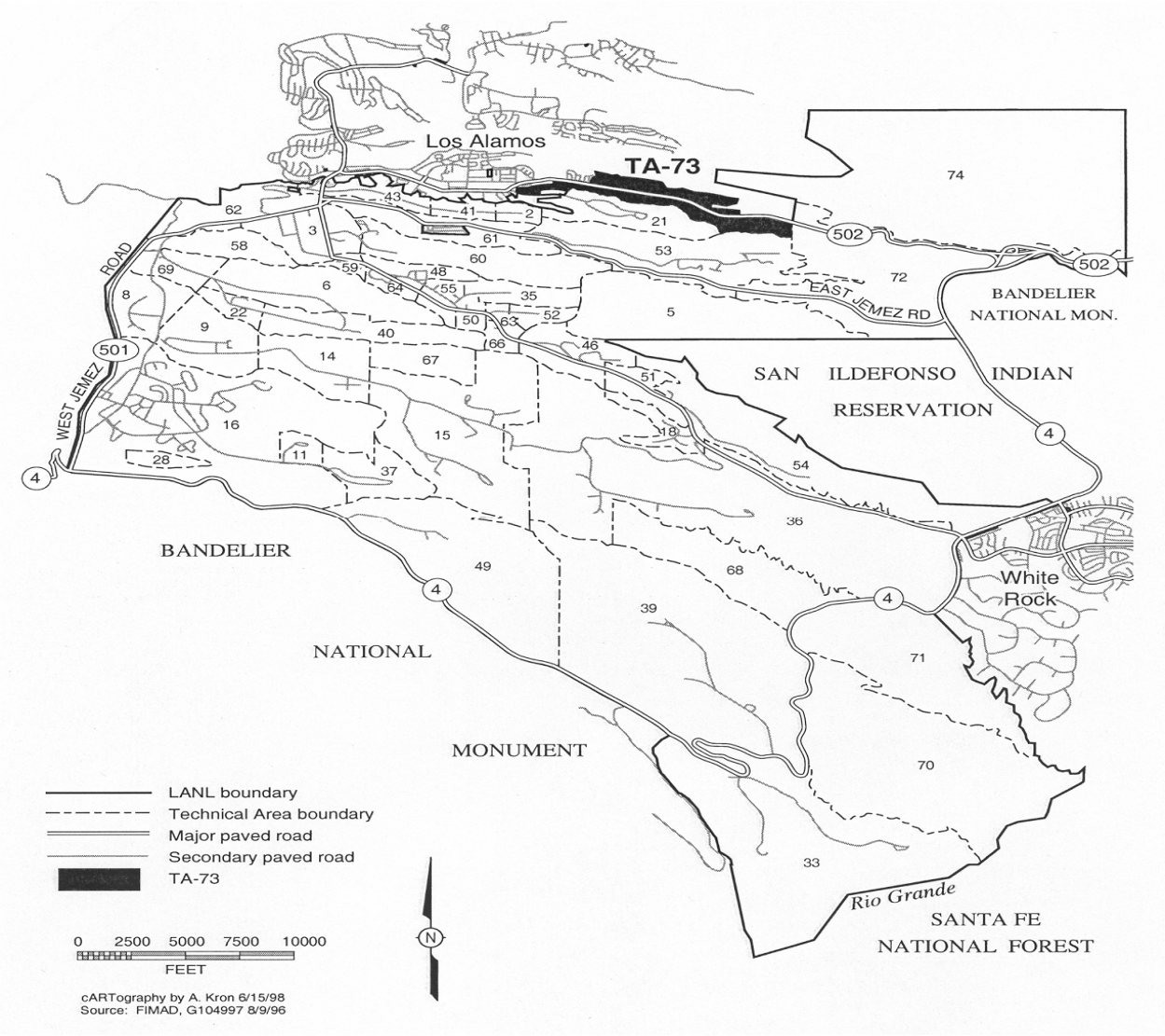

Figure 1.1-1. Location of TA-73 at Los Alamos National Laboratory

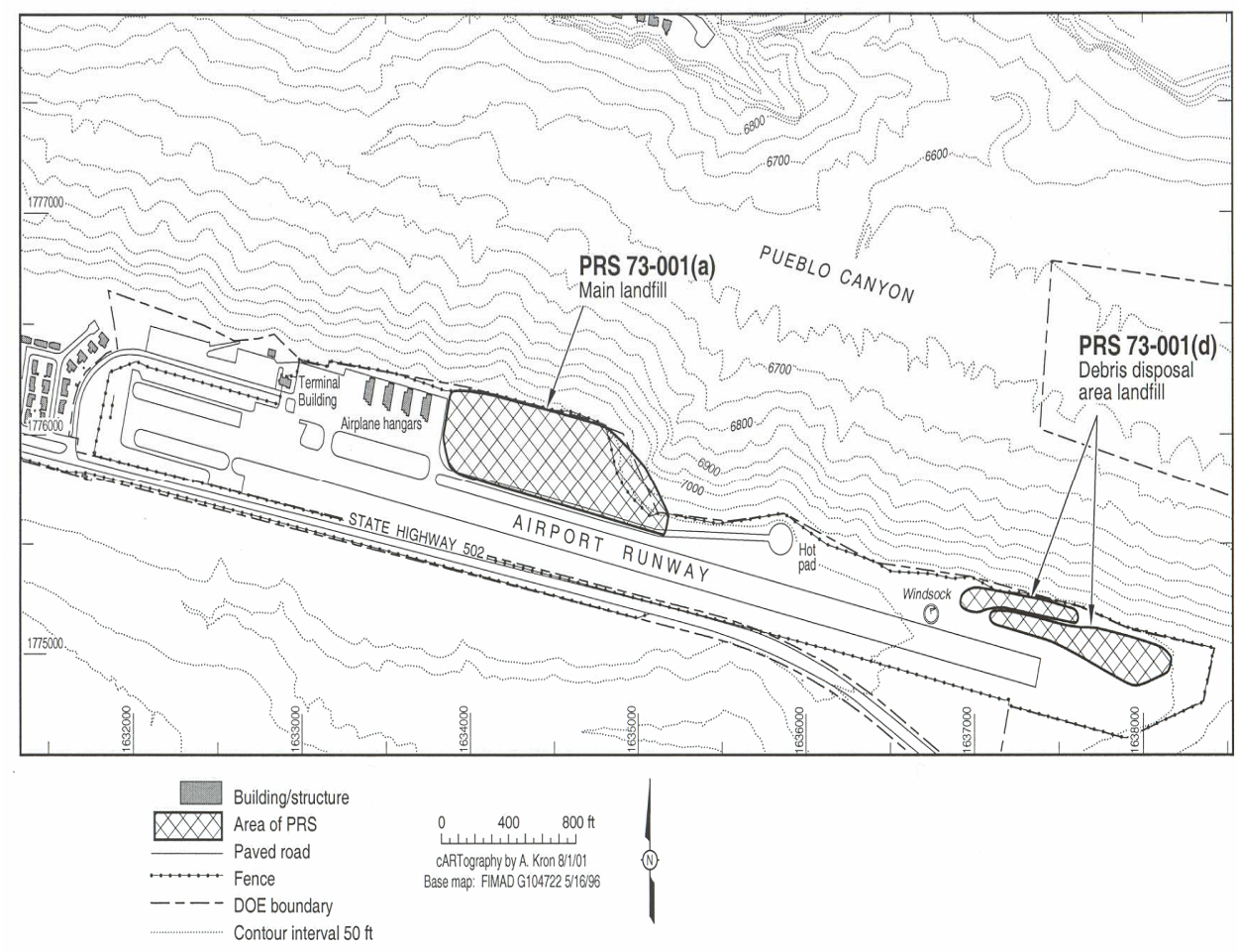

Figure 1.1-2. Location of potential release sites at TA-73

In 1943, the DOE began using the hanging valley north of the airport runway as the main landfill. Garbage was collected twice a week from LANL and the town site and burned on the edge of the hanging valley. Heavy equipment was then used to push the burned residues and ash into whichever landfill disposal area was being used at the time. This intentional burning ceased in 1965 when Los Alamos County assumed operation of the landfill. The county continued to operate the landfill until June 30, 1973.

The DDA was used from 1984 to 1986 to bury debris excavated from the western portion of the main landfill. This material was excavated and replaced with clean fill to prepare the western portion of the landfill for the construction of airplane hangars and tie-down areas. Since the wastes placed in the DDA came from the main landfill, both areas contain similar types of debris. In 1986, the DDA landfill was covered with soil and hydroseeded.

1.2 Scope

This CQCP applies to construction quality control (CQC) activities during construction of the final design remedy at the main landfill and DDA. Generally, CQC activities assure compliance to approved construction specifications and drawings. These design elements have been prepared by Weston Solutions, Inc. (WESTON) in an iterative process. The process began with a conceptual design presented in the Design Basis Document for LASO TA-73 Airport Landfill (North Wind 2004b) and will culminate with a final design

approved by DOE and NMED. The final design package will include specifications and drawings. As such, the CQCP extensively references the final construction specifications. Reference shall be by the specification number and title (e.g., Specification 01010, Summary of Work). If construction specifications change following issuance of Revision 0 of this CQCP, the document will be revised as necessary.

Construction specifications take precedence over construction drawings, which in turn take precedence over ancillary project scoping plans.

1.3 Document Interfaces

The Phase II Work Plan for LASO TA-73 Airport Landfill (North Wind 2004d) is the primary scoping document for the project. The Phase II Work Plan includes by reference or incorporation:

- Final construction specifications, drawings, and engineering calculations
- Construction Plan (North Wind 2004a)
- This CQCP
- Post-closure Care and Monitoring Plan for LASO TA-73 Airport Landfill (North Wind 2004e)

In addition to the Phase II Work Plan, the following project plans direct or implement CQC activities and will be onsite and complied with during construction:

Project Quality Assurance Plan

Overall project quality assurance (QA) is managed according to the Project Quality Assurance Plan for LASO TA-73 Airport Landfill (PQAP) (North Wind 2004g). The PQAP establishes an audit schedule, defines methods to qualify subcontractor QA programs, and discusses the protocol for nonconformance reporting and resolution.

Project Management Plan

The Project Management Plan for LASO TA-73 Airport Landfill (PMP) (North Wind 2004f) describes the overall management structure and methods for the project. The PMP defines meeting and reporting protocols, provides overall organizational structure, and defines methods for procurement of materials and services.

Storm Water Pollution Prevention Plan

The Storm Water Pollution Prevention Plan for LASO TA-73 Airport Landfill (SWPPP) (North Wind 2004j) describes storm water runoff and erosion controls that will be implemented.

Health and Safety Plan

The Health and Safety Plan for the LASO TA-73 Airport Landfill (HASP) (North Wind 2004c) provides controls for the use of field test equipment (e.g., nuclear density gauge).

2.0 QUALITY CONTROL PROGRAM

Specification 01400, Quality Control, provides overall quality control specifications. North Wind has contracted with WESTON to perform CQC services for the Airport Landfill project. Specifically, North Wind will manage the CQC program and WESTON will provide a QC Field Engineer.

Primary CQC activities and objectives include:

- Collecting and analyzing offsite borrow source material to assure that these materials comply with respective specifications,
- Verifying that man-made materials (e.g., geosynthetic liners, silt fences, chain link fence) installed during construction of the final remedy comply with specifications,
- Field-testing installed components of the landfill cover for appropriate parameters (e.g., moisture content and compaction), and
- Verifying that landfill cover components (e.g., soils, riprap, geosynthetic liners) and ancillary components (e.g., storm water runoff and erosion control devices, fencing) are properly installed, maintained, and inspected in compliance with approved specifications.

Assigned tasks and assumed responsibilities necessary to fulfill these objectives are detailed below in Section 2.1. The CQC organizational chart is shown in Figure 2.0-1.

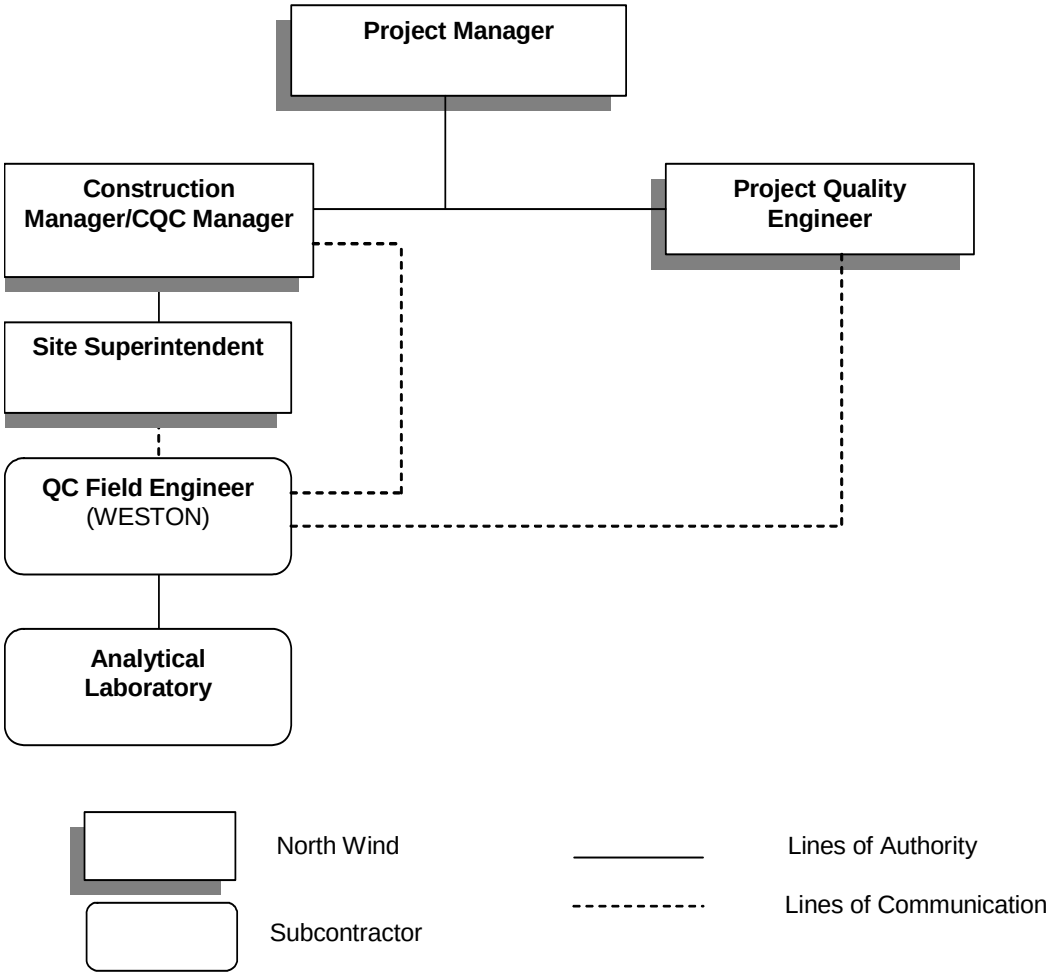

Figure 2.0-1. CQC organizational chart for Airport Landfill project

2.1 Organizational Structure and Responsibilities

The Airport Landfill project CQC roles include the CQC Manager (the Construction Manager will act in this role), the Site Superintendent (SS), the QC Field Engineer, the Project Quality Engineer (PQE), and approved subcontractors (i.e., geotechnical testing laboratory [GTL]).

2.1.1 CQC Manager

The North Wind CQC Manager has overall responsibility for implementing the CQC program. The CQC Manager has the sole authority to direct and manage personnel and equipment to accomplish this task.

The CQC Manager will have sufficient educational, technical, and administrative experience to fulfill this role. The CQC Manager will be cognizant of specific construction practices relating to construction, observation, and testing procedures, documentation procedures and construction-level specifications, permit requirements and regulations applicable to the Airport Landfill project.

The CQC Manager reports to the North Wind Project Manager and directs the SS.

2.1.2 Site Superintendent

The North Wind SS is responsible for daily work activities and directly manages field construction crews and support staff. This is a fulltime, onsite position. The primary responsibility of the SS is to ensure that all aspects of the project are conducted in accordance with the final construction specifications, construction drawings, and project scoping documents, using necessary and industry-accepted construction procedures. Additional CQC responsibilities tasked to the SS include:

- Ensures adequate quantities or required materials are available, and schedules the delivery of these materials
- Ensures equipment (e.g., heavy equipment, onsite testing devices) is available and functional to obtain required results and meet project specifications
- Visually inspects delivered offsite borrow source material for undesired elements, such as large rocks or debris
- Obtains material certifications (e.g., seed tags, geotextile and fencing certifications) and provides these certifications to the QC Field Engineer
- Inspects construction activities, including installation of landfill cover components, to verify they are performed compliant with specifications
- Ensures soil layers are not placed, spread, or compacted during unfavorable weather conditions
- Performs or oversees intermittent grade checks by visual means or survey, to control cut and fill operations
- Checks survey data for consistency, completeness, and accuracy, to the extent possible
- Works with the QC Field Engineer and PQE to resolve nonconformances
- Inspects subgrade for loose or unstable areas

- Manages and maintains project documents and records in accordance with North Wind Project Work Instruction (PWI)-4201-001, Project Files (North Wind 2003a) and Section 6.0

The SS reports to the Construction Manager and directs field personnel and subcontractors. The SS interfaces with the QC Field Engineer and provides access, equipment, materials, and other support as needed to enable the QC Field Engineer to complete required tasks described below in Section 2.1.3.

2.1.3 QC Field Engineer

The WESTON QC Field Engineer is responsible for conducting CQC activities in accordance with this CQCP and will be onsite as needed during construction of the landfill cover. The QC Field Engineer will be under the direct supervision of a Professional Engineer registered in the State of New Mexico in civil or geotechnical engineering. The QC Field Engineer will have sufficient practical, technical, and managerial experience to successfully complete assigned CQC activities, and will be knowledgeable of permit requirements, specifications, and implementing project plans.

The primary task assigned to the QC Field Engineer is certifying that the various components of the landfill cover, such as the infiltration layer and topsoil, have been installed according to specifications. This certification will be documented at hold points with Incremental Certification Reports, (ICRs), as described in Section 6.3.2. Other CQC inspection or test results will be documented in the daily CQC field reports, as described in Section 63.1. Additional CQC tasks assigned to the QC Field Engineer include:

- “Pre-qualifying” offsite borrow material to ensure the material is compliant with specifications (see Section 3.0)
- Oversees field tests to ensure that soil layers are properly installed and compacted
- Periodically monitors the loading of offsite borrow material to ensure it was excavated from a “pre-qualified” location
- Checks delivered material against certifications to ensure the materials conform to specifications; Part 1.03 of Specification 01400, Quality Control, provides additional materials certification information
- Verifies that the equipment used in CQC field testing meets the test requirements (including calibration), and that testing is completed according to standardized procedures
- Recommends acceptance or rejection of work items, particularly with regard to installation of soil layers
- Documents CQC activities in conformance with PWI-4201-001, Project Files (North Wind 2003a); PWI-4201-002, Field Activities Documentation (North Wind 2003b); and Section 6.0
- Prepares daily and monthly summary CQC reports (see Section 6.3.1)
- Prepares ICRs (see Section 6.3.2)

The QC Field Engineer reports to the SS on a daily basis and may report to the CQC Manager on certain issues. The QC Field Engineer interfaces with the North Wind PQE to report and resolve nonconformances, and directs GTL staff on issues related to sample collection and analysis, operation of certain field test equipment, and data reporting.

2.1.4 Project Quality Engineer

The North Wind PQE is primarily responsible for managing nonconformances, as described in North Wind Quality Assurance Procedure (QAP)-14, Corrective and Preventive Action (North Wind 2002). Additional detail is provided in Section 6.1. The PQE will also conduct project audits on the schedule provided in the PQAP and will review and certify subcontractor QA programs as needed, in conformance with the PQAP.

The PQE reports to the Construction Manager, primarily on nonconformance issues, and interfaces with the QC Field Engineer.

2.1.5 Geotechnical Testing Laboratory

A GTL will be subcontracted for sample analysis and data reporting, as described in Section 3.0. GTL personnel will collect samples for as-delivered testing (Sections 5.3.1 and 5.4.1), and will operate field test equipment (e.g., nuclear density gauge).

2.2 Review of Quality Control Information

The QC Field Engineer will be responsible for obtaining GTL test results and field test data and for reviewing these data for conformance to the specifications, drawings, and the CQCP. A copy of these data will be provided to the North Wind SS and/or CQC Manager. Deficient work items not resolved between the QC Field Engineer and North Wind will be documented with nonconformance reports (NCRs), as described in Section 6.1.

2.3 Project Meetings

The SS and QC Field Engineer will communicate on a regular basis to ensure the requirements in this CQCP, supporting documents listed in Section 1.3, and construction specifications are being met. This will be accomplished through meetings held during the progress of the work. The meetings will be documented and the documentation will be managed according to Section 6.0 and PWI-4201-001, Project Files (North Wind 2003a)

Additional pre-construction and progress meeting requirements are discussed in the Construction Plan (North Wind 2004a) and PMP (North Wind 2004f).

3.0 OFFSITE BORROW MATERIAL TESTING

Offsite borrow material will be tested according to Part 1.04B of Specification 02200, Earthwork. Representative samples will be collected and submitted for GTL analysis of the parameters shown in Table 02200-1 of Specification 02200, Earthwork. Methods and materials for sample collection, analysis, and data reporting are provided in Appendix B. Offsite borrow material to be tested includes:

- Infiltration layer material (low-permeability soil)
- Topsoil

Structural fill (some or all of the structural fill may be salvaged soil from the main landfill; this material will be tested as described in this section and Appendix B)

4.0 MOBILIZATION AND SITE PREPARATION

Mobilization and site preparation activities are detailed in the Construction Plan (North Wind 2004a). The following subsections provide appropriate CQC information relating to mobilization and site preparation activities.

4.1 Construct Access Roads

Access roads to the main landfill and DDA will be constructed in accordance with Specification 02500, Gravel/Access Roads.

4.2 Survey DDA and Main Landfill

Surveying will be conducted in accordance with Specification 02005, Surveying. A survey subcontractor will be procured in accordance with the PQAP (North Wind 2004g), the PMP (North Wind 2004f), and applicable North Wind corporate procedures. Survey work will be performed under the direction of a Land Surveyor registered in the State of New Mexico. The SS will check survey data for consistency and accuracy, to the extent possible. The following surveys will be performed:

- The subgrade surface after removal of existing interim cover material from the main landfill
- The excavated and placed waste material on the main landfill
- The top surface of the infiltration layer to ensure an adequate thickness of this material
- The final grade surface of the main landfill and DDA after the topsoil layer has been installed to verify adequate topsoil thickness and final finished grade

4.3 Install Perimeter Fencing

Chain link perimeter fencing will be installed in accordance with Specification 02980, Chain Link Fence. The SS will obtain material certifications for delivered fencing and the QC Field Engineer will check the certifications against the specification to ensure compliance. The QC Field Engineer will also periodically (spot-check) rolls of fencing against the certification to ensure the proper material was delivered.

4.4 Install Storm Water Controls

Storm water runoff and erosion controls will be installed, maintained, and inspected in accordance with the SWPPP (North Wind 2004j) and the following final construction specifications:

- Specification 02720, Storm Drain System
- Specification 02750, Stormwater Management and Discharge
- Specification 02930, Erosion and Sediment Control

The SS will verify that the erosion control materials listed in the above references are available on site and will obtain manufacturer certifications for silt fence, storm drain system components, and other erosion control materials. The QC Field Engineer will check the certifications against the specification to ensure compliance and will also periodically (spot-check) rolls of fencing against the certification to ensure the proper material was delivered.

5.0 LANDFILL COVER CONSTRUCTION

Landfill cover construction activities are detailed in the Construction Plan (North Wind 2004a). The following subsections provide appropriate CQC information relating to cover construction at the main landfill and recontouring and reseeding of the DDA.

5.1 Excavate at Main Landfill

Excavation at the main landfill will be conducted in accordance with Part 3.01 of Specification 02200, Earthwork, and Specification 02266, Landfill Waste Placement Procedures. This activity consists of relocating existing landfill waste from the east and north slopes to obtain an effective grade of 3H:1V slope. Bedrock will not be excavated. The excavated waste will be relocated to fill areas on the flat portion (top cap) of the landfill.

Waste will be emplaced in fill areas at the direction of the SS (no required lift thickness) and will be compacted by dozer tracking only. The QC Field Engineer will visually confirm that dozer tracking has adequately prepared a uniform and firm base for construction of the landfill cover. There are no other required field tests for waste excavation.

5.2 Prepare Subgrade

The subgrade will be prepared in accordance with Part 3.02.B of Specification 02200, Earthwork. The subgrade consists of 12 to 24 in. of interim cover material (structural fill). Soil will be salvaged from the main landfill and stockpiled. After waste relocation has been completed, salvaged soil will be placed over the waste as interim cover material. As described in Section 3.0, salvaged soil will be tested at the GTL to ensure compatibility with construction specifications.

The subgrade will be installed with maximum 1.0-foot (ft) thick lifts, depending on location and amount of material required to bring the final subgrade surface to survey control. After emplacement, lift(s) will be compacted.

5.2.1 Pre-use Inspection

Subgrade material (structural fill) will be pre-qualified before use, as described in Section 3.0. Before use, the SS will visually inspect the material for undesirable components such as rocks, debris, waste, organics, excess moisture, large clods, miscellaneous or deleterious material, or other visual indicators suggesting the material does not conform to construction specifications. Stockpiles will be designated as accepted or rejected based on this visual observation. Rejected material will not be used.

5.2.2 Field Testing Subgrade

Compacted lift(s) will be tested by GTL personnel under the supervision of the QC Field Engineer for the parameters shown in Table 02200-2 of Specification 02200, Earthwork. The actual number and locations of the moisture-density tests shall be determined and documented by the QC Field Engineer. Damage to the subgrade resulting from field tests shall be repaired with granular or powdered sodium bentonite.

5.2.3 Subgrade Hold Point

After the subgrade has been prepared, it will be surveyed as described in Section 4.2 and inspected by the QC Field Engineer for loose or unstable areas. Based on this visual observation and analysis of survey data and field test results, the QC Field Engineer will accept or reject the subgrade by written notification to the

SS, via an ICR. If rejected, work will not proceed on the landfill cover until the subgrade has been repaired or re-installed.

5.3 Install Infiltration Layer

The infiltration layer will be installed in accordance with Part 3.02 of Specification 02200, Earthwork. The infiltration layer consists of nominal 18 in. of low-permeability material, obtained from the offsite borrow source. The infiltration layer will be installed in a minimum of two nominal 9-in. lifts (the emplaced lifts will be more than 9 in. to account for compaction). After emplacement, each lift will be compacted. The QC Field Engineer will ensure each lift is thoroughly mixed and visually checked before compaction to ensure uniform distribution of moisture content and lift thickness.

During infiltration layer construction, the QC Field Engineer will ensure the fill area is free of standing water and low-permeability soil materials are not placed, spread, or compacted during unfavorable weather conditions. When the work is interrupted by rain, fill operations will not be resumed until field tests are conducted per Table 5.3.1-1 to show that the moisture content and density of the fill are within the limits specified. A previously approved and compacted layer may require reworking and/or compaction before the next lift is installed.

5.3.1 As-delivered Inspection and Testing

Infiltration layer material will be pre-qualified before delivery to the site, as described in Section 3.0. Upon delivery, the SS will visually inspect the material for undesirable components such as rocks, debris, waste, organics, excess moisture, large clods, miscellaneous or deleterious material, or other visual indicators suggesting the material does not conform to construction specifications.

GTL personnel, under the supervision of the QC Field Engineer, will collect samples from delivered and stockpiled material for as-delivered testing and analysis by the GTL. Table 5.3.1-1 shows test parameters and sampling frequency. Material will be segregated by stockpiling and designated as accepted or rejected based on this visual observation and as-delivered testing. Rejected material will not be used and will be returned to the supplier.

Table 5.3.1-1
As-delivered Testing Requirements for Infiltration Layer Material

Property	Test Method	Minimum Frequency	Acceptance Criteria
Particle Size Analysis (sieve only)	ASTM D421/422	1 sample per 2500 cy of delivered material	Range to be determined[1]

[1] Acceptable range for particle size distribution will be established upon completion of pre-qualifying QC testing, as described in Section 3.0
ASTM = American Society of Testing and Materials
cy = Cubic yards

5.3.2 Field Testing Installed Lifts

Each compacted lift will be tested by GTL personnel under the supervision of the QC Field Engineer for density and moisture content as shown in Table 02200-2 in Specification 02200, Earthwork. The actual number and locations of the moisture-density tests shall be determined and documented by the QC Field Engineer. Damage to the infiltration layer resulting from any field tests shall be repaired with granular or powdered sodium bentonite.

Based on field test results, the QC Field Engineer will accept or reject the lift (or portions of the lift) and will communicate acceptance/rejection to the SS. If rejected, the lift (or portions of the lift) may be re-wetted and re-compacted, or removed and replaced. The QC Field Engineer will then perform additional tests per Table 02200-2 in Specification 02200, Earthwork, to determine if the area has been sufficiently reworked to meet design specifications.

5.3.3 Infiltration Layer Hold Point

After the final lift of the infiltration layer has been installed, it will be surveyed as described in Section 4.2 and inspected by the QC Field Engineer to ensure the surface is free of any protruding objects (e.g., rocks, landfill debris) that may interfere with installation of the topsoil. Based on this visual observation and analysis of survey data (ensures the specified thickness of topsoil is present) and field test results, the QC Field Engineer will accept or reject the final infiltration layer grade by written notification to the SS, via an ICR. If rejected, work will not proceed on the landfill cover until the final infiltration layer grade has been repaired or re-installed.

5.4 Install Topsoil

Topsoil will be installed in accordance with Specification 02200, Earthwork. At the main landfill, topsoil will be placed nominally 0.5 ft thick over the top cap. At the DDA, topsoil will be placed in amounts such that there is a nominal 12 in. cover over landfill waste.

5.4.1 As-delivered Inspection and Testing

Topsoil will be pre-qualified before delivery to the site, as described in Section 3.0. Upon delivery, the SS will visually inspect the material for undesirable components such as refuse, hard clods, woody vegetation, stiff clay, construction debris, boulders, stones larger than 2 in., hydrocarbons, petroleum materials or chemicals toxic to vegetation, other deleterious inclusions, or other visual indicators suggesting the material does not conform to construction specifications.

The QC Field Engineer will supervise GTL personnel in collection of samples from delivered stockpiled material for as-delivered testing and analysis by the GTL. Test parameters and sampling frequency are shown in Table 5.4.1-1. Material will be segregated by stockpiling and designated as accepted or rejected based on this visual observation and as-delivered testing. Rejected material will not be used and will be returned to the supplier.

Table 5.4.1-1
As-delivered Testing Requirements for Topsoil

Property	Test Method	Minimum Frequency	Acceptance Criteria
Particle Size Analysis (sieve only)	ASTM D421/422	1 sample per 500 cy of delivered material	Range to be determined[1]

[1] Acceptable range for particle size distribution will be established upon completion of pre-qualifying QC testing, as described in Section 3.0
ASTM = American Society of Testing and Materials
cy = Cubic yards

5.4.2 Topsoil Hold Point

After the final topsoil lift has been installed, it will be surveyed as described in Section 4.2 and inspected by the QC Field Engineer to ensure the surface is adequate for revegetation. Based on this visual observation and analysis of survey data to ensure the specified thickness of topsoil is present and the final grade

conforms to specifications, the QC Field Engineer will accept or reject the final topsoil grade by written notification to the SS, via an ICR. If rejected, work will not proceed on the landfill cover (e.g., revegetation) until the final topsoil grade has been repaired or re-installed.

5.5 Install Geosynthetics

Geotextiles will be obtained and installed in accordance with Specification 06020, Geotextiles. A geosynthetic liner will be installed overt the infiltration layer on the east and north slopes of the main landfill.

The SS will obtain manufacturer certifications for geotextiles. The QC Field Engineer will check the certifications against the requirements listed in Table 06020-1 of Specification 06020, Geotextiles, to ensure compliance and will also periodically (spot-check) rolls of geotextiles against the certification to ensure the proper material was delivered.

The QC Field Engineer will review construction drawings showing the proposed installation of geosynthetic materials and will ensure that every effort is taken to minimize the number of field seams, especially in critical areas (e.g., slopes and sump areas).

5.5.1 Geosynthetics Hold Point

After installation of the geotextile liner, the QC Field Engineer will inspect for defects, tears, cuts, poor seams, or other factors that may jeopardize the cover. The QC Field Engineer will notify the SS in writing of acceptance or rejection of the geotextile layer, via an ICR. If rejected, the layer will be replaced or repaired before work will resume (i.e., install riprap).

5.6 Install Riprap

Riprap will be installed in accordance with Parts 2.01 and 3.01 of Specification 02270, Channel Protection. Riprap will be placed starting at the toe of the slope and proceeding upslope.

The QC Field Engineer shall visually inspect riprap materials to ensure that the materials comply with the construction specifications.

5.6.1 Riprap Hold Point

After riprap has been installed, it will be inspected by the QC Field Engineer to ensure uniform coverage and conformance with specifications. Based on this visual observation, the QC Field Engineer will accept or reject riprap emplacement by written notification to the SS, via an ICR. If rejected, work will not proceed on the landfill cover (e.g., demobilization) until the riprap has been repaired or re-installed.

5.7 Seeding, Mulching, and Restoration

Seeding, mulching, and restoration of the main landfill and DDA will be conducted in compliance with Specification 02932, Seeding, Mulching, and Restoration. Vegetation is an important storm water runoff and erosion control; as such, additional information is provided in the SWPPP (North Wind 2004j).

6.0 DOCUMENTATION

The SS will verify that CQC records generated during construction are managed according to PWI-4201-001, Project Files (North Wind 2003a). Copies of relevant CQC documentation shall be maintained at the field office. This includes project scoping plans listed in Section 1.3 that affect CQC activities, as well as other project plans listed in the PMP (North Wind 2004f).

A set of final construction drawings will be located in the office trailer for red-lining changes for constructing as-built drawings. The project schedule will be displayed on the wall for quick reference and weekly progress tracking. The Construction Plan (North Wind 2004a) provides additional documentation requirements.

6.1 Nonconformances and Field Changes

A nonconformance is a deficiency in characteristics, documentation or procedures that renders the quality of an item or activity unacceptable or indeterminate. If a deficiency cannot be repaired or replaced to the satisfaction of the QC Field Engineer within the guidelines established by this CQCP, then such a deficiency will be considered a nonconformance. During the course of construction, site personnel, particularly the QC Field Engineer and SS, may identify nonconformances. Nonconformances will be documented according to QAP-14, Corrective and Preventive Action (North Wind 2002) and the PQAP (North Wind 2004g).

Nonconforming items will be reported to the PQE who will prepare a NCR. The NCR will document the nonconformance, the root cause, and corrective actions taken (or to be taken) to prevent reoccurrence of the nonconformance.

Field changes to project documents may be required based on actual site conditions, unforeseeable circumstances, or client-initiated change control. Field changes will be identified and documented in accordance with PWI-4201-005, Field Change (North Wind 2004h).

6.2 Field Logbooks

The SS and Field QC Engineer will maintain separate field logbooks in accordance with PWI-4201-002, Field Activities Documentation (North Wind 2003b). In addition to the requirements stated in PWI-4201-002, field logbooks will contain the information necessary for the reporting requirements listed below in Section 6.3.

6.3 Reporting

The PMP provides overall direction for reporting. Other reports will be prepared, as described in the following subsections.

6.3.1 Daily CQC Field Reports

Daily CQC field reports and monthly summary reports will be prepared by the QC Field Engineer with input from the SS, as required. The reports will be submitted to the SS. At a minimum, the daily report will include the following items, as applicable. The monthly reports will be a summarized rollup of this information.

- Date and project name
- Description of areas of work observed and/or tested
- Weather conditions
- Work locations
- Equipment and personnel used
- Arrival and departure times and times of work interruption
- Summary of completed field testing
- Description of receipt of offsite materials

- Decisions made regarding acceptance of specific portions of work and/or remedial actions implemented in cases of sub-standard quality
- Identification of work that the QC Field Engineer believes should be accepted, rejected, or uncovered for observation, or that may require special testing, inspection, or approval
- Analysis and interpretation of GTL data and field test results
- Description of nonconformances identified
- General description of photographs taken

6.3.2 Incremental Certification Reports

The QC Field Engineer will prepare and submit to North Wind ICRs that certify various key components of the landfill cover have been installed in accordance with this CQCP and the final construction specifications and drawings. ICRs will be submitted at the CQC hold points identified throughout this document. At a minimum, the ICRs will include the following:

- General summary of work to include, but not limited to, construction activities, observations, problems and corrective actions, and deviations from design
- Interpretation of GTL data, survey data, and field test results as they relate to acceptability of delivered materials or proper placement and compaction of soil lifts (raw data may be included in the ICR, as appropriate)
- Manufacturers' certification(s) of materials used in the construction
- Surface acceptance forms
- Project photographs with dates and captions
- Field directives specific to installation, including design and field change notices
- NCRs, as applicable
- DOE change orders specific to the installation

6.4 Equipment Calibration

A nuclear density gauge will be used for field testing. The QC Field Engineer (or designee) will review initial equipment calibration records supplied by the instrument manufacturer to confirm that they meet the project specifications or applicable ASTM standards. In addition, the QC Field Engineer (or designee) will perform and document daily count checks and other daily instrument checks per the manufacturer's instructions. These performance check records will be filed on site and furnished to the SS, as requested.

The nuclear density gauge contains an internal radioactive source; therefore, health and safety requirements relative to the radioactive source are applicable. The HASP provides additional details (North Wind 2004c).

7.0 SUSPECT/COUNTERFEIT ITEMS

Installed items that may potentially be suspect/counterfeit items (S/CI) will be inspected in accordance with the PQAP (North Wind 2004g) and DOE Guide 440.1-6, "Implementation Guide for Use with Suspect/Counterfeit Items Requirements of DOE O 440.1, Worker Protection Management; 10 CFR 830.120; and DOE 5700.6c, Quality Assurance" (DOE 1997). In addition, items used during construction activities that may cause injury or fatalities if failure occurs (e.g., ratchet straps/tie down assemblies, fasteners, bridal slings, hoisting slings) will also be inspected on a regular basis in accordance with the PQAP and DOE Guide 440.1-6.

8.0 REFERENCES

The following list includes all of the documents cited in this CQCP and appendices. The parenthetical information following each reference provides the author, publication date, and LANL Environmental Restoration identification number (as applicable). This information is also included in the text citations and can be used to locate documents on this list.

American Society of Testing and Materials (ASTM), 2001. "ASTM D 6051-96, Standard Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities," published by American Society of Testing and Materials, West Conshohocken, Pennsylvania. (ASTM 2001)

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New Mexico Environment Department (NMED) April 1, 2003. Letter from Ms. Vickie Maranville (New Mexico Environment Department) to Mr. G. Pete Nanos (Los Alamos National Laboratory) and Mr. Everett Trollinger (U.S. Department of Energy, Los Alamos Site Office) entitled "Conditional Approval of Voluntary Corrective Measures (VCM) Plan for Potential Release Sites (PRSs) 73-001(a)-99 and 73-001(b)-99," Los Alamos National Laboratory EPA ID# NM0890010515 HWB-Facility-02-020, Santa Fe, New Mexico. (NMED 2003)

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North Wind, Inc. (North Wind), April 2004. "Construction Plan for Los Alamos Site Office TA-73 Airport Landfill," Revision 1, North Wind, Inc. document NW-ID-2004-001, Idaho Falls, Idaho. (North Wind 2004a)

North Wind, Inc. (North Wind), April 2004. "Design Basis Document for Los Alamos Site Office TA-73 Airport Landfill," Revision 1, North Wind, Inc. document NW-ID-2004-042, Idaho Falls, Idaho. (North Wind 2004b)

North Wind, Inc. (North Wind), March 2004. "Health and Safety Plan for Los Alamos Site Office TA-73 Airport Landfill," Revision 0, North Wind, Inc. document NW-ID-2004-017, Idaho Falls, Idaho. (North Wind 2004c)

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North Wind, Inc. (North Wind), April 2004. "Project Quality Assurance Plan for Los Alamos Site Office TA-73 Airport Landfill," Revision 1, North Wind, Inc. document NW-ID-2003-071, Idaho Falls, Idaho. (North Wind 2004g)

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North Wind, Inc. (North Wind), April 2004. "Storm Water Pollution Prevention Plan for Los Alamos Site Office TA-73 Airport Landfill," Revision 1, North Wind, Inc. document NW-ID-2004-005, Idaho Falls, Idaho. (North Wind 2004j)

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Weston Solutions, Inc. (WESTON), February 2004. "Cone Penetrometer Test Data and Geotechnical Data for Los Alamos Site Office TA-73 Airport Landfill, 60% Design Submittal," Albuquerque, New Mexico. (WESTON 2004)

Appendix A
Acronyms

Acronyms

ASTM	American Society for Testing and Materials
cm/sec	Centimeters per second
CQC	Construction quality control
CQCP	Construction Quality Control Plan
cy	Cubic yard(s)
DDA	Debris Disposal Area
DOE	U.S. Department of Energy
ft	Foot (feet)
GTL	Geotechnical testing laboratory
HASP	Health and Safety Plan
ICR	Incremental Certification Report
in.	Inch(es)
Ksat	Saturated hydraulic conductivity
LANL	Los Alamos National Laboratory
LASO	Los Alamos Site Office
NCR	Nonconformance report
NMED	New Mexico Environment Department
P	Phosphorous
PMP	Project Management Plan
PQAP	Project Quality Assurance Plan
PQE	Project Quality Engineer
PRS	Potential Release Site
PWI	Project Work Instruction
QA	Quality assurance
QAP	Quality Assurance Procedure
QC	Quality control
SS	Site Superintendent
SWPPP	Storm Water Pollution Prevention Plan

TA	Technical Area
TKN	Total Kjeldahl Nitrogen

Appendix B
Sampling and Analysis Requirements for Offsite Borrow Material

B1.0 INTRODUCTION

This sampling and analysis plan (SAP) provides methods and materials to test offsite borrow source material for use in the prescribed landfill cover. The Airport Landfill closure cover design specifies 1) an infiltration barrier layer comprised of a minimum of 18-in of earthen material with a minimum saturated hydraulic conductivity (Ksat) of 1E-05 centimeters per second (cm/sec), overlain by 2) an erosion control layer consisting of a minimum of 6-in of topsoil that is capable or sustaining native plant growth. Other material specifications are provided in Specification 02200, Earthwork.

B1.1 Problem Statement

The problem statement is:

"It is not known if offsite borrow material is available, in sufficient quantity and at an affordable cost, that meets the requirements specified in Specification 02200, Earthwork."

After considering numerous material sources in the Los Alamos area, one was found which met the initial requirements. This source belongs to Parker Construction Company (Parker), located in Los Alamos, New Mexico. One grab sample of each required material type (i.e., topsoil, structural fill, and infiltration layer material) were collected and analyzed under the Site Characterization Plan for LASO TA-73 Airport Landfill (North Wind 2004i). Data analysis showed that the grab samples met or exceeded design specifications for the specific material type. Analytical data are presented in "Cone Penetrometer Test Data and Geotechnical Data for Los Alamos Site Office TA-73 Airport Landfill, 60% Design Submittal" (WESTON 2004).

B1.2 Plan Objectives

The primary objective of this SAP is to determine whether or not the average properties for the sources identified for the topsoil, structural fill, and infiltration layer material meet design specifications. The specific objective of this SAP is to collect and analyze an adequate number of samples to determine average properties of each proposed borrow source. A secondary objective is to determine the acceptable window of moisture content and density for the infiltration layer that will achieve the required Ksat of 1E-05 cm/sec.

B2.0 DEPOSIT INFORMATION

The deposit is located on Parker property in Los Alamos, New Mexico. The deposit will be mined by Parker from its bank location. Values for deposit area, average deposit depth, and deposit volume will be obtained, if possible. If obtained, this specific information will be used to determine sample locations. If the information is not available, it is assumed that regardless of shape, the deposit will be divided into four separate quadrants for composite sampling purposes.

B3.0 SAMPLING PLAN

This section describes required properties for each of the borrow materials, provides a rationale for composite sampling, and describes a sequential process for obtaining samples. Additional detail is provided in Specification 02200, Earthwork.

B3.1 Testing Requirements

The overall goal of the sampling plan is to obtain average soil properties for the material types as shown in Table B3.1-1. Enough information must be acquired to calculate a statistical representation of the deposit.

This will be accomplished by composite sampling, described in Section 10.2.

Table B3.1-1
Testing Requirements for Borrow Material

Property	Topsoil	Structural Fill	Infiltration Layer
Particle size analysis with hydrometer	X	X	X
Atterberg Limits	--	X	X
Organic content	X	X	--
Moisture content	X	X	X
Standard Proctor compaction	--	X	X
Permeability	--	--	X
pH	X	--	--
USCS classification	X	--	--
Nitrogen (TKN)	X	--	--
Phosphorous, Orthophosphate (as P)	X	--	--

X = Required
-- = Not required
USCS = Unified Soil Classification System
TKN = Total Kjeldahl Nitrogen
P = Phosphorous

B3.2 Composite Sampling

Prior to defining the composite sampling method, it is necessary to clarify the difference between an individual sample and a composite sample. An individual sample is obtained in the field and is tested as a single unit in the laboratory. Individual sampling is quite costly, due to the degree of testing which is performed on each sample. A composite sample, on the other hand, is obtained by physically mixing numerous individual samples and testing the mixture as one homogeneous unit. The composite sample is then used to represent each of the original individual samples. This method requires less laboratory analysis and most often returns an acceptable value of the population mean.

It is important to note that in some cases, composite sampling is not appropriate due to high degrees of contaminant constituent variance. In cases such as these, retesting is required for all positive test results. This increases the cost for compositing significantly. This scenario is not applicable to the barrow material source. This material is currently uncontaminated, undisturbed, and considered to be uniform in composition. Since this scenario is not applicable, the compositing method is adequate for obtaining representative samples.

B3.3 Sample Plan

The sampling plan for the borrow material source will be outlined in a step by step fashion, utilizing the compositing method describe above. The compositing method will be used to maximize information, as well as minimize total cost. Composite sampling will be conducted according to ASTM Standard D 6051-96 (ASTM 2001).

Step 1: Draw up a map representing the area of interest for each material type. This map will ultimately be

used as the sample plan map. The map must be to scale and contain accurate northing, easting, and elevation information.

Step 2: Divide the property area to be mined into four quadrants and record on the map.

Step 3: Designate coordinate locations on sample plan map for five samples per quadrant section. These individual samples should be located in approximately equal locations throughout each quadrant.

Step 4: Locate sample areas using global positioning system equipment and excavate test pits using Parker's onsite excavator. This method will allow for quality samples at minimum cost. The samples will be collected from the excavator bucket by an onsite North Wind employee. As stated above**,** four samples must be obtained from each quadrant to be used in the final composite, as shown in Figure B3.3-1.

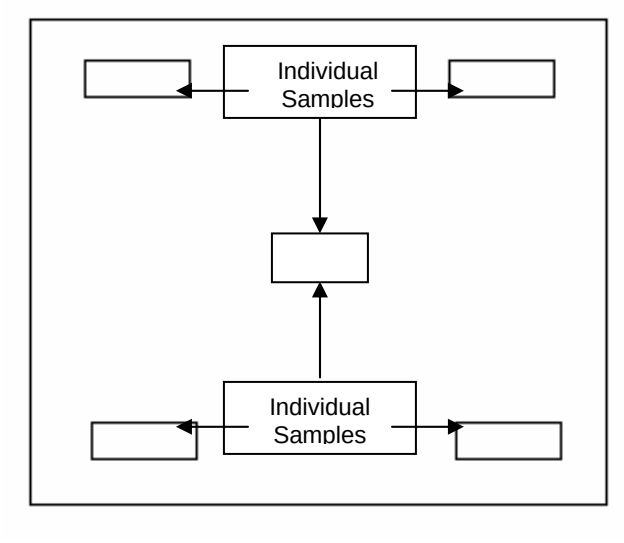


Figure B3.3-1. Compositing diagram

Step 5: Samples will be sent to the GTL to be mixed prior to analysis. Lab tests will be performed on each composite to determine all relevant soil properties as per ASTM standards.

Step 6: If the composite test results return positive Ksat values (values that are not in compliance), the material source must be rejected.

B4.0 LABORATORY ANALYSIS

The selected GTL is Klienfelder, located in Albuquerque, New Mexico. Klienfelder has done all project testing to date at the least amount of cost. The following ASTM standardized tests are proposed for each composite sample:

- ASTM D-SMAD-422 – Hydrometer Test
- ASTM D-2216 – Moisture Content
- ASTM D-4318 – Atterburg Limits
- ASTM D-854 – Specific Gravity

- ASTM D-584 – Permeability
- ASTM D-698 – Standard Compaction
- ASTM-D-2974 – Standard Test Methods for Organic Soils

In the preliminary permeability tests that were run on the borrow material, calculations for the hydraulic conductivity were based upon optimum moisture content (found on the dry density vs. water content, percent curve). The hydraulic conductivity calculations will be completed for water contents below, at, and above optimum. This will provide a window of moisture contents and densities that meet the required Ksat. In order to acquire this information, the Falling Head Permeability test will have to be run at all three moisture contents for each composite sample.

B5.0 COST ANALYSIS

This section provides a detailed cost analysis for the compositing method discussed above in the proposed sampling plan. In addition to calculation of total cost, a cost comparison between compositing and individual sampling is considered. Total cost is calculated by Equation 1, given below:

Equation 1. Total Cost, C_c, for Analysis of One Composite Sample Having n Sub-samples (Lock 1996.)

$$C_c = nc_c + nc_p + c_t + c_a$$

Where:

- C_c – total cost of composite analysis
- C_i – total cost of individual sample analysis
- c_c – cost of collection of each sample
- c_p – cost of preparation for each sample
- c_t – cost of compositing
- c_a – cost of analysis and reporting
- n – the number of samples in the composite
- x – the number of total samples

Total Cost for individual samples is calculated using Equation 2, give below:

Equation 2. Total Cost C_i for n Individual Samples (Lock 1996)

$$C_i = n(c_c + c_p + c_a)$$

The total savings in cost per composite sample is as given in Equation 3:

Equation 3. The cost Savings per Composite Sample (Lock 1996)

$$C_i - C_c = (nc_c + nc_p + c_a) - [n(c_c + c_p) + c_t + c_a]$$

If there are x samples, there are x/n composites, and the total savings are expressed as given in Equation 4:

Equation 4. Total Costs Savings for Samples vs. Composites (Lock 1996)

$$TotalCostSavings = (x/n)*[c_a(n-1) - c_t]$$

Table B5.0-1
Calculated Values for Equations 1 through 4

C_c	$2,389.00
C_i	$9,505.00
C_c-C_i	$7,116.00
c_c	$112.00
c_p (*Included in* c_a)	$0.00
c_t	$40.00
c_a	$1,789.00
n	5
x	20
Total Cost for Compositing	**$11,945.00**
Total Cost Savings	**$28,464.00**

Individual spreadsheets used to calculate cc, ct, and ca are retained in project files.

B6.0 CONCLUSION

After analyzing the cost comparison provided in Section B5.0 above, it is obvious that composite sampling is a more cost effective method for obtaining the required information for the Borrow material. Because this deposit is undisturbed and assumed to be uniform, compositing is an acceptable method for obtaining the necessary soil data. It is important, however, that a few guidelines are followed throughout the sample collection process. These guidelines are given below:

- All samples collected should have approximately the same mass;
- Spatial distribution should be approximately equal between individual sample;
- Each sample quadrant should contain five sub-samples so that statistics can be calculated for the material;
- Sample mixing for each quadrant may be conducted in the field only by trained sampling personnel;

- If trained sampling personnel are not available, sample mixing should be completed by the GTL, and
- Mixing should be completed according to ASTM Standard D6051-96 (ASTM 2001). The technique to be used is the Pan Mixing Method. In this method, sample material is combined into a glass or stainless steel pan and divided into quarters. Each quarter is mixed separately. Following individual mixing, all quarters are mixed into the center of the pan. This procedure is repeated a minimum of three times. Although other mixing techniques are acceptable, this procedure will be implemented for all composite samples to maintain consistency.

Refer to ASTM D6051-96, Standard for Composite Sampling and Field Sub-sampling and Environmental Waste Management Activities (ASTM 2001) for procedures concerning mixing methods.

NW-ID-2004-040
Final Revision 0

ENGINEERING CALCULATIONS FOR LOS ALAMOS SITE OFFICE TA-73 AIRPORT LANDFILL

Final Revision 0

April 2004

Prepared for:

North Wind, Inc.
545 Shoup Avenue, Suite 200
Idaho Falls, Idaho 83402

Prepared by:

Weston Solutions, Inc.
6565 Americas Parkway N.E., Suite 200
Albuquerque, New Mexico 87110

HYDRAULIC CALCULATIONS

CLIENT/SUBJECT LANL W.O. NO 00000000000

TASK DESCRIPTION Drainage Structures Hydraulic Design TASK NO 000000

PREPARED BY SW	DEPT 1495	DATE 10 Mar 2004		APPROVED BY
MATH CHECK BY RWM	DEPT 1495	DATE 10 Mar 2004		
METHOD REV. BY RWM	DEPT 1495	DATE 10 Mar 2004	DEPT	DATE

Objective: Provide hydraulic calculations for site drainage features.

References: USDA Technical Release 55 (TR-55) "Urban Hydrology for Small Watersheds" (Adobe Acrobat copy available at *http://www.wcc.nrcs.usda.gov/hydro/hydro-tools-models-tr55.html*); Soil Conservation Service National Engineering Handbook, Section 4 "Hydrology".

Discussion:

1. Runoff: Peak discharge for a 25-yr 24 hr storm (3.2 inches) was determined using TR-55 method for each drainage structure. This storm was selected pursuant to solid waste regulatory requirements for Subtitle D landfills (40 CFR Part 258 Criteria for Municipal Solid Waste Landfills).
2. Channel 1: Designed to handle runoff from the southern landfill slope and strip of land along the taxiway. Based on flow velocity and shear, an erosion mat can be used for channel protection.
3. Drainage pipe: Designed to convey Channel 1 flow beyond landfill limits. The package includes hydraulic design, and inlet/outlet control check worksheets.
4. Landfill slope Benches 1 through 4: Each bench is designed to carry flow from the center of the eastern slope of the landfill to the respective side. Each bench was designed as a 10-ft wide triangular channel with bed slope of 4%, and side slopes of 2.75% (actual landfill side slope) and 10% (bench slope). Based on flow velocities and shear forces as shown in the Hydraulic Calculations Summary, R-3 Rip Rap is sufficient for channel protection for Benches 1 through 4.
5. Landfill Bench 5: The top bench is oversized (18 feet wide) due to additional runoff from the top of the landfill. Other dimensions remain the same as other benches. Based on flow velocity and shear stress, R-4 Rip Rap is required for the bed protection.
6. Downchute: Trapezoidal downchute conveys flow from Bench 5 to the toe of the landfill slope. Minimum of R-6 Rip Rap is required based on the shear stress level, resulting from the steep slope. Downchute will discharge into the Rip Rap outlet at the toe of the landfill slope. Rip Rap outlet was designed based on the equivalent pipe size of 12" (flow area of 12" pipe flowing full compared to the downchute flow area). Attached worksheet provides minimum apron design parameters.

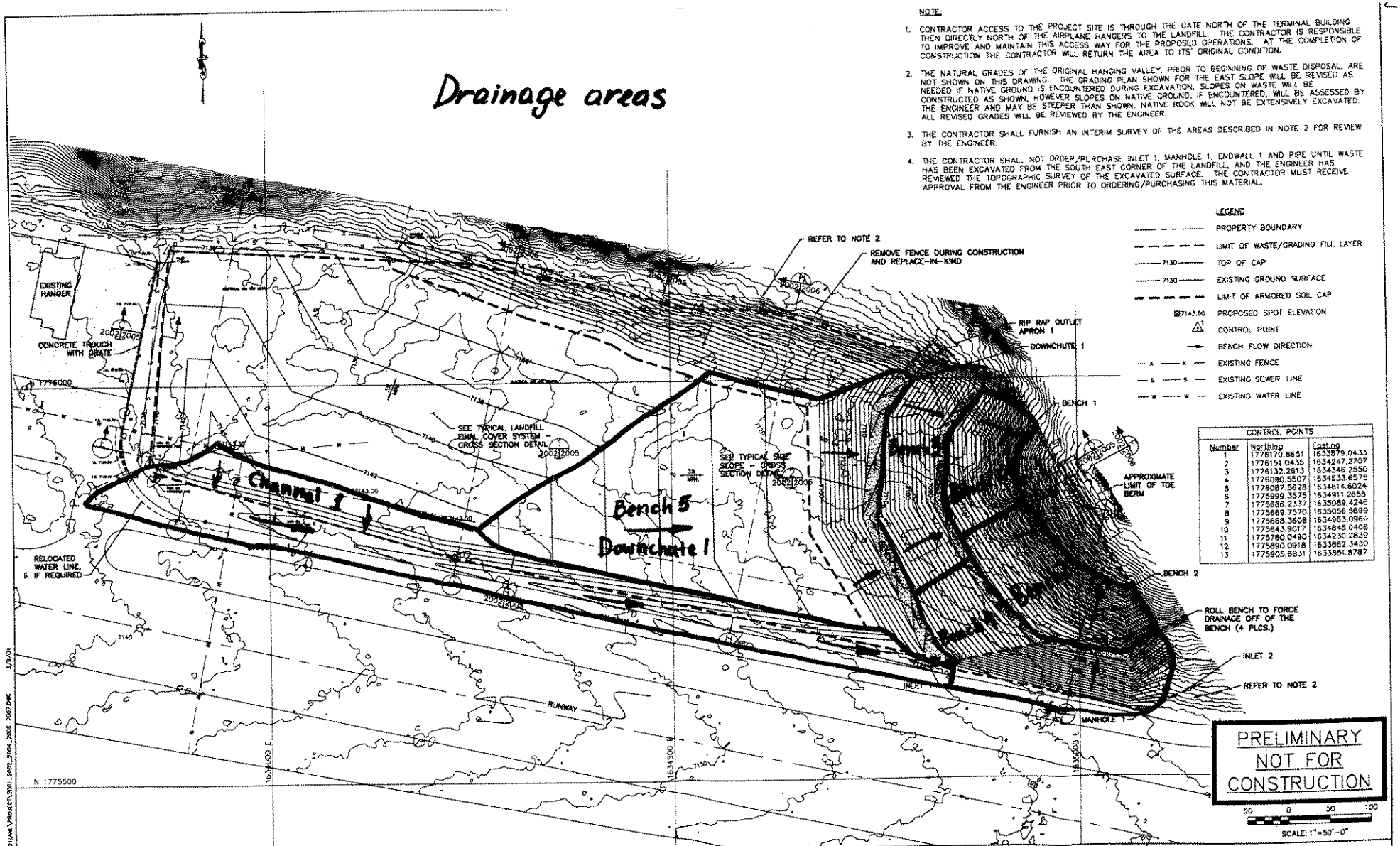
NOTE:

1. CONTRACTOR ACCESS TO THE PROJECT SITE IS THROUGH THE GATE NORTH OF THE TERMINAL BUILDING THEN DIRECTLY NORTH OF THE AIRPLANE HANGERS TO THE LANDFILL. THE CONTRACTOR IS RESPONSIBLE TO IMPROVE AND MAINTAIN THIS ACCESS WAY FOR THE PROPOSED OPERATIONS. AT THE COMPLETION OF CONSTRUCTION THE CONTRACTOR WILL RETURN THE AREA TO ITS' ORIGINAL CONDITION.

2. THE NATURAL GRADES OF THE ORIGINAL HANGING VALLEY, PRIOR TO BEGINNING OF WASTE DISPOSAL, ARE NOT SHOWN ON THIS DRAWING. THE GRADING PLAN SHOWN FOR THE EAST SLOPE WILL BE REVISED AS NEEDED IF NATIVE GROUND IS ENCOUNTERED DURING EXCAVATION. SLOPES ON WASTE WILL BE CONSTRUCTED AS SHOWN, HOWEVER SLOPES ON NATIVE GROUND, IF ENCOUNTERED, WILL BE ASSESSED BY THE ENGINEER AND MAY BE STEEPER THAN SHOWN. NATIVE ROCK WILL NOT BE EXTENSIVELY EXCAVATED. ALL REVISED GRADES WILL BE REVIEWED BY THE ENGINEER.

3. THE CONTRACTOR SHALL FURNISH AN INTERIM SURVEY OF THE AREAS DESCRIBED IN NOTE 2 FOR REVIEW BY THE ENGINEER.

4. THE CONTRACTOR SHALL NOT ORDER/PURCHASE INLET 1, MANHOLE 1, ENDWALL 1 AND PIPE UNTIL WASTE HAS BEEN EXCAVATED FROM THE SOUTH EAST CORNER OF THE LANDFILL, AND THE ENGINEER HAS REVIEWED THE TOPOGRAPHIC SURVEY OF THE EXCAVATED SURFACE. THE CONTRACTOR MUST RECEIVE APPROVAL FROM THE ENGINEER PRIOR TO ORDERING/PURCHASING THIS MATERIAL.



CONTROL POINTS

Number	Northing	Easting
1	1776170.8651	1633979.0433
2	1776151.0435	1634247.2707
3	1776132.2613	1634346.2550
4	1776090.5507	1634531.6575
5	1776087.5628	1634614.6024
6	1775999.3575	1634911.2655
7	1775886.2337	1635089.4246
8	1775869.7570	1635056.9699
9	1775668.3608	1634963.0969
10	1775643.9017	1634845.0408
11	1775780.0490	1634230.2839
12	1775890.0918	1633862.3430
13	1775905.8831	1633851.8787

B	2/24/04	90% DESIGN SUBMITTAL	
A	1/26/04	60% DESIGN SUBMITTAL	
NO.	DATE	APPR.	REVISION

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON TEAM

		DATE
CHECKED	RWM	03/23/04
DES ENG	SW	03/23/04
PROJ ENG	AH	03/23/04
PROJ MGR	BK	03/23/04
APPROVED	BK	03/23/04
APPROVED		

CLIENT APPROVALS — DATE

LANDFILL
TOP OF CAP GRADING PLAN

DRAWN GDM	DATE 02/06/04	DWG. NO. 2002	REV. NO. B
SCALE AS SHOWN	W.O. NO. 13104.002.001	SHT. OF	

C:\ACADPROJ\13104.002.001\AHL\PROJECT\2001, 2002, 2004, 2006, 2007.DWG 3/8/04

Technical Release 55 Method of Analysis for Finding Peak Discharges:

Client/Subject: **Channel 1**
Description: **LANL**
Prepared by: **SW**
Date: **09 Mar 04**

Print Date: 11Mar04 10:39 a
W. O. #: **00000-000-000**

Math Check:	SW
Method Check:	RWM

Runoff Curve Number:

Soil Group	Cover Description	Area (acres)	CN	Product
C	Grass	1.9	85	161.5
				0.0
				0.0
				0.0
				0.0
		1.9		161.5

Composite CN= 85

Runoff Time of Concentration:

Use Assumed Travel Time? no (yes/no)

(Equations and TR-55 References)

Sheet Flow

Manning Roughness, n=	0.03		From Table 3-1
Sheet flow length, Lsf=	60	feet (300 ft max)	
Two year 24 hour rainfall, P 2yr=	1.51	inches	
Average land slope, Ssf=	0.03	ft/ft	
Travel time, Tsf=	**0.04**	**hours**	0.007 * (n*L)^0.8 / P2yr^0.5 * S^0.4

Shallow Concentrated Flow

Surface Description:	Unpaved	(paved/unpaved)	
Flow Length, Lsc=	0	feet	
Average Land Slope, Ssc=	0.02	ft/ft	
Average Velocity, Vsc=	2.3	ft/s	From Figure 3-1
Travel time, Tsc	**0.00**	**hours**	L / 3600V

Channel Flow

Use Assumed Velocity?	yes	(yes/no)
Assumed Vc=	5	ft/s

Disregard subsection:
Using assumed velocity

Average velocity, Vc=	5.00	ft/s	(1.49 * Rh^2/3 * Sc^1/2) / n
Flow Length, Lc=	1000	feet	
Travel time, Tc=	**0.06**	**hours**	L / 3600V

Total Time of Conc.= 0.10 hours

Peak Discharge:

Drainage Area:	1.9	acres	
Da=	0.00297	sq mi	
Runoff curve number, CN=	85.0		
Time of Concentration, Tc=	0.10	hours	
Rainfall Distrubution Type:	II		From Figure B-2
Storm Frequency:	25	years	
24 hour duration Rainfall, P=	3.20	inches	From Figures B-3 to B-8
Initial Abstraction, Ia =	0.353		From Table 4-1
Ia / P =	0.11		
Direct Runoff, Q=	1.76		From Table 2-1
Unit peak discharge, Qu=	1002	csm/in	From Exhibit 4-I , 4-IA, 4-II, 4-III
Peak Discharge, Qp=	***5.2***	***cfs***	Qu * sq miles * Q

File: Channel 1
Spreadsheet Template By Brian Miller

Channel 1
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Channel 1 - NEW
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.017000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	2.00	ft
Discharge	5.20	cfs

Results		
Depth	0.49	ft
Flow Area	1.7	ft^2
Wetted Perimeter	5.08	ft
Top Width	4.92	ft
Critical Depth	0.47	ft
Critical Slope	0.019756	ft/ft
Velocity	3.09	ft/s
Velocity Head	0.15	ft
Specific Energy	0.63	ft
Froude Number	0.93	
Flow Type	Subcritical	

Pipe - 18", 0.01 ft/ft
Worksheet for Circular Channel

Project Description		
Worksheet	Pipe - Segment 1	
Flow Element	Circular Channel	
Method	Manning's Formula	
Solve For	Channel Depth	

Input Data		
Mannings Coefficient	0.012	
Slope	0.010000	ft/ft
Diameter	18	in
Discharge	5.50	cfs

Results		
Depth	0.74	ft
Flow Area	0.9	ft^2
Wetted Perimeter	2.33	ft
Top Width	1.50	ft
Critical Depth	0.90	ft
Percent Full	49.0	%
Critical Slope	0.005104	ft/ft
Velocity	6.38	ft/s
Velocity Head	0.63	ft
Specific Energy	1.37	ft
Froude Number	1.49	
Maximum Discharge	12.24	cfs
Discharge Full	11.38	cfs
Slope Full	0.002336	ft/ft
Flow Type	Supercritical	

See attached for inlet/outlet control check

PIPE - 18", 0.17 ft/ft
Worksheet for Circular Channel

Project Description		
Worksheet	Pipe – segment 2	
Flow Element	Circular Channel	
Method	Manning's Formula	
Solve For	Channel Depth	

Input Data		
Mannings Coefficient	0.012	
Slope	0.170000	ft/ft
Diameter	18	in
Discharge	5.20	cfs

Results		
Depth	0.34	ft
Flow Area	0.3	ft^2
Wetted Perimeter	1.48	ft
Top Width	1.25	ft
Critical Depth	0.88	ft
Percent Full	22.5	%
Critical Slope	0.004990	ft/ft
Velocity	17.49	ft/s
Velocity Head	4.76	ft
Specific Energy	5.09	ft
Froude Number	6.33	
Maximum Discharge	50.47	cfs
Discharge Full	46.92	cfs
Slope Full	0.002088	ft/ft
Flow Type	Supercritical	

CLIENT/SUBJECT LANL

TASK DESCRIPTION Inlet/outlet control check

PREPARED BY SW DEPT 1495 DATE 4/10/04

MATH CHECK BY ____ DEPT ____ DATE ____

METHOD REV. BY ____ DEPT ____ DATE ____

WESTON MANAGERS DESIGNERS/CONSULTANTS

W.O. NO. ____ TASK NO. ____ SHEET 7 of ____

APPROVED BY DEPT ____ DATE ____

HYDROLOGIC AND CHANNEL INFORMATION

18" CULVERT

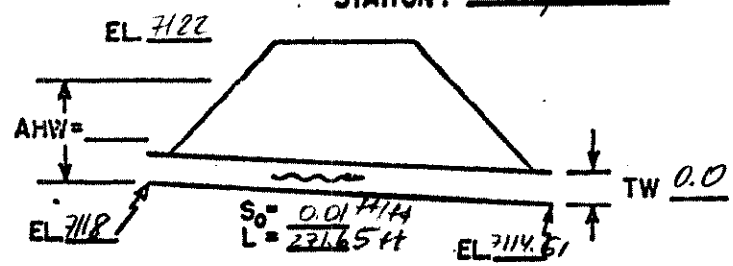
Q_1 = 5.2 cfs TW_1 = ____

Q_2 = ____ TW_2 = ____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}; Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: N/A



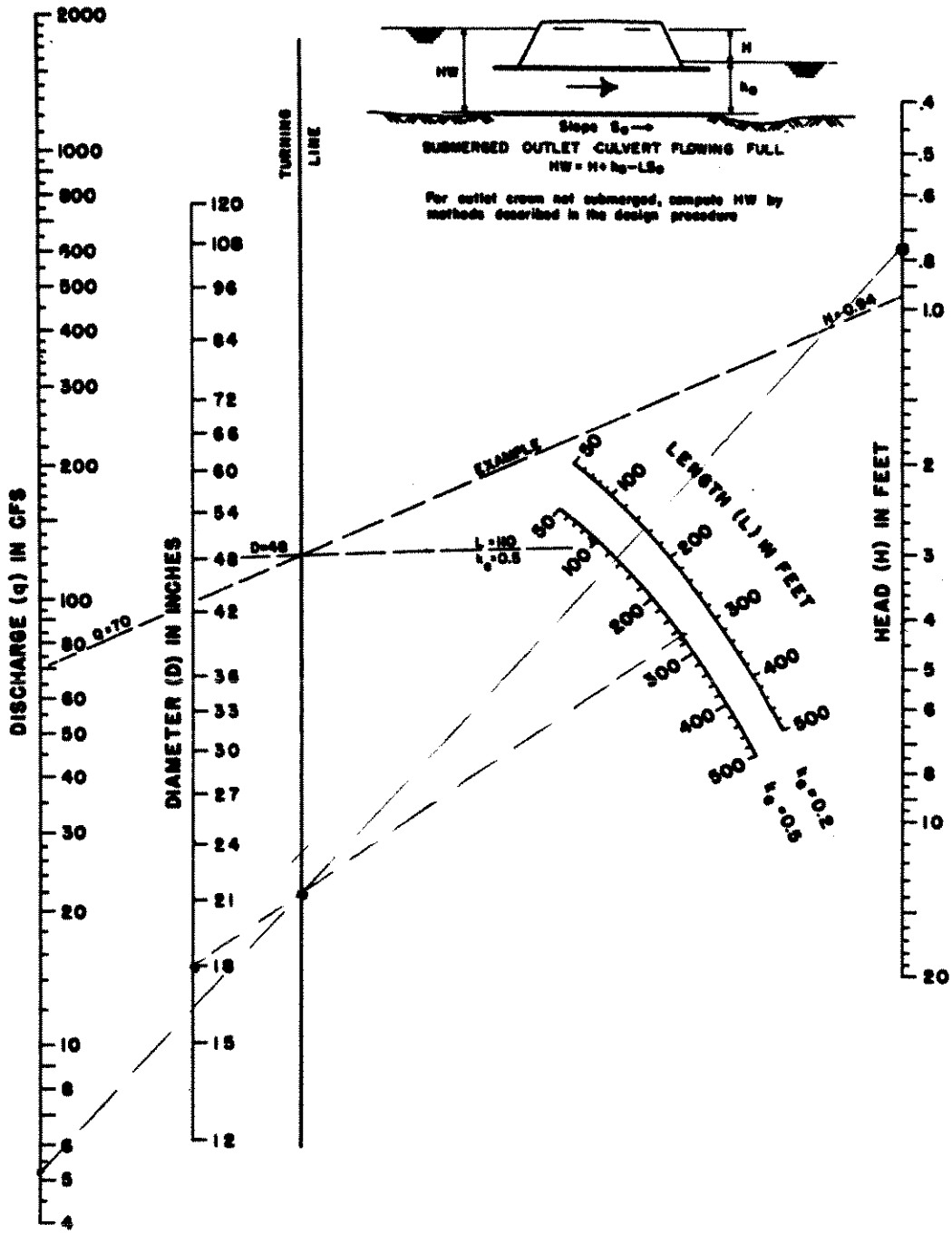
MEAN STREAM VELOCITY = ____

MAX. STREAM VELOCITY = ____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
18" CULVERT (INLET BOX)	5.2	1.5'	0.86	1.29	0.5	0.75	0.85	1.175	0	1.175	2.3765	-0.7965	Inlet			

SUMMARY & RECOMMENDATIONS:

8

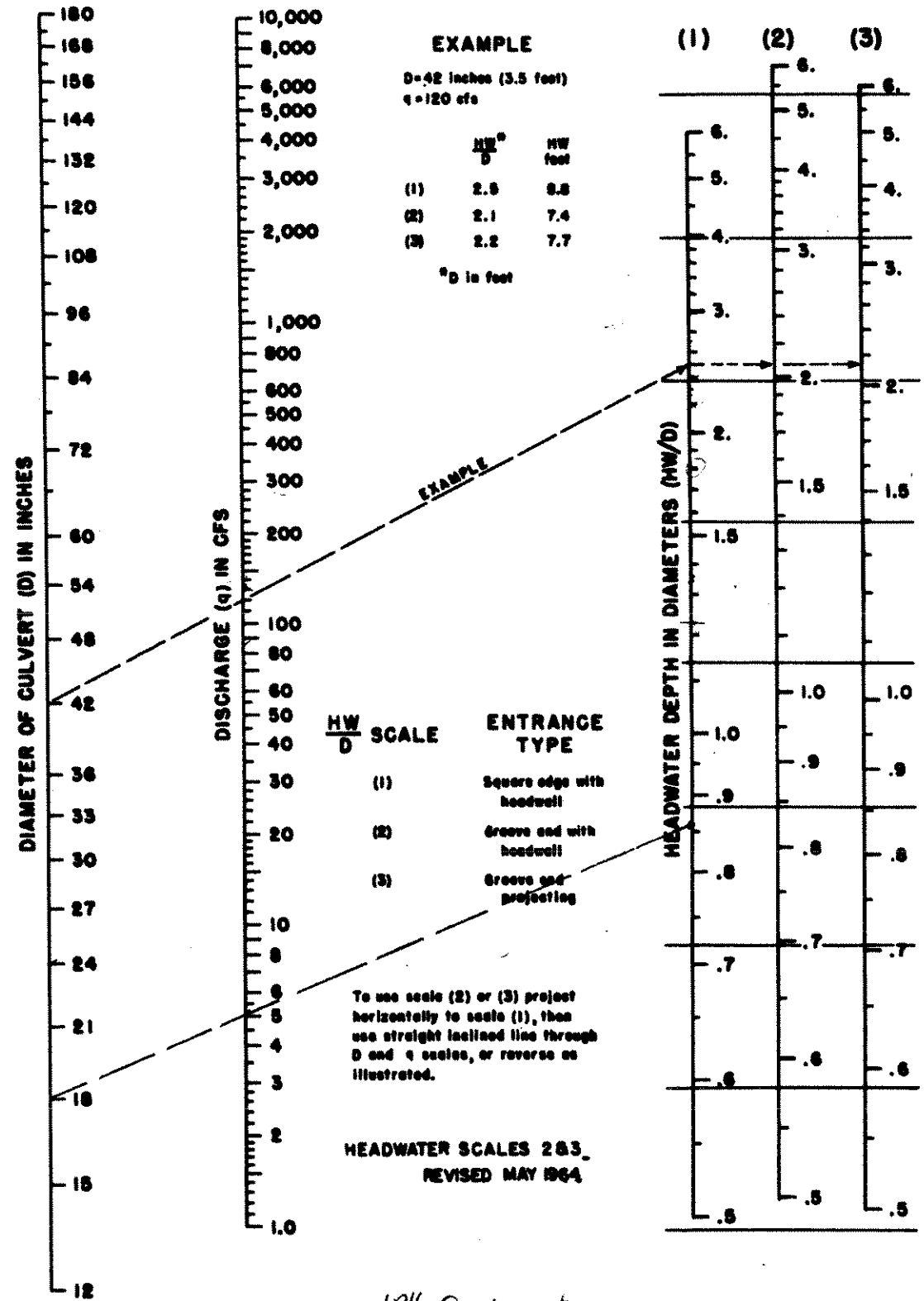


18" culvert

BUREAU OF PUBLIC ROADS JAN. 1963

Exhibit 14-12. Head for concrete pipe culverts flowing full n = 0.012.

From: SCS National Engineering Handbook



18" Culvert

Exhibit 14-7. Headwater depth for concrete pipe culverts with inlet control.

NEH Notice 4-102, August 1972

From: SCS National Engineering Handbook

Technical Release 55 Method of Analysis for Finding Peak Discharges:

Client/Subject: **Bench 1**
Description: **LANL**
Prepared by: **SW**
Date: **09 Mar 04**

Print Date: 11Mar04 10:58 a
W. O. #: **00000-000-000**

Math Check:	SW
Method Check:	RWM

Runoff Curve Number:

Soil Group	Cover Description	Area (acres)	CN	Product
				0.0
C	Rock	0.3	90	27.9
				0.0
				0.0
				0.0
		0.3		27.9

Composite CN= 90

Runoff Time of Concentration:

Use Assumed Travel Time? no (yes/no)

(Equations and TR-55 References)

Sheet Flow

Manning Roughness, n=	0.13		From Table 3-1
Sheet flow length, Lsf=	0.9	feet (300 ft max)	
Two year 24 hour rainfall, P 2yr=	1.51	inches	
Average land slope, Ssf=	0.36	ft/ft	
Travel time, Tsf=	**0.00**	**hours**	0.007 * (n*L)^0.8 / P2yr^0.5 * S^0.4

Shallow Concentrated Flow

Surface Description:	Unpaved	(paved/unpaved)	
Flow Length, Lsc=	0	feet	
Average Land Slope, Ssc=	0.36	ft/ft	
Average Velocity, Vsc=	9.7	ft/s	From Figure 3-1
Travel time, Tsc	**0.00**	**hours**	L / 3600V

Channel Flow

Use Assumed Velocity?	yes	(yes/no)	
Assumed Vc=	3	ft/s	

Disregard subsection:
Using assumed velocity

Average velocity, Vc=	3.00	ft/s	(1.49 * Rh^2/3 * Sc^1/2) / n
Flow Length, Lc=	130	feet	
Travel time, Tc=	**0.01**	**hours**	L / 3600V

Total Time of Conc.= 0.10 hours

Peak Discharge:

Drainage Area:	0.3	acres	
Da=	0.00048	sq mi	
Runoff curve number, CN=	90.0		
Time of Concentration, Tc=	0.10	hours	
Rainfall Distrubution Type:	II		From Figure B-2
Storm Frequency:	25	years	
24 hour duration Rainfall, P=	3.20	inches	From Figures B-3 to B-8
Initial Abstraction, Ia =	0.222		From Table 4-1
Ia / P =	0.10		
Direct Runoff, Q=	2.17		From Table 2-1
Unit peak discharge, Qu=	1010	csm/in	From Exhibit 4-I , 4-IA, 4-II, 4-III

Peak Discharge, Qp= 1.1 cfs — Qu * sq miles * Q

Bench 1
Worksheet for Triangular Channel

Project Description	
Worksheet	Bench 1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data			
Mannings Coefficient	0.045		Extrapolated from Fig. 3 (see attached)
Slope	0.040000	ft/ft	
Left Side Slope	2.75	H : V	
Right Side Slope	10.00	H : V	
Discharge	1.10	cfs	

Results		
Depth	0.30	ft
Flow Area	0.6	ft^2
Wetted Perimeter	3.95	ft
Top Width	3.88	ft
Critical Depth	0.28	ft
Critical Slope	0.057893	ft/ft
Velocity	1.86	ft/s
Velocity Head	0.05	ft
Specific Energy	0.36	ft
Froude Number	0.84	
Flow Type	Subcritical	

Technical Release 55 Method of Analysis for Finding Peak Discharges:

Client/Subject: **Bench 2**
Description: **LANL**
Prepared by: **SW**
Date: **09 Mar 04**

Print Date: 11Mar04 10:34 a
W. O. #: **00000-000-000**

Math Check:	SW
Method Check:	RWM

Runoff Curve Number:

Soil Group	Cover Description	Area (acres)	CN	Product
				0.0
C	Rock	0.5	90	45.9
				0.0
				0.0
				0.0
		0.5		45.9

Composite CN= 90

Runoff Time of Concentration:

Use Assumed Travel Time? no (yes/no)

(Equations and TR-55 References)

Sheet Flow

Manning Roughness, n=	0.13		From Table 3-1
Sheet flow length, Lsf=	92	feet (300 ft max)	
Two year 24 hour rainfall, P 2yr=	1.51	inches	
Average land slope, Ssf=	0.36	ft/ft	
Travel time, Tsf=	**0.06**	**hours**	0.007 * (n*L)^0.8 / P2yr^0.5 * S^0.4

Shallow Concentrated Flow

Surface Description:	Unpaved	(paved/unpaved)	
Flow Length, Lsc=	0	feet	
Average Land Slope, Ssc=	0.36	ft/ft	
Average Velocity, Vsc=	9.7	ft/s	From Figure 3-1
Travel time, Tsc	**0.00**	**hours**	L / 3600V

Channel Flow

Use Assumed Velocity?	yes	(yes/no)
Assumed Vc=	3	ft/s

Disregard subsection:
Using assumed velocity

Average velocity, Vc=	3.00	ft/s	(1.49 * Rh^2/3 * Sc^1/2) / n
Flow Length, Lc=	220	feet	
Travel time, Tc=	**0.02**	**hours**	L / 3600V

Total Time of Conc.= 0.10 hours

Peak Discharge:

Drainage Area:	0.5	acres	
Da=	0.00080	sq mi	
Runoff curve number, CN=	90.0		
Time of Concentration, Tc=	0.10	hours	
Rainfall Distrubution Type:	II		*From Figure B-2*
Storm Frequency:	25	years	
24 hour duration Rainfall, P=	3.20	inches	From Figures B-3 to B-8
Initial Abstraction, Ia =	0.222		From Table 4-1
Ia / P =	0.10		
Direct Runoff, Q=	2.17		From Table 2-1
Unit peak discharge, Qu=	1010	csm/in	From Exhibit 4-I , 4-IA, 4-II, 4-III

Peak Discharge, Qp= 1.7 cfs — Qu * sq miles * Q

Bench 2
Worksheet for Triangular Channel

Project Description	
Worksheet	Bench 2
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data			
Mannings Coefficient	0.045		Extrapolated from Fig. 3 (see attached)
Slope	0.040000	ft/ft	
Left Side Slope	2.75	H : V	
Right Side Slope	10.00	H : V	
Discharge	1.70	cfs	

Results		
Depth	0.36	ft
Flow Area	0.8	ft^2
Wetted Perimeter	4.65	ft
Top Width	4.57	ft
Critical Depth	0.34	ft
Critical Slope	0.054631	ft/ft
Velocity	2.08	ft/s
Velocity Head	0.07	ft
Specific Energy	0.43	ft
Froude Number	0.86	
Flow Type	Subcritical	

Technical Release 55 Method of Analysis for Finding Peak Discharges:

Client/Subject: **Bench 3**
Description: **LANL**
Prepared by: **SW**
Date: **09 Mar 04**

Print Date: 11Mar04 10:35 a
W. O. #: **00000-000-000**

Math Check:	SW
Method Check:	RWM

Runoff Curve Number:

Soil Group	Cover Description	Area (acres)	CN	Product
				0.0
C	Rock	0.5	90	45.0
				0.0
				0.0
				0.0
		0.5		45.0

Composite CN= 90

Runoff Time of Concentration:

Use Assumed Travel Time? no (yes/no)

(Equations and TR-55 References)

Sheet Flow

Manning Roughness, n=	0.13		From Table 3-1
Sheet flow length, Lsf=	75	feet (300 ft max)	
Two year 24 hour rainfall, P 2yr=	1.51	inches	
Average land slope, Ssf=	0.36	ft/ft	
Travel time, Tsf=	**0.05**	**hours**	0.007 * (n*L)^0.8 / P2yr^0.5 * S^0.4

Shallow Concentrated Flow

Surface Description:	Unpaved	(paved/unpaved)	
Flow Length, Lsc=	0	feet	
Average Land Slope, Ssc=	0.36	ft/ft	
Average Velocity, Vsc=	9.7	ft/s	From Figure 3-1
Travel time, Tsc	**0.00**	**hours**	L / 3600V

Channel Flow

Use Assumed Velocity?	yes	(yes/no)	
Assumed Vc=	3	ft/s	

Disregard subsection:
Using assumed velocity

Average velocity, Vc=	3.00	ft/s	(1.49 * Rh^2/3 * Sc^1/2) / n
Flow Length, Lc=	260	feet	
Travel time, Tc=	**0.02**	**hours**	L / 3600V

Total Time of Conc.= 0.10 hours

Peak Discharge:

Drainage Area:	0.5	acres	
Da=	0.00078	sq mi	
Runoff curve number, CN=	90.0		
Time of Concentration, Tc=	0.10	hours	
Rainfall Distrubution Type:	II		*From Figure B-2*
Storm Frequency:	25	years	
24 hour duration Rainfall, P=	3.20	inches	From Figures B-3 to B-8
Initial Abstraction, Ia =	0.222		From Table 4-1
Ia / P =	0.10		
Direct Runoff, Q=	2.17		From Table 2-1
Unit peak discharge, Qu=	1010	csm/in	From Exhibit 4-I , 4-IA, 4-II, 4-III

Peak Discharge, Qp= 1.7 cfs — Qu * sq miles * Q

Bench 3
Worksheet for Triangular Channel

Project Description	
Worksheet	Bench 3
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data			
Mannings Coefficient	0.045		Extrapolated from Fig. 3 (see attached)
Slope	0.040000	ft/ft	
Left Side Slope	2.75	H : V	
Right Side Slope	10.00	H : V	
Discharge	1.70	cfs	

Results		
Depth	0.36	ft
Flow Area	0.8	ft^2
Wetted Perimeter	4.65	ft
Top Width	4.57	ft
Critical Depth	0.34	ft
Critical Slope	0.054631	ft/ft
Velocity	2.08	ft/s
Velocity Head	0.07	ft
Specific Energy	0.43	ft
Froude Number	0.86	
Flow Type	Subcritical	

Technical Release 55 Method of Analysis for Finding Peak Discharges:

Client/Subject: **Bench 4**
Description: **LANL**
Prepared by: **SW**
Date: **09 Mar 04**

Print Date: 11Mar04 10:34 a
W. O. #: **00000-000-000**

Math Check:	SW
Method Check:	RWM

Runoff Curve Number:

Soil Group	Cover Description	Area (acres)	CN	Product
				0.0
C	Rock	0.6	90	56.7
				0.0
				0.0
				0.0
		0.6		56.7

Composite CN= 90

Runoff Time of Concentration:

Use Assumed Travel Time? no (yes/no)

(Equations and TR-55 References)

Sheet Flow

Manning Roughness, n=	0.13		From Table 3-1
Sheet flow length, Lsf=	72	feet (300 ft max)	
Two year 24 hour rainfall, P 2yr=	1.51	inches	
Average land slope, Ssf=	0.67	ft/ft	
Travel time, Tsf=	**0.04**	**hours**	0.007 * (n*L)^0.8 / P2yr^0.5 * S^0.4

Shallow Concentrated Flow

Surface Description:	Unpaved	(paved/unpaved)	
Flow Length, Lsc=	0	feet	
Average Land Slope, Ssc=	0.36	ft/ft	
Average Velocity, Vsc=	9.7	ft/s	From Figure 3-1
Travel time, Tsc	**0.00**	**hours**	L / 3600V

Channel Flow

Use Assumed Velocity?	yes	(yes/no)
Assumed Vc=	3	ft/s

Disregard subsection:
Using assumed velocity

Average velocity, Vc=	3.00	ft/s	(1.49 * Rh^2/3 * Sc^1/2) / n
Flow Length, Lc=	300	feet	
Travel time, Tc=	**0.03**	**hours**	L / 3600V

Total Time of Conc.= 0.10 hours

Peak Discharge:

Drainage Area:	0.6	acres	
Da=	0.00098	sq mi	
Runoff curve number, CN=	90.0		
Time of Concentration, Tc=	0.10	hours	
Rainfall Distrubution Type:	II		From Figure B-2
Storm Frequency:	25	years	
24 hour duration Rainfall, P=	3.20	inches	From Figures B-3 to B-8
Initial Abstraction, Ia =	0.222		From Table 4-1
Ia / P =	0.10		
Direct Runoff, Q=	2.17		From Table 2-1
Unit peak discharge, Qu=	1010	csm/in	From Exhibit 4-I , 4-IA, 4-II, 4-III

Peak Discharge, Qp= 2.2 cfs — Qu * sq miles * Q

File: Bench 4
Spreadsheet Template By Brian Miller

Bench 4
Worksheet for Triangular Channel

Project Description	
Worksheet	Bench 4
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.045	Extrapolated from Fig. 3 (see attached)
Slope	0.040000 ft/ft	
Left Side Slope	2.75 H : V	
Right Side Slope	10.00 H : V	
Discharge	2.20 cfs	

Results	
Depth	0.39 ft
Flow Area	1.0 ft²
Wetted Perimeter	5.12 ft
Top Width	5.03 ft
Critical Depth	0.37 ft
Critical Slope	0.052784 ft/ft
Velocity	2.21 ft/s
Velocity Head	0.08 ft
Specific Energy	0.47 ft
Froude Number	0.88
Flow Type	Subcritical

Technical Release 55 Method of Analysis for Finding Peak Discharges:

Client/Subject: **Bench 5**
Description: **LANL**
Prepared by: **SW**
Date: **23 Feb 04**

Print Date: 11Mar04 10:38 a
W. O. #: **00000-000-000**

Math Check:	SW
Method Check:	RWM

Runoff Curve Number:

Soil Group	Cover Description	Area (acres)	CN	Product
C	Grass	1.9	85	161.5
C	Rock	0.6	90	54.0
				0.0
				0.0
				0.0
		2.5		215.5

Composite CN= 86

Runoff Time of Concentration:

Use Assumed Travel Time? no (yes/no)

(Equations and TR-55 References)

Sheet Flow

Manning Roughness, n=	0.1	From Table 3-1
Sheet flow length, Lsf=	300 feet (300 ft max)	
Two year 24 hour rainfall, P 2yr=	1.51 inches	
Average land slope, Ssf=	0.03 ft/ft	
Travel time, Tsf=	**0.35 hours**	0.007 * (n*L)^0.8 / P2yr^0.5 * S^0.4

Shallow Concentrated Flow

Surface Description:	Unpaved (paved/unpaved)	
Flow Length, Lsc=	180 feet	
Average Land Slope, Ssc=	0.15 ft/ft	
Average Velocity, Vsc=	6.2 ft/s	From Figure 3-1
Travel time, Tsc	**0.01 hours**	L / 3600V

Channel Flow

Use Assumed Velocity? yes (yes/no)
Assumed Vc= 4 ft/s

Disregard subsection:
Using assumed velocity

Average velocity, Vc=	4.00 ft/s	(1.49 * Rh^2/3 * Sc^1/2) / n
Flow Length, Lc=	240 feet	
Travel time, Tc=	**0.02 hours**	L / 3600V

Total Time of Conc.= 0.38 hours

Peak Discharge:

Drainage Area:	2.5 acres	
Da=	0.00391 sq mi	
Runoff curve number, CN=	86.0	
Time of Concentration, Tc=	0.38 hours	
Rainfall Distrubution Type:	II	From Figure B-2
Storm Frequency:	25 years	
24 hour duration Rainfall, P=	3.20 inches	From Figures B-3 to B-8
Initial Abstraction, Ia =	0.326	From Table 4-1
Ia / P =	0.10	
Direct Runoff, Q=	1.84	From Table 2-1
Unit peak discharge, Qu=	609 csm/in	From Exhibit 4-I , 4-IA, 4-II, 4-III

Peak Discharge, Qp= 4.4 cfs — Qu * sq miles * Q

Bench 5
Worksheet for Triangular Channel

Project Description	
Worksheet	Bench 5
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data			
Mannings Coefficient	0.060		Fig. 3 (see attached)
Slope	0.040000	ft/ft	
Left Side Slope	2.75	H : V	
Right Side Slope	10.00	H : V	
Discharge	4.40	cfs	

Results		
Depth	0.57	ft
Flow Area	2.1	ft^2
Wetted Perimeter	7.40	ft
Top Width	7.27	ft
Critical Depth	0.49	ft
Critical Slope	0.085554	ft/ft
Velocity	2.12	ft/s
Velocity Head	0.07	ft
Specific Energy	0.64	ft
Froude Number	0.70	
Flow Type	Subcritical	

Downchute 1
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Downchute 1 - NEW
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data			
Mannings Coefficient	0.090		Extrapolated from Fig. 3 (see attached)
Slope	0.333333	ft/ft	
Left Side Slope	3.00	H : V	
Right Side Slope	3.00	H : V	
Bottom Width	12.00	ft	
Discharge	4.40	cfs	

Results			
Depth	0.14	ft	
Flow Area	1.7	ft²	
Wetted Perimeter	12.89	ft	
Top Width	12.84	ft	
Critical Depth	0.16	ft	
Critical Slope	0.221824	ft/ft	
Velocity	2.52	ft/s	
Velocity Head	0.10	ft	
Specific Energy	0.24	ft	
Froude Number	1.20		Weak undular hydraulic jump with surface turbulence; per Fig. 15-4, V.T. Chow "Open Channel Hydraulics", 1959. No visible turbulence anticipated due to the size of Rip Rap vs. depth of flow (interstitial flow).
Flow Type	Supercritical		

zontal rectangular channels. For horizontal nonrectangular channels, similar curves may also be prepared.

The theoretical curves for y_2/E_1 and h_j/E_1 have been verified experimentally by Bakhmeteff and Matzke [17], who found that these curves give values of y_2/E_1 and h_j/E_1 about 3 to 4% greater than the experimental values.[1] The characteristic curves were also checked with U.S.

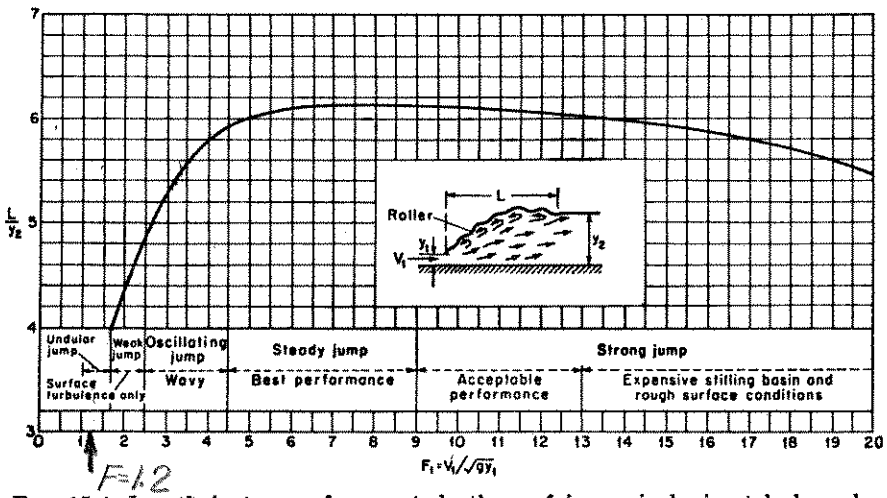


FIG. 15-4. Length in terms of sequent depth y_2 of jumps in horizontal channels. (*Based on data and recommendations of U.S. Bureau of Reclamation* [34].)

Bureau of Reclamation data [34,35] obtained from six test flumes. Perfect agreement was found between the y_1/E_1 curve and the data. The agreement between the E_2/E_1 or $\Delta E/E_1$ curve and the data was fairly good except for $\mathbf{F}_1 < 2$. The experimental curve for $\Delta E/E_1$ recommended by the Bureau is shown by the dashed line (Fig. 15-3). The agreement between the y_2/E_1 and h_j/E_1 curves and the data was good for high $\mathbf{F}_1$ values, but the scattered data failed to define the curves accurately for $\mathbf{F}_1 < 3$.

15-5. Length of Jump. The *length of a jump* may be defined as the distance measured from the front face of the jump to a point on the surface immediately downstream from the roller. This length cannot be determined easily by theory, but it has been investigated experimentally by many hydraulicians.[2]

[1] It is possible that at least part of this discrepancy is due to the scale effect of the testing model (see next article).

[2] Among them Safranez at the Technical University of Berlin [36,37], Wóycicki at the Federal Institute of Technology in Zürich, Switzerland [38], Aravin in Russia [39], Bakhmeteff and Matzke at Columbia University [17], Moore at the California Institute of Technology [40], and the engineers of the U.S. Bureau of Reclamation [34,35].

15-2. Jump in Horizontal Rectangular Channels.[1] For supercritical flow in a horizontal rectangular channel, the energy of flow is dissipated through frictional resistance along the channel, resulting in a decrease in velocity and an increase in depth in the direction of flow. A hydraulic jump will form in the channel if the Froude number $\mathbf{F}_1$ of the flow, the flow depth y_1, and a downstream depth y_2 satisfy the equation

$$\frac{y_2}{y_1} = \tfrac{1}{2}(\sqrt{1 + 8\mathbf{F}_1^2} - 1) \qquad (3\text{-}21)$$

This equation may be represented by the curve in Fig. 15-1. This curve has been verified satisfactorily with many experimental data and will be found very useful in the analysis and design for hydraulic jumps.

15-3. Types of Jump. Hydraulic jumps on horizontal floor are of several distinct types. According to the studies of the U.S. Bureau of Reclamation [34,35], these types can be conveniently classified according to the Froude number $\mathbf{F}_1$ of the incoming flow (Fig. 15-2), as follows:

For $\mathbf{F}_1 = 1$, the flow is critical, and hence no jump can form.

For $\mathbf{F}_1 = 1$ to 1.7, the water surface shows undulations, and the jump is called an *undular jump*.

For $\mathbf{F}_1 = 1.7$ to 2.5, a series of small rollers develop on the surface of the jump, but the downstream water surface remains smooth. The velocity throughout is fairly uniform, and the energy loss is low. This jump may be called a *weak jump*.

For $\mathbf{F}_1 = 2.5$ to 4.5, there is an oscillating jet entering the jump bottom to surface and back again with no periodicity. Each oscillation produces

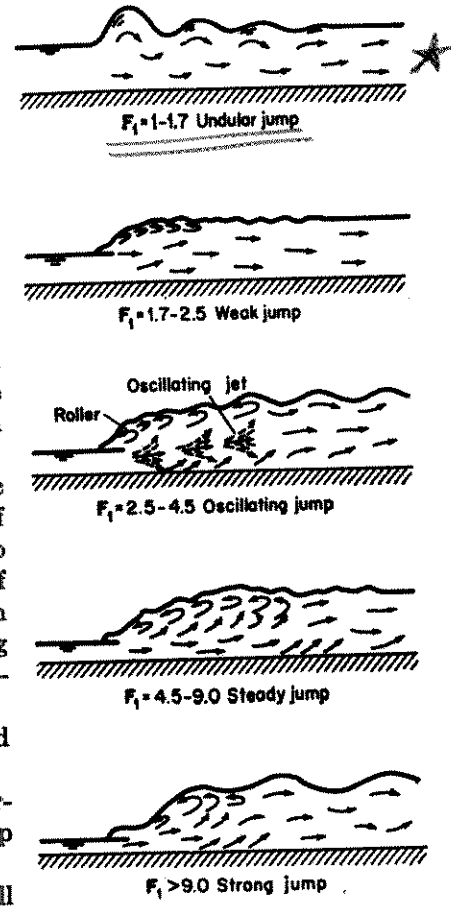


FIG. 15-2. Various types of hydraulic jump.

[1] For hydraulic jumps in trapezoidal channels, see [30] and [31]. For jumps in closed conduits, see [29] and [32]. For a general treatment of nonrectangular channels, see [33].

20a

TABLE 6
Maximum Permissible Shear Stresses for Various Channel Liners

Lining Category	Lining Type	lb/ft^2
Unlined - Erodible Soils*	Silts, Fine -Medium Sands	0.03
	Coarse Sands	0.04
	Very Coarse Sands	0.05
	Fine Gravel	0.10
Erosion Resistant Soils**	Clay loam	0.25
	Silty Clay loam	0.18
	Sandy Clay Loam	0.10
	Loam	0.07
	Silt Loam	0.12
	Sandy Loam	0.02
	Gravely, Stony, Channery Loam	0.05
	Stony or Channery Silt Loam	0.07
Temporary Liners	Jute	0.45
	Straw with Net	1.45
	Coir - Double Net	2.25
	Coconut Fiber -Double Net	2.25
	Curled Wood Mat	1.55
	Curled Wood-Double Net	1.75
	Curled Wood - Hi Velocity	2.00
	Synthetic Mat	2.00
Vegetative Liners	Class B	2.10
	Class C	1.00
	Class D	0.60
Riprap***	R-1	0.25
	R-2	0.50
	R-3	1.00
	R-4	2.00
	R-5	3.00
	R-6	4.00
	R-7	5.00
	R-8	8.00

* Soils having an erodibility "K" factor greater than 0.37.
** Soils having an erodibility "K" factor less than or equal to 0.37
*** Permissible shear stresses based on rock at 165 lb/cuft. Adjust velocities for other rock weights used. See Table 12.

Manufacturer's shear stress values based on independent tests may be used.

From: DADEP Erosion & Sediment Pollution Control Program Manual

Wherever vegetative linings are proposed, a suitable temporary liner shall be provided. Separate calculations should be provided showing sufficient capacity and adequate protection both before and after establishment of the vegetation. Maximum shear stress and roughness coefficients for the temporary liners should conform to Table 6 or the manufacturer's specifications. Wherever manufacturer's specifications are used, they should be documented in the narrative. Table 8 provides roughness coefficients for some commonly used temporary liners. Additional information on the design and use of channel linings may be obtained from the Federal Highway Administration's Hydraulic Engineering Circular No. 15 (April 1988). Copies of this publication may be obtained by contacting:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: (703) 605-6000
Publication No.: PB-86-184-835

TABLE 8
Manning's Roughness Coefficient ("n") for Commonly Used Temporary Channel Linings

Lining Type	Manning's "n" Dept Ranges		
	0 - 0.5 ft. (0 - 0.15 m)	0.5 - 2.0 ft. (0.15 - 0.61 m)	>2.0 ft (>0.61 m)
Jute Net	0.028	0.022	0.019
Curled Wood Mat	0.066	0.035	0.028
Synthetic Mat	0.036	0.025	0.021

The maximum permissible shear stresses for Riprap channel linings are given in Table 6. The value of Manning's "n" used should be taken from Figure 3. Since the roughness coefficient varies significantly with the size of the rock and the depth of flow, use of standard "n" values may result in undersizing of the channel or of the riprap protection. **NOTE: Due to the rapid increase in shear stress with increasing bed slope, reno mattresses or gabions should be considered for gradients > 10% (0.10 ft/ft).**

TABLE 9
Riprap Gradation, Filter Blanket Requirements, Maximum Velocities

NSA No.	Graded Rock Size (in)			Filter Blanket Requirements**		V_{max} (ft/sec
	Max.	d_{50}*	Min.	Size NSA No.	Placement Thickness	
R-1	1.5	.75	No. 8	FS-1	N/A	2.5
R-2	3	1.5	1	FS-1	N/A	4.5
R-3	6	3	2	FS-1	3	6.5
R-4	12	6	3	FS-2	4	9.0
R-5	18	9	5	FS-2	6	11.5
R-6	24	12	7	FS-3	8	13.0
R-7	30	15	12	FS-3	10	14.5

* The d_{50} stone size is the size exceeded by 50% of the total weight of the tonnage shipped (i.e. 50% by weight shall consist of pieces larger than the d_{50} stone size").

** This is a general standard. Soil conditions at each site should be analyzed to determine actual filter size. A suitable woven or non-woven geotextile underlayment, used according to manufacturer's recommendations, may be substituted for the filter stone.

From: PADEP Erosion & Sediment Pollution Control Program Manual

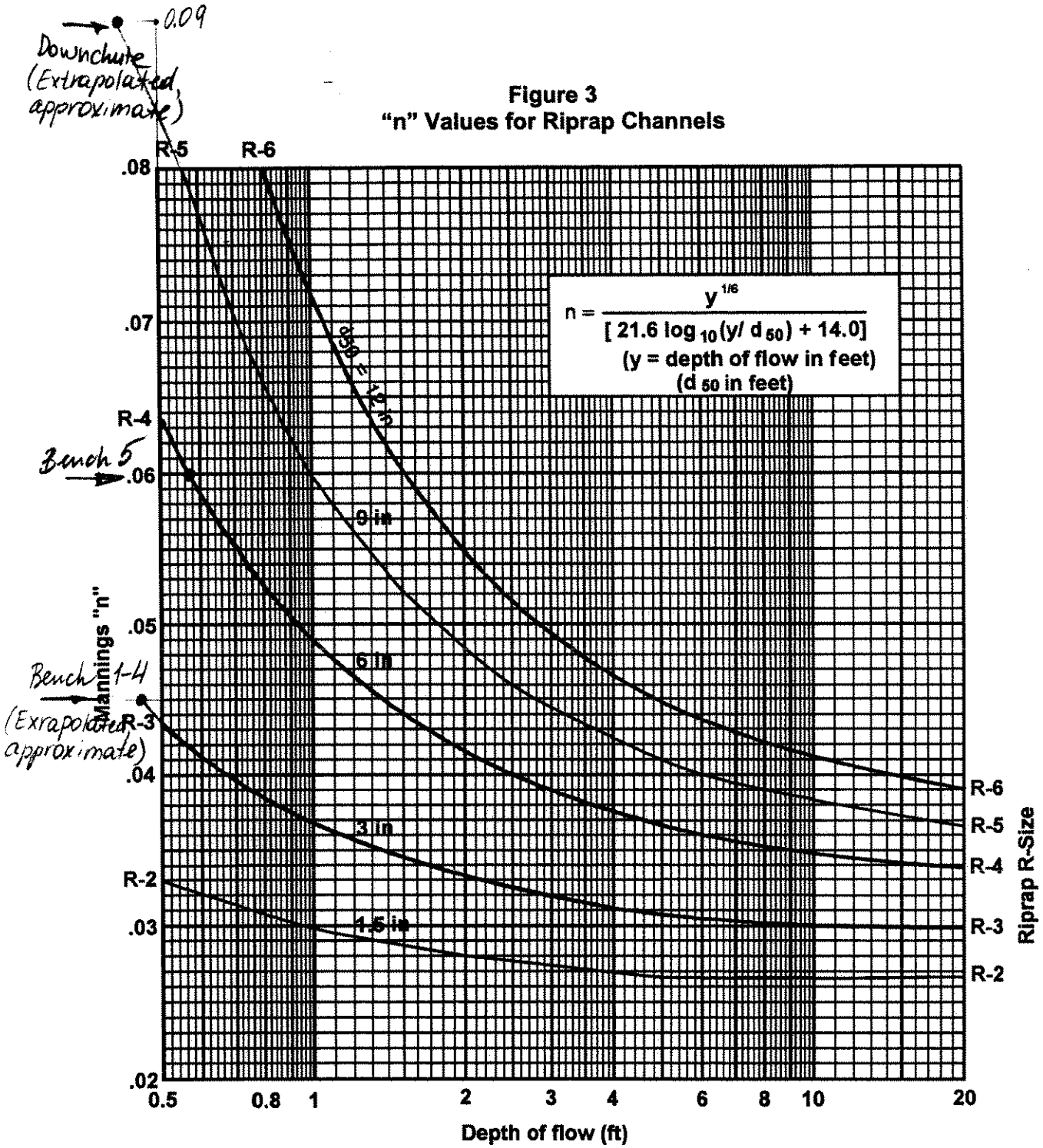


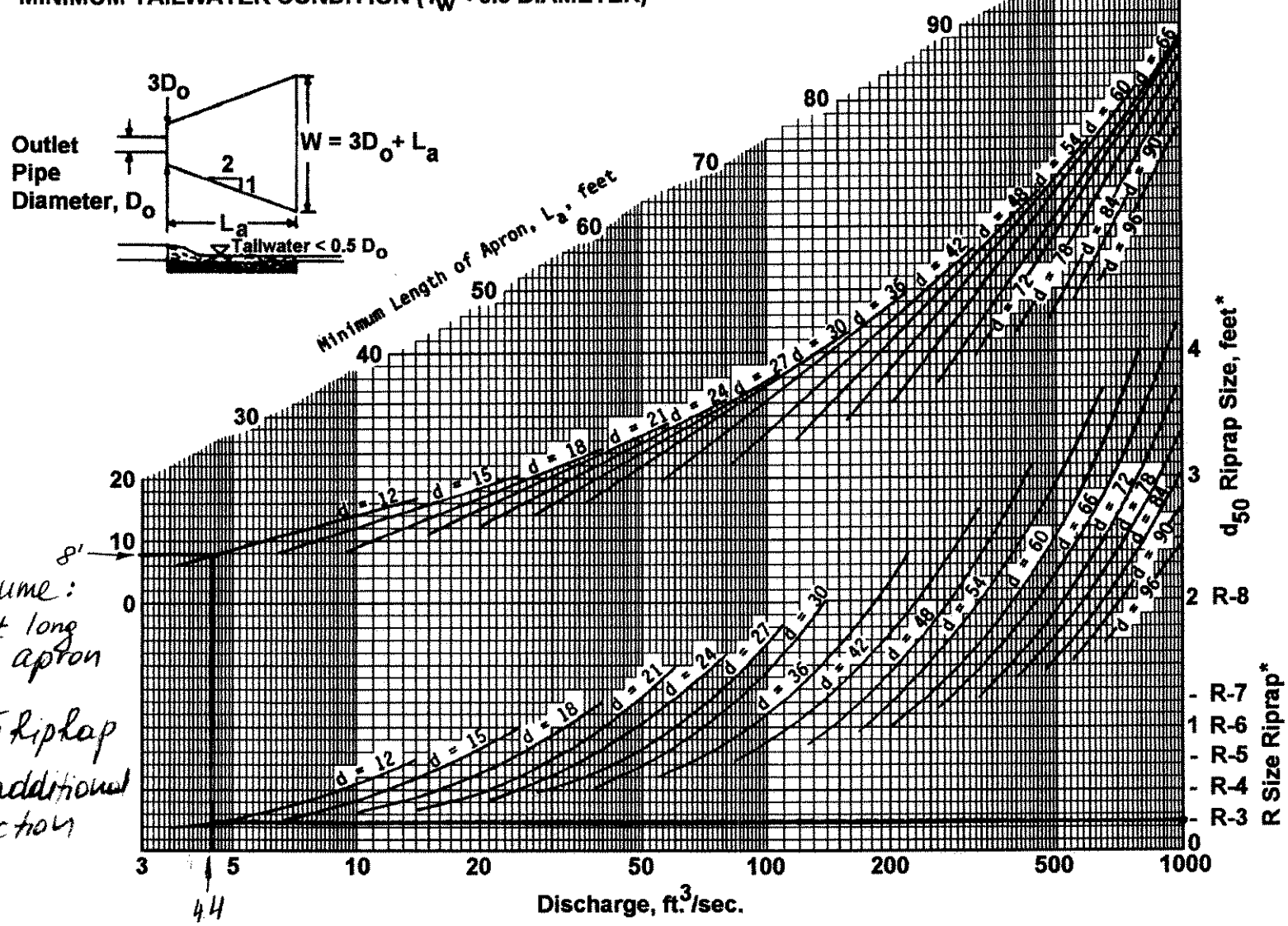
Figure 3
"n" Values for Riprap Channels

From: PADEP Erosion & Sediment Pollution Control Program Manual

Apron #1

Equivalent pipe diameter (based on flow area): 1.7 ft² ~ d=12"

DESIGN OF RIPRAP APRON OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL
MINIMUM TAILWATER CONDITION (T_W < 0.5 DIAMETER)



Assume: 10ft long apron

R-5 Riprap for additional protection

* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.

FIGURE 21
Riprap Apron Design, Minimum Tailwater Condition

From: PADEP Erosion Sediment Pollution Control Program Manual

Los Alamos Airport Landfill
TA-73
Hydraulic Calculations Summary

Drainage Feature	Estimated 25-yr 24-hr storm discharge	Bed Slope	Flow Depth	Shear	Flow Velocity	Proposed Slope Protection
	CFS	ft/ft	ft	psf	fps	
Channel 1	5.2	0.017	0.49	0.52	3.09	Erosion Mat
Bench 1	1.1	0.04	0.30	0.75	1.86	R-3 Rip Rap
Bench 2	1.7	0.04	0.36	0.90	2.08	R-3 Rip Rap
Bench 3	1.7	0.04	0.36	0.90	2.08	R-3 Rip Rap
Bench 4	2.2	0.04	0.39	0.97	2.21	R-3 Rip Rap
Bench 5	4.4	0.04	0.57	1.42	2.12	R-4 Rip Rap
Downchute 1	4.4	0.33	0.14	2.88	2.52	R-5 Rip Rap

Shear stress calculated as:

$$\tau = \gamma * d * s$$

where,

τ = shear stress, psf
γ = unit weight of water, pcf (62.4 pcf)
d = flow depth, ft
s = bed slope, ft/ft

CLIENT/SUBJECT LANL W.O. NO 00000000000

TASK DESCRIPTION Landfill Top Erosion Forces Estimate TASK NO 000000

PREPARED BY SW	DEPT 1495	DATE 4/14/2004	APPROVED BY	
MATH CHECK BY RCM	DEPT 1495	DATE 4/14/2004		
METHOD REV. BY RWM	DEPT 1495	DATE 4/14/2004	DEPT	DATE

Objective: Determine velocities and shear forces generated by the sheet flow atop of the Los Alamos Airport Landfill during 2-yr, 24-hr storm.

References: US Department of Agriculture, Soil Conservation Service "Urban Hydrology For Small Watersheds. Technical Release 55" (TR-55).

Discussion:

This calculation approximates velocities and shear forces experienced by the cover of the landfill during a 2-yr 24-hr storm. Calculations address two sets of conditions: bare soil prior to the establishment of vegetation, and established vegetation. Attached are calculations for both conditions. Sheet flow was examined for a 300-ft length of a 3% slope. Time of travel for sheet flow was calculated based on the TR-55 Equation 3-3:

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} S^{0.4}}$$

Where: T_t = travel time, hr

n = Manning's roughness coefficient

L = flow length, ft

P_2 = 2-yr, 24-hr rainfall, in

S = slope, ft/ft

Manning's coefficient is assumed 0.05 for rough, bare soil, and 0.15 for short prairie grass (stabilized conditions) per TR-55 Table 3-1. Resulting time of travel T_t is 0.20 hrs for bare soil, and 0.49 hrs for stabilized conditions. Based on time of travel and 300-ft length, average velocities are 0.4 fps for bare soil and 0.2 fps for stabilized conditions (calculated at length/time of travel).

However, for shallow concentrated flow that might start to form on runs longer than 300 ft, time of travel is only 0.02 hrs for the remaining 180 ft, with average velocity of about 2.8 fps for both pre- and post-stabilization conditions (see attached).

CLIENT/SUBJECT LANL W.O. NO 00000000000

TASK DESCRIPTION Landfill Top Erosion Forces Estimate TASK NO 000000

				APPROVED BY
PREPARED BY SW	DEPT 1495	DATE 4/14/2004		
MATH CHECK BY RCM	DEPT 1495	DATE 4/14/2004		
METHOD REV. BY RWM	DEPT 1495	DATE 4/14/2004	DEPT	DATE

Velocities generated by these calculations are generally found acceptable for vegetated surfaces. Velocity of 2.8 cfs for shallow concentrated flow on bare soil may be excessive for some of the soils identified in Section 02200 of Construction Specifications as acceptable for topsoil materials. Therefore an attempt should be made to control flow velocities before vegetation establishment.

Shear forces can be calculated as:

$$\tau = \gamma d S$$

Where: τ = shear stress, lb/ft^2

γ = unit weight of water, lb/ft^3

d = flow depth, ft

S = slope, ft/ft

Depth of flow can be estimated by approximating sheet flow as a very wide and shallow channel. Calculations using Haestad Flowmaster program are attached. Discharge was assumed using the worst-case scenario: flow along the eastern edge of the landfill, before it enters a 3:1 area (see attached calculations). Channel width was assumed to be 300 ft (the entire eastern edge). Both scenarios yielded depth of flow of about 0.02 ft, which results in a shear stress of:

$$\tau = 62.4 \bullet 0.02 \bullet 0.03 = 0.037\ lb/ft^2$$

This shear stress can be assumed acceptable per "Maximum Permissible Velocities and Corresponding Unit Tractive Force (Shear Stress)" U.S. Bureau of Reclamation Research, Fortier and Scobey, 1926. See attached tables for reference on allowable velocities and shear stress.

Technical Release 55 Method of Analysis for Finding Peak Discharges:

Client/Subject: **LANL**
Description: **Worst-case bare soil flow**
Prepared by: **SW**
Date: **14 Apr 04**

Print Date: 14Apr04 2:23 p
W. O. #: **00000-000-000**

Math Check:	SW
Method Check:	RWM

Runoff Curve Number:

Soil Group	Cover Description	Area (acres)	CN	Product
C	Bare Soil	1.9	90	171.0
				0.0
				0.0
				0.0
				0.0
		1.9		171.0

Composite CN= 90

Runoff Time of Concentration:

Use Assumed Travel Time? no (yes/no)

(Equations and TR-55 References)

Sheet Flow

Manning Roughness, n=	0.05		From Table 3-1
Sheet flow length, Lsf=	300	feet (300 ft max)	
Two year 24 hour rainfall, P 2yr=	1.51	inches	
Average land slope, Ssf=	0.03	ft/ft	
Travel time, Tsf=	**0.20**	**hours**	0.007 * (n*L)^0.8 / P2yr^0.5 * S^0.4

Shallow Concentrated Flow

Surface Description:	Unpaved	(paved/unpaved)	
Flow Length, Lsc=	180	feet	
Average Land Slope, Ssc=	0.03	ft/ft	
Average Velocity, Vsc=	2.8	ft/s	From Figure 3-1
Travel time, Tsc	**0.02**	**hours**	L / 3600V

Channel Flow

Use Assumed Velocity?	yes	(yes/no)	
Assumed Vc=	4	ft/s	

Disregard subsection:
Using assumed velocity

Average velocity, Vc=	4.00	ft/s	(1.49 * Rh^2/3 * Sc^1/2) / n
Flow Length, Lc=	0	feet	
Travel time, Tc=	**0.00**	**hours**	L / 3600V

Total Time of Conc.= 0.22 hours

Peak Discharge:

Drainage Area:	1.9	acres	
Da=	0.00297	sq mi	
Runoff curve number, CN=	90.0		
Time of Concentration, Tc=	0.22	hours	
Rainfall Distrubution Type:	II		From Figure B-2
Storm Frequency:	2	years	
24 hour duration Rainfall, P=	1.51	inches	From Figures B-3 to B-8
Initial Abstraction, Ia =	0.222		From Table 4-1
Ia / P =	0.15		
Direct Runoff, Q=	0.69		From Table 2-1
Unit peak discharge, Qu=	752	csm/in	From Exhibit 4-I , 4-IA, 4-II, 4-III
Peak Discharge, Qp=	***1.5***	***cfs***	Qu * sq miles * Q

Technical Release 55 Method of Analysis for Finding Peak Discharges:

Client/Subject: **LANL**
Description: **Worst-Case scenario grass**
Prepared by: **SW**
Date: **14 Apr 04**

Print Date: 14Apr04 2:52 p
W. O. #: **00000-000-000**

Math Check:	SW
Method Check:	RWM

Runoff Curve Number:

Soil Group	Cover Description	Area (acres)	CN	Product
C	Grass	1.9	85	161.5
				0.0
				0.0
				0.0
				0.0
		1.9		161.5

Composite CN= 85

Runoff Time of Concentration:

Use Assumed Travel Time? no (yes/no)

(Equations and TR-55 References)

Sheet Flow

Manning Roughness, n=	0.15		From Table 3-1
Sheet flow length, Lsf=	300	feet (300 ft max)	
Two year 24 hour rainfall, P 2yr=	1.51	inches	
Average land slope, Ssf=	0.03	ft/ft	
Travel time, Tsf=	**0.49**	**hours**	0.007 * (n*L)^0.8 / P2yr^0.5 * S^0.4

Shallow Concentrated Flow

Surface Description:	Unpaved	(paved/unpaved)	
Flow Length, Lsc=	180	feet	
Average Land Slope, Ssc=	0.03	ft/ft	
Average Velocity, Vsc=	2.8	ft/s	From Figure 3-1
Travel time, Tsc	**0.02**	**hours**	L / 3600V

Channel Flow

Use Assumed Velocity?	yes	(yes/no)	
Assumed Vc=	4	ft/s	

Disregard subsection:
Using assumed velocity

Average velocity, Vc=	4.00	ft/s	(1.49 * Rh^2/3 * Sc^1/2) / n
Flow Length, Lc=	0	feet	
Travel time, Tc=	**0.00**	**hours**	L / 3600V

Total Time of Conc.= 0.50 hours

Peak Discharge:

Drainage Area:	1.9	acres	
Da=	0.00297	sq mi	
Runoff curve number, CN=	85.0		
Time of Concentration, Tc=	0.50	hours	
Rainfall Distrubution Type:	II		From Figure B-2
Storm Frequency:	2	years	
24 hour duration Rainfall, P=	1.51	inches	From Figures B-3 to B-8
Initial Abstraction, Ia =	0.353		From Table 4-1
Ia / P =	0.23		
Direct Runoff, Q=	0.46		From Table 2-1
Unit peak discharge, Qu=	478	csm/in	From Exhibit 4-I , 4-IA, 4-II, 4-III

Peak Discharge, Qp= 0.6 cfs — Qu * sq miles * Q

File: Worst Case grass flow
Spreadsheet Template By Brian Miller

Bare Soil Sheet Flow
Worksheet for Rectangular Channel

Project Description	
Worksheet	Bare Soil
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.050	
Slope	0.030000	ft/ft
Bottom Width	300.00	ft
Discharge	1.50	cfs

Results		
Depth	0.02	ft
Flow Area	4.7	ft²
Wetted Perimeter	300.03	ft
Top Width	300.00	ft
Critical Depth	0.01	ft
Critical Slope	0.173913	ft/ft
Velocity	0.32	ft/s
Velocity Head	1.6e-3	ft
Specific Energy	0.02	ft
Froude Number	0.45	
Flow Type	Subcritical	

Grass Sheet Flow
Worksheet for Rectangular Channel

Project Description	
Worksheet	Grass
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.150	
Slope	0.030000	ft/ft
Bottom Width	300.00	ft
Discharge	0.60	cfs

Results		
Depth	0.02	ft
Flow Area	5.2	ft^2
Wetted Perimeter	300.03	ft
Top Width	300.00	ft
Critical Depth	4.99e-3	ft
Critical Slope	1.918617	ft/ft
Velocity	0.12	ft/s
Velocity Head	2.06e-4	ft
Specific Energy	0.02	ft
Froude Number	0.15	
Flow Type	Subcritical	

which are always more effective than control practices applied after erosion has occurred. The design approaches described in this module can be also used with different criteria, based on allowable erosion yield.

General Channel Stability Shear Stress Relationship

The following discussion on the general shear stress relationships and channel bed movement is summarized from COE (1994; *Engineering and Design: Channel Stability Assessment for Flood Control Projects*. EM 1110-2-1418). Although this reference is specifically for large channels, many of the basic concepts are similar to what occurs at construction site, and these are specifically addressed in the following. More extensive information on these topics is available in numerous textbooks and manuals on sediment transport and channel design.

Allowable Velocity and Shear Stress

The concepts of allowable velocity and allowable shear stress are closely linked. They have been used mainly to design channels free from boundary erosion. In channels transporting sediment, however, the design should ensure that sediment outflow equals sediment inflow. Modifications of allowable velocity or shear stress to allow for sediment transport have been proposed in a few references, but are of limited applicability (see the discussion on the "regime" theory in McCuen 1998, for example).

Allowable Velocity Data

The concept of allowable velocities for various soils and materials dates from the early days of hydraulics. An example of simple velocity criteria data is given by Table 5-1 (COE undated, EM 1110-2-1601). Table 5-2 is a similar table, from U.S. Bureau of Reclamation research (Fortier and Scobey 1926, reprinted by McCuen 1998), that also shows the corresponding allowable shear stresses and Manning's roughness values.

Table 5-1. Example of Simple Allowable Velocity Data (From COE undated, EM 1110-2-1601)

Channel Material	Mean Channel Velocity (ft/sec)
Fine Sand	2.0
Coarse Sand	4.0
Fine Gravel	6.0
Earth	
Sandy Silt	2.0
Silt clay	3.5
Clay	6.0
Grass-lined Earth (Slopes less than 5%)	
Bermuda Grass	
Sandy Silt	6.0
Silt Clay	8.0
Kentucky Blue Grass	
Sandy Silt	5.0
Silt Clay	7.0
Poor Rock (usually sedimentary)	10.0
Soft Sandstone	8.0
Soft Shale	3.5
Good Rock (usually igneous or hard metamorphic)	20.0

Table 5-2. Maximum Permissible Velocities and Corresponding Unit Tractive Force (Shear Stress) (U.S. Bureau of Reclamation research, Fortier and Scobey 1926)

		Clear Water (diversion structures)		Water Transporting Colloidal Silts (on site and down slope)	
Material	n	V	t_o	V	t_o

		(ft/sec)	(lb/ft^2)	(ft/sec)	(lb/ft^2)
Fine sand, colloidal	0.020	1.50	0.027	2.50	0.075
Sandy loam, noncolloidal	0.020	1.75	0.037	2.50	0.075
Silt loam, noncolloidal	0.020	2.00	0.048	3.00	0.11
Alluvial silts, noncolloidal	0.020	2.00	0.048	3.50	0.15
Ordinary firm loam	0.020	2.50	0.075	3.50	0.15
Volcanic ash	0.020	2.50	0.075	3.50	0.15
Stiff clay, very colloidal	0.025	3.75	0.26	5.00	0.46
Alluvial silts, colloidal	0.025	3.75	0.26	5.00	0.46
Shales and hardpans	0.025	6.00	0.67	6.00	0.67
Fine gravel	0.020	2.50	0.075	5.00	0.32
Graded loam to cobbles when noncolloidal	0.030	3.75	0.38	5.00	0.66
Graded silts to cobbles when noncolloidal	0.030	4.00	0.43	5.50	0.80
Coarse gravel, noncolloidal	0.025	4.00	0.30	6.00	0.67
Cobbles and shingles	0.035	5.00	0.91	5.50	1.10

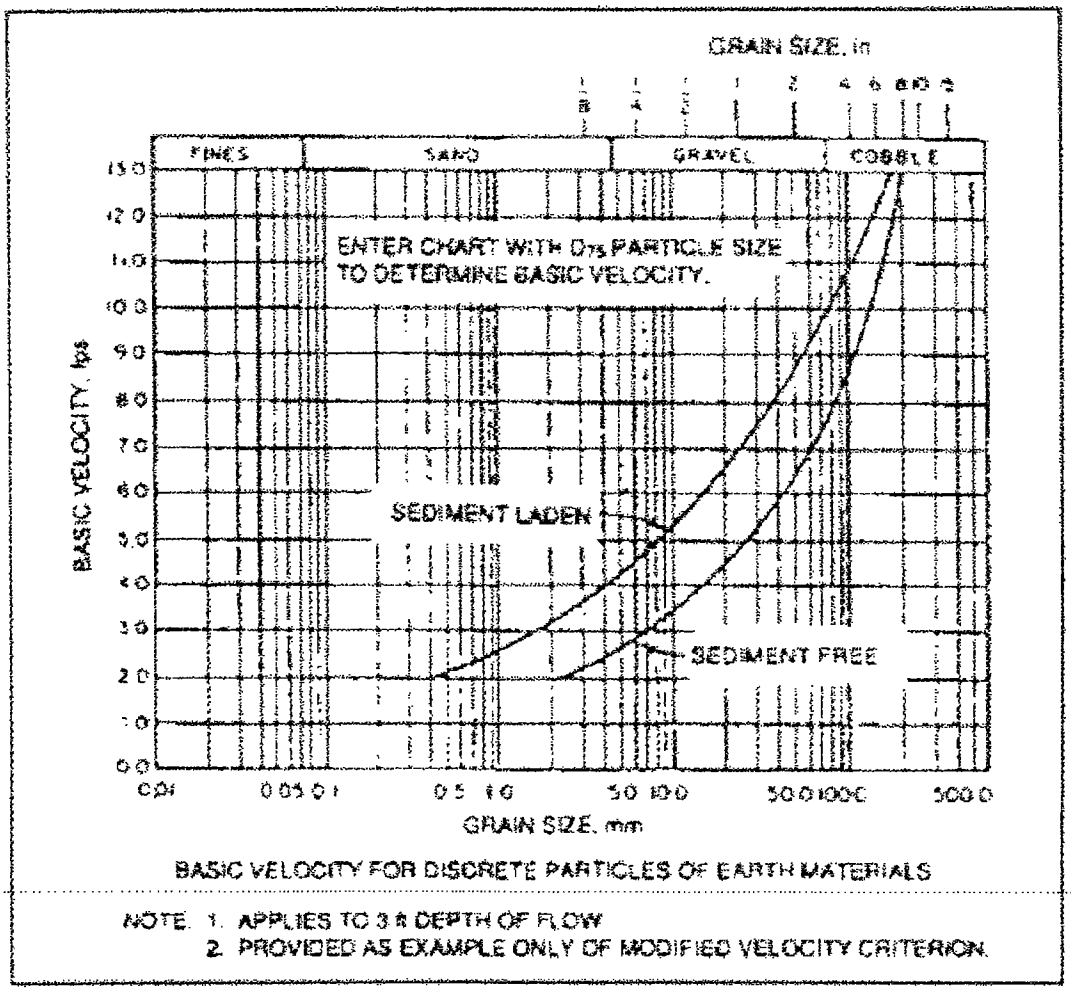
Note:

- an increase in velocity of 0.5 ft/sec can be added to these values when the depth of water is greater than 3 ft.

- a decrease in velocity of 0.5 ft/sec should subtracted then the water contains very coarse suspended sediments.

- for high and infrequent discharges of short duration, up to 30% increase in velocity can be added

Another example is Figure 5-1, which shows data provided by the Soil Conservation Service (U.S. Department of Agriculture (USDA 1977). This figure discriminates between "sediment-free" and "sediment-laden" flow. Adjustment factors are suggested by the USDA for depth of flow, channel curvature, and bank slope.



SETTLEMENT EVALUATIONS

CLIENT/SUBJECT TA-73 LOS ALAMOS AIRPORT LANDFILL CLOSURE W.O. NO 13104.002.001

TASK DESCRIPTION Differential Settlement Evaluation TASK NO. 1140

PREPARED BY A. Harpur DEPT 1495 DATE 3/09/04

MATH CHECK BY W.L. Deutsch DEPT 1495 DATE 3/10/04

METHOD REV. BY W.L. Deutsch DEPT 1495 DATE 3/10/04

BACKGROUND

As part of the closure of the Los Alamos Airport Landfill, approximately 65,000 cubic yards of existing waste will be relocated on-site and soils will be imported to the site to construct a final cap over the waste materials. With the relocation of waste and the construction of an earthen cap, there exists a potential for settlement to occur, caused by the application of a surcharge load over potentially compressible materials. Based on the final grading plan, it has been determined that relocated waste is to be placed in thicknesses up to about 10 feet. The proposed earthen cap will consist of a minimum 6 inches of existing or relocated interim cover material, an 18-inch thick infiltration layer and a 6-inch thick vegetative or erosion protection layer.

Waste will be primarily excavated from the east slope of the landfill in order to achieve the desired effective slope inclination of 3H:1V, and will be relocated onto the existing flat area of the landfill. The maximum thickness of waste excavation is estimated to be about 35 feet.

The design slope inclination for the flat portion of the landfill cap is 3%. The final slope inclination of the flat portion of the landfill, per NMAC regulations must be between 2 and 5%. In order to demonstrate that the minimum final slope will be maintained it is necessary to complete a settlement analysis.

Settlement can be induced by several processes including the following:

1. An increase in the load imposed on potentially compressible materials.
2. Self-weight consolidation, i.e., the material itself densifies and consolidates under its own weight.
3. Degradation/decomposition of existing subsurface materials.
4. Dewatering of the subsurface.

For the purposes of this analysis, settlement will be calculated based on two factors:

a. Increased load (stress) imposed on undisturbed waste as a result of placing relocated waste and capping materials in areas of the landfill.
b. Self-weight consolidation of the relocated waste, including the stress imposed by the weight of the capping materials.

CLIENT/SUBJECT TA-73 LOS ALAMOS AIRPORT LANDFILL CLOSURE W.O. NO 13104.002.001

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MATH CHECK BY W.L. Deutsch DEPT 1495 DATE 3/10/04

METHOD REV. BY W.L. Deutsch DEPT 1495 DATE 3/10/04

Settlement due to degradation of the waste material will be neglected. The justification for neglecting potential settlement due to this process is the age of the waste, which has been in place for 30 to 60 years (placed 1943 to 1973), the climatic conditions (18 inches of precipitation per year), and the fact that a cap (that will limit infiltration) will be constructed to further retard the degradation process, if it is indeed still active. Settlement due to dewatering will also be neglected as no dewatering of the waste mass has been proposed. Furthermore, there is no evidence of a perched water table or leachate mound within the landfill.

In some areas of the site it is anticipated that there will be a net decrease in load due to waste relocation, or in very limited areas, potentially no increase in load. In these areas, it is reasonable to assume that settlement will not occur or will be negligible.

Finally, it is assumed that imported materials used to construct the cap, which will be placed in a controlled manner and compacted, will be essentially incompressible and therefore will not contribute to the overall settlement of the landfill. The underlying native soils are also assumed to be incompressible.

Settlement of soils may occur almost immediately (elastic settlement) or can occur over an extended period of time (primary consolidation and secondary compression). Generally speaking, granular soils (sand and gravel) experience immediate settlement, while fine-grained soils (silt and clay) experience time-dependant settlement. The three stages or phases of settlement are primary consolidation, secondary compression (creep) settlement. Waste settlement behavior is similar to soils. For purposes of this analysis, the equation used to calculate the waste settlement implicitly assumes that 100% primary consolidation of the compressible material has occurred. It therefore includes the elastic and primary consolidation components of settlement, but does not encompass time dependant secondary compression which occurs after primary consolidation is complete and is analogous to biodegradation settlement for waste material containing organic constituents.

The existing grade, the estimated thickness of waste, and the proposed (final) grade are shown on Figures 1, 2, and 3.

ANALYSIS

In order to complete this settlement analysis, a 100 by 100 foot grid was placed over the landfill footprint. The total settlement at each nodal point was then calculated. The differential settlement between nodal points was subsequently determined and the slope of the landfill surface between nodal

CLIENT/SUBJECT TA-73 LOS ALAMOS AIRPORT LANDFILL CLOSURE W.O. NO 13104.002.001

TASK DESCRIPTION Differential Settlement Evaluation TASK NO. 1140

PREPARED BY A. Harpur DEPT 1495 DATE 3/09/04

MATH CHECK BY W.L. Deutsch DEPT 1495 DATE 3/10/04

METHOD REV. BY W.L. Deutsch DEPT 1495 DATE 3/10/04

points was estimated and compared with the regulatory values listed above.

The following equation was used to calculate settlement based on one-dimensional primary consolidation theory. The following is a fundamental equation in basic soil mechanics and is referenced in many soil mechanics text books.

$$\Delta H = C'_c H \log\left(\frac{p_{o(i)} + \Delta p}{p_{o(i)}}\right) \qquad \text{Equation 1}$$

$$\Delta H = \frac{C_c H}{1 + e_o} \log\left(\frac{p_{o(i)} + \Delta p}{p_{o(i)}}\right) \qquad \text{Equation 1A}$$

Where:
ΔH = calculated settlement of compressible layer
C_c = compression index of compressible material [*note*: $C'_c = C_c/(1+e_o)$]
H = thickness of compressible layer
e_o = initial void ratio of compressible material before load application
$p_{o(i)}$ = initial average effective overburden stress at mid-height of compressible layer
$\Delta p_{(i)}$ = attenuated increase in vertical load at mid-height of compressible layer

The input parameters listed above were determined as follows:

- C'_c, for waste was obtained from work performed by WESTON at a municipal solid waste landfill in eastern Pennsylvania[1]. From this study, the average value of C_c' based on a 56-point data base was determined to be 0.22. A value of 0.3 was calculated based on the mean value plus two standard deviations of the data base. There is therefore a 95.4% confidence level that the actual value of C_c'

[1] Deutsch, W.L., O. Esterly, and J. Vitale. 1994 "Modeling Settlements of an Existing Municipal Solid Waste (MSW) Landfill Sideslope Using an Earthen Surcharge Pile." Proceedings of "Settlement 94" Conference, Texas A&M University, College Station, Texas.

CLIENT/SUBJECT TA-73 LOS ALAMOS AIRPORT LANDFILL CLOSURE W.O. NO 13104.002.001

TASK DESCRIPTION Differential Settlement Evaluation TASK NO. 1140

PREPARED BY A. Harpur DEPT 1495 DATE 3/09/04

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METHOD REV. BY W.L. Deutsch DEPT 1495 DATE 3/10/04

will be less than 0.3, or, stated differently, 95.4% of the time, a measured value of C_c' for MSW will be less than 0.3.

- H, thickness of the compressible layer, i.e., waste, was based on the results of the CPT work and subsurface data provided in the VCM Plan indicating the thickness of waste.
- e_o, initial void ratio of the waste – not required when using C_c'
- $p_{o(i)}$, the initial overburden stress at the mid-height of the waste, was based on the estimated unit weight of the waste and the thickness of the waste. The unit weight of the waste was based on the results of CPT work and literature values.
- $\Delta p_{(i)}$, the attenuated increase in vertical load at the mid-height of the waste, was based on the regraded geometry of the landfill and included the thickness of relocated waste and imported soil materials. At some locations there was a reduction in load due to the excavation and relocation of waste.

The analysis was separated into two parts: 1) settlement of the undisturbed waste due to the load generated by the placement of relocated waste and capping materials and 2) settlement of relocated waste due to self-weight consolidation.

Since the analysis was repeated at variation locations within the landfill footprint, a spreadsheet was developed for efficiency. An example/verification calculation is presented below to demonstrate that the spreadsheet functions correctly.

An example calculation has been completed for point B5. At this location, the thickness of in-place waste is approximately 24 feet with a thickness of relocated waste of approximately 7.0 feet. The analysis will be completed in two parts as discussed below.

Table 1 lists the parameters used in the analysis.

Table 1 – Material Properties

Material	Total Unit Weight (pcf)	Thickness (ft)
Undisturbed Waste	85	varies
Relocated Waste	90	varies
Interim Cover Soil	110	1
Final Cover Soil	115	2

CLIENT/SUBJECT TA-73 LOS ALAMOS AIRPORT LANDFILL CLOSURE W.O. NO 13104.002.001

TASK DESCRIPTION Differential Settlement Evaluation TASK NO. 1140

PREPARED BY A. Harpur DEPT 1495 DATE 3/09/04

MATH CHECK BY W.L. Deutsch DEPT 1495 DATE 3/10/04

METHOD REV. BY W.L. Deutsch DEPT 1495 DATE 3/10/04

Settlement due to consolidation of undisturbed waste

With respect to point B5:

The existing ground surface elevation is 7132. *This is the top of the existing interim cover obtained from plan view – Figure 1.*
Subtract 1-foot of interim cover soil (assumed thickness) to determine the top of waste elevation.
Top of existing waste elevation is 7132 – 1 = 7131 feet.
The thickness of waste is 24 feet. *Refer to Figure 2.*
The bottom of waste elevation is 7131 – 24 = 7107.
Final grade (top of cap) elevation is 7141.1. *Refer to Figure 3.*
Prep grade (top of relocated interim cover) elevation is 7141.1 – 2 = 7139.1.
Therefore, the top of relocated waste elevation is 7139.1 – 1 = 7138.1. *It is assumed that 1-foot of relocated interim cover soil will be placed above the relocated waste.*
Top of existing waste elevation is 7132 – 1 = 7131 feet, see above.
Therefore the thickness of relocated waste is 7138.1 – 7131 = 7.1 feet. Round to nearest ½-foot increment.
Load due to relocated waste is 7.0 ft x 90 pcf = 630 psf.
Thickness of proposed cover soil is 2 feet.
Load due to new cover system = 2 ft x 115 pcf = 230 psf.

Change in load = 630 psf + 230 psf = 860 psf.
This is the net increase in load that will cause settlement.

The thickness of in-place waste is 24 feet. *Refer to Figure 2.*
Therefore the mid-height of the layer is 24/2 = 12 feet.
The existing interim cover is assumed to be 1-foot thick.
The effective stress at the mid-height of the waste layer is
(12 feet x 85 pcf) + (1-foot x 110 pcf) = 1130 psf.

Now, use Equation 1 above to determine the change in thickness of the in-place waste.

CLIENT/SUBJECT TA-73 LOS ALAMOS AIRPORT LANDFILL CLOSURE W.O. NO 13104.002.001

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$$\Delta H = C_c' H \log\left(\frac{p_{o(i)} + \Delta p}{p_{o(i)}}\right) \qquad \text{Equation 1}$$

$$\Delta H = 0.3 \times 24\, ft \ \log\left(\frac{1130\, psf + 860\, psf}{1130\, psf}\right) = 1.77\ feet$$

The calculated settlement at each nodal point is presented in Attachment 1.

Settlement due to self-weight consolidation of relocated waste

In order to complete this analysis, the relocated waste thickness must be subdivided into a number of sublayers of equal thicknesses. For this analysis, the waste thickness was subdivided into 6-inch thick sublayers. Therefore, there will be a total of 14 sublayers to be analyzed for nodal point B5. The consolidation of each sublayer will be estimated considering the load imposed on it by the overlying waste layers and the cover system soils. For purposes of this analysis, the cover system soils will consist of 1-foot of interim cover and 2 feet of final cover soil.

Thickness of each sublayer is 0.5 feet.
Effective stress at mid-height of each sublayer is 0.25 ft x 90 pcf = 22.5 psf.
Thickness of relocated waste is 7.0 feet.
Therefore the top of the lowest sublayer is 7 feet below the top of waste.
The stress generated by the relocated waste on the top of the lowest sublayer is
6.5 ft x 90 pcf = 585 psf.
The stress generated by 1-foot of interim cover is 1 ft x 110 pcf = 110 psf.
The stress generated by 2 feet of cover soil is 2 ft x 115 pcf = 230 psf.
Therefore, the total stress generated by the overlying mass is 585 + 110 + 230 = 925 psf.

Now, use Equation 1 above to determine the change in thickness of the in-place waste.

$$\Delta H = C_c' H \log\left(\frac{p_{o(i)} + \Delta p}{p_{o(i)}}\right)$$

CLIENT/SUBJECT TA-73 LOS ALAMOS AIRPORT LANDFILL CLOSURE W.O. NO 13104.002.001

TASK DESCRIPTION Differential Settlement Evaluation TASK NO. 1140

PREPARED BY A. Harpur DEPT 1495 DATE 3/09/04

MATH CHECK BY W.L. Deutsch DEPT 1495 DATE 3/10/04

METHOD REV. BY W.L. Deutsch DEPT 1495 DATE 3/10/04

$$\Delta H = 0.3 \times 0.5\,ft\ \log\left(\frac{22.5\,psf + 925\,psf}{22.5\,psf}\right) = 0.244\ feet\ for\ 14th\ sublayer$$

This is only the anticipated settlement of the 15th sublayer due to the stress imposed by 7 feet of relocated waste and 3 feet of soil. It is necessary to estimate the settlement that will be caused in the overlying 14 sublayers due to the stress imposed by the respective overlying materials and add the settlement of each sublayer in order to determine the total settlement for the 7.0 feet thick relocated waste layer. This is done following the same procedure presented above. The calculated settlement of each sublayer is presented in Attachment 2. As can be seen in this spreadsheet, the consolidation of each ½-foot thick sublayer increases with increasing thickness of overlying waste, i.e., increasing overburden pressure

Attachment 2 presents a summary table which documents these self-weight consolidation results for relocated waste thicknesses ranging from 0.5 feet to 10 feet in ½-foot increments.

Combined Settlement

With the settlement of the undisturbed waste due to the imposition of additional load in the form of relocated waste and final cover soil at each nodal point and the settlement of the relocated waste due to self-weight consolidation plus interim cover and final cover soil weight calculated for various ½-foot increments of relocated waste thickness, the total anticipated settlement at each nodal point can be determined. The combined settlement requires the addition of the settlement estimated at each nodal point with the settlement estimated for the corresponding relocated waste thickness at the same point. For nodal point B5, the settlement of the undisturbed waste was estimated to be 1.77 feet. The settlement of the relocated waste (7.0 feet) was estimated to be 3.04 feet resulting in a combined total settlement of 4.81 feet. The combined settlement is shown in Attachment 3.

Evaluation of post-settlement cover system inclination

With the settlement determined at each nodal point, the slope of the post-settlement landfill cap can be estimated. While the differential settlement between each point can be mathematically determined, it may not be meaningful in regards to the slope, and ultimately the drainage pattern of the final cover system. Therefore, differential settlement and slope will only be determined between those nodal points which relate to drainage.

CLIENT/SUBJECT TA-73 LOS ALAMOS AIRPORT LANDFILL CLOSURE W.O. NO 13104.002.001

TASK DESCRIPTION Differential Settlement Evaluation TASK NO. 1140

PREPARED BY A. Harpur DEPT 1495 DATE 3/09/04

MATH CHECK BY W.L. Deutsch DEPT 1495 DATE 3/10/04

METHOD REV. BY W.L. Deutsch DEPT 1495 DATE 3/10/04

RESULTS

The results of the settlement analysis are presented in Attachments 1, 2 and 3. The initial (design) slope between various nodal points and the post-settlement slopes between the same nodal points are shown on Attachment 4. As can be seen, based on these analyses, the slope between each nodal point remains greater than 2% but less than 5% as required by the regulations, except on the sideslopes of the landfill. It is also noted that between nodal points C4 and D5 the post-settlement slope (i.e., 1.8%) is shown to be less than 2%. This slope is not measured perpendicular to the flow or fall line but is rather measured across the slope and is therefore not a true representation of the slope inclination.

CONCLUSIONS

Based on the analysis, it can be concluded that post-settlement positive drainage will be maintained within the regraded landfill flattop. It is acknowledged that the value of C_c' utilized in the calculations is likely to be conservative as compared to the actual C_c' value of the in-place waste. The presence of non-MSW debris such as concrete, asphalt and brick in the waste mass will tend to decrease the value of C_c' and therefore decrease the magnitude of settlement that will occur. Regardless of the value of C_c', the calculations show the relative settlement between the various points. A reduction in the value of C_c' will reduce the magnitude of settlement that occurs at any single location, but the relative change in elevation between adjacent points will remain the same. There is a one-to-one correlation between the magnitude of settlement and the value of C_c'; that is, if C_c' is reduced by 50%, the magnitude of settlement will also be reduced by 50%.

In addition, due to the anticipated rate of settlement of the landfill and consolidation of the relocated waste due to compaction by construction equipment, it is likely that the final grades shown on the project drawings will not be achieved. A significant portion of the settlement will likely occur during construction assuming granular soil-like waste behavior occurs. The rate of consolidation will be significantly slower if fine-grained or sludge-like materials are encountered or if these types of materials are present within the undisturbed waste mass. It will be necessary to sequence the excavation and placement of waste such that the intent of the final grading plan can be achieved even if the actual elevations cannot be achieved. It is particularly important to maintain positive drainage and a design slope of approximately 3% on the top area of the landfill. Likewise it is necessary to achieve positive slope and drainage in perimeter channels and culverts. The design may have to be modified as construction progress and changes to the sequence of construction may be required in order to achieve the design intent.

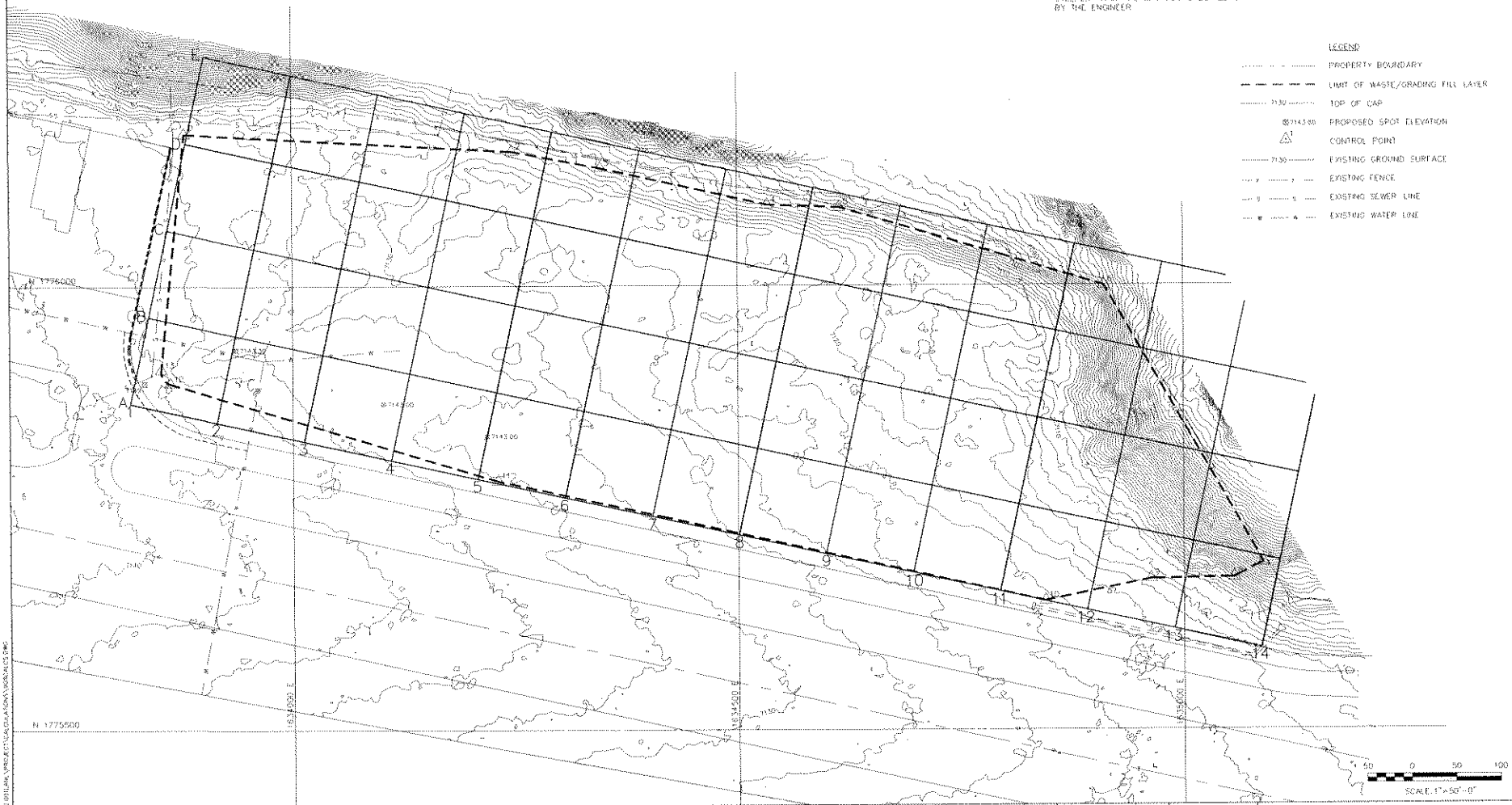
NOTE:

1. CONTRACTOR ACCESS TO THE PROJECT SITE IS THROUGH THE GATE NORTH OF THE TERMINAL BUILDING THEN DIRECTLY NORTH OF THE AIRPLANE HANGERS TO THE LANDFILL. THE CONTRACTOR IS RESPONSIBLE TO IMPROVE AND MAINTAIN THIS ACCESS WAY FOR THE PROPOSED OPERATIONS AT THE COMPLETION OF CONSTRUCTION THE CONTRACTOR WILL RETURN THE AREA TO ITS' ORIGINAL CONDITION.

2. THE GRADES PRIOR TO WASTE PLACEMENT ARE NOT REFLECTED ON THIS PLAN. IT IS THE DESIGN INTENT TO EXCAVATE AND REMOVE THE WASTE TO THOSE PRE-EXISTING CONDITIONS. THE GRADING PLAN WILL BE REVISED IN THE FIELD TO ACCOMMODATE THE CONDITIONS ENCOUNTERED AT THAT TIME. SLOPES OVER WASTE WILL ADHERE TO THE MINIMUM AND MAXIMUM VALUES SPECIFIED ON THIS DRAWING. SLOPES IN NATIVE SOIL WILL BE ASSESSED BY THE ENGINEER AND MAY BE STEEPER THAN THE MAXIMUM SPECIFIED SLOPE OF 3H:1V. ALL REVISED GRADES WILL BE REVIEWED BY THE ENGINEER.

LEGEND

- PROPERTY BOUNDARY
- LIMIT OF WASTE/GRADING FILL LAYER
- 7130 TOP OF CAP
- 7143.00 PROPOSED SPOT ELEVATION
- CONTROL POINT
- 7130 EXISTING GROUND SURFACE
- EXISTING FENCE
- EXISTING SEWER LINE
- EXISTING WATER LINE



D	1/19/04	90% DESIGN SUBMITTAL			
A	2/18/04	60% DESIGN SUBMITTAL			
NO	DATE	APPR	REVISION	NO	DATE	APPR	REVISION

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON SOLUTIONS TEAM

		DATE	DESIGN APPROVALS	DATE
DRAWN	PWH	02/23/04		
DES ENG	SW	02/23/04		
PROJ ENG	JAH	02/23/04		
PROJ MGR	BV	02/23/04		
APPROVED	BW	02/23/04		
APPROVED				

LANDFILL
EXISTING GRADE

DRAWN CDM	DATE 02/06/04	DWG NO FIG. 1	REV NO A
SCALE AS SHOWN	W.O. NO 13104 002 001	SHT	OF

D:\ACAD\PROJ\13104 002 001\AIR\PROJECT\GRADING\GRADING\FIG1.DWG

DEPTH OF WASTE BASED ON FIGURE 2.3.4.2-1 ISOPACHMAP OF LANDFILL THICKNESS AND LOCATIONS OF CROSS-SECTIONS A-A', B-B', C-C' D-D', RFI REPORT FOR AIRPORT LANDFILL, NOVEMBER 20, 1998

NOTE:

1. CONTRACTOR ACCESS TO THE PROJECT SITE IS THROUGH THE GATE NORTH OF THE TERMINAL BUILDING THEN DIRECTLY NORTH OF THE AIRPLANE HANGERS TO THE LANDFILL. THE CONTRACTOR IS RESPONSIBLE TO IMPROVE AND MAINTAIN THIS ACCESS WAY FOR THE PROPOSED OPERATIONS. AT THE COMPLETION OF CONSTRUCTION THE CONTRACTOR WILL RETURN THE AREA TO ITS' ORIGINAL CONDITION.
2. THE GRADES PRIOR TO WASTE PLACEMENT ARE NOT REFLECTED ON THIS PLAN. IT IS THE DESIGN INTENT TO EXCAVATE AND REMOVE THE WASTE TO THOSE PRE-EXISTING CONDITIONS. THE GRADING PLAN WILL BE REVISED IN THE FIELD TO ACCOMMODATE THE CONDITIONS ENCOUNTERED AT THAT TIME. SLOPES OVER WASTE WILL ADHERE TO THE MINIMUM AND MAXIMUM VALUES SPECIFIED ON THIS DRAWING. SLOPES IN NATIVE SOIL WILL BE ASSESSED BY THE ENGINEER AND MAY BE STEEPER THAN THE MAXIMUM SPECIFIED SLOPE OF 3H:1V. ALL REVISED GRADES WILL BE REVIEWED BY THE ENGINEER.

REV.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
B	3/23/04		90% DESIGN SUBMITTAL				
A	3/9/04		60% DESIGN SUBMITTAL				

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON TEAM

		DATE
CHECKED	RMM	03/23/04
REV. ENG.	SW	03/23/04
PROJ. ENG.	AH	03/23/04
PROJ. MGR.	BK	03/23/04
APPROVED	BA	03/23/04
APPROVED		

CLIENT APPROVALS DATE

LANDFILL
WASTE THICKNESS
ISOPACH MAP

DRAWN	DATE	DWG. NO.	REV. NO.
GOM	02/06/04	FIG. 2	A
SCALE	W.O. NO.		
AS SHOWN	13104.002.001	SHT. OF	

G:\ACADPROJ\13104.002\PLANE\PROJECT\CALCULATIONS\SITE CALCS.DWG

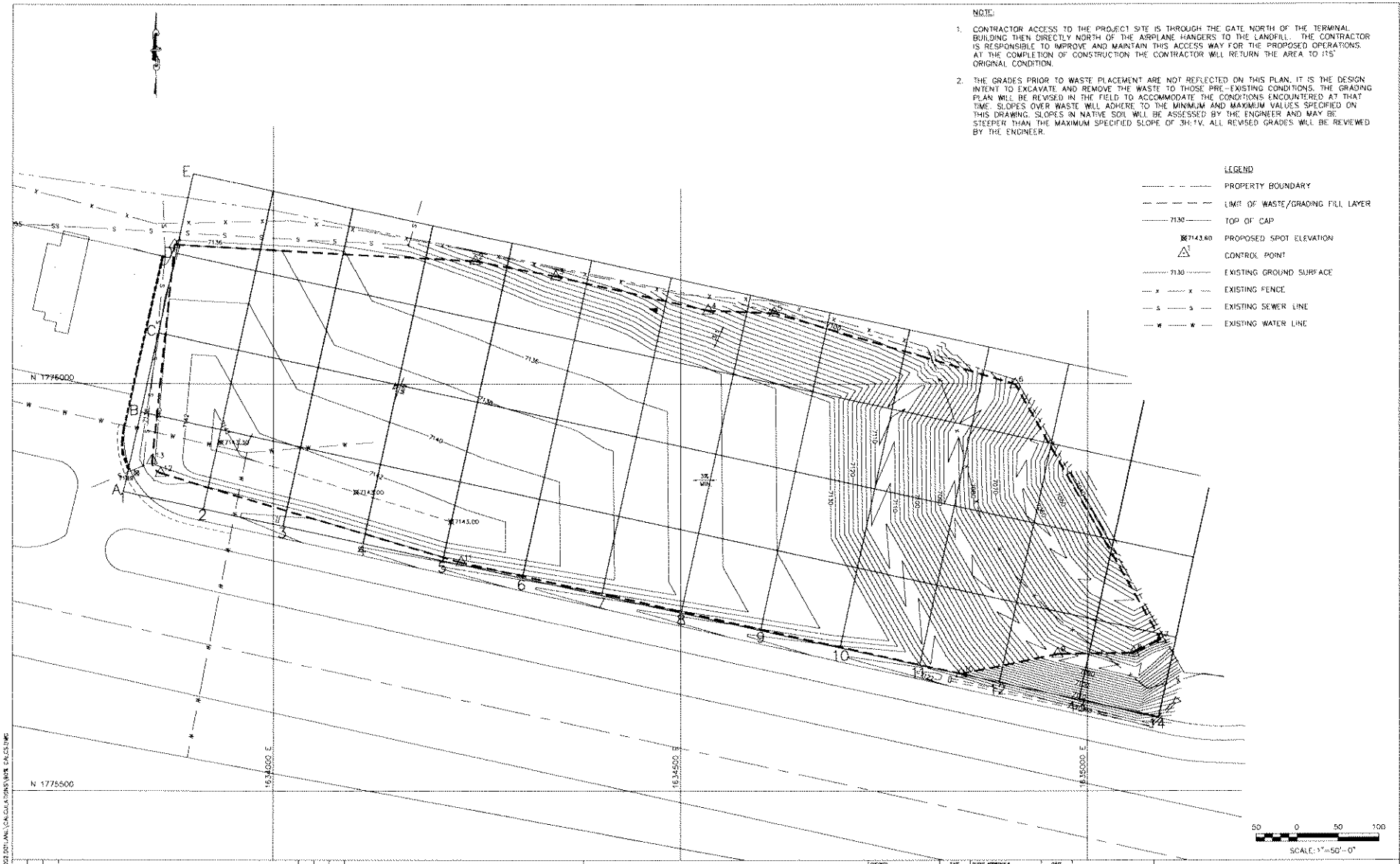
NOTE:

1. CONTRACTOR ACCESS TO THE PROJECT SITE IS THROUGH THE GATE NORTH OF THE TERMINAL BUILDING THEN DIRECTLY NORTH OF THE AIRPLANE HANGERS TO THE LANDFILL. THE CONTRACTOR IS RESPONSIBLE TO IMPROVE AND MAINTAIN THIS ACCESS WAY FOR THE PROPOSED OPERATIONS. AT THE COMPLETION OF CONSTRUCTION THE CONTRACTOR WILL RETURN THE AREA TO ITS' ORIGINAL CONDITION.

2. THE GRADES PRIOR TO WASTE PLACEMENT ARE NOT REFLECTED ON THIS PLAN. IT IS THE DESIGN INTENT TO EXCAVATE AND REMOVE THE WASTE TO THOSE PRE-EXISTING CONDITIONS. THE GRADING PLAN WILL BE REVISED IN THE FIELD TO ACCOMMODATE THE CONDITIONS ENCOUNTERED AT THAT TIME. SLOPES OVER WASTE WILL ADHERE TO THE MINIMUM AND MAXIMUM VALUES SPECIFIED ON THIS DRAWING. SLOPES IN NATIVE SOIL WILL BE ASSESSED BY THE ENGINEER AND MAY BE STEEPER THAN THE MAXIMUM SPECIFIED SLOPE OF 3H:1V. ALL REVISED GRADES WILL BE REVIEWED BY THE ENGINEER.

LEGEND

- PROPERTY BOUNDARY
- LIMIT OF WASTE/GRADING FILL LAYER
- 7130 TOP OF CAP
- 7143.60 PROPOSED SPOT ELEVATION
- CONTROL POINT
- 7130 EXISTING GROUND SURFACE
- EXISTING FENCE
- EXISTING SEWER LINE
- EXISTING WATER LINE



NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON SOLUTIONS TEAM

		DATE		DATE
CHECKED			CLIENT APPROVAL	
DES. ENG.				
PROJ. ENG.	A.H.	3/9/04		
PROJ. MGR.				
APPROVED				
APPROVED				

LANDFILL
TOP OF CAP GRADING PLAN

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	3/9/04	FIG. 3	A
SCALE	W.O. NO.	SHT. ___ OF ___	
AS SHOWN	13104.002.001		

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Grid Point	Bottom of Waste (Elevation)	Thickness of Waste (feet)	Top of Waste (Elevation)	Thickness of Existing Cover Soil (feet)	Existing Grade (Elevation)	Prep Grade (Elevation)	Thickness of Relocated Waste (feet)	Thickness of Cover Soil (feet)	Top of Cover (Elevation)	Total Unit Weight of Existing Waste (pcf)	Total Unit Weight of Existing Cover Soil (pcf)	Total Unit Weight of Relocated Waste (pcf)	Total Unit Weight of Proposed Cover Soil (pcf)	Change in Load (psf)	Effective Stress at Midheight of Waste (psf)	C_c'	δ_{ult} undisturbed waste (feet)
B2	7128	5	7133	1	7134	7141.1	7.0	2	7143.1	85	110	90	115	860	322.5	0.3	0.85
B3	7127	5	7132	1	7133	7140	7.0	2	7142	85	110	90	115	860	322.5	0.3	0.85
B4	7114	18	7132	1	7133	7139.8	7.0	2	7141.8	85	110	90	115	860	875	0.3	1.61
B5	7107	24	7131	1	7132	7139.1	7.0	2	7141.1	85	110	90	115	860	1130	0.3	1.77
B6	7101	28	7129	1	7130	7138.1	8.0	2	7140.1	85	110	90	115	950	1300	0.3	2.00
B7	7092.5	34	7126.5	1	7127.5	7135.8	8.5	2	7137.8	85	110	90	115	995	1555	0.3	2.19
B8	7085	39	7124	1	7125	7133	8.0	2	7135	85	110	90	115	950	1767.5	0.3	2.19
B9	7076.5	45	7121.5	1	7122.5	7130	7.5	2	7132	85	110	90	115	905	2022.5	0.3	2.17
B10	7069.5	50	7119.5	1	7120.5	7128	4.5	2	7127	85	110	90	115	435	2235	0.3	1.43
B11	7065	52	7117	1	7118	7106	-12.0	2	7108	85	110	90	115	900	2320	0.3	0.00
B12	7068.5	45	7113.5	1	7114.5	7084	-30.5	2	7086	85	110	90	115	2472.5	2022.5	0.3	0.00
B13[1]	7039	54	7093	1	7094	7065.5	-28.5	2	7067.5	85	110	90	115	2302.5	2405	0.3	0.00
C2	7123	12	7135	1	7136	7139.5	3.5	2	7141.5	85	110	90	115	545	620	0.3	0.99
C3	7116	15	7131	1	7132	7137.1	5.0	2	7139.1	85	110	90	115	680	747.5	0.3	1.26
C4	7108.5	21	7129.5	1	7130.5	7136.58	6.0	2	7138.6	85	110	90	115	770	1002.5	0.3	1.56
C5	7105.5	24	7129.5	1	7130.5	7136.1	5.5	2	7138.1	85	110	90	115	725	1130	0.3	1.55
C6	7100	27	7127	1	7128	7135.9	8.0	2	7137.9	85	110	90	115	950	1257.5	0.3	1.98
C7	7091	33	7124	1	7125	7135	10.0	2	7137	85	110	90	115	1130	1512.5	0.3	2.40
C8	7078.5	43	7121.5	1	7122.5	7132.2	9.5	2	7134.2	85	110	90	115	1085	1937.5	0.3	2.49
C9	7069	50	7119	1	7120	7129.5	9.5	2	7131.5	85	110	90	115	1085	2235	0.3	2.58
C10	7051	45	7116	1	7117	7112	-5.0	2	7114	85	110	90	115	305	2872.5	0.3	0.00
C11	7042	70	7112	1	7113	7087	-26.0	2	7089	85	110	90	115	2990	3085	0.3	0.00
C12[1]	7039	40	7079	1	7080	7060	-20.0	2	7062	85	110	90	115	1580	1810	0.3	0.00
D2	7124	11	7135	1	7136	7136.4	0.5	2	7138.4	85	110	90	115	275	577.5	0.3	0.56
D3	7115.5	15	7130.5	1	7131.5	7134.8	3.5	2	7136.8	85	110	90	115	545	747.5	0.3	1.07
D4	7109	18	7127	1	7128	7133.6	6.0	2	7135.6	85	110	90	115	770	875	0.3	1.48
D5	7105.5	22	7127.5	1	7128.5	7133.16	4.5	2	7135.2	85	110	90	115	635	1045	0.3	1.36
D6	7102.5	23	7125.5	1	7126.5	7132.8	6.5	2	7134.8	85	110	90	115	815	1087.5	0.3	1.68
D7	7099	25	7124	1	7125	7132.2	7.0	2	7134.2	85	110	90	115	860	1172.5	0.3	1.79
D8	7089.5	33	7122.5	1	7123.5	7130	6.5	2	7132	85	110	90	115	815	1512.5	0.3	1.85
D9	7077	40	7117	1	7118	7126	8.0	2	7128	85	110	90	115	950	1810	0.3	2.20
D10	7071	45	7116	1	7117	7106	-11.0	2	7108	85	110	90	115	815	2022.5	0.3	0.00
D11[1]	7039	72	7111	1	7112	7082	-30.0	2	7084	85	110	90	115	2430	3170	0.3	0.00
D12[1]	7039	13	7052	1	7053	7051	-2.0	2	7053	85	110	90	115	50	662.5	0.3	0.00

[1] The thicknesses of waste for these grid points were estimated by subtracting the elevation of the toe of slope from the existing grade elevations.

7134 indicates a change in elevation of the final cover system from the 60% design

7134 indicates the point was eliminated from consideration in the 90% design as a result of regrading of the east slope. Points are located on the north or east slopes.

SELF-WEIGHT CONSOLIDATION

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Relocated Waste			Stress at mid-height of 0.5-ft thick layer	Interim Cover			Cover Soil			Total Combined Load	C'c	ΔH for .5-ft sublayer	ΔH
2	Thickness	Unit Weight	Load		Thickness	Unit Weight	Load	Thickness	Unit Weight	Load				
3	(ft)	(pcf)	(psf)	(psf)	(ft)	(pcf)	(psf)	(ft)	(pcf)	(psf)	(psf)		(ft)	(ft)
4														
5	0.5	90	0	22.5	1	110	110	2	115	230	340	0.3	0.181	0.181
6	1.0	90	45	22.5	1	110	110	2	115	230	385	0.3	0.189	0.370
7	1.5	90	90	22.5	1	110	110	2	115	230	430	0.3	0.196	0.565
8	2.0	90	135	22.5	1	110	110	2	115	230	475	0.3	0.202	0.767
9	2.5	90	180	22.5	1	110	110	2	115	230	520	0.3	0.207	0.974
10	3.0	90	225	22.5	1	110	110	2	115	230	565	0.3	0.213	1.187
11	3.5	90	270	22.5	1	110	110	2	115	230	610	0.3	0.217	1.404
12	4.0	90	315	22.5	1	110	110	2	115	230	655	0.3	0.222	1.626
13	4.5	90	360	22.5	1	110	110	2	115	230	700	0.3	0.226	1.852
14	5.0	90	405	22.5	1	110	110	2	115	230	745	0.3	0.230	2.082
15	5.5	90	450	22.5	1	110	110	2	115	230	790	0.3	0.234	2.316
16	6.0	90	495	22.5	1	110	110	2	115	230	835	0.3	0.237	2.553
17	6.5	90	540	22.5	1	110	110	2	115	230	880	0.3	0.240	2.793
18	7.0	90	585	22.5	1	110	110	2	115	230	925	0.3	0.244	3.037
19	7.5	90	630	22.5	1	110	110	2	115	230	970	0.3	0.247	3.284
20	8.0	90	675	22.5	1	110	110	2	115	230	1015	0.3	0.250	3.533
21	8.5	90	720	22.5	1	110	110	2	115	230	1060	0.3	0.252	3.785
22	9.0	90	765	22.5	1	110	110	2	115	230	1105	0.3	0.255	4.040
23	9.5	90	810	22.5	1	110	110	2	115	230	1150	0.3	0.258	4.298
24	10.0	90	855	22.5	1	110	110	2	115	230	1195	0.3	0.260	4.558

Grid Point	ΔH undistrubed waste (feet)	$\Delta H_{relocated\ waste}$ (feet)	ΔH_{total} (feet)	DesignTop of Cover (Elevation)	Long Term Top of Cover (Elevation)
B2	0.85	3.04	3.883	7143.1	7139.2
B3	0.85	3.04	3.883	7142.0	7138.1
B4	1.61	3.04	4.642	7141.8	7137.2
B5	1.77	3.04	4.806	7141.1	7136.3
B6	2.00	3.53	5.534	7140.1	7134.6
B7	2.19	3.79	5.977	7137.8	7131.8
B8	2.19	3.53	5.719	7135.0	7129.3
B9	2.17	3.28	5.452	7132.0	7126.5
~~B10~~	~~1.63~~	~~1.85~~	~~3.481~~	~~7127.0~~	~~7123.5~~
~~B11~~	~~0.00~~	~~0.00~~	~~0.000~~	~~7108.0~~	~~7108.0~~
~~B12~~	~~0.00~~	~~0.00~~	~~0.000~~	~~7086.0~~	~~7086.0~~
~~B13[1]~~	~~0.00~~	~~0.00~~	~~0.000~~	~~7067.5~~	~~7067.5~~
C2	0.99	1.40	2.390	7141.5	7139.1
C3	1.26	2.08	3.346	7139.1	7135.8
C4	1.56	2.55	4.112	7138.6	7134.5
C5	1.55	2.32	3.865	7138.1	7134.2
C6	1.98	3.53	5.513	7137.9	7132.4
C7	2.40	4.56	6.957	7137.0	7130.0
C8	2.49	4.30	6.789	7134.2	7127.4
C9	2.58	4.30	6.876	7131.5	7124.6
~~C10~~	~~0.00~~	~~0.00~~	~~0.000~~	~~7114.0~~	~~7114.0~~
~~C11~~	~~0.00~~	~~0.00~~	~~0.000~~	~~7089.0~~	~~7089.0~~
~~C12[1]~~	~~0.00~~	~~0.00~~	~~0.000~~	~~7062.0~~	~~7062.0~~
D2	0.56	0.18	0.739	7138.4	7137.7
D3	1.07	1.40	2.474	7136.8	7134.3
D4	1.48	2.55	4.033	7135.8	7131.8
D5	1.36	1.85	3.213	7135.2	7131.9
D6	1.68	2.79	4.469	7134.8	7130.3
D7	1.79	3.04	4.829	7134.2	7129.4
D8	1.85	2.79	4.646	7132.0	7127.4
D9	2.20	3.53	5.732	7128.0	7122.3
~~D10~~	~~0.00~~	~~0.00~~	~~0.000~~	~~7108.0~~	~~7108.0~~
~~D11[1]~~	~~0.00~~	~~0.00~~	~~0.000~~	~~7084.0~~	~~7084.0~~
~~D12[1]~~	~~0.00~~	~~0.00~~	~~0.000~~	~~7053.0~~	~~7053.0~~

SUMMARY OF SLOPE BETWEEN NODAL POINTS

Point	B2	C4	B4	C5	B5	C6	B6	C7	B7	B8	B8	B9	C2	D3	C3	D4	C4	D5	C5	D6	C6	D7	C7	C8	C8	C9
Initial Elevation (ft)	7143.1	7138.6	7141.8	7138.1	7141.1	7137.9	7140.1	7137.0	7137.8	7135.0	7135.0	7132.0	7141.5	7136.8	7139.1	7135.6	7138.6	7135.2	7138.1	7134.8	7137.9	7134.2	7137.0	7134.2	7134.2	7131.5
Change in elevation	4.5		3.7		3.2		3.1		2.8		3.0		4.7		3.3		3.4		3.3		3.7		2.8		2.7	
Length (ft)	141		141		141		141		100		100		141		141		141		141		141		100		100	
Slope	3.2%		2.6%		2.3%		2.2%		2.8%		3.0%		3.3%		2.3%		2.4%		2.3%		2.6%		2.8%		2.7%	
	Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable	
Post-Settlement Elevation (ft)	7139.2	7134.5	7137.2	7134.2	7136.3	7132.4	7134.6	7130.0	7131.8	7129.3	7129.3	7126.5	7139.1	7134.3	7135.8	7131.8	7134.5	7131.9	7134.2	7130.3	7132.4	7129.4	7130.0	7127.4	7127.4	7124.6
Change in elevation	4.7		2.9		3.9		4.5		2.5		2.7		4.8		4.0		2.5		3.9		3.0		2.6		2.8	
Length (ft)	141		141		141		141		100		100		141		141		141		141		141		100		100	
Slope	3.4%		2.1%		2.8%		3.2%		2.5%		2.7%		3.4%		2.8%		1.8%		2.8%		2.1%		2.6%		2.8%	
	Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Acceptable		Too Flat		Acceptable		Acceptable		Acceptable		Acceptable	

NOTE: The post-settlement slope between points C4 and D5 is shown to be less than 2%. Upon review of the final grading plan (Figure 3), it can be seen that the slope between points C4 and D5 is not parallel to the direction of flow. The line between points C4 and D5 runs across the line of flow. Therefore, the slope between points C4 and D5 does not reflect the actual flow lines and so it is concluded that the reported slope of 1.8% is not a concern as it does not reflect the true slope of the landfill surface measured perpendicular to the flow or fall line.

SLOPE STABILITY

CLIENT/SUBJECT TA-73 LOS ALAMOS AIRPORT LANDFILL CLOSURE W.O. NO 13104.002.001

TASK DESCRIPTION Global Slope Stability TASK NO. 1140

PREPARED BY A. Harpur DEPT 1495 DATE 3/09/04

MATH CHECK BY W.L. Deutsch DEPT 1495 DATE 3/10/04

METHOD REV. BY W.L. Deutsch DEPT 1495 DATE 3/10/04

BACKGROUND

As part of the closure of the Los Alamos Airport Landfill, approximately 65,000 cubic yards of existing waste will be relocated on-site and soils will be imported to the site to construct a final cap over the waste materials. Most of the waste to be relocated will be removed from the east and to a lesser extent the north slopes of the landfill. The east and north slopes of the landfill are currently inclined at a slope of approximately 1.5H:1V (33.7°). Although NMAC regulations require landfill sideslopes to be inclined at no steeper than 4H:1V (14°), it is proposed that the east and north slopes be configured at an effective slope of no steeper than 3H:1V (18.4°). The primary purpose for seeking to construct slopes steeper than those required in the regulations is to limit the volume of waste that must be relocated. In order to demonstrate that 3H:1V slopes will be stable, a slope stability analysis was completed.

ANALYSIS

The Los Alamos Airport Landfill received waste from about 1943 to about 1973. Between 1943 and about 1965 the waste was burned at the edge of the landfill and then pushed into the landfill using heavy construction equipment. The intentional burning of waste was terminated in 1965. The landfill was filled from west to east so the youngest and freshest waste is anticipated to be encountered during excavation activities on the east slope. It is not anticipated that burned waste or ash will be encountered in the area of the east slope. Burned waste and ash may be encountered along the north slope.

Geotechnical data was obtained from cone penetrometer testing completed within the landfill footprint. From the data obtained from this investigation, the internal friction angle of the waste was estimated to be 27° with an average cohesive strength of 2,326 pounds per square foot (psf). The cohesive strength ranged between 165 and 3,232 psf. Since the literature values used in the analyses completed for the 60% design are more conservative, they will again be referenced in this submittal.

Although the youngest waste is at least 30 years old (1973 to 2003), the degree of decomposition is unknown. Because of the relatively dry climate and the placement of a soil cap, the amount of moisture that penetrated the waste has likely been limited and so the rate of decomposition was probably somewhat retarded. Given that the degree of decomposition is unknown, shear strength parameters for both fresh and decomposed waste were utilized in the analysis. The unit weight of the waste was estimated based on aged waste rather than on freshly placed waste. Aged waste, because of its potential to absorb water can have a unit weight (density) of between about 80 and 100 pounds per cubic foot (pcf). The unit weight of freshly placed waste typically ranges between about 30 and 50 pcf. The ranges

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of unit weight are based on WESTON's experience related to the designing of MSW landfills.

The material properties used in the analysis are summarized in Table 1.

Table 1 – Material Properties based on literature values

Material	Total Unit Weight (pcf)	Drained Shear Strength		Undrained Shear Strength	
		Internal Friction Angle (degrees)	Cohesion (psf)	Internal Friction Angle (degrees)	Cohesion (psf)
Cover soil	125	30	20	30	20
Waste[1]	90	25	30	0	1460
Bedrock	135	45	200	45	200

Notes:

a) The waste parameters indicated in the table are the minimum values listed in Reference 1. Also see Attachment 1.

b) Drained shear strength waste parameters represent fresh waste, which behaves like a granular soil (sand and gravel). Fresh waste tends to be more fibrous because of the composition of the material and its relatively dry state.

c) Undrained shear strength waste parameters represent decomposed waste, which behaves like a fine-grained soil (silt and clay). As waste decomposes, the material becomes sludge-like in consistency.

Three conditions will be analyzed for both the east and north slopes. These conditions are as follows:

1. Short-term with equipment load located at the top of slope after regarding. The minimum required factor-of-safety (FS) is 1.25.
2. Long-term with no equipment load. The minimum required FS is 1.5.
3. Long-term with seismic load. The minimum required FS is 1.0.

The locations of the sections that were analyzed are shown on Figure 1. Slopes on the south and west side of the landfill are relatively flat and short, and therefore do not pose any stability concerns. An area

[1] Singh, S. and Murphy, B., "Evaluation of The Stability of Sanitary Landfills," Geotechnics of Waste Fills – Theory and Practice, ASTM STP 1070, Landva, A. and Knowles, D., editors, American Society of Testing and Materials, Philadelphia, PA, 1990.

in the southeast part of the site may be sloped at an inclination steeper than 3H:1V. However, if this occurs, it is anticipated that the slope will be formed from the native soil after waste material is removed.

An equipment surcharge load of 250 psf was included in the analysis to simulate construction equipment staged at the top of the slope. (This load was input in the model as a 2-foot high soil layer). While construction loads can be modeled as line loads or as small area loads equal to the width of the equipment tracks or wheels, it has been WESTON's experience that a large areal surcharge load generally yields more conservative results. (Typically a large areal load will impact a larger number of the slices within the failure arc than smaller, more concentrated loads, with a corresponding lesser, and therefore more conservative, calculated factor-of-safety value.) An analysis was also completed considering a surcharge load of 1,000 psf using drained waste parameters. This increased load was applied to determine the impacts of the use of heavier equipment.

A seismic coefficient of 0.262g was based on a 98% probability of non-exceedance in 50 years, or stated conversely, a 2% probability of exceedance in 50 years[2]. The coefficient was determined from the USGS Probabilistic Hazard Lookup by Zipcode, 1996 using a zip code of 87544 for the Los Alamos County Airport, see Attachment 2 and http://eqint.cr.usgs.gov/eq/html/zipcode.shtml.

The slope stability analysis was completed using a commercially available computer program, Slope/W distributed by Geo-Slope International. Two failure mechanisms were evaluated, circle arc and planar (linear).

RESULTS

The results of the slope stability analysis are presented in the form of graphical cross-sections that depict the location of the failure surfaces (circular arc or planar) with the lowest factor-of-safety. For reference, the corresponding input files have also been included to illustrate the limits of the search routine executed by the software. The input and output files are presented in Attachment 3. The results are summarized in Tables 2 and 3.

[2] As shown in Attachment 2, a seismic coefficient which has a statistical probability of non-exceedance of 98% in 50 years is approximately the same as one having a statistical probability of non-exceedance of 90% in 250 years, the CFR standard for MSW landfills (see 40 CFR, Part 258).

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Table 2 – Summary of Results –circular arc failure analysis

Location	Condition	Waste	Factor-of-Safety		Status
			Required	Achieved	
East slope	Construction	Drained	1.25	1.434	Acceptable
	Long-term		1.5	1.434	Marginal[1]
	Seismic		1.0	1.065	Acceptable
	Construction	Undrained	1.25	1.892	Acceptable
	Long-term		1.5	1.887	Acceptable
	Seismic		1.0	1.383	Acceptable
North slope	Construction	Drained	1.25	1.671	Acceptable
	Long-term		1.5	1.666	Acceptable
	Seismic		1.0	1.207	Acceptable
	Construction	Undrained	1.25	2.774	Acceptable
	Long-term		1.5	2.774	Acceptable
	Seismic		1.0	1.905	Acceptable

Note 1. Because the factor-of-safety for the long-term condition (using the *minimum* drained waste parameters) is less than 1.5, the analysis was repeated using the *average* internal friction angle estimated from the CPT data, $\phi = 27^\circ$ and c = 30 psf. This analysis resulted in a factor-of-safety of 1.540, which is greater than the required factor-of-safety of 1.5, and is therefore acceptable. See Attachment 3 for output file of this case.

Table 3 – Summary of Results – planar failure analysis

Location	Condition	Waste	Factor-of-Safety		Status
			Required	Achieved	
East slope	Long-term	Drained	1.5	1.814	Acceptable
		Undrained	1.5	2.395	Acceptable

Since the calculated factor-of-safety values for the two planar failure analyses are greater than the corresponding values for the circular arc analyses, 1.814 versus 1.434 and 2.395 versus 1.887, the other stability scenarios shown in Table 2 were not evaluated.

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An analysis was also completed to evaluate the impact the using heavier equipment resulted in a factor-of-safety of 1.434 using drained waste shear strength parameters. The heavier and larger surcharge had no influence on the critical failure circle and so the factor-of-safety remained unchanged.

CONCLUSIONS

Based on the results of the slope stability analysis it was concluded that the slopes inclined at no steeper than 3H:1V (effective) will be stable. It is acknowledged that for one case it was necessary to increase the shear strength parameters of the waste from the minimum values to the average values in order to achieve the minimum factor-of-safety requirements.

It should also be noted that the drained waste parameters (ϕ and c) are typically assigned to fresh MSW. Fresh waste is generally evaluated under the short-term scenario only. The minimum acceptable factor-of-safety for a short-term condition is typically 1.3; 1.25 if an equipment surcharge load is modeled in the analysis. Considering the use of drained waste parameters for a long-term analysis is not strictly required and was only done in order to bound the complete range of waste shear strength parameters that may be encountered at the site. It is likely that the actual waste shear strength parameters would be found to lie between the drained and undrained parameters, which are the extreme conditions, i.e., newly placed fresh waste and completely biodegraded waste.

Stability of slopes during construction was addressed in a separate memo.

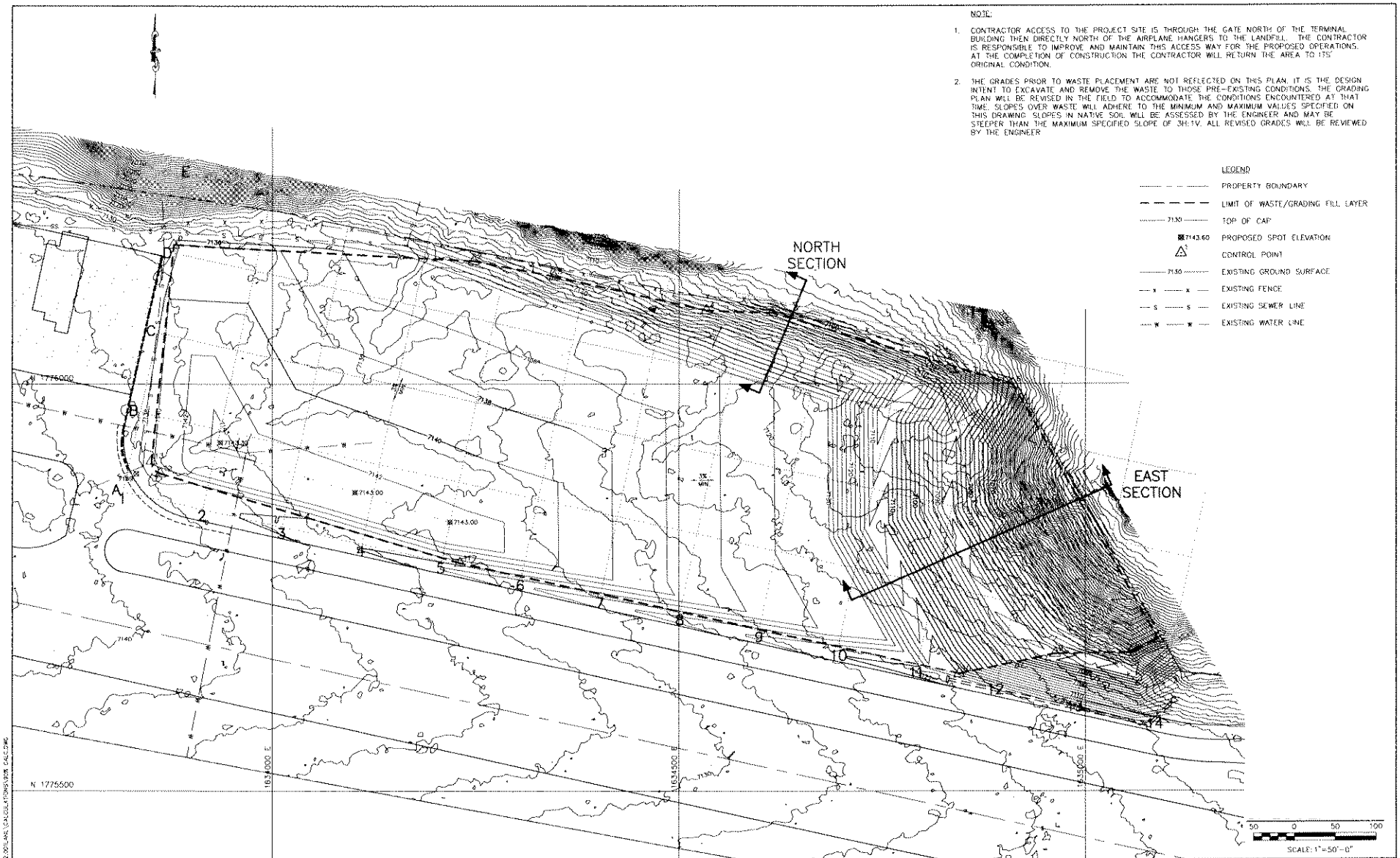
NOTE:

1. CONTRACTOR ACCESS TO THE PROJECT SITE IS THROUGH THE GATE NORTH OF THE TERMINAL BUILDING THEN DIRECTLY NORTH OF THE AIRPLANE HANGERS TO THE LANDFILL. THE CONTRACTOR IS RESPONSIBLE TO IMPROVE AND MAINTAIN THIS ACCESS WAY FOR THE PROPOSED OPERATIONS. AT THE COMPLETION OF CONSTRUCTION THE CONTRACTOR WILL RETURN THE AREA TO ITS' ORIGINAL CONDITION.

2. THE GRADES PRIOR TO WASTE PLACEMENT ARE NOT REFLECTED ON THIS PLAN. IT IS THE DESIGN INTENT TO EXCAVATE AND REMOVE THE WASTE TO THOSE PRE-EXISTING CONDITIONS. THE GRADING PLAN WILL BE REVISED IN THE FIELD TO ACCOMMODATE THE CONDITIONS ENCOUNTERED AT THAT TIME. SLOPES OVER WASTE WILL ADHERE TO THE MINIMUM AND MAXIMUM VALUES SPECIFIED ON THIS DRAWING. SLOPES IN NATIVE SOIL WILL BE ASSESSED BY THE ENGINEER AND MAY BE STEEPER THAN THE MAXIMUM SPECIFIED SLOPE OF 3H:1V. ALL REVISED GRADES WILL BE REVIEWED BY THE ENGINEER.

LEGEND

- PROPERTY BOUNDARY
- LIMIT OF WASTE/GRADING FILL LAYER
- 7130 TOP OF CAP
- 7143.60 PROPOSED SPOT ELEVATION
- CONTROL POINT
- 7130 EXISTING GROUND SURFACE
- EXISTING FENCE
- EXISTING SEWER LINE
- EXISTING WATER LINE



LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON TEAM

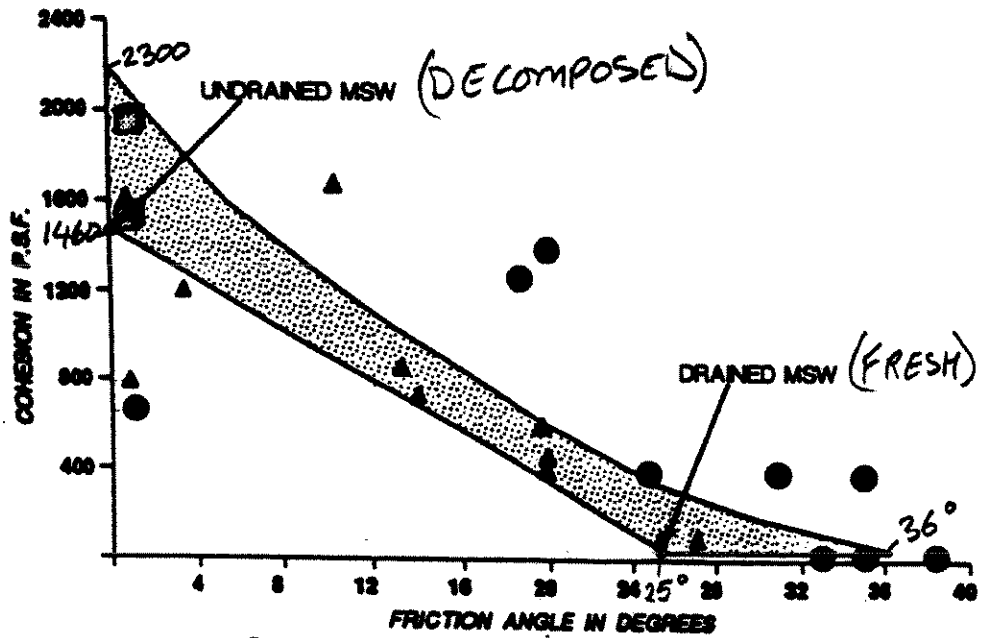
CHECKED	DATE	CLIENT APPROVALS	DATE
DES. ENG			
PROJ. ENG AH	3/9/04		
PROJ. MGR			
APPROVED			
APPROVED			

LANDFILL
SLOPE STABILITY SECTIONS

DRAWN GDM	DATE 3/9/04	DWG NO FIG. 1	REV. NO A
SCALE AS SHOWN	W.O. NO 13104.002.001	SHT ___ OF ___	

ATTACHMENT #1

MSW SHEAR STRENGTH PARAMETERS



Summary Plot for All Tests with Recommended Parameters Shaded

REF: SINGH S. & MURPHY B. "A CRITICAL EXAMINATION OF THE STRENGTH AND STABILITY OF SANITARY LANDFILLS."

SHEAR STRENGTH PARAMETERS FOR MUNICIPAL SOLID WASTE

ATTACHMENT #1

ATTACHMENT #2

SEISMIC COEFFICIENT

USGS
Earthquake Hazards Program

```
The input zip-code is 87544.
ZIP CODE                          87544
LOCATION                          35.8678 Lat. -106.2682 Long.
DISTANCE TO NEAREST GRID POINT    4.5840 kms
NEAREST GRID POINT                35.9 Lat. -106.3 Long.
Probabilistic ground motion values, in %g, at the Nearest Grid point are:
             10%PE in 50 yr   5%PE in 50 yr   2%PE in 50 yr
   PGA         8.963270        14.212500       26.153641
0.2 sec SA    20.231220        33.854210       59.950050
0.3 sec SA    18.002939        28.778629       54.664909
1.0 sec SA     5.927866         9.756920       18.967649
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

0.262g

The input zip-code is .
Zip code is zero and we go to the end and stop.

PROJECT INFO: Home Page
SEISMIC HAZARD: Hazard by Zip Code

Home

Airport Info

Approach & Departure Info

Fuel

Aircraft Rental

Instruction

Aircraft Repair

Transportation & Car Rental

Links & Photos

Visitor's Guide

Contact Info

Welcome to the Los Alamos County Airport

Los Alamos County Airport
1040 Airport Road
Los Alamos, NM 87544
505-662-8420

county airport manager: manager@lamairport.com

airport operations manager: opsmanager@lamairport.com

NOTE: Administrative aspects of airport management are handled by the county airport manager. Day-to-day operations and on-site operations management (i.e. - most things of interest to pilots) are handled by the airport operations manager

webmaster: webmaster@lamairport.com

Information obtained from USGS Earthquake Hazard Program
http://eqhazmaps.usgs.gov/faq/parm08.html

Frequently Asked Questions (FAQ) About Return Periods

Your map is for ground motions having a 2% probability of exceedance in 50 years. Are those values the same as those for 10% in 250?

Yes, basically. This conclusion will be illustrated by using an approximate rule-of-thumb for calculating Return Period (RP).

A typical seismic hazard map may have the title, "Ground motions having 90 percent probability of not being exceeded in 50 years." The 90 percent is a "non-exceedance probability"; the 50 years is an "exposure time." An equivalent alternative title for the same map would be, "Ground motions having 10 percent probability of being exceeded in 50 years." A typical shorthand to describe these ground motions is to say that they are 475-year return-period ground motions. This means the same as saying that these ground motions have an annual probability of occurrence of 1/475 per year. "Return period" is thus just the inverse of the annual probability of occurrence (of getting an exceedance of that ground motion).

To get an approximate value of the return period, RP, given the exposure time, T, and exceedance probability, r = 1 - non-exceedance probability, NEP, (expressed as a decimal, rather than a percent), calculate

RP = T / r* Where r* = r(1 + 0.5r).

r* is an approximation to the value -loge (NEP).

In the above case, where r = 0.10, r* = 0.105 which is approximately = -loge (0.90) = 0.10536 Thus, approximately, when r = 0.10, RP = T / 0.105

Consider the following table.

				Rule of Thumb		Exact
NEP	T	r	r*	Calculation	RP	RP
0.90	50	0.10	0.105	50 / 0.105	476.2	474.6
0.90	100	0.10	0.105	100 / 0.105	952.4	949.1
0.90	250	0.10	0.105	250 / 0.105	2381.0	2372.8

In this table, the exceedance probability is constant for different exposure times. Compare the results of the above table with those shown below, all for the same exposure time, with differing exceedance probabilities.

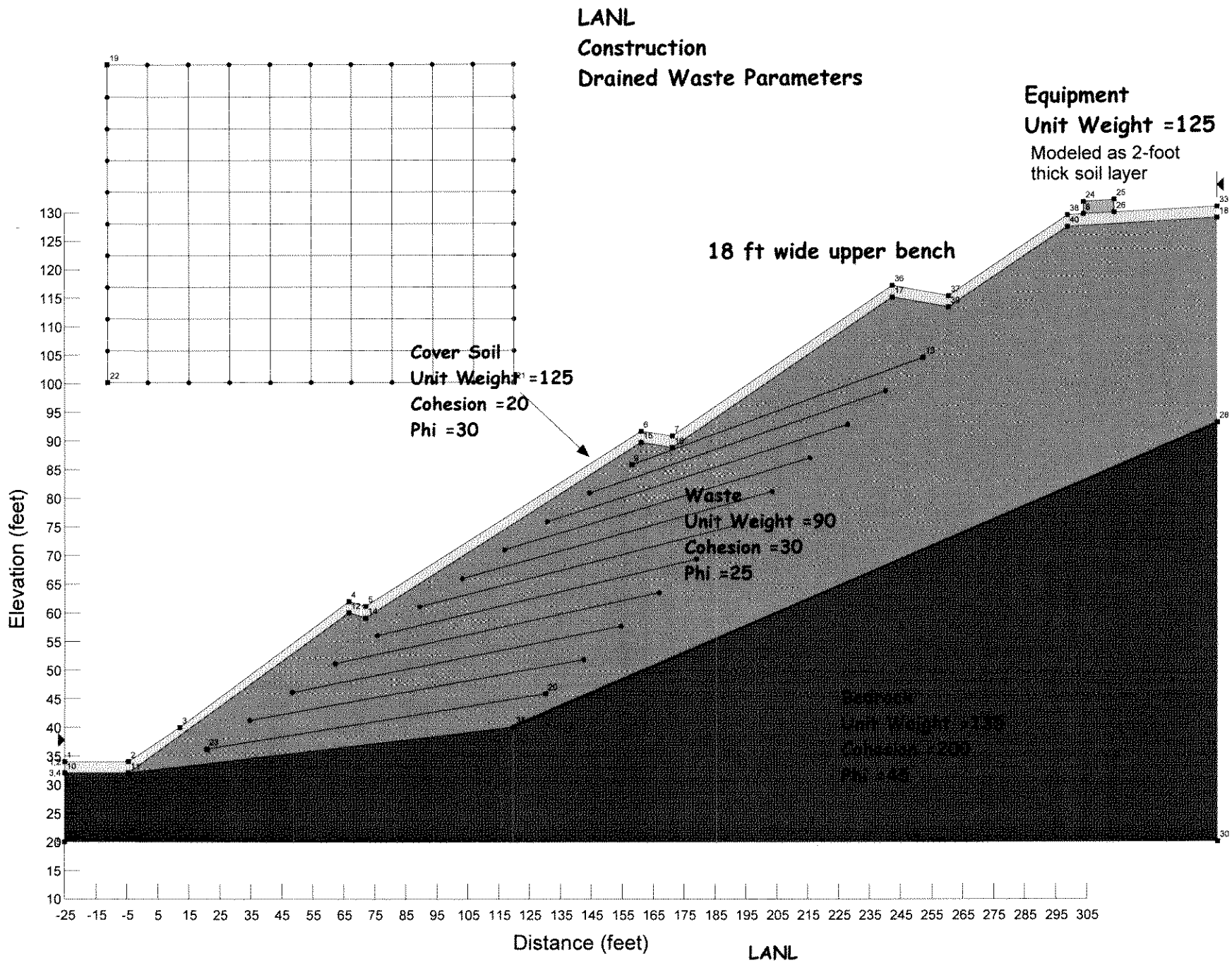
NEP	T	r	r*	Rule of Thumb Calculation	RP	Exact RP
0.90	50	0.10	0.105	50 / 0.105	476.2	474.6
0.95	50	0.05	0.05125	50 / 0.05125	975.6	974.8
0.98	50	0.02	0.0202	50 / 0.0202	2475.2	2475.9

Comparison of the last entry in each table allows us to see that ground motion values having a 2% probability of exceedance in 50 years should be approximately the same as those having 10% probability of being exceeded in 250 years: The annual exceedance probabilities differ by about 4%. Corresponding ground motions should differ by 2% or less in the EUS and 1 percent or less in the WUS, based upon typical relations between ground motion and return period.

ATTACHMENT #3

SLOPE STABILITY
INPUT/OUTPUT FILES

EAST SLOPE
CIRCULAR ANALYSES



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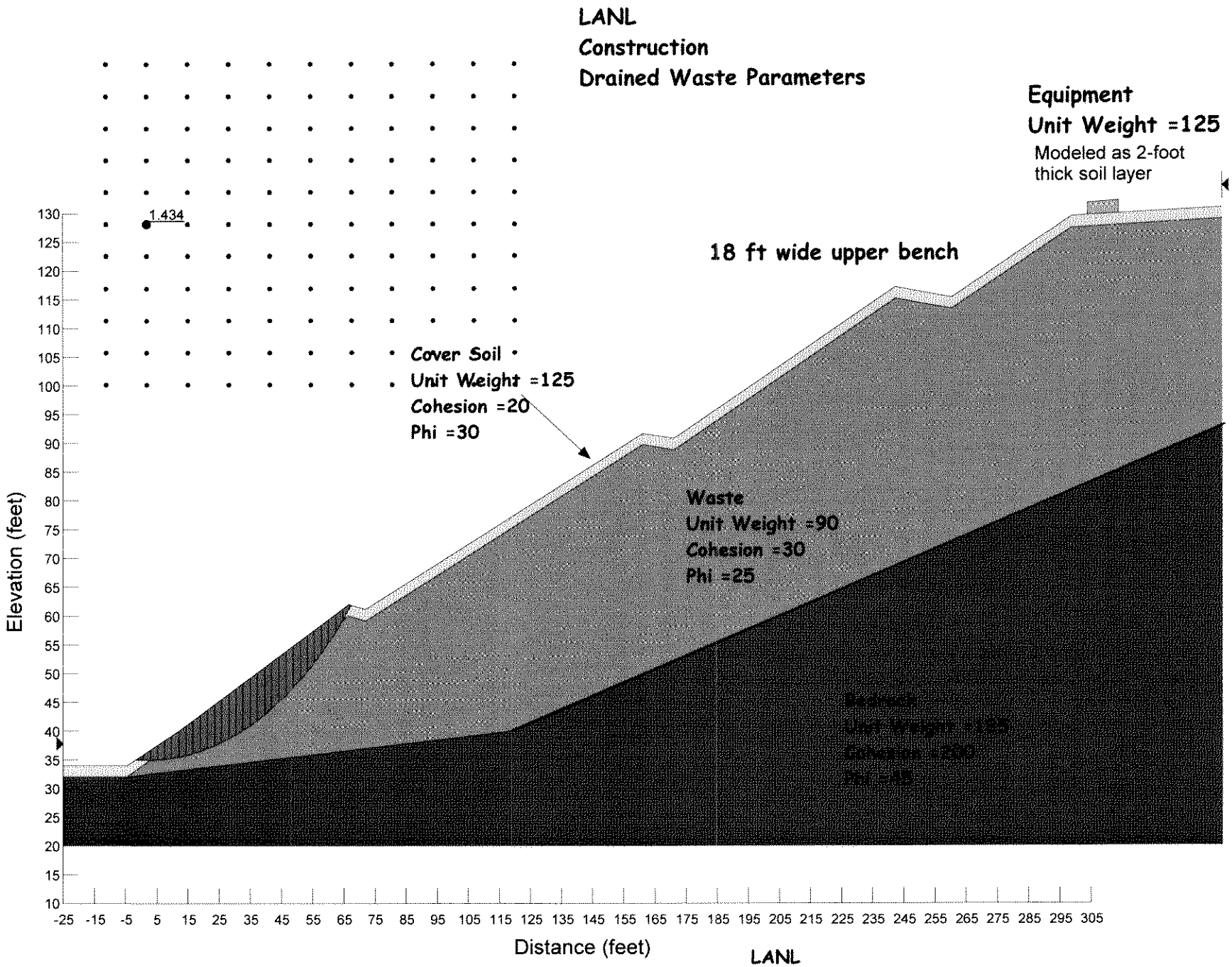
Last Saved Date: 3/11/2004
Last Saved Time: 3:08:48 PM



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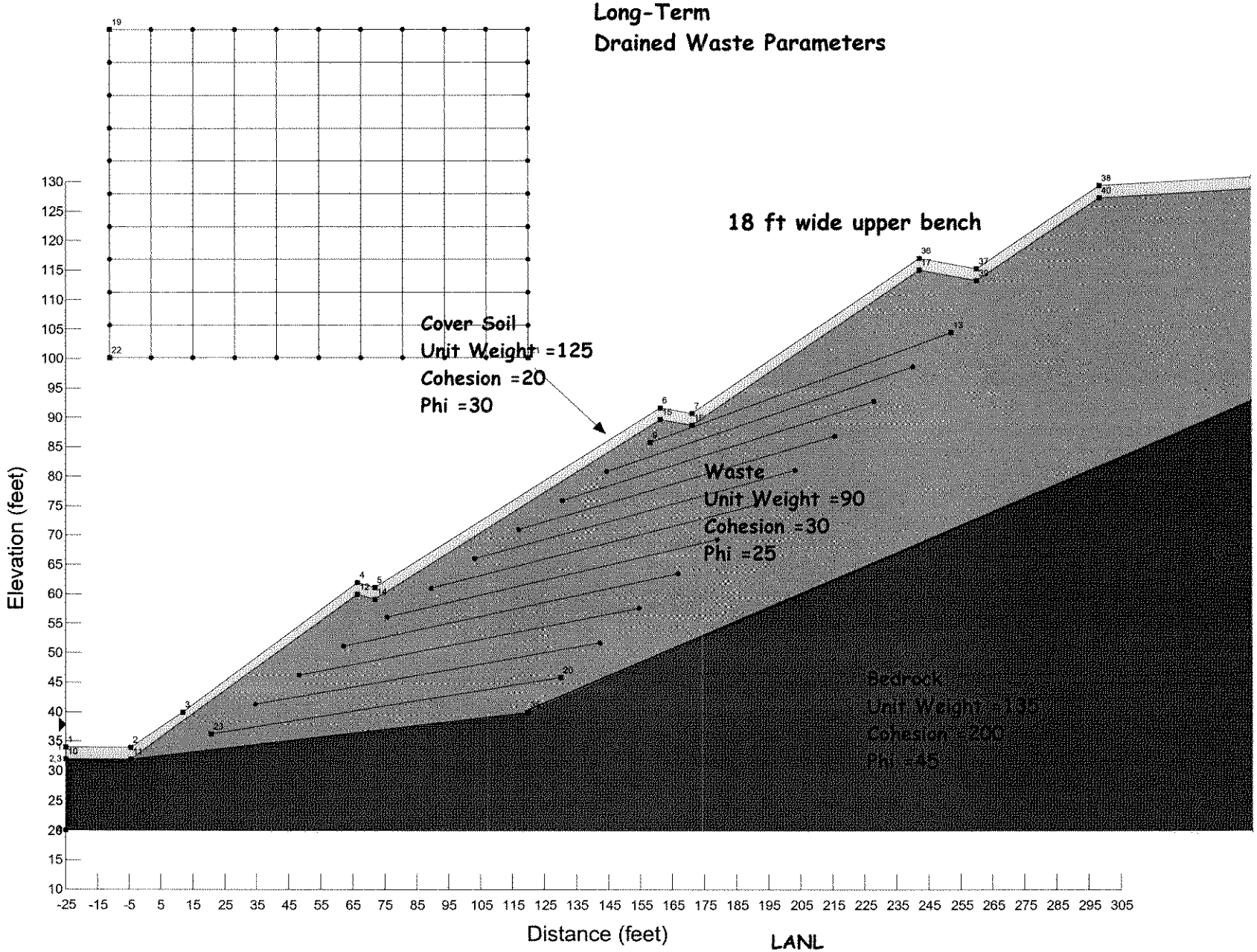
Last Saved Time: 3:08:48 PM

LANL
Long-Term
Drained Waste Parameters



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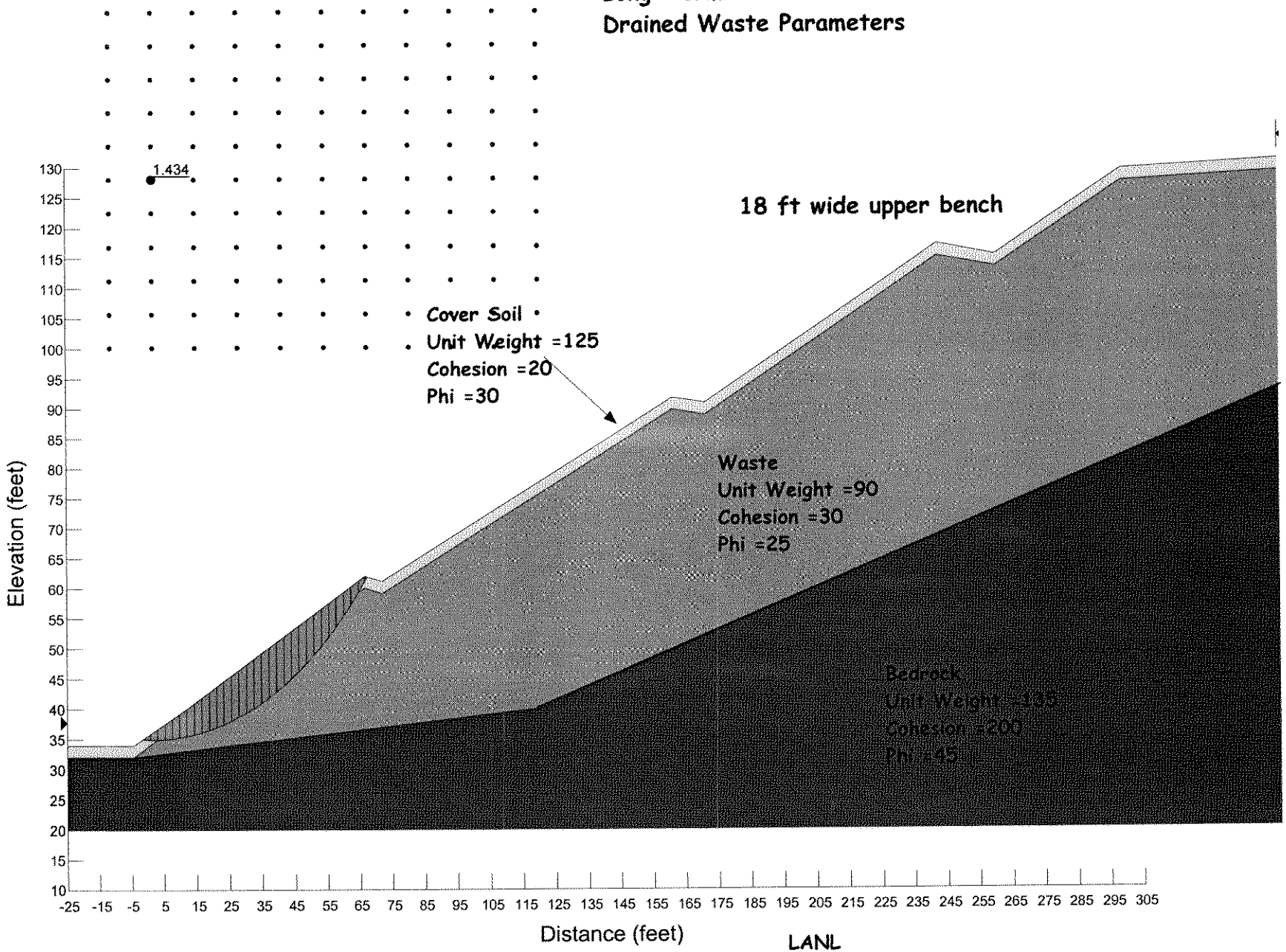
Drained Waste Parameters



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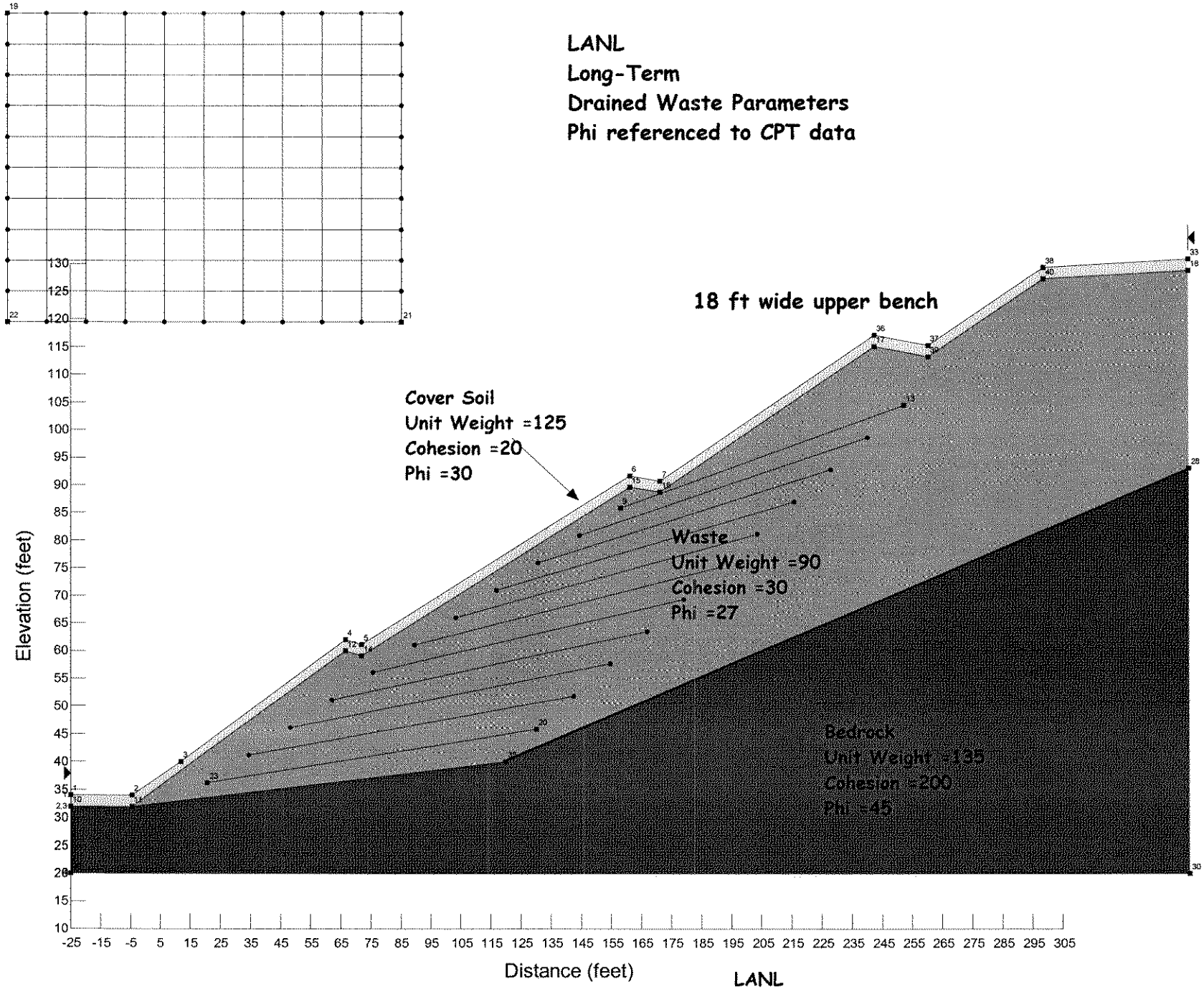

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Drained Waste Parameters
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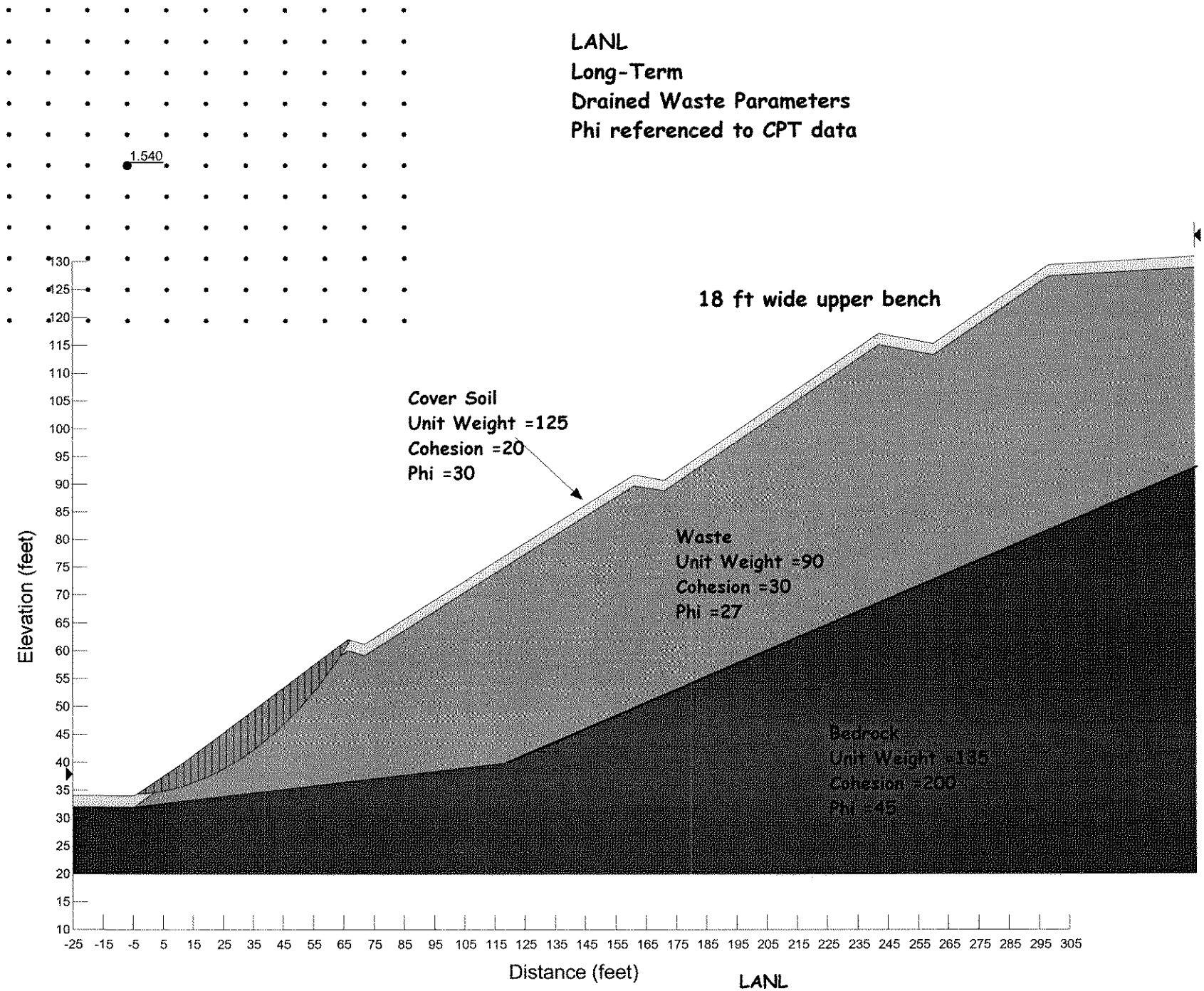

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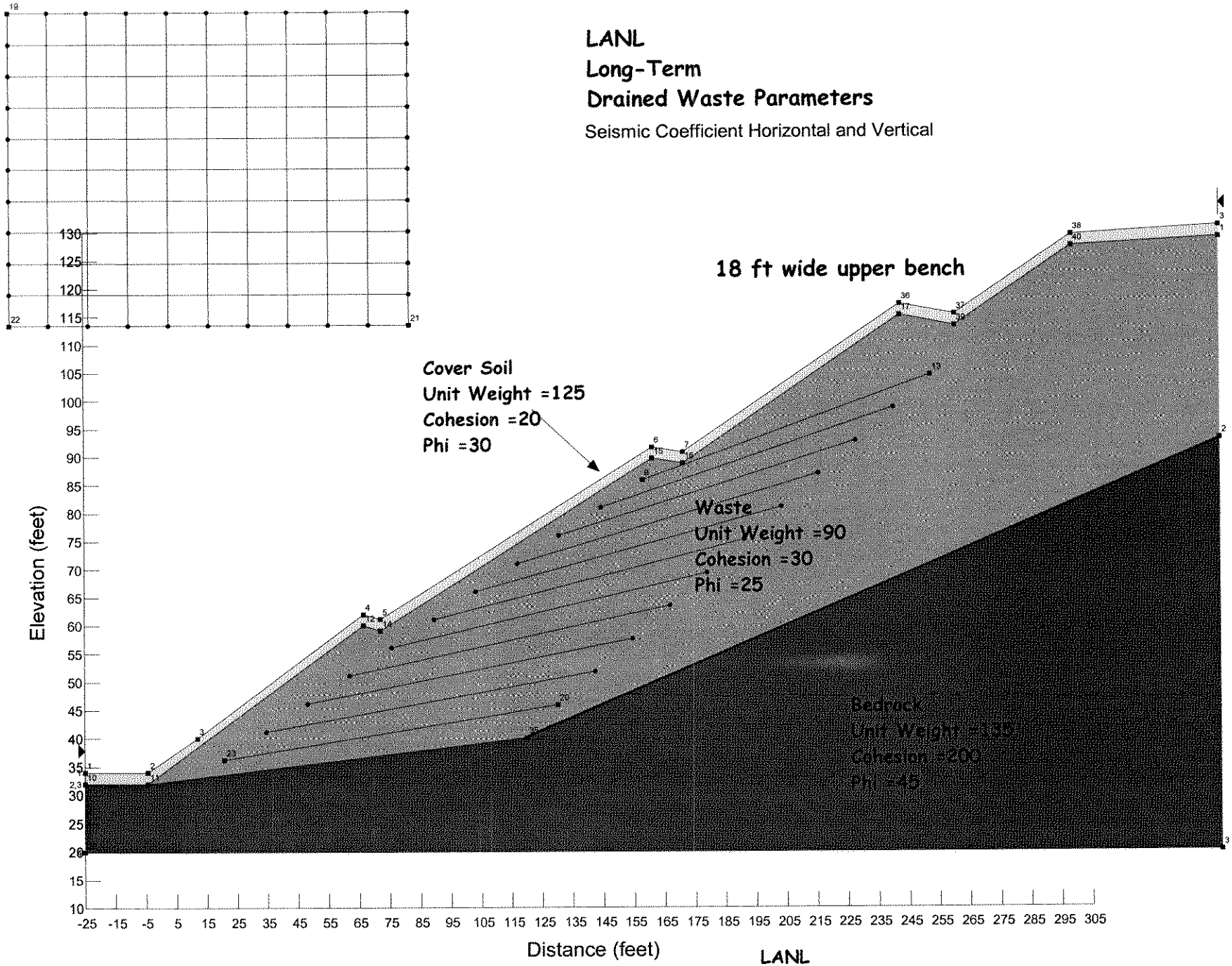
Long-Term
Drained Waste Parameters
Seismic Coefficient Horizontal and Vertical



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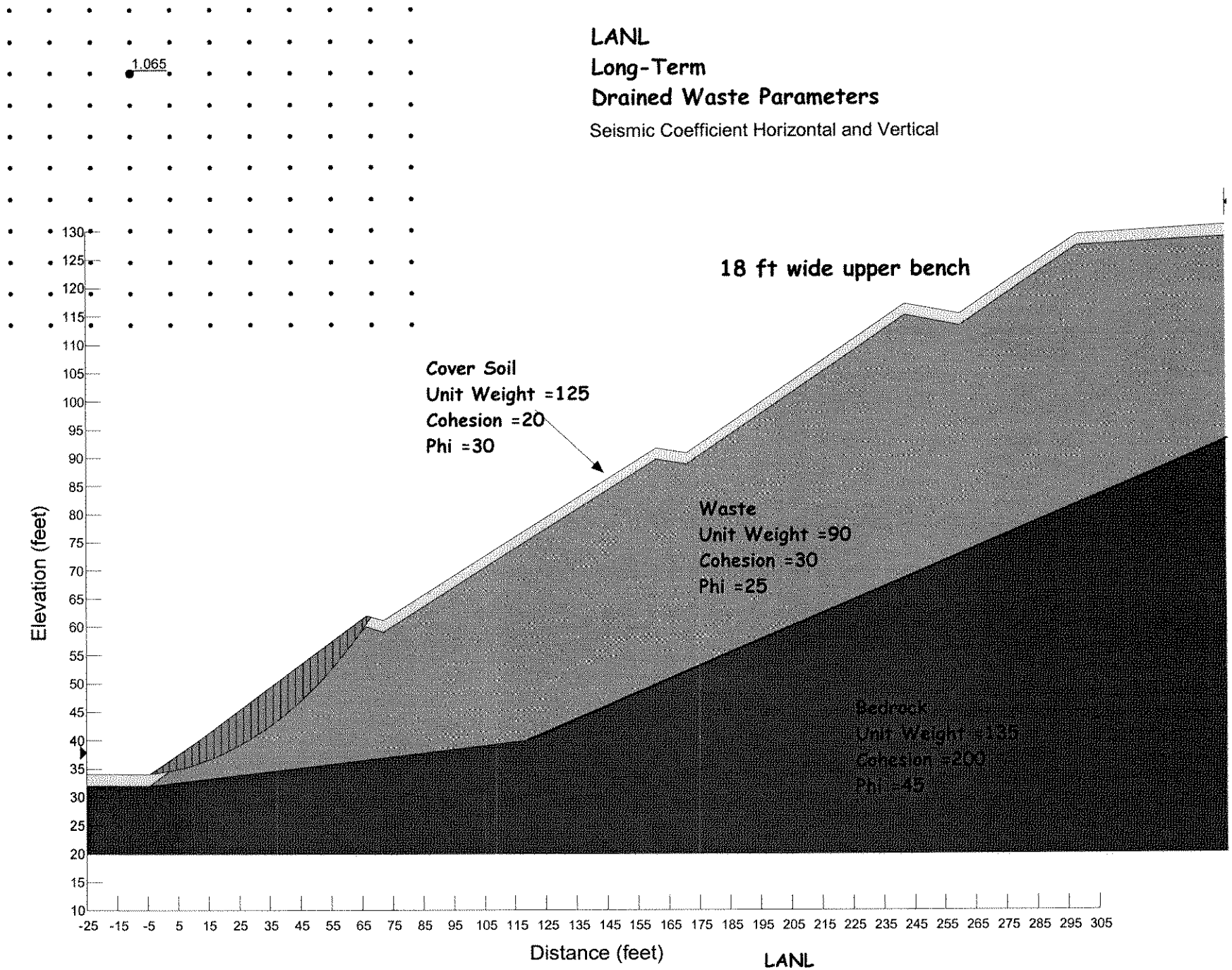
LANL
Long-Term
Drained Waste Parameters
Seismic Coefficient Horizontal and Vertical



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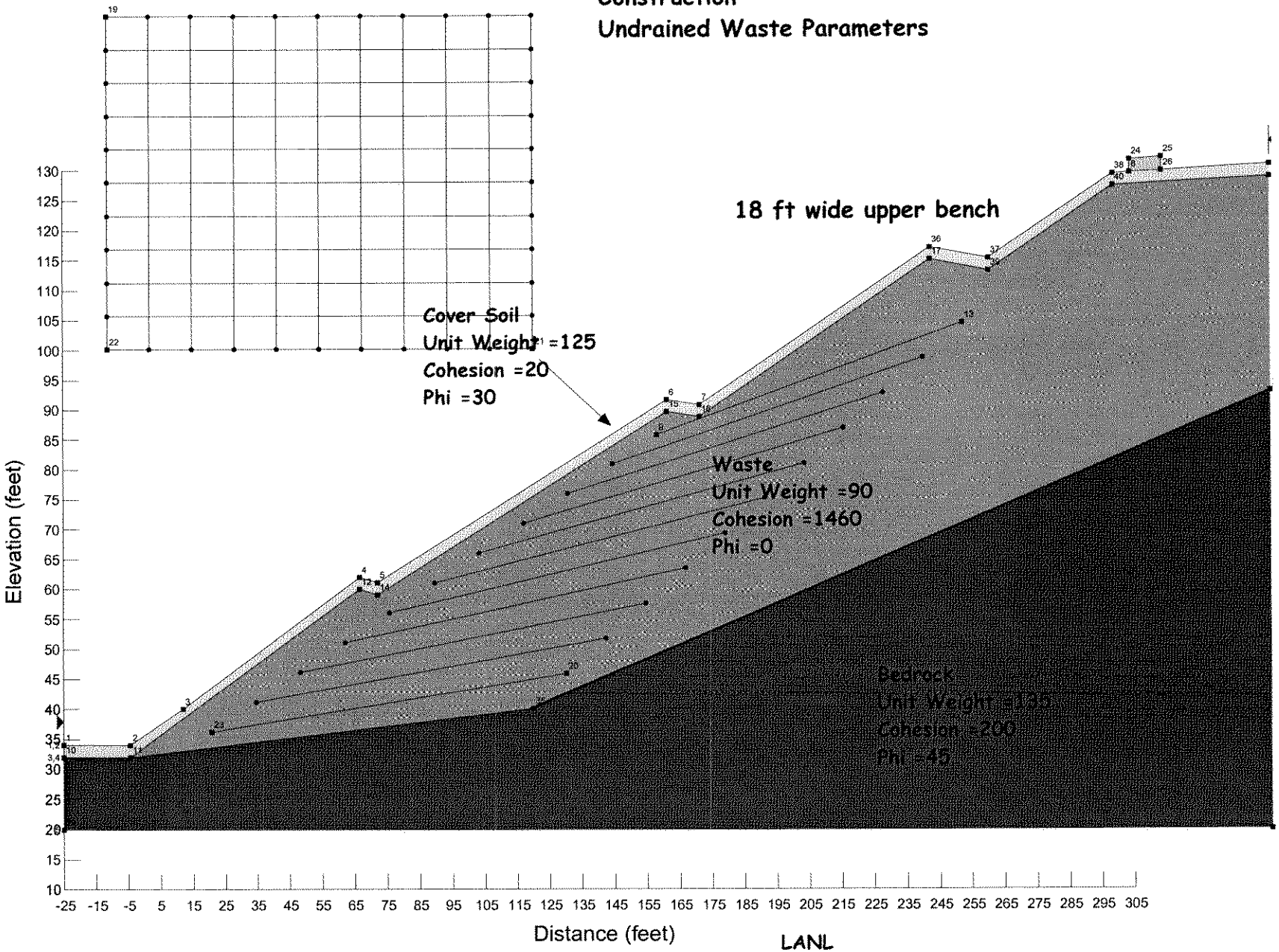
Undrained Waste Parameters



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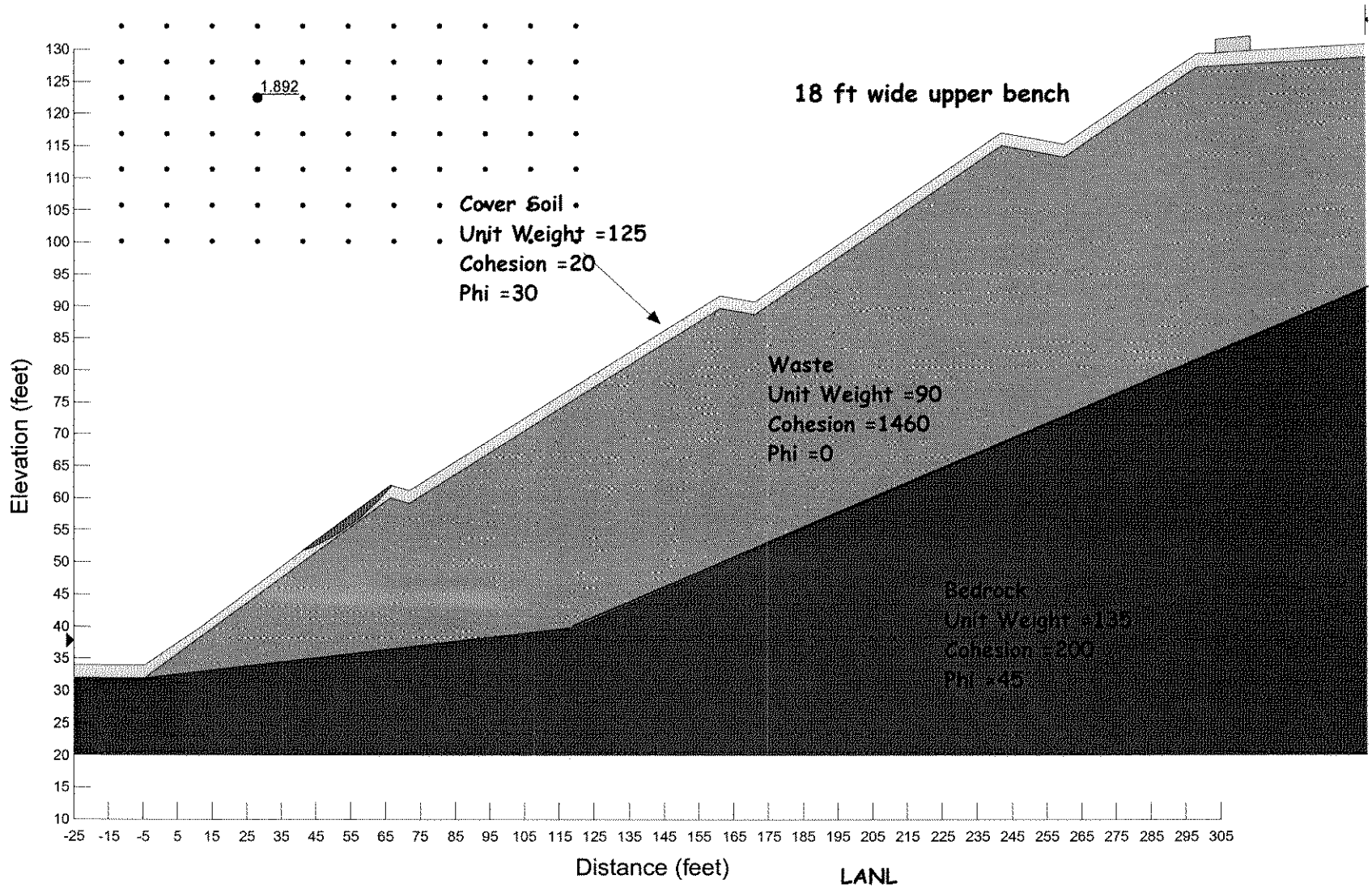

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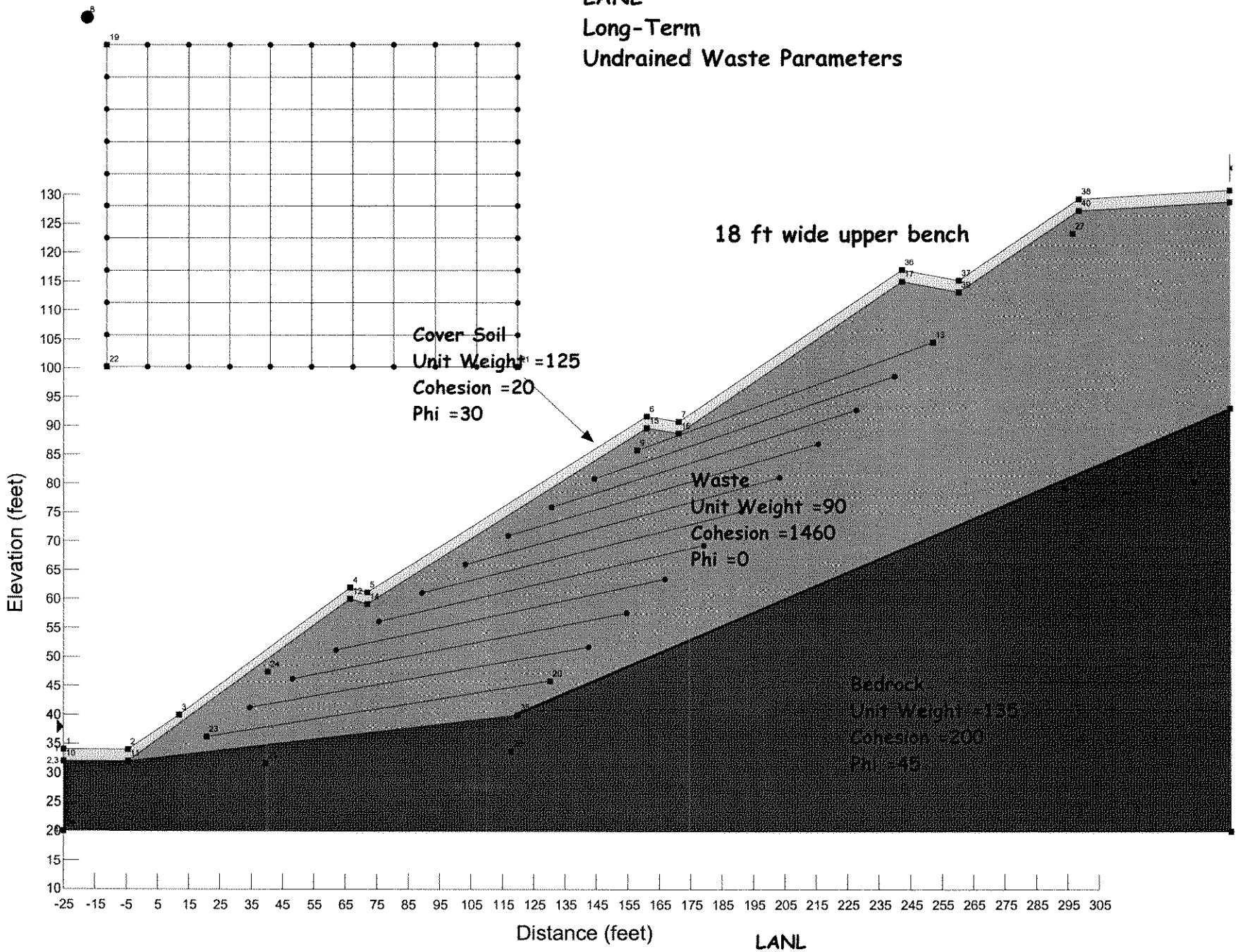

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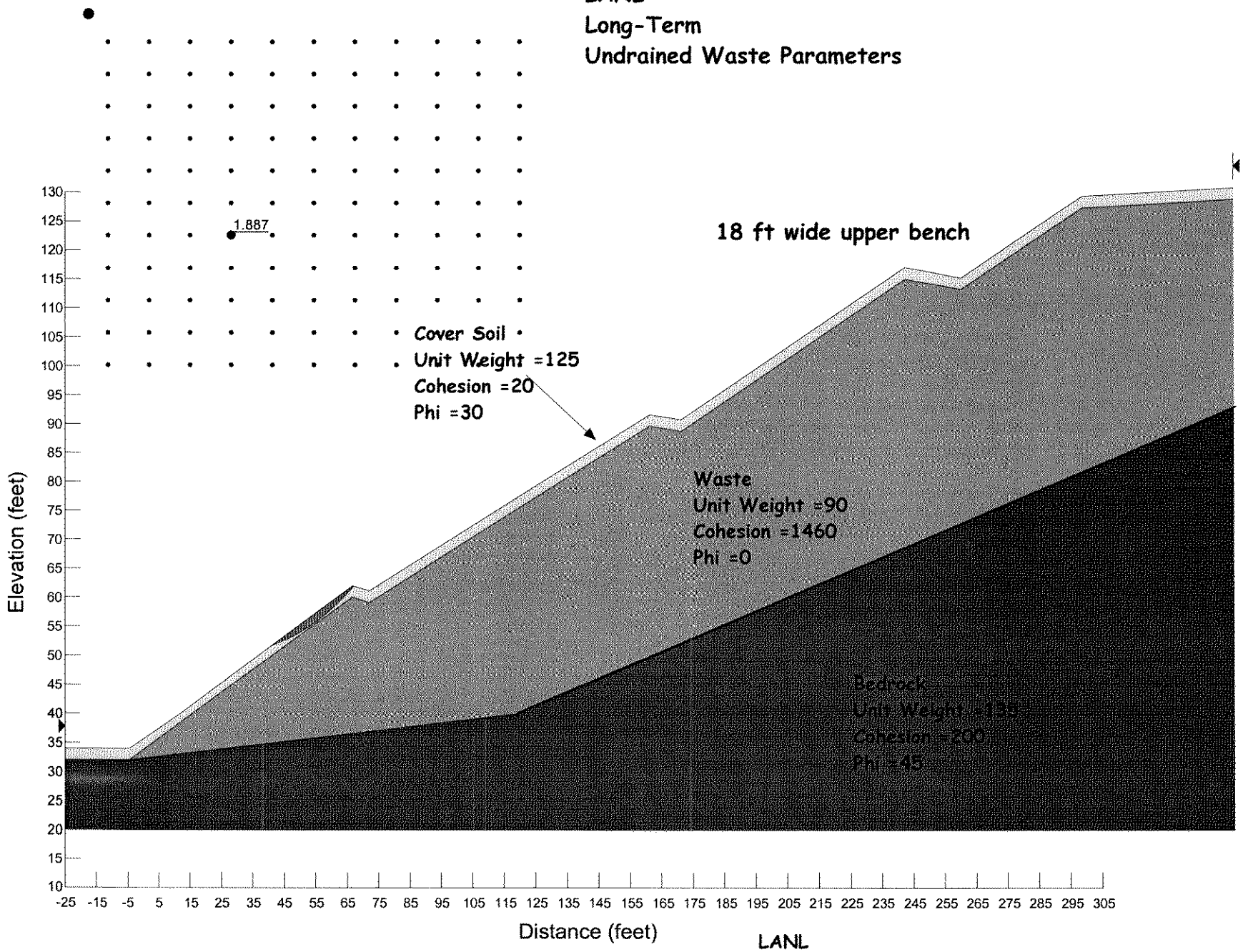
Long-Term
Undrained Waste Parameters



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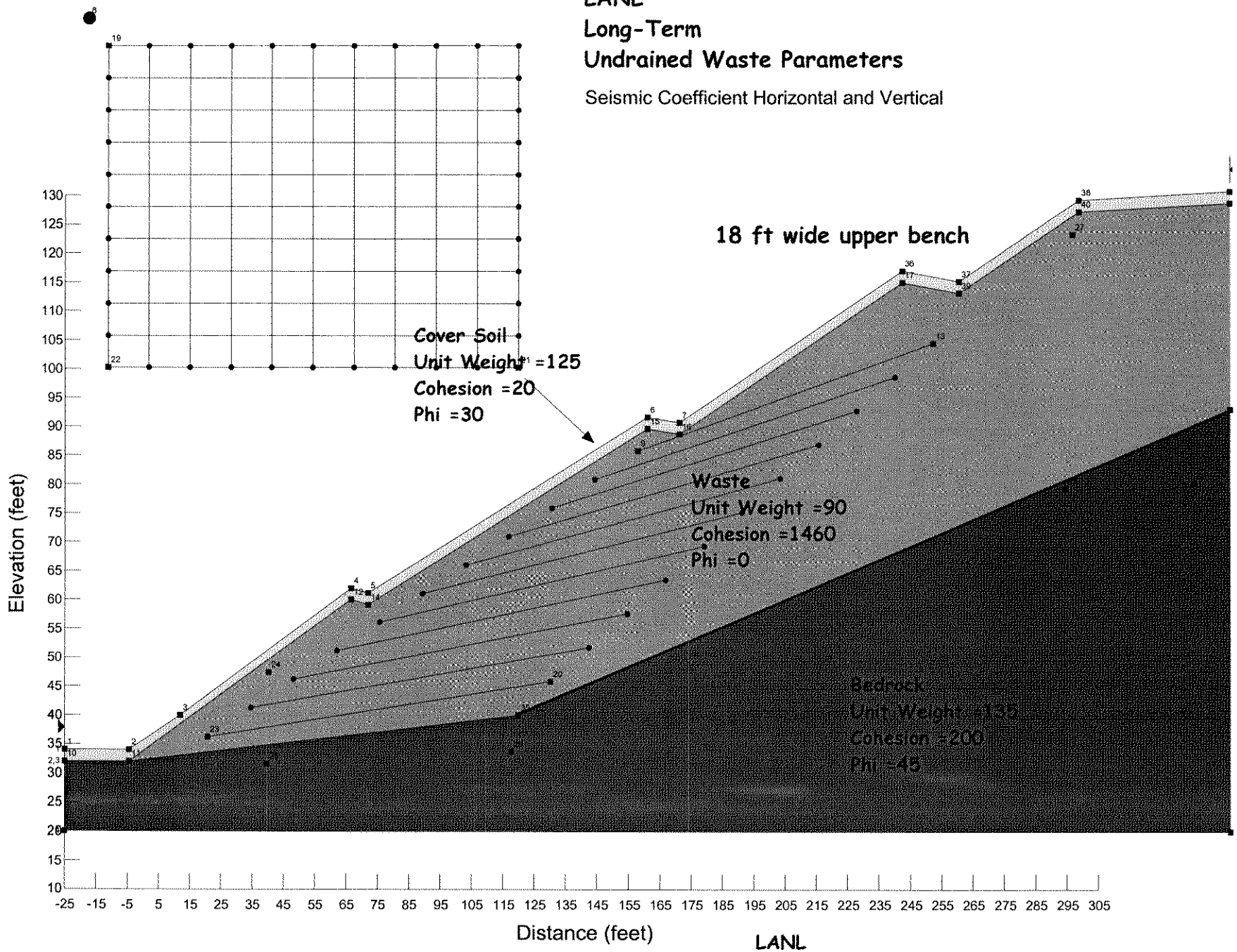
LANL
Long-Term
Undrained Waste Parameters

Seismic Coefficient Horizontal and Vertical



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LANL
Long-Term
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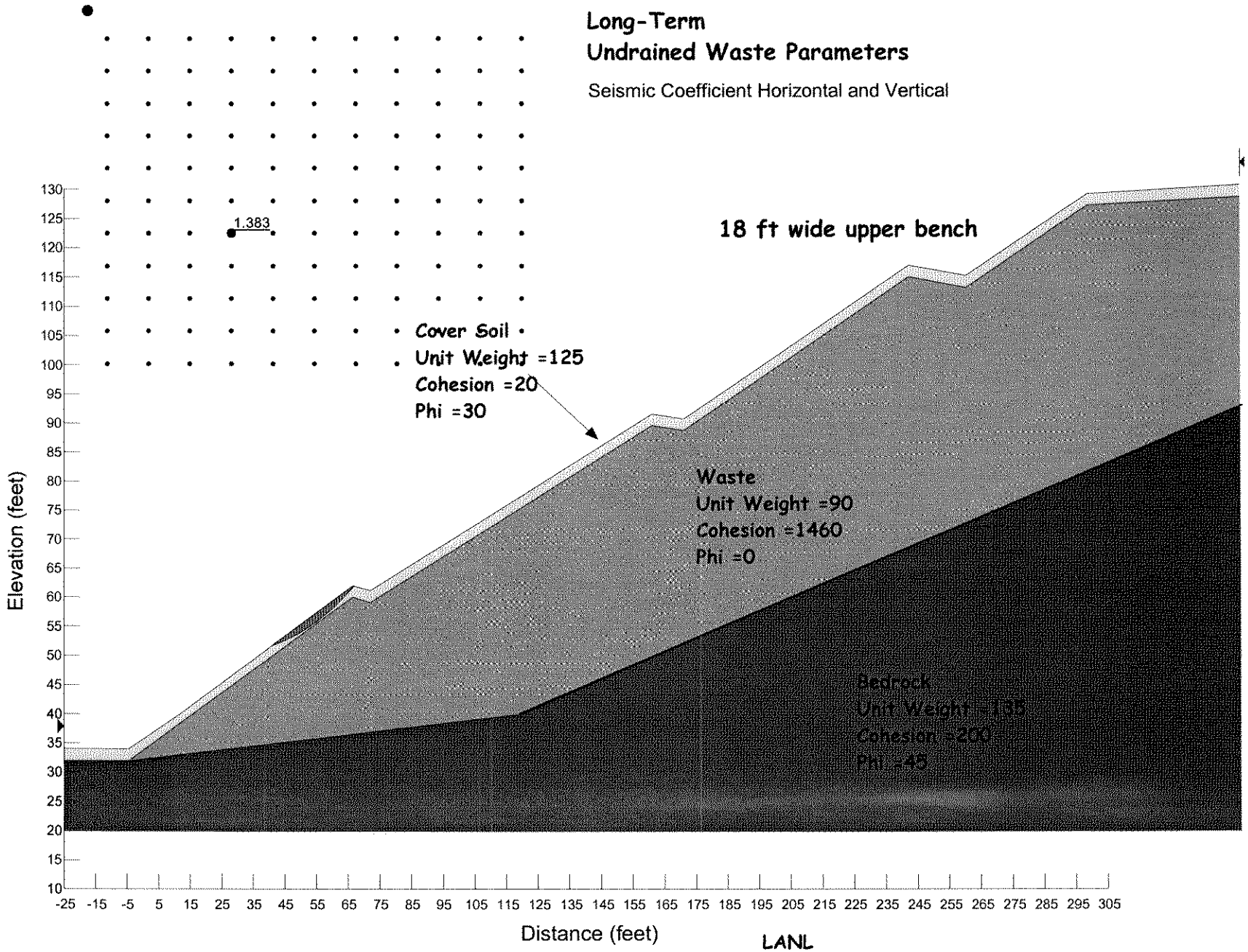
Seismic Coefficient Horizontal and Vertical



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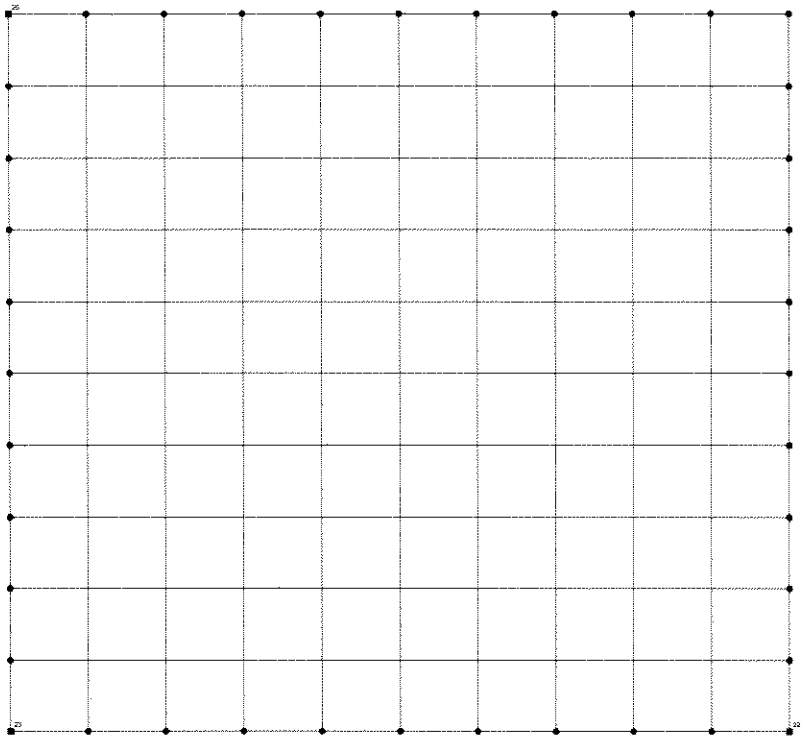
NORTH SLOPE
CIRCULAR ANALYSES



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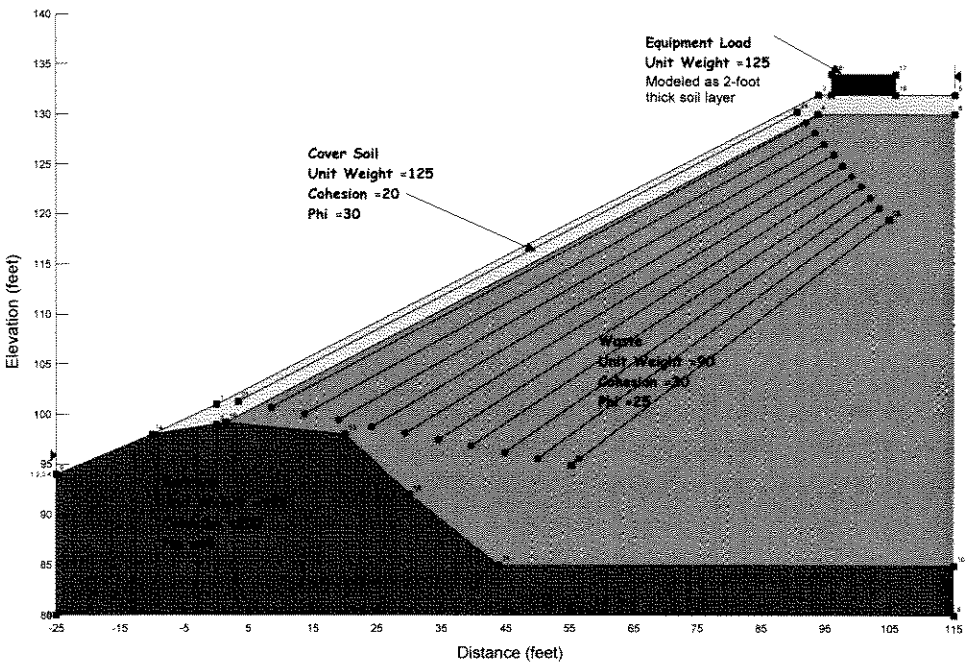
Drained Waste Parameters



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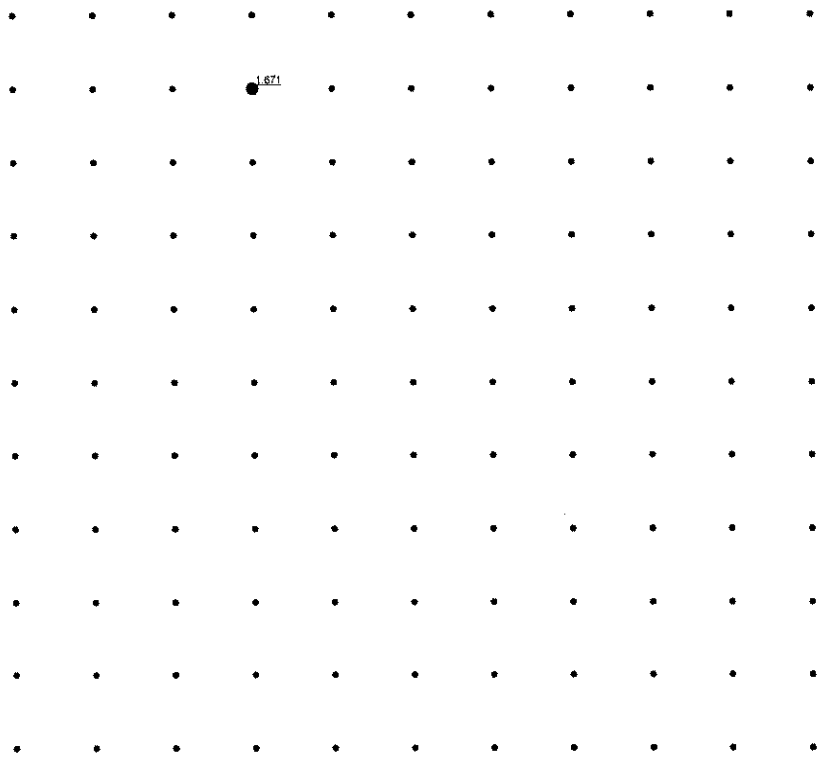

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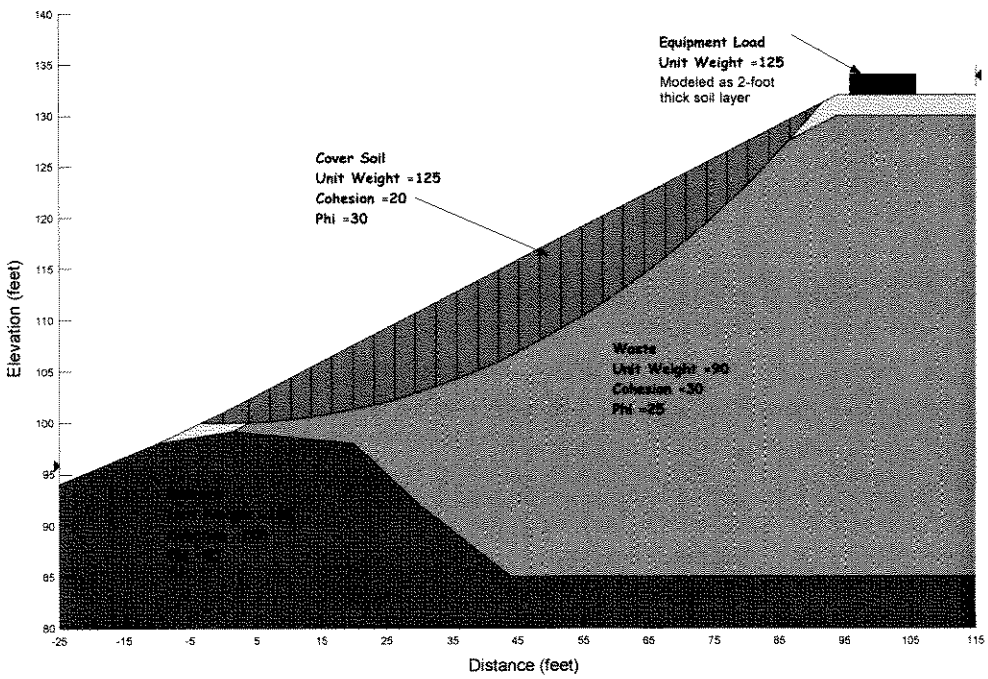
Construction Case
Drained Waste Parameters



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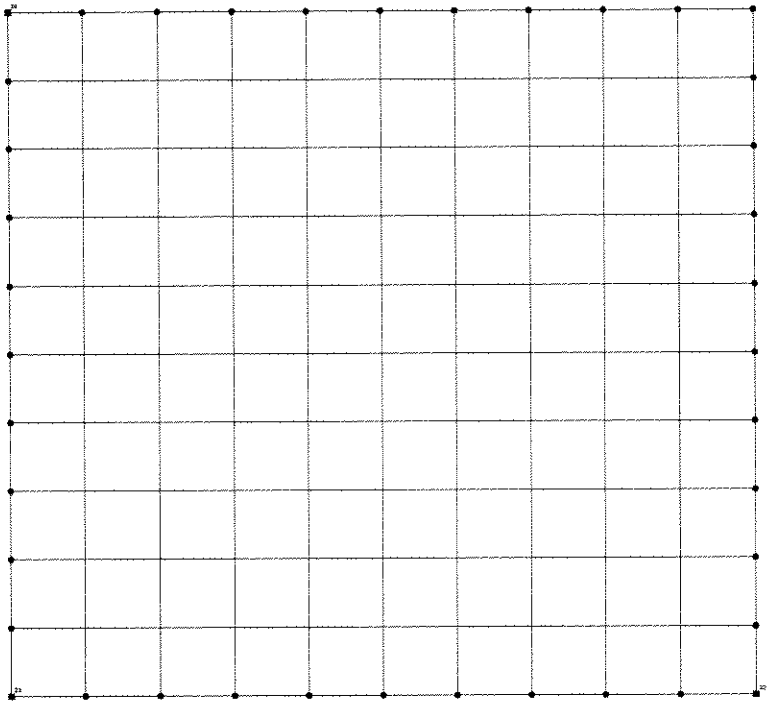

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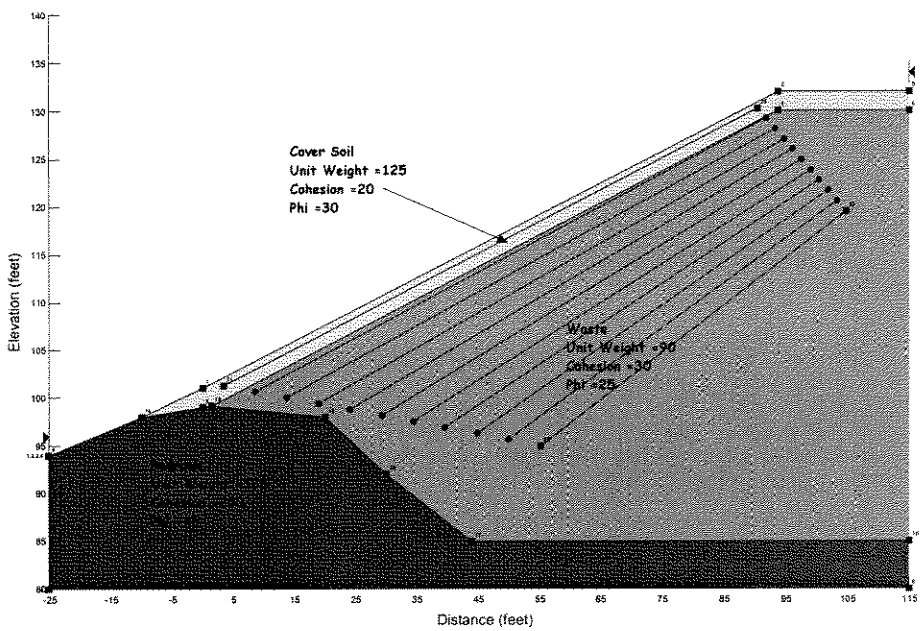
Long-Term
Drained Waste Parameters



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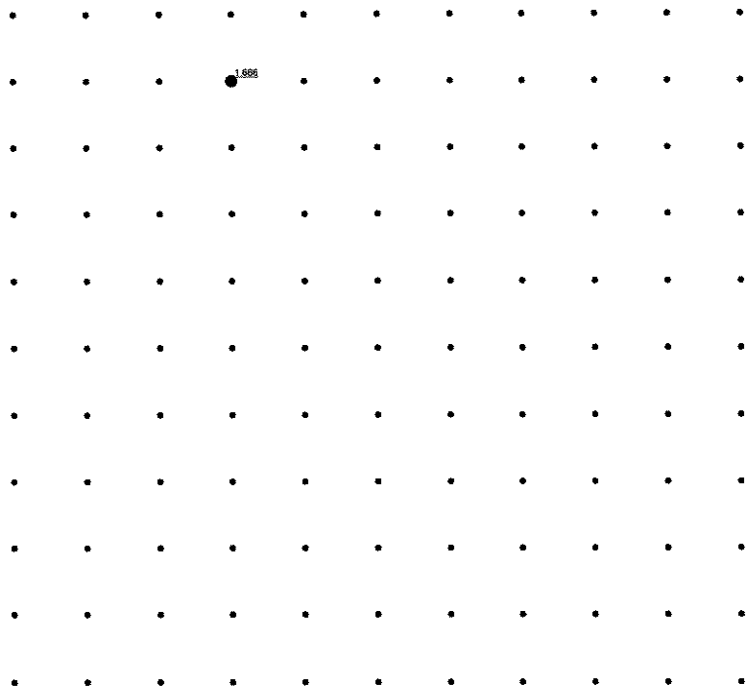

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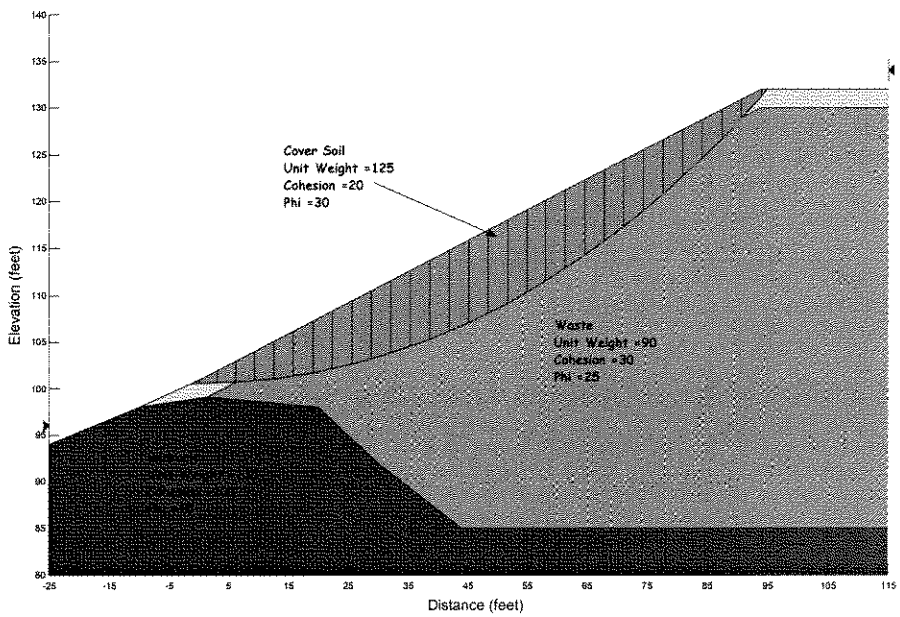
Long-Term
Drained Waste Parameters



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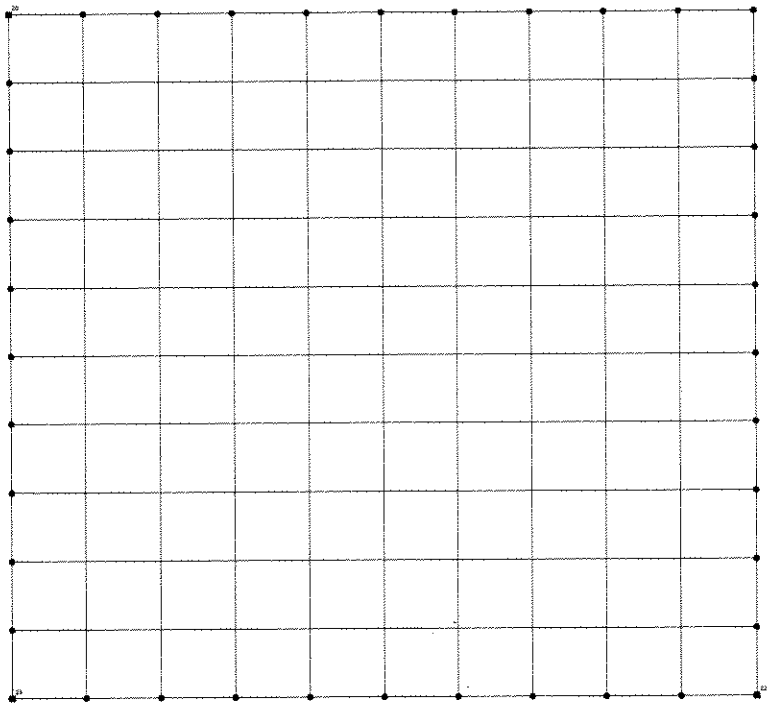
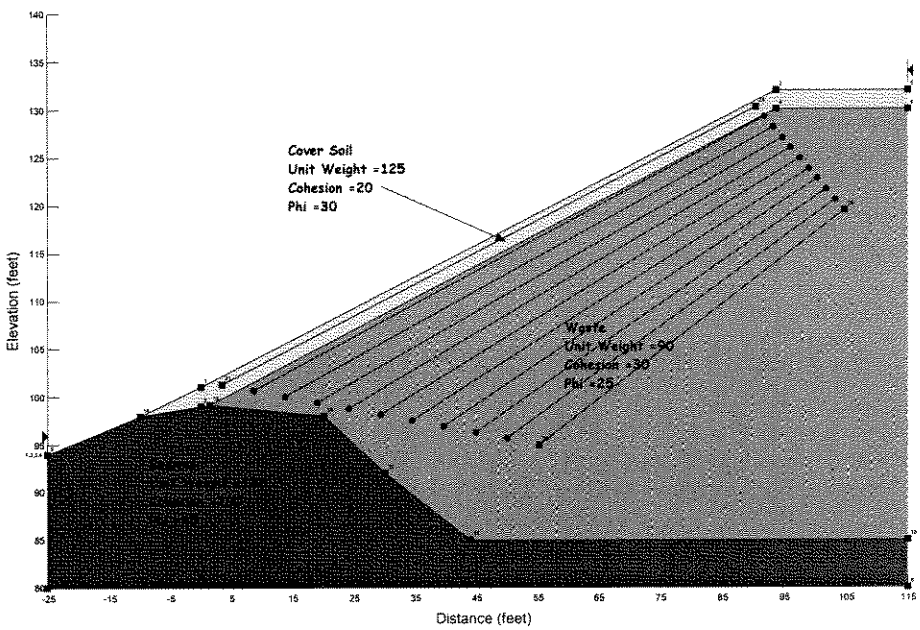


LANL
Long-Term
Drained Waste Parameters
With Seismic Loading
(Seismic Coefficient = 0.262g)



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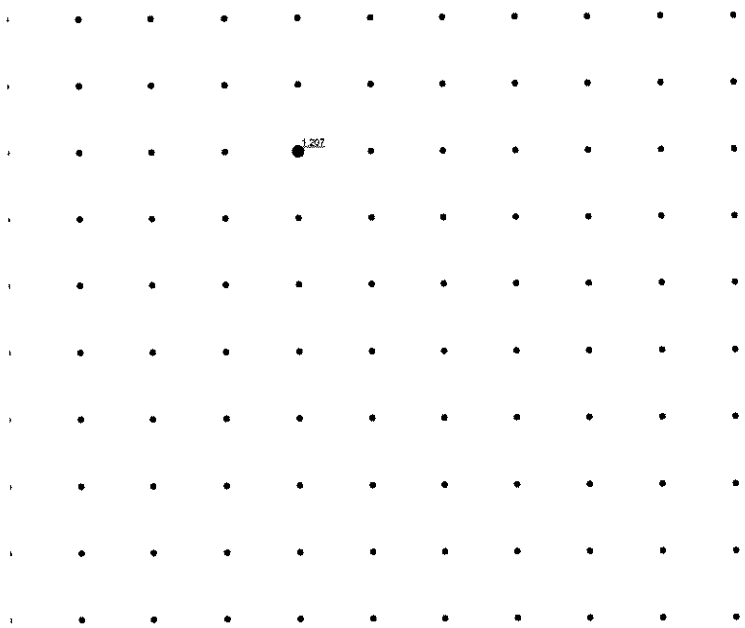
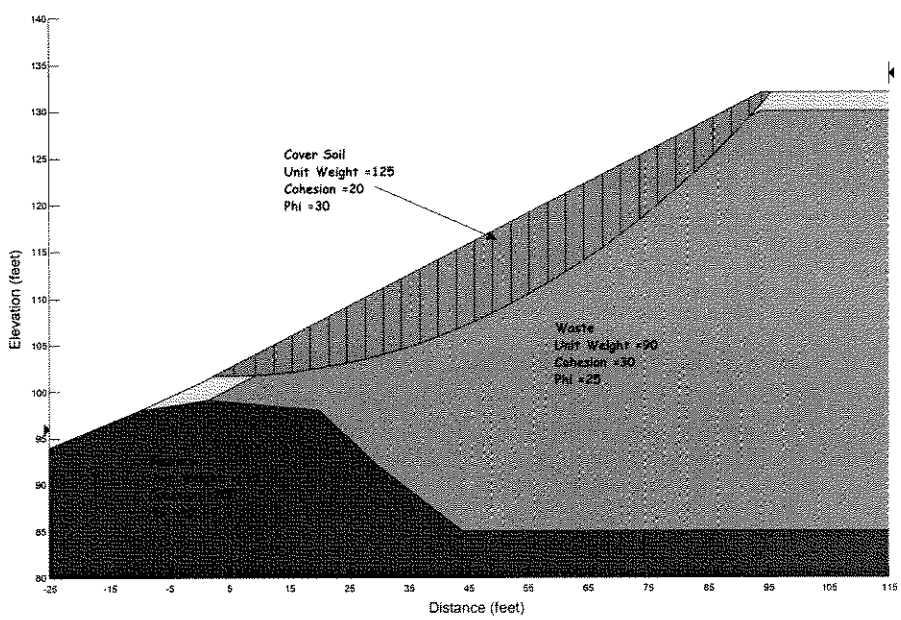


LANL
Long-Term
Drained Waste Parameters
With Seismic Loading
(Seismic Coefficient = 0.262g)



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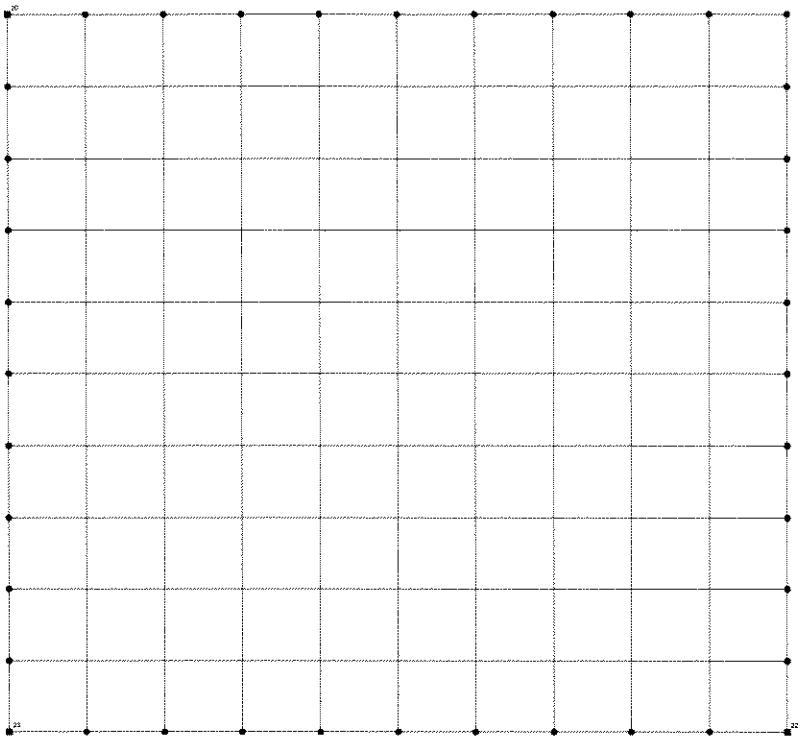

LANL
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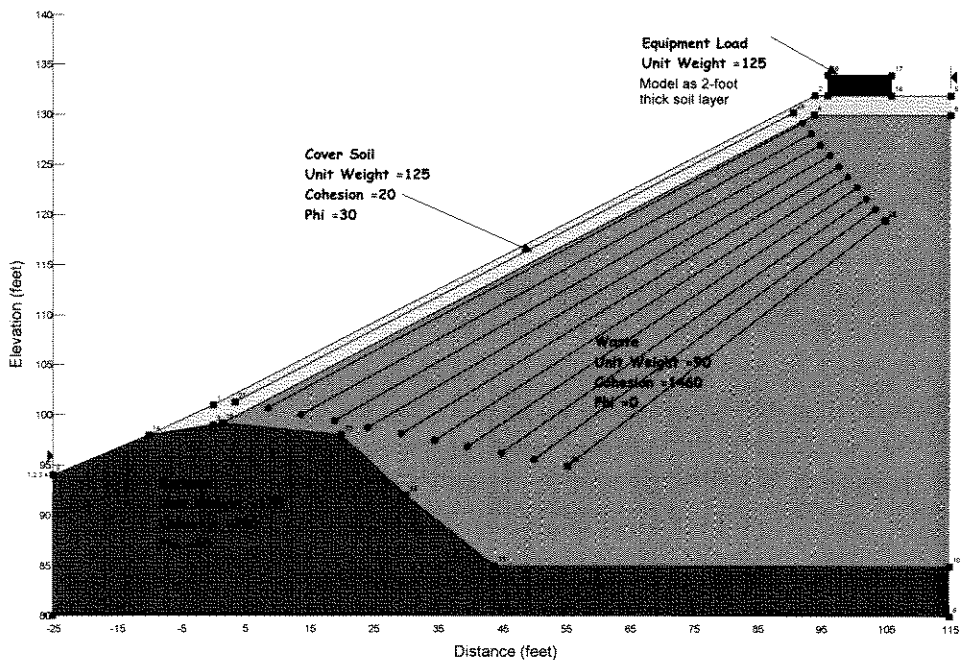
Undrained Waste Parameters



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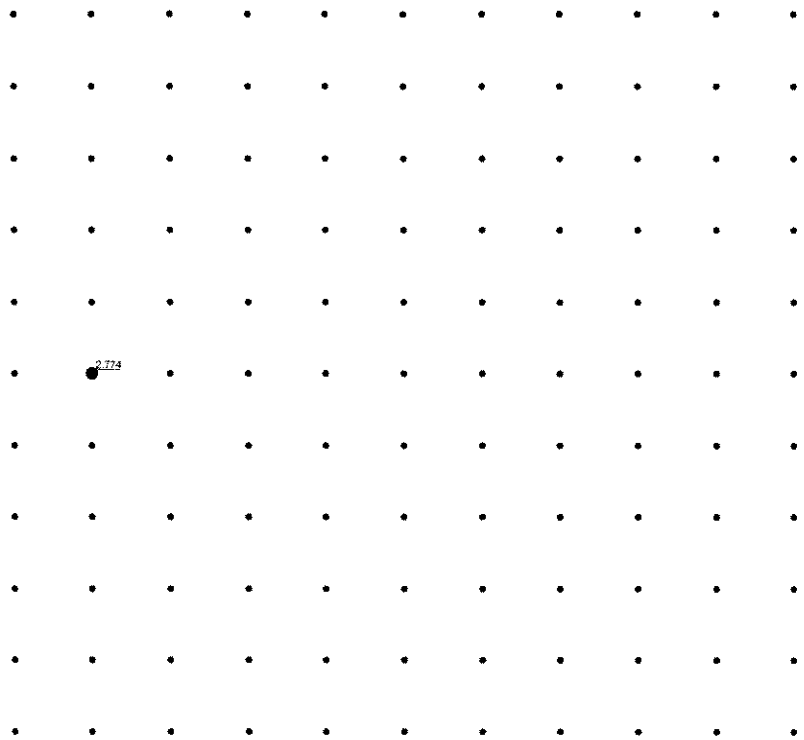

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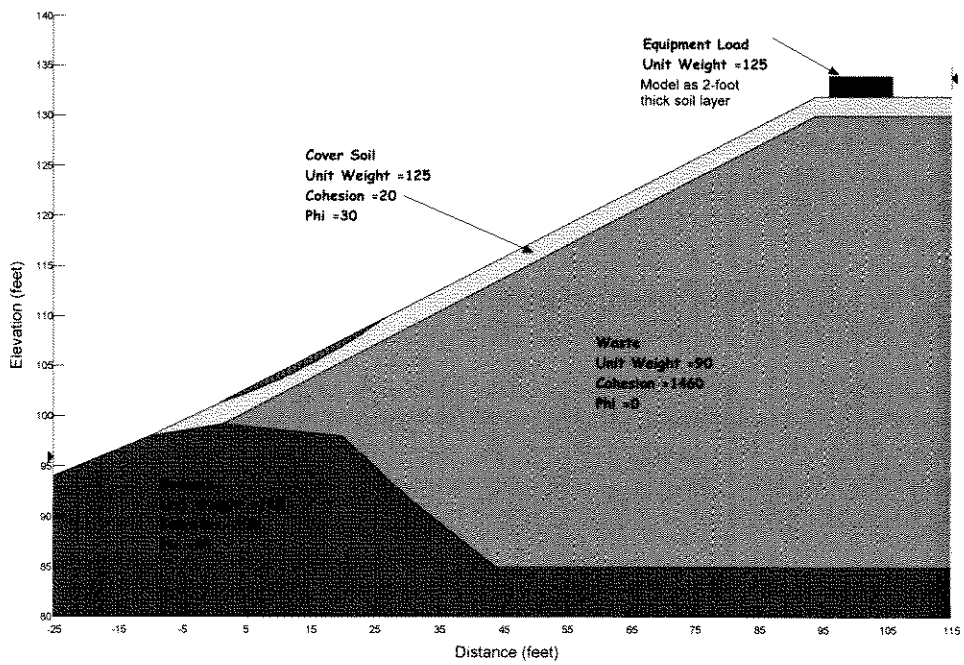
Undrained Waste Parameters



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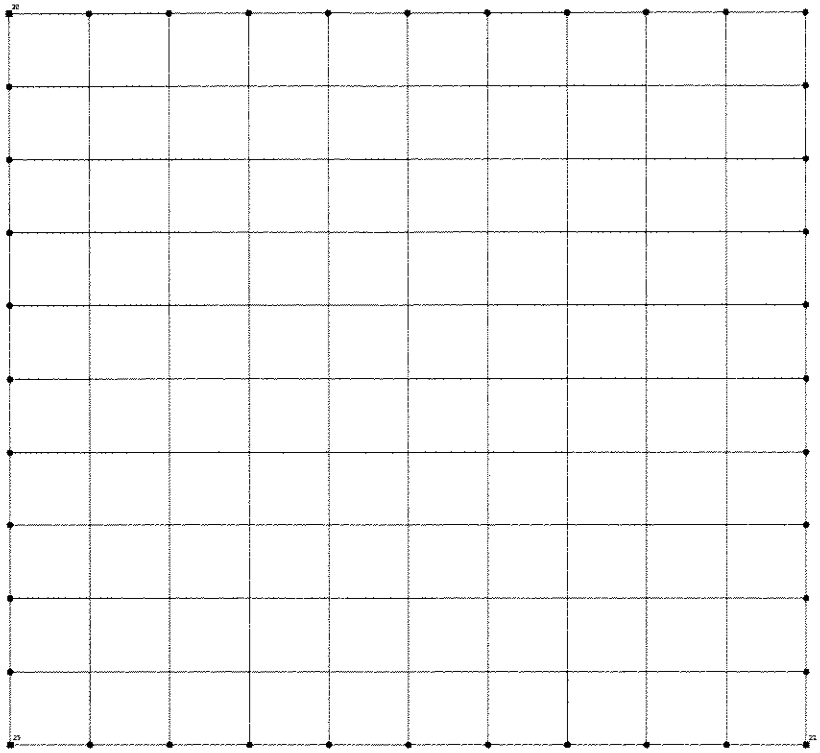
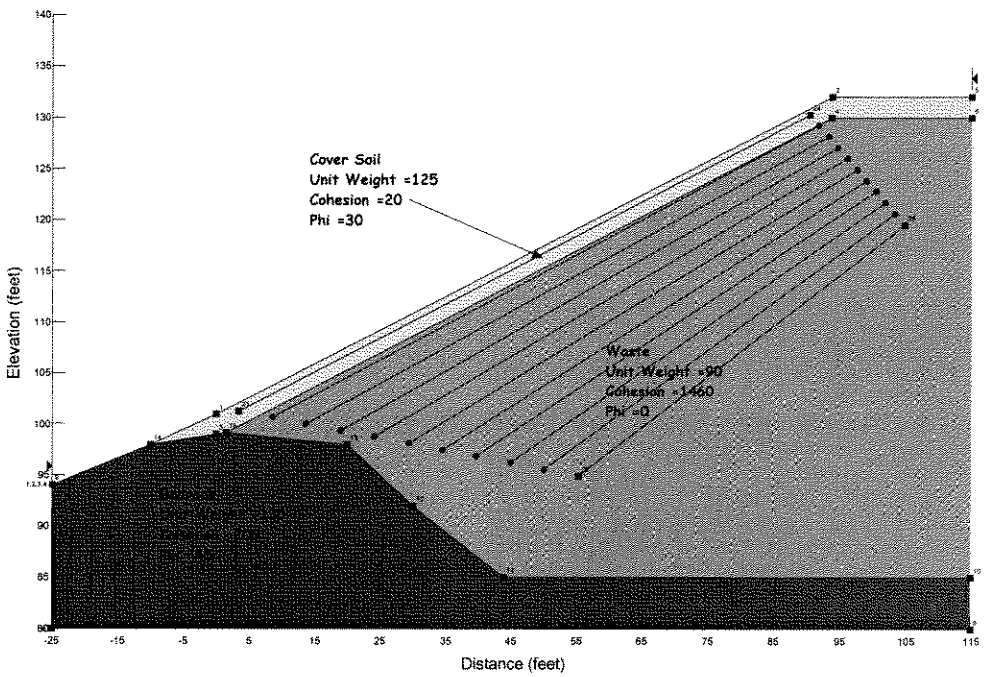


LANL
Long-Term
Undrained Waste Parameters



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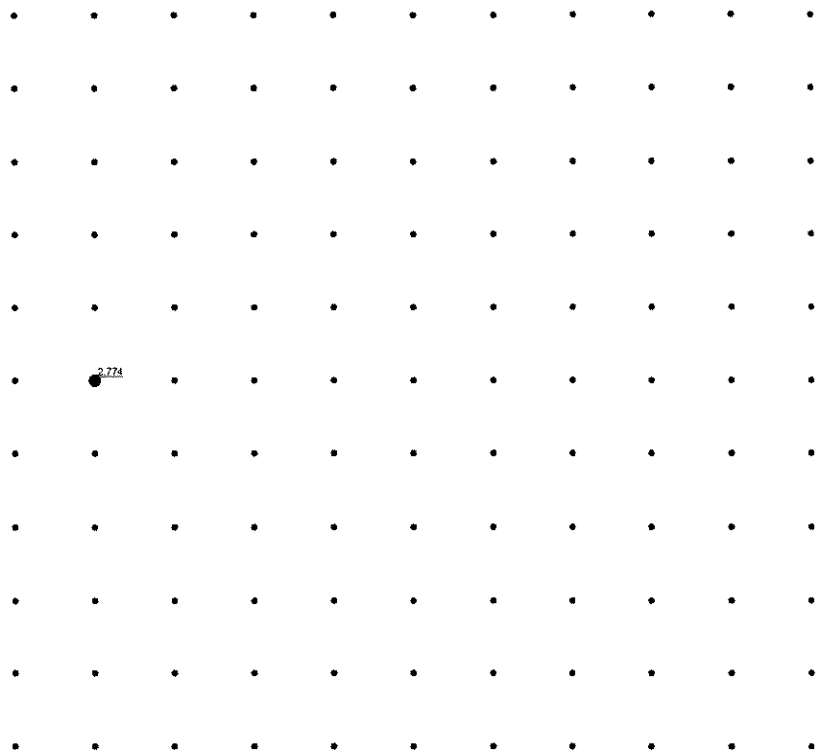
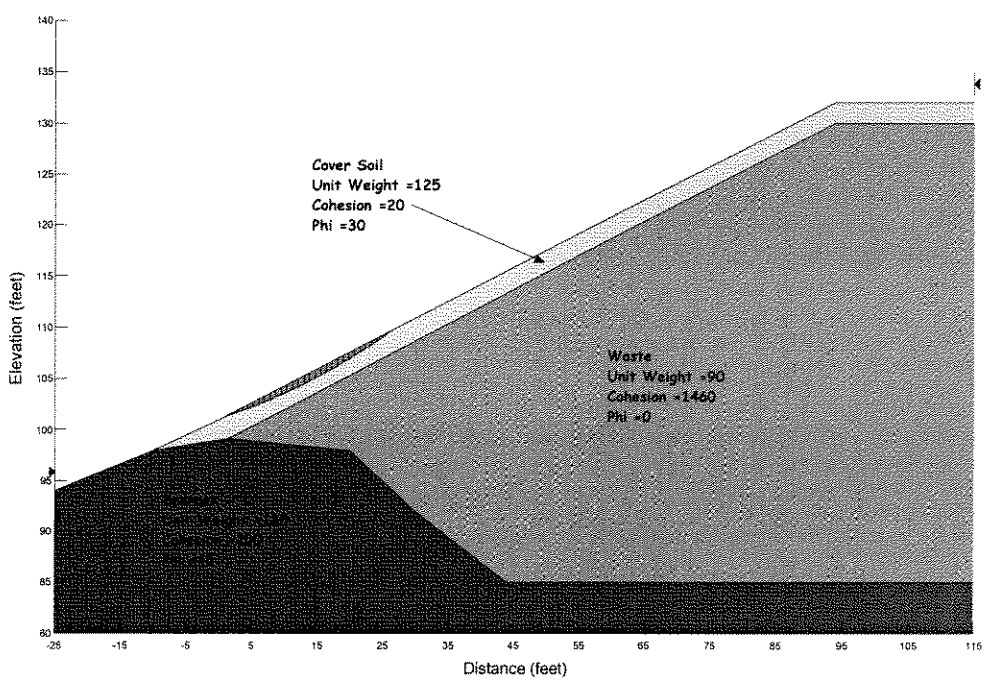


LANL
Long-Term
Undrained Waste Parameters



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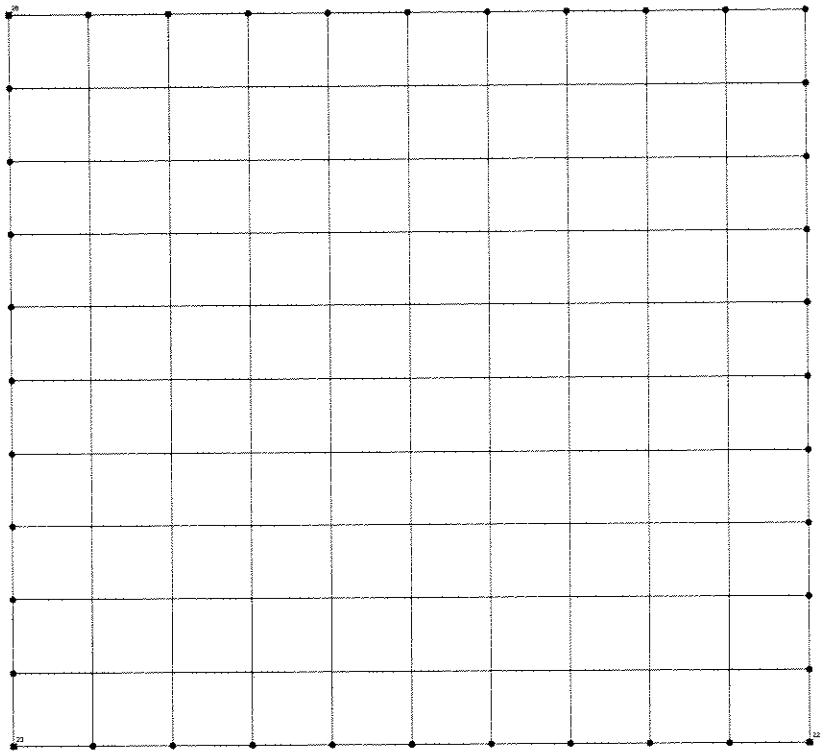
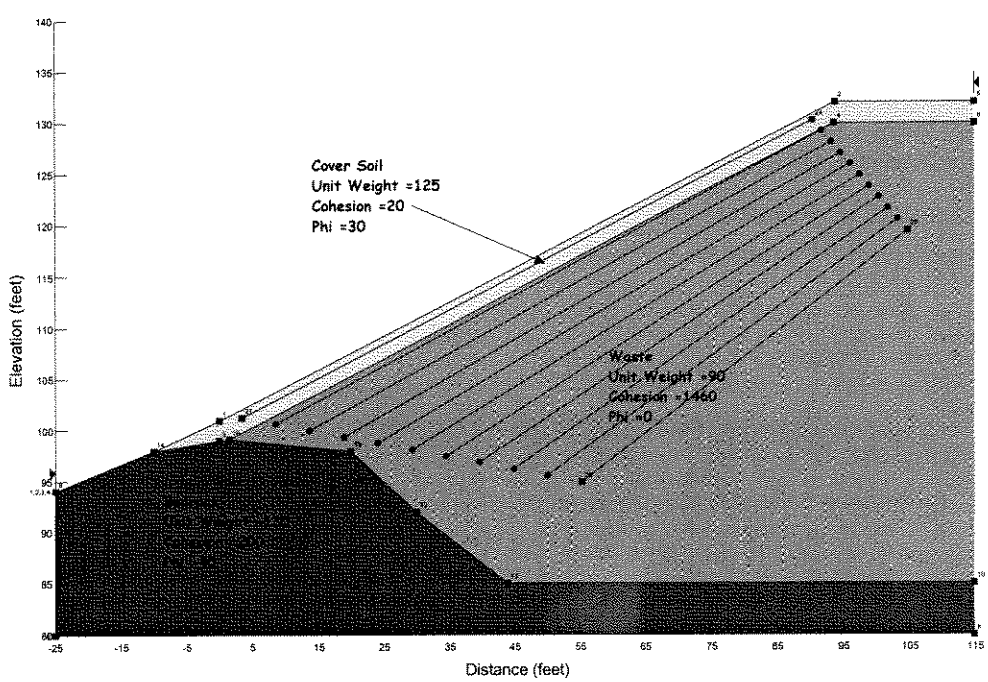


LANL
Long-Term
Undrained Waste Parameters
With Seismic Loading
(Seismic Coefficient = 0.262g)



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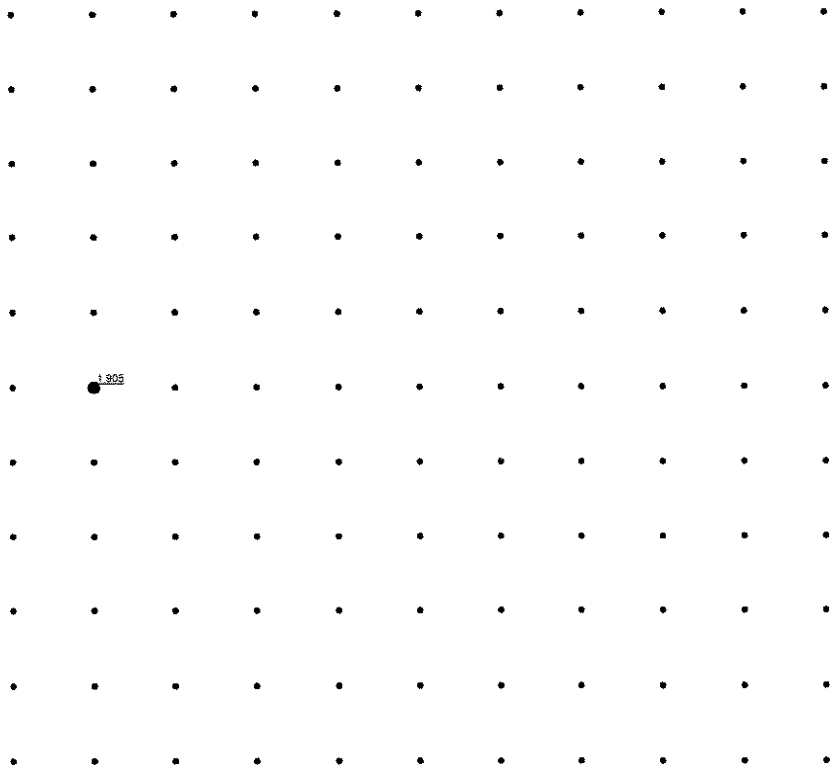
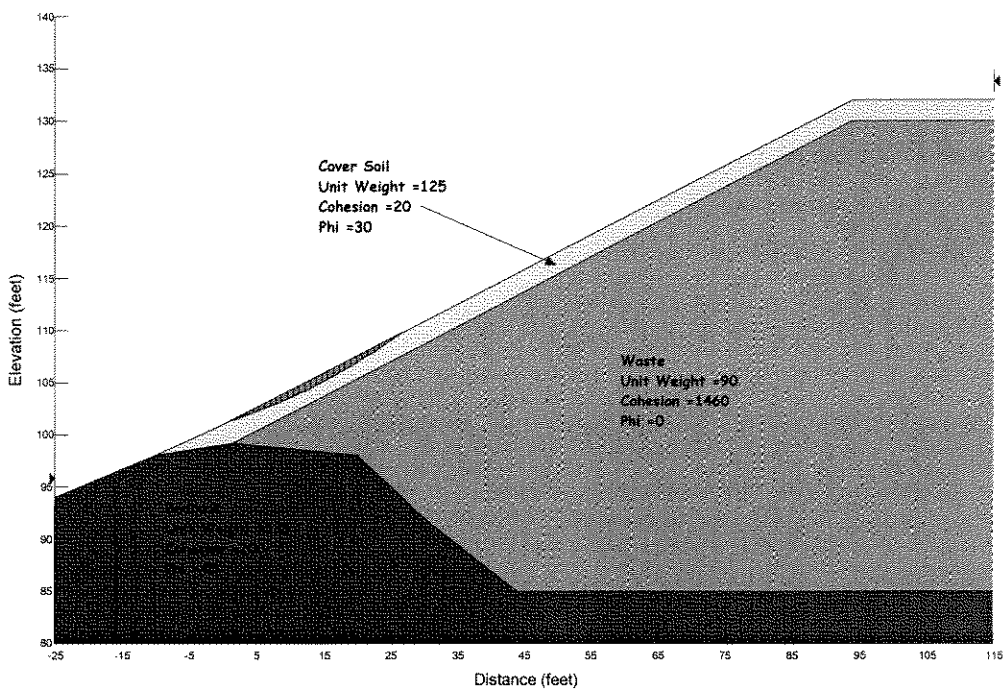


LANL
Long-Term
Undrained Waste Parameters
With Seismic Loading
(Seismic Coefficient = 0.262g)



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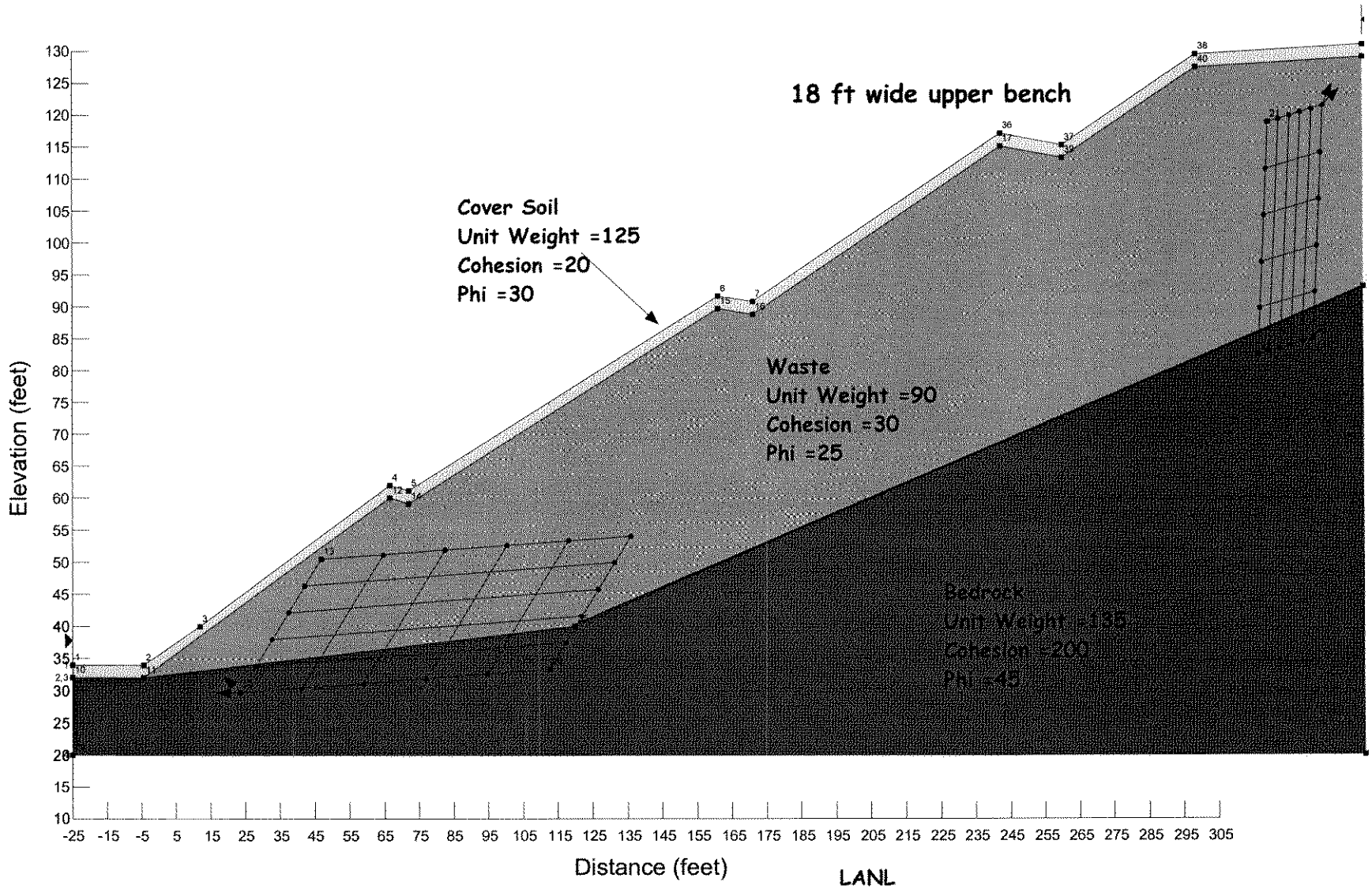
EAST SLOPE
PLANAR ANALYSES

LANL
Long-Term
Drained Waste Parameters



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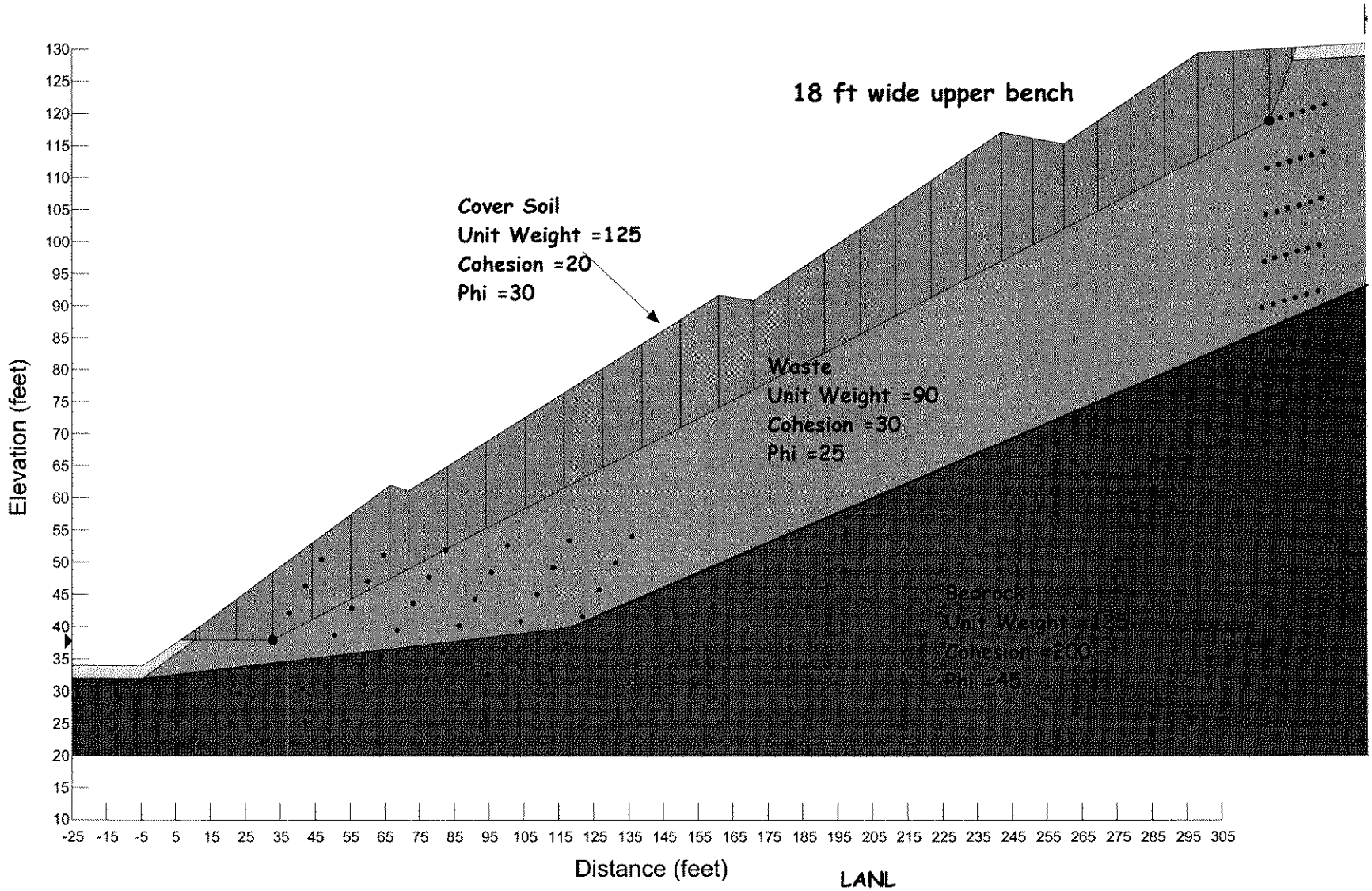
1.814

LANL
Long-Term
Drained Waste Parameters



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Long-Term
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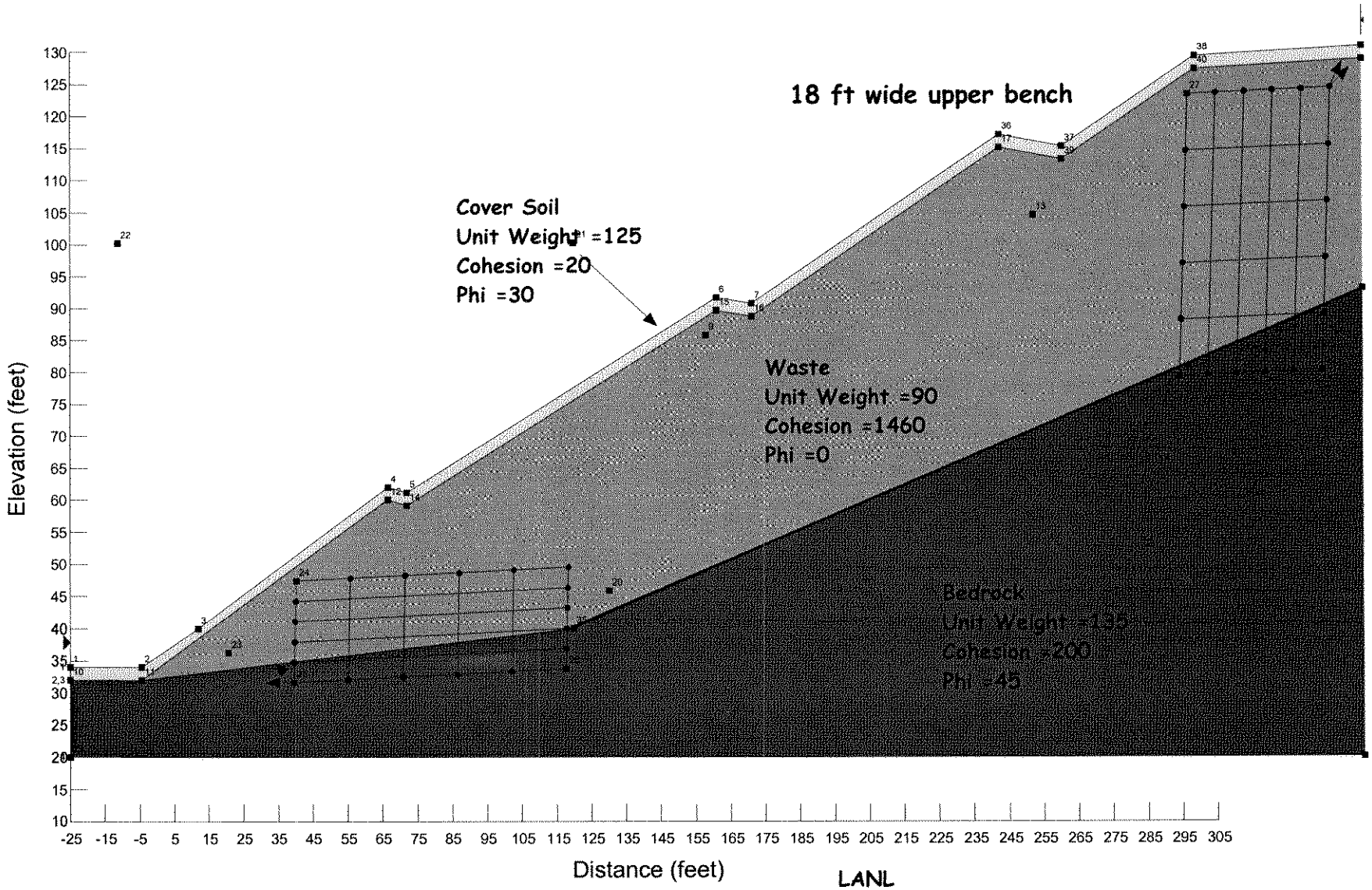

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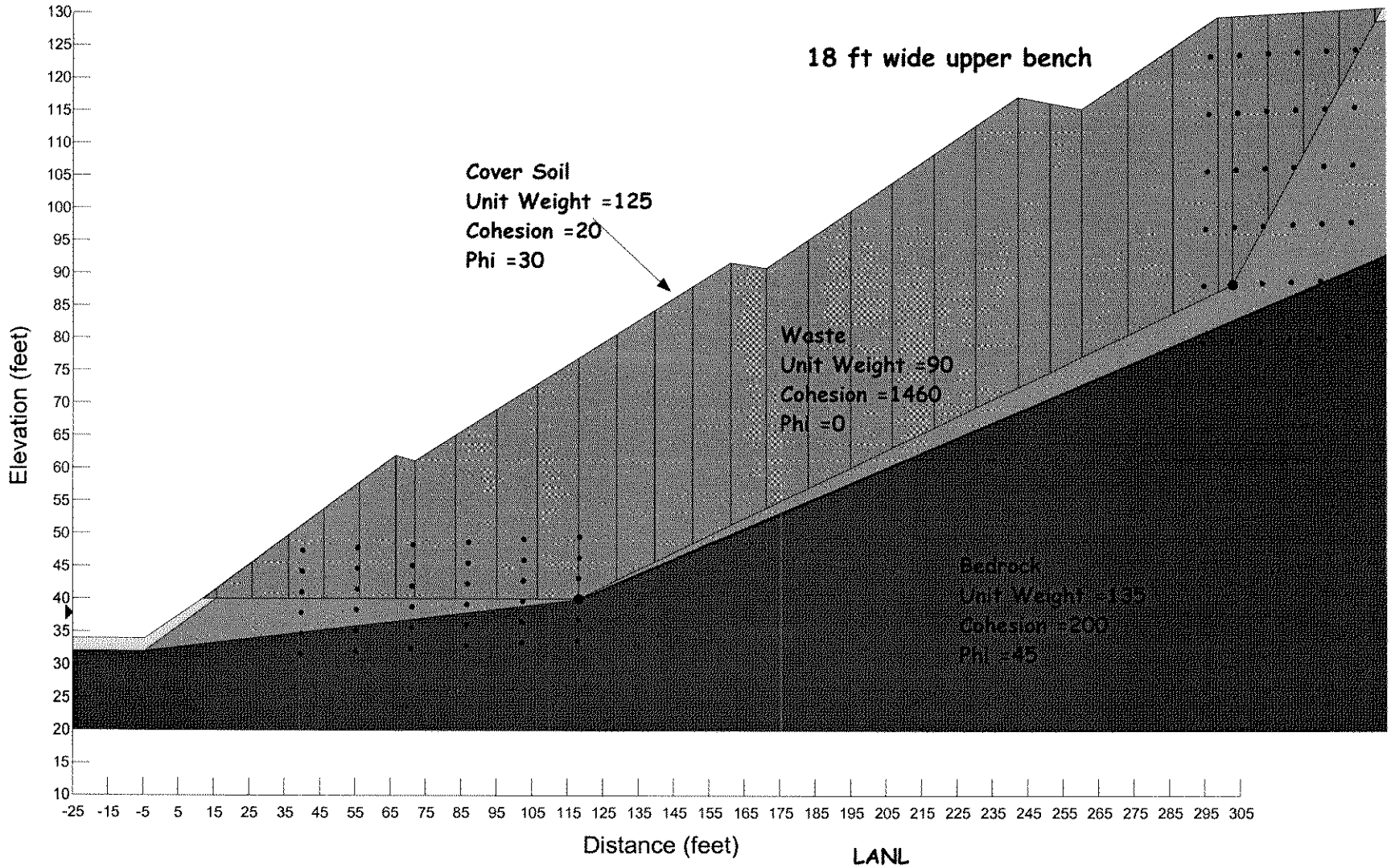
2.395

LANL
Long-Term
Undrained Waste Parameters



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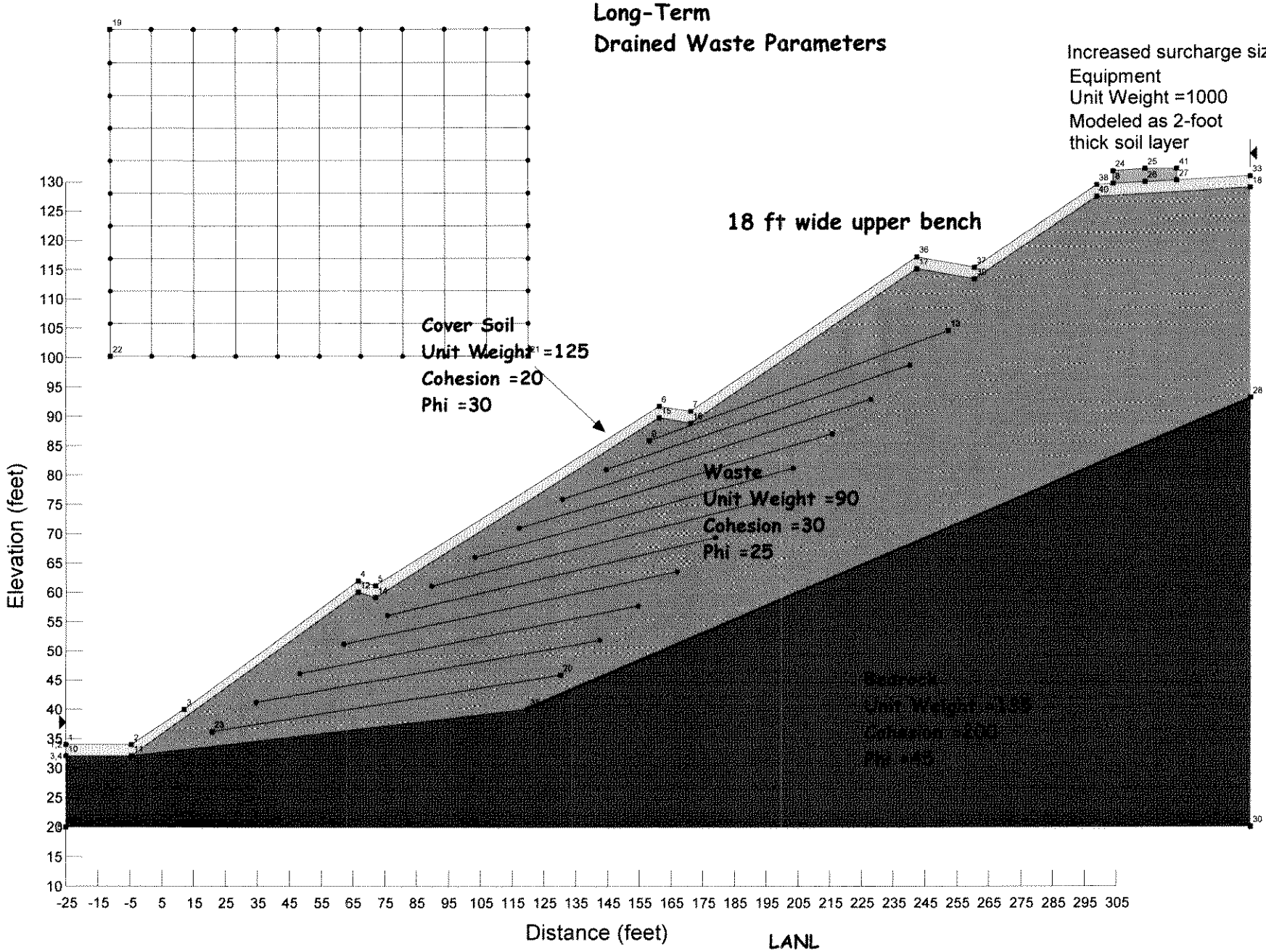
EAST SLOPE
INCREASED SURCHARGE LOAD

LANL
Long-Term
Drained Waste Parameters



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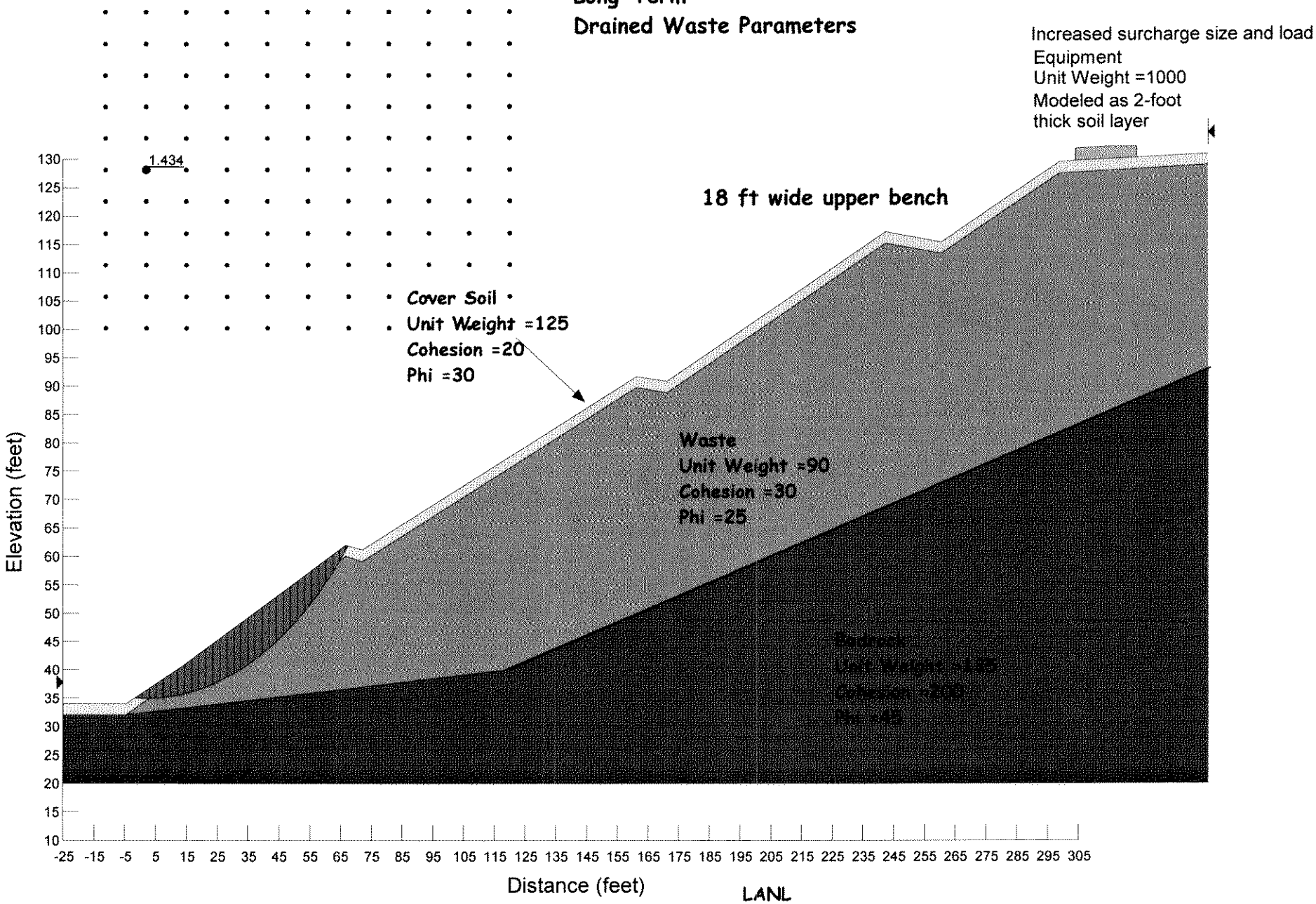
LANL
Long-Term
Drained Waste Parameters



LANL
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LANDFILL
GAS ASSUMPTIONS

LANDFILL GAS PRODUCTION SUMMARY
FOR LOS ALAMOS SITE OFFICE TA-73 AIRPORT LANDFILL

1.0 INTRODUCTION

This summary examines the regulatory and technical requirements for landfill gas (LFG) at the TA-73 landfill, and estimates quantities of LFG produced. The results are discussed in the context of previous methane measurements and calculations for the landfill. The report recommends LFG monitoring at the landfill boundaries only in the event that enclosed structures are built nearby; and recommends gas collection only in the vicinity of such structures in the event that the regulatory limit is exceeded based on monitoring results.

2.0 REGULATORY AND TECHNICAL REQUIREMENTS

Regulatory and technical requirements for the TA-73 Landfill Closure are identified in the Design Basis Document (DBD) (North Wind 2004). State of New Mexico statute NMAC 20.9.1.400.B.2 requires that the landfill owner/operator prevent the generation and lateral migration of methane gas such that gas concentration does not exceed 25% of the lower explosive limit (LEL) in structures and at the property boundary. The TA-73 Airport Landfill is subject to these rules. New Federal regulations limit the amount of volatile contaminants that can be emitted from larger, newer landfills, but due to the age of the TA-73 Airport Landfill, it is exempt from this rule. Additionally the estimated in-place tonnage of 268,400 tons is less than the 2.75 million ton regulatory threshold.

The only applicable regulatory requirement is therefore to prevent the horizontal underground migration of the gas onto adjacent properties at concentrations exceeding 25% of the LEL. The lower explosive limit for methane in atmospheric air is 5% by volume.

Technical requirements relevant to LFG include mitigating effects on the landfill closure cover vegetated surface. The Voluntary Corrective Measures (VCM) Plan (LANL 2002) cites the potential for vegetation stress due to development of anoxic conditions in plant root zones resulting from migration of LFG.

3.0 GAS GENERATION ESTIMATES

The estimation of LFG generation rates is not an exact science. No two landfills are alike, and the many factors that affect LFG production can vary significantly over time, from one site to another, and even from place to place within the same landfill. A variety of methods are used to estimate LFG generation, including computer models, mathematical calculations, observed readings and empirical estimates.

Anaerobic bacteria that consume organic matter in refuse produce landfill gas. It is composed primarily of methane (about 55%) and carbon dioxide (CO_2, about 45%) (SWANA). Methane is a colorless, odorless, flammable and potentially explosive gas. In addition to methane and CO_2, other major gases that may be present include oxygen, nitrogen, and water vapor, traces of hydrogen and many other trace gases including volatile organic compounds (VOCs). Oxygen and nitrogen are usually present because of air in the landfill. The LEL for for methane in atmospheric air is 5% by volume.

Landfill gas production usually begins as early as six months after waste is deposited and continues for many years after waste is accepted at the landfill. Typically, by the time waste is about 20 years old, gas generation significantly decreases as the amount of organic matter available for decomposition diminishes.

The rate of landfill gas generation and resulting migration is dependent on the physical characteristics of the waste (e.g., volume, type, age, moisture, pH, temperature, and compaction) and the landfill design (configuration, containment setting, geology, climate, cover material, and liner system). LFG migrates either horizontally or vertically based on the path of least resistance, by means of either pressure-driven flow (convection) or diffusion (diffusive flow). The gas migrates by either or both convection or diffusive flow in an attempt to reach ground surface and disperse into the atmosphere or collection systems.

An estimate of the amount of LFG generated by the landfill (SWANA 1993) is required to properly evaluate the need for gas collection to control migration of the potentially flammable and explosive gases, and to design an extraction system if needed. The empirical calculation of LFG production rate presented in the following subsection seeks to estimate the probable maximum and minimum landfill gas generation rates over time. Empirical estimates are often more accurate than theoretical models or equations since the estimates are based on parameters derived from actual refuse degradation and gas generations observed in landfills and laboratory analyses. A probable average generation rate can also be suggested based on a broad interpretation of contributing factors such as moisture, pH, refuse age, input rate, compaction, etc. Calculations are based on the approximate tonnage in the landfill. The landfill is evaluated based on its environment and is not compared to other sites. The calculations provide probable best and worst-case conditions.

3.1 Models and Equations

LFG models and equations are based upon an assumption that each truckload, ton or cubic yard of refuse generates an equal quantity of LFG at a consistent but ever decreasing rate over a specific period of time. A "gas generation curve" can be plotted by entering an actual or assumed refuse input rate and an assumed gas generation rate that decreases over time. However, this does not take into account the many variables that determine actual gas generation rates, such as moisture content, pH or composition of the refuse stream itself, nor have such models been verified by comparing predicted generation with actual results. In the few cases where comparisons have been made, correlation has been poor.

3.2 Factors Affecting LFG Generation

Composition, compaction, age, and placement of refuse are factors affecting LFG generation. Although these factors are known to have an impact on LFG generation rates, no precise quantifiable relationships have ever been established. The effect of these factors can therefore only be expressed in broad, general terms. Assumptions for the TA-73 airport landfill are presented below.

Composition and Compaction: The Voluntary Corrective Measure (VCM) Plan (LANL 2002, ER2002-0359) states the TA-73 airport landfill accepted typical municipal sanitary solid waste (MSW), construction debris, and laboratory waste. It is assume the waste was placed and compacted in a typical manner using heavy equipment (bulldozers and track loaders). There is no evidence of heavy liquid or hazardous waste placement. The typical composition of the refuse would result in an average gas production rate, whereas the lighter compaction density might result in more exposed surface area within the refuse and therefore more rapid decomposition of organic material during the early years, leaving even less material to generate gas currently.

Age and Placement of Refuse: The VCM Plan (LANL 2002, ER2002-0359) indicates the TA-73 airport landfill began receiving waste in 1943 and ceased accepting waste 1973. The landfill covers a surface area of approximately 11.5 acres, and the VCM Plan calculated the volume of waste as approximately 536,800 cubic yards (cy). The landfill is 30 to 60 years old, and therefore probably now produces LFG at a lower than average rate due to the fact that much of the organic refuse has already decomposed, leaving less material to generate gas.

Total Tonnage Estimate Based On VCM Plan Waste Estimates:

Using the formula A x B = Tonnage

Where:

A = Volume of waste = 429,400 cy

B = A constant to convert cy to tons = 1000 lb/cy / (2000 lb/ton)

A x B = (429,400 cy) x (1000 lb/cy / (2000 lb/ton)) = 214,700 Tons

A total of 214,700 tons is the value used for further calculations.

3.3 Estimated Ranges of Gas Generation Rates

Published material (SWANA 1993) estimates the theoretical range of LFG production rates from a low of 0.02 cubic feet of LFG per pound of refuse per year in standard cubic feet per pound per year (scf/lb yr) in small, dry sites, to a theoretical high of 0.14 scf/lb yr in large, new sites in very rainy areas. The maximum rate observed in the field at a number of operating LFG recovery facilities typically does not exceed 0.10 scf/lb yr.

The LFG production rate is not the same as the total LFG production volume, which is primarily dependent on the total volume of refuse, and can range from 1.0 scf/lb to 7.0 scf/lb generated over a 10 to 100 year period. Only the rate of production of gas volume is significant in the evaluation or design of LFG control systems.

Maximum Estimated LFG Production Volume

The maximum estimate LFG production volume was calculated as follows:

Using the formula (A x D x L) / y = Maximum LFG Production Volume, where:

A = Amount of waste (estimated) in tons;
D = Conversion of waste tons to pounds;
L = LFG production rate, assume maximum rate = 0.10 scf/lb yr;
y = Days per year.
A x D x L / y = (214,700 tons x 2,000 lb/ton x 0.1 scf/lb/yr)/(365 days/yr)
= 117,644 scfd

Converted to standard cubic feet per minute (scfm)

117,644 scfd/1,440 minutes/day
Maximum LFG production volume = 82 scfm

The maximum estimated gas production volume for the TA-73 Airport Landfill, under ideal conditions with fresh refuse, is 82 scfm. It also represents the size requirement for maximum gas collection.

Minimum Estimated LFG Production Volume

The minimum estimated LFG production volume was calculated using the same approach with the landfill production rate (L) assumed to be the minimum found in published literature, equal to 0.02 scf/lb/yr. Using this minimum L value, results in a rate of 23,529 scfd or 16 scfm for the minimum probable estimated gas production volume for this site. As the landfill ages, it decreases toward these production levels. This minimum volume also represents the lower end of the required operating capacity range for the LFG control system equipment.

Estimated Midrange LFG Production Volume

The estimated midrange estimated LFG production volume can be calculated similarly using an LFG production rate of 0.06 scf/lb/yr, resulting in an estimated production volume of 70,586 scfd or 49 scfm. This provides a working figure based on a conservative midrange of potential estimated gas production for the TA-73 Airport Landfill.

3.4 Summary of Estimated Ranges of Gas Generation Rates

Table 1 summarizes the estimated production volume calculations and the gas generation rates presented in Appendix H of the VCM Plan (LANL 2002, ER2002-0359). The lower than average gas generation rate may be due to the refuse's age, placement, and compaction at the TA-73 Landfill. . Composition content appears to be average for a site of this size and age. Moisture content appears to be below average for a site of this size and age, and the effect of these factors supports an average to below average LFG production rate from waste decomposition.

Table 1. TA-73 Airport Landfill Gas Generation Rates

Landfill Volume (cy)	Waste Density (lb/ton)	Waste Volume (tons)	LFG Generation Range (ft^3/min)	Average LFG Generation (ft^3/min)	LFG Collection Efficiency Range (%)	LFG Collection Efficiency Range (ft^3/min)
Total Landfill – Estimated based on published literature values						
429,400	0.5	214,700	16 - 82	49	45% - 65%	22 - 32
Year 2002 Landfill Gas Generation Rates – VCM Plan						
429,400	0.5	214,700	19.06[a]	--	--	19.06[a]

Notes:
LFG = Landfill Gas which consists of methane (40-60% by volume), carbon dioxide (30-50% by volume), oxygen (0.1-1% by volume), and nitrogen (0-12% by volume)
[a] This is the Year 2002 Total LFG generation rate for the entire landfill

4.0 GAS GENERATION MEASUREMENTS

Gas concentrations and generation rates were measured during the RFI and reported in the RFI Report (DOE-LANL 1998). Figure 2.3.5.1-5 shows the estimated lateral extent of methane in soil gas. The figure shows that the methane plume is bounded on the north at the property boundary, with no methane observed in soil gas monitoring locations LPS-1 and LP-8 on the shelf at the edge of Pueblo Canyon. The plume is bounded on the west with no methane observed in soil gas monitoring locations LP-9 and LP-5. The west end of the plume is shown as more than 100 ft from the nearest existing airport hanger. The plume is not bounded on the south by monitoring wells but is inferred to extend under the runway but short of the southern property boundary. The plume is bounded on the east by soil gas monitoring location CP-1, about 100 ft from the nearest property boundary at the edge of Pueblo Canyon.

Figure 2.3.5.1-6 shows the vertical extent of the methane in soil gas. Concentrations generally decrease with depth and range from non-detect in the underlying tuff to 59% by volume in the waste zone in LI-2 near the center of the landfill. The inferred depth of the plume is over 200 ft below ground surface (bgs).

Concentrations are observed to fluctuate seasonally, with apparent increases during spring and summer. These increases are believed to correlate to increasing subsurface temperatures and thereby increased microbial methane production.

The VCM Plan (LANL 2002) reported indeterminate correlation between areas of high methane in soil gas and stressed vegetation, as evidenced by rooting depth observed in trenches and plant density. The report concluded that while areas with high methane exhibited stressed vegetation, bare ground or reduced rooting depths, other factors including soil chemistry, thickness of the soil profile and soil physical characteristics may control vegetation density. For example, two locations showing high methane and sparse or moderate vegetation also showed reduced cover thickness (1-1.5 ft) and were located in areas of subsidence, where ponding of water for extended periods could also promote anoxic conditions. All areas with abundant or thriving vegetation showed no methane in the root zone, however.

5.0 GAS COLLECTION EFFICIENCY

The collection efficiency of a landfill gas collection system is measured by the percentage of generated LFG that it can draw from the refuse without drawing air. The lower end of the collection efficiency range may be 50% or less for small landfills with compacted earthen covers. Since air is easily drawn through a loose earthen cover, less vacuum can be applied. This lower vacuum, combined with the lowered porosity of the refuse due to moisture infiltration results in less gas being drawn and lower collection efficiency.

The upper end of the collection efficiency range can exceed 90% for large landfills with geomembrane caps that preclude air and water intrusion. The highest collection efficiencies can be achieved by installing wells in a matrix ("checkerboard") layout with a maximum spacing of 300 feet, and by sealing wells and other points of air entry into the refuse.

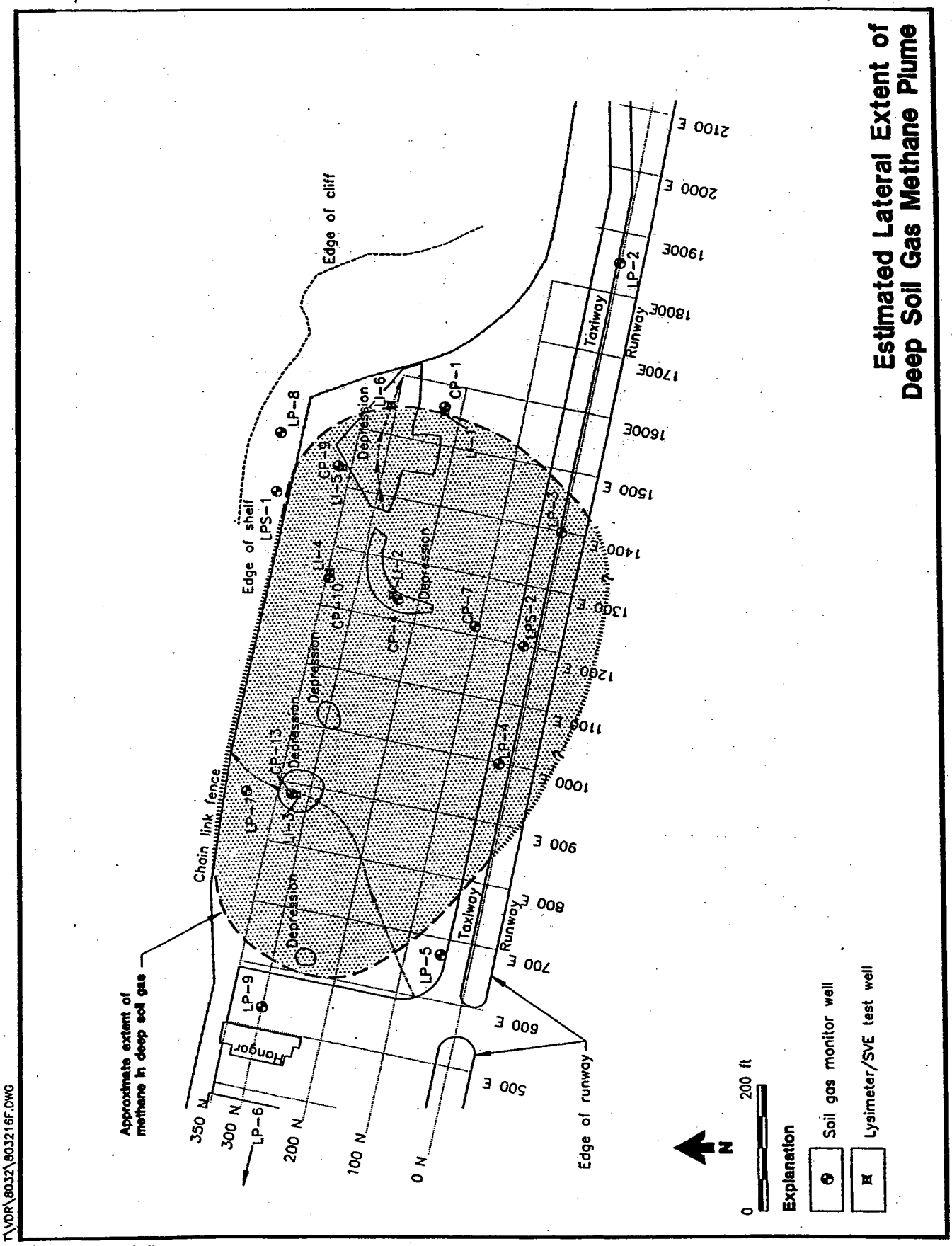


Figure 2.3.5.1-5

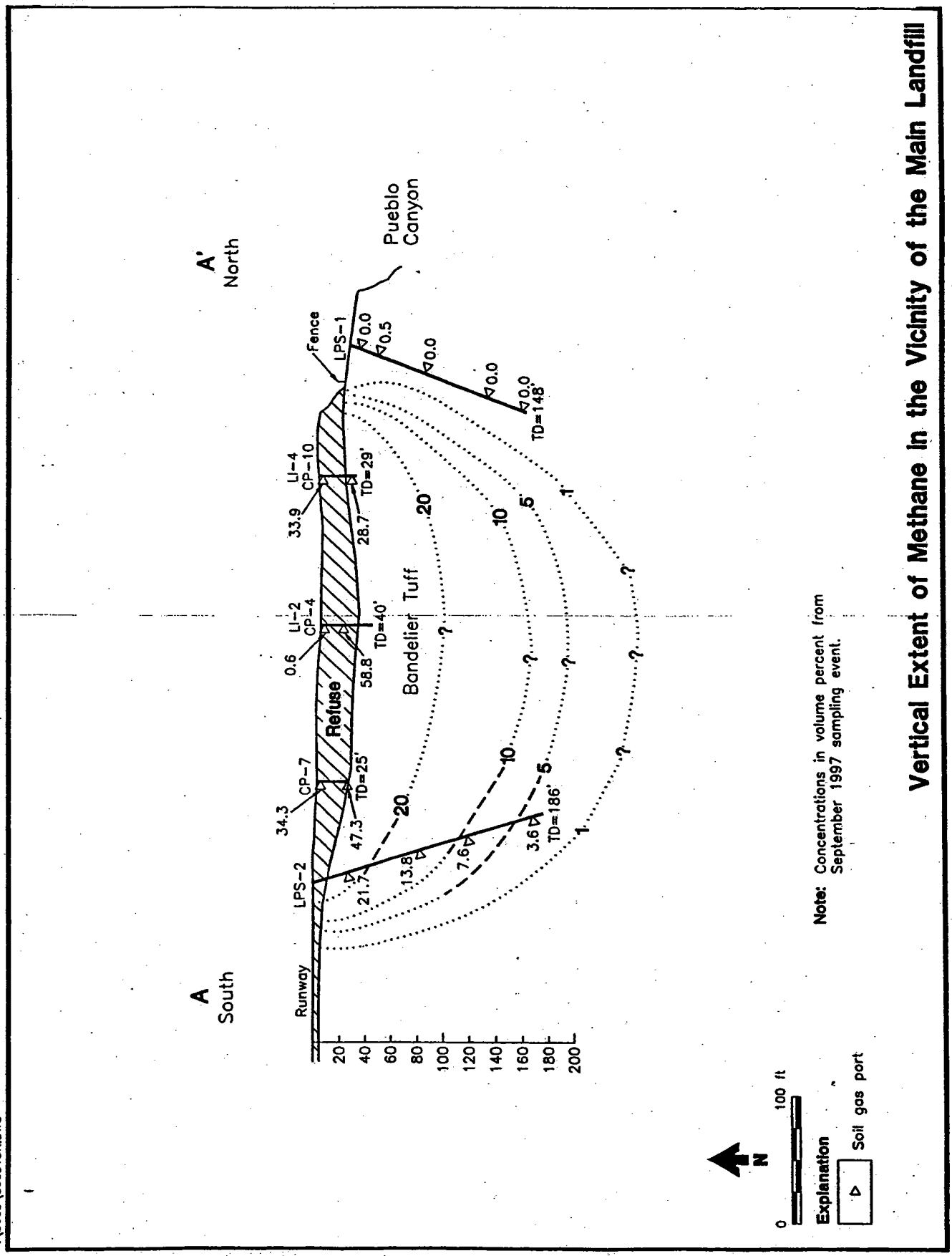


Figure 2.3.5.1-6

The estimated collection efficiency for the TA-73 Airport Landfill depends on several factors. The collection efficiency is reduced due to the lack of liner in the landfill to preclude drawing air from the surrounding loose soils. Based on these factors, the collection efficiency of the landfill is estimated at 45% to 65%, and the average gas generation production volume of 49 scfm results in a probable gas collection volume of 22 to 32 scfm.

If the final cover material, such as compacted soil, is impervious enough to slow or block the escape of the LFG, the gas will build up in the voids in the refuse from top to bottom, seeking another path of least resistance to follow. If such a path is found through adjacent soils, the gas may travel underground for some distance before rising to the surface. If it enters an enclosed space, the methane component of the gas can be explosive or flammable under certain conditions.

Passive or active systems may be used to control the gas. When used for migration control, passive control systems rely on pressure gradients to move gases toward wells, trenches or other vents placed around the perimeter of the refuse as a means of interdicting horizontal gas flow. Continuous trenches with membrane barriers on their exterior wall are the best passive control for venting gas to the atmosphere while blocking its further movement off site.

Passive vents placed in the refuse may reduce the pressure gradient that causes migration by allowing gases to vent more freely when there is an impervious cover. This may also raise the potential for increased odor emanating from the landfill. There is far too little LFG generated by the TA-73 Airport Landfill for a passive system to affect any significant change in horizontal migration.

Active control systems use wells, pipes and blowers to physically collect and remove the gas under vacuum before it can move into an unwanted area or carry odors and contaminants into the atmosphere. Collection wells are placed in the interior of the landfill, and the gas is carried to a flare station, where it is burned. Typical systems operate at systems that can produce LFG between 200 to over 2000 scfm. Landfills with production rates of between 20 and 200 scfm are marginal at best in maintaining full time operation of a flare for the purposes of controlling LFG. The TA-73 Airport Landfill is in the lower end of LFG production (16 to 82 scfm) and is not likely to benefit from the installation of an active or passive collection system.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The New Mexico Solid Waste Management Regulations (NMAC 20.9.1.400.B.2) require that methane not exceed 25% of the lower explosive limit (LEL) in structures and at the property boundary. Soil gas measurements indicate that the methane plume is entirely contained within the property boundary, and is more than 100 ft from the nearest structure, which is not enclosed. Therefore the regulatory requirements for this landfill are met in it's current configuration. The final closure cover will not include an impermeable membrane and therefore the lateral extent of migration is not expected to increase significantly.

The overall effect of the final closure cover will be to reduce infiltration of precipitation, thereby also reducing gas generation rates as the waste dries over time. Methane oxidation occurs aerobically in the root zone in soils and the cover should thereby provide an additional methane control function. High concentrations of LFG near the ground surface for long periods of time can stress vegetation by displacing oxygen in soil gas, however the extent to which this may occur at the TA-73 landfill is expected to decline after a thicker, more uniform cover is established over the waste and gas generation rates decline.

The age of the waste placed in the landfill indicates that the generation rate of LFG is past its prime and will either remain at the same generation rate or continue to decrease over time. This is confirmed by in the VCM Plan (LANL 2002) (Appendix H, Figure 2). The explosive component of LFG is methane that is typically 40-60% of landfill gas. The above calculations result in methane generation in the range of 10 scfm to 22 scfm. Landfill gas collection would be inefficient under either active or passive conditions at this generation rate.

There is no evidence that LFG is the source of any VOC contamination in groundwater. Depth to groundwater is more than 1,000 feet below ground surface. The depth of groundwater prevents mixing of landfill gas with groundwater that can produce VOC contamination.

The facility is below the in-place waste volume that Federal Rules require a landfill to obtain a Title V permit for air emissions. Therefore, the facility is not required to install a gas collection and control system.

A landfill gas collection or control system would provide little if any technical benefit for this landfill and there is no regulatory requirement for the control of LFG at this landfill. Gas generation is already at the low end of a typical landfill and is continuing to decrease with time. The proposed cover will further reduce water infiltration into the landfill, therefore, gas generation should continue to decrease. Gas collection is therefore not required or recommended at this time.

If required in the future, gas collection at this landfill will likely not be very efficient for the reasons cited in Section 4. If enclosed structures are built near the landfill boundary in the future, and if monitoring indicates that the regulatory levels may be exceeded, then gas collection efforts should be focused at the landfill boundary nearest the structures. A gas collection system for the entire landfill is not needed based on regulatory requirements, and on calculations and measurements to date described in this report.

7.0 REFERENCES

North Wind 2004, "Design Basis Document for Los Alamos Site Office TA-73 Airport Landfill", January 2004.

LANL 1998, "RFI Report for Potential Release Sites 73-001(a,b,c,d) and 73-004(d), Airport Landfill Areas", LA-UR-98-3824, November 1998.

LANL 2002, "Voluntary Corrective Measure Plan for Potential Release Sites 73-001(a)-99 and 73-001(b)-99", LA-UR-02-4433, October 2002.

U.S. DEPARTMENT OF ENERGY

LOS ALAMOS SITE OFFICE

TA-73 AIRPORT LANDFILLS

FINAL CLOSURE

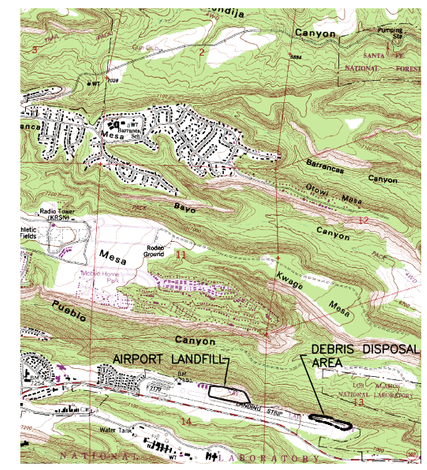
FINAL, REV. 0

LIST OF DRAWINGS:

DRAWING NO.	TITLE
COVER	COVER SHEET/INDEX OF DRAWINGS
1000	GENERAL NOTES, UTILITY LIST & LEGEND
2000	SITE DEVELOPMENT PLAN
2001	LANDFILL – EXCAVATION TICK PLAN
2002	LANDFILL – TOP OF CAP GRADING PLAN
2003	GENERAL SITE DETAILS
2004	LANDFILL – STORM SEWER PLAN AND PROFILE
2005	CAPPING SYSTEM DETAILS
2006	LANDFILL CROSS-SECTIONS E, F, G, AND H, SHEET 1 OF 3
2007	LANDFILL CROSS-SECTIONS E, F, G, AND H, SHEET 2 OF 3
2008	LANDFILL CROSS-SECTION I, SHEET 3 OF 3
2009	DEBRIS DISPOSAL AREA – FILL PLAN
2010	DEBRIS DISPOSAL AREA – TOP OF CAP GRADING PLAN
2011	DEBRIS AREA CROSS-SECTIONS C, D, E, AND F, SHEET 1 OF 2
2012	DEBRIS AREA CROSS-SECTIONS C, D, E, AND F, SHEET 2 OF 2
2013	EROSION AND SEDIMENTATION CONTROL PLAN – LANDFILL AREA
2014	EROSION AND SEDIMENTATION CONTROL PLAN – DEBRIS DISPOSAL AREA
2015	STORMWATER CONTROL DETAILS
2016	EROSION AND SEDIMENTATION CONTROL NOTES
2017	EROSION AND SEDIMENTATION CONTROL DETAILS
2018	SETTLEMENT PLATE – LAYOUT AND DETAILS

LOS ALAMOS COUNTY, NM

W.O. NO. 13104.002.001.1140



LOCATION MAP

1"=2,000'

North Wind \ WESTON SOLUTIONS TEAM

GENERAL NOTES

1. BASE MAP OBTAINED FROM:
   GISLAB
   MAP NO. M200001
   FEBRUARY 26, 2002

2. DEBRIS DISPOSAL AREA GROUND SURVEY BY:
   ALBUQUERQUE SURVEYING COMPANY INC.
   FEBRUARY 2004

3. HORIZONTAL DATUM: STATE PLANE COORDINATE SYSTEM NAD83
   (SOUTH ZONE) US SURVEY UNITS
   VERTICAL DATUM: NAVD88 US SURVEY FOOT UNITS

4. UNDERGROUND UTILITIES

   A. ALL APPROPRIATE UTILITIES WILL BE NOTIFIED OF THE WORK SCHEDULE PRIOR TO THE START OF CONSTRUCTION. EACH UTILITY OWNER SHALL VERIFY AND MARK THE LOCATION OF THEIR RESPECTIVE MAIN AND SERVICE LINES IN THE FIELD BEFORE THE START OF WORK.

   B. THE LOCATIONS OF EXISTING UTILITIES SHOWN ON THE PLANS ARE APPROXIMATE BASED ON THE BEST AVAILABLE INFORMATION AND DATA PROVIDED BY ALBUQUERQUE SURVEYING COMPANY INC. THE ACCURACY OF LOCATIONS FOR EXISTING SUBSURFACE UTILITY STRUCTURES SHOWN ON THE DRAWINGS IS NOT GUARANTEED. ALL EXISTING SURFACE OR SUBSURFACE UTILITIES MAY NOT BE SHOWN ON THE DRAWINGS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE PRESENCE AND LOCATION OF ALL UTILITIES PRIOR TO CONSTRUCTION.

   C. NECESSARY PRECAUTIONS WILL BE TAKEN TO MAINTAIN EXISTING UTILITIES SERVICE. ALL UTILITY MAINS, LATERALS AND SERVICE UTILITY LINES EXPOSED DURING CONSTRUCTION SHALL BE SECURED AND PROTECTED THROUGHOUT ALL OPERATIONS. IN THE EVENT THAT ANY EXISTING UTILITY LINE IS DAMAGED, THE CONTRACTOR WILL NOTIFY THE UTILITY OWNER IMMEDIATELY. ALL REPAIRS SHALL BE DIRECTED BY THE UTILITY OWNER.

5. FIELD MEASUREMENTS OF THE HORIZONTAL AND VERTICAL AS-BUILT LOCATIONS SHALL BE MAINTAINED AND SHALL BE RECORDED ON THE DRAWINGS FOR THE DEVELOPMENT OF FINAL RECORD PLANS.

6. OVERHEAD UTILITIES – OVERHEAD (OH) UTILITY LINES HAVE BEEN SHOWN FOR REFERENCE ONLY. GROUND TO CABLE CLEARANCE HAS NOT BEEN DETERMINED. OPERATION OF HEAVY EQUIPMENT UNDER THESE AERIAL UTILITIES SHALL BE CONDUCTED WITH EXTREME CAUTION AND IN ACCORDANCE WITH UTILITY LINE CLEARANCE RESTRICTIONS.

7. ACCESS TO WORK AREAS WILL FOLLOW THE ROUTES SHOWN ON THE SITE DEVELOPMENT PLAN. THERE WILL BE NO DEVIATION FROM THE ROUTE, UNLESS APPROVED BY THE ENGINEER.

8. ALL CONSTRUCTION EQUIPMENT AND VEHICLES WILL ADHERE TO FAA CIRCULARS FOR SIGNAGE.

9. NORTHWIND\WESTON TEAM SHALL HEREAFTER BE REFERRED TO AS THE CONTRACTOR.

LIST OF UNDERGROUND USERS

ONE CALL SYSTEM TELEPHONE NO. 1-505-260-1990
nmonecall.org (REFERENCE COMPANY CODE 645)

USER'S NAME	TELEPHONE
LOS ALAMOS COUNTY	505-260-1990
LOS ALAMOS CABLE	800-826-1954
PNM GAS	800-464-7462
USWEST COMMUNICATIONS	800-573-1311
COMCAST	505-260-1990
QUEST COMMUNICATIONS	800-321-2537

IN CASE OF EMERGENCY CALL 1-866-DIG-NMOC (1-866-344-6662)
DURING REGULAR BUSINESS HOURS.

AIRPORT MONUMENTS

DESCRIPTION	SPC	GEODETIC	ELEVATION
R/W 27	1774918.731 1637374.111	35° 52' 41.413" N 106° 15' 36.974" W	7087.890
R/W 9	1776111.273 1631956.007	35° 52' 53.197" N 106° 16' 42.822" W	7170.640
MONUMENT A0001 "AIRPORT"	1775240.121 1634333.458	35° 52' 44.586" N 106° 16' 13.927" W	7136.000

NOTES:

1. RUNWAY END MONUMENTS ARE ALUMINUM CAPS MARKED LS 8670.
2. MONUMENT A0001 IS BRASS CAP MARKED LIMBAUGH "AIRPORT".
3. LAT/LONG, SPC, AND ELEVATION DATA SHOWN ABOVE IS FROM CONTROL SURVEY MAP PERFORMED BY JIM BOTSFORD, NMPS #5211, OCTOBER 2002.
4. ELEVATION IS MSL IN FEET.

LEGEND

—— - - —— - - ——	PROPERTY LINE	△1	CONTROL POINT
—x—x—x—x—	FENCE	⊗7145.55	SPOT ELEVATION
—s—s—s—s—	SEWER		
—w—w—w—w—	WATER		
7200	EXISTING CONTOUR		
—— 7200 ——	PROPOSED CONTOUR		

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
O	4/16/04		FINAL				
C	3/30/04		DRAFT FINAL				
B	3/23/04		90% DESIGN SUBMITTAL				
A	2/10/04		60% DESIGN SUBMITTAL				

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

NORTHWIND \ WESTON SOLUTIONS TEAM

CHECKED		DATE	CLIENT APPROVALS	DATE
	RWM	03/30/04		
DES. ENG.	SW	03/30/04		
PROJ. ENG.	AH	03/30/04		
PROJ. MGR.	BK	03/30/04		
APPROVED	BK	03/30/04		
APPROVED				

GENERAL NOTES, UTILITY LIST & LEGEND

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	1000	0
SCALE N.T.S.	W.O. NO. 13104.002.001	SHT. ___ OF ___	

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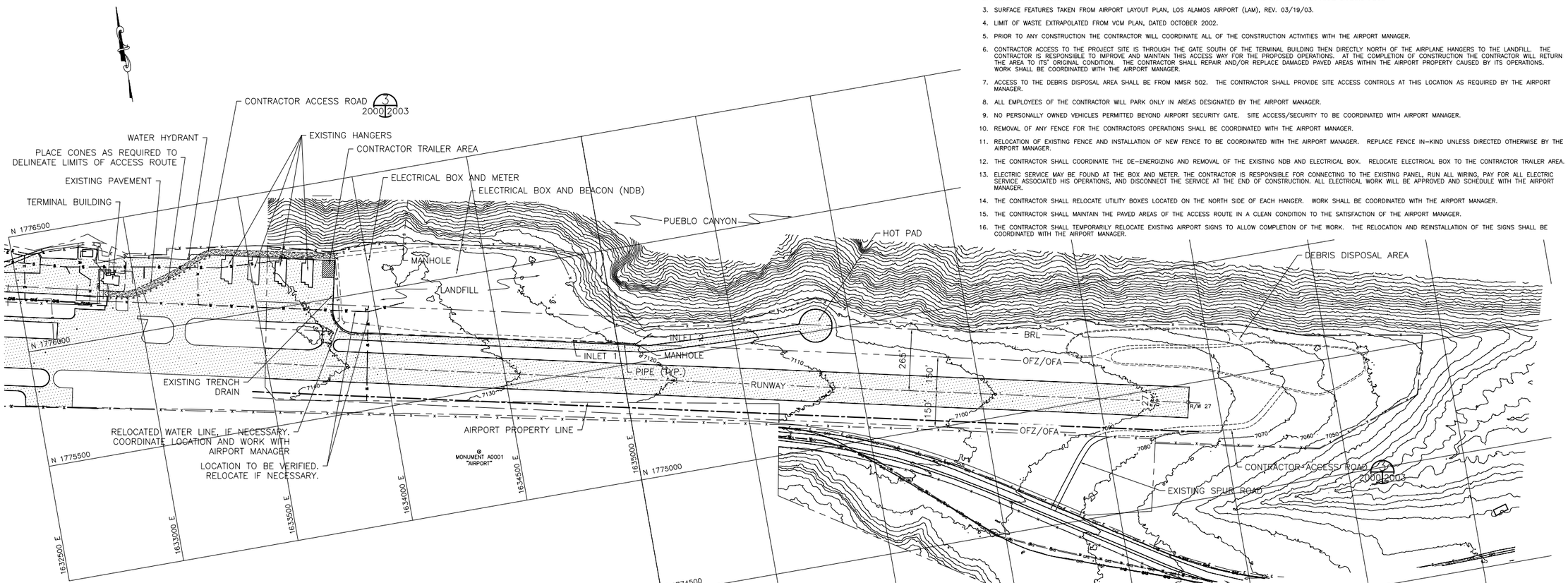
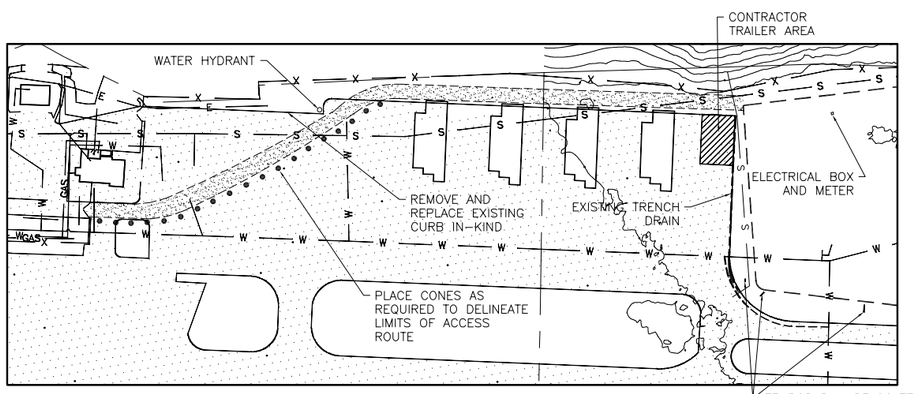
NOTES:

1. REFER TO DWG. 1000 FOR LEGEND AND NOTES.
2. REFER TO DWG. 2002 FOR LANDFILL FINAL GRADING PLAN AND DWG. 2010 FOR DEBRIS DISPOSAL AREA FINAL GRADING PLAN.
3. SURFACE FEATURES TAKEN FROM AIRPORT LAYOUT PLAN, LOS ALAMOS AIRPORT (LAM), REV. 03/19/03.
4. LIMIT OF WASTE EXTRAPOLATED FROM VCM PLAN, DATED OCTOBER 2002.
5. PRIOR TO ANY CONSTRUCTION THE CONTRACTOR WILL COORDINATE ALL OF THE CONSTRUCTION ACTIVITIES WITH THE AIRPORT MANAGER.
6. CONTRACTOR ACCESS TO THE PROJECT SITE IS THROUGH THE GATE SOUTH OF THE TERMINAL BUILDING THEN DIRECTLY NORTH OF THE AIRPLANE HANGERS TO THE LANDFILL. THE CONTRACTOR IS RESPONSIBLE TO IMPROVE AND MAINTAIN THIS ACCESS WAY FOR THE PROPOSED OPERATIONS. AT THE COMPLETION OF CONSTRUCTION THE CONTRACTOR WILL RETURN THE AREA TO ITS' ORIGINAL CONDITION. THE CONTRACTOR SHALL REPAIR AND/OR REPLACE DAMAGED PAVED AREAS WITHIN THE AIRPORT PROPERTY CAUSED BY ITS OPERATIONS. WORK SHALL BE COORDINATED WITH THE AIRPORT MANAGER.
7. ACCESS TO THE DEBRIS DISPOSAL AREA SHALL BE FROM NMSR 502. THE CONTRACTOR SHALL PROVIDE SITE ACCESS CONTROLS AT THIS LOCATION AS REQUIRED BY THE AIRPORT MANAGER.
8. ALL EMPLOYEES OF THE CONTRACTOR WILL PARK ONLY IN AREAS DESIGNATED BY THE AIRPORT MANAGER.
9. NO PERSONALLY OWNED VEHICLES PERMITTED BEYOND AIRPORT SECURITY GATE. SITE ACCESS/SECURITY TO BE COORDINATED WITH AIRPORT MANAGER.
10. REMOVAL OF ANY FENCE FOR THE CONTRACTORS OPERATIONS SHALL BE COORDINATED WITH THE AIRPORT MANAGER.
11. RELOCATION OF EXISTING FENCE AND INSTALLATION OF NEW FENCE TO BE COORDINATED WITH THE AIRPORT MANAGER. REPLACE FENCE IN-KIND UNLESS DIRECTED OTHERWISE BY THE AIRPORT MANAGER.
12. THE CONTRACTOR SHALL COORDINATE THE DE-ENERGIZING AND REMOVAL OF THE EXISTING NDB AND ELECTRICAL BOX. RELOCATE ELECTRICAL BOX TO THE CONTRACTOR TRAILER AREA.
13. ELECTRIC SERVICE MAY BE FOUND AT THE BOX AND METER. THE CONTRACTOR IS RESPONSIBLE FOR CONNECTING TO THE EXISTING PANEL, RUN ALL WIRING, PAY FOR ALL ELECTRIC SERVICE ASSOCIATED HIS OPERATIONS, AND DISCONNECT THE SERVICE AT THE END OF CONSTRUCTION. ALL ELECTRICAL WORK WILL BE APPROVED AND SCHEDULE WITH THE AIRPORT MANAGER.
14. THE CONTRACTOR SHALL RELOCATE UTILITY BOXES LOCATED ON THE NORTH SIDE OF EACH HANGER. WORK SHALL BE COORDINATED WITH THE AIRPORT MANAGER.
15. THE CONTRACTOR SHALL MAINTAIN THE PAVED AREAS OF THE ACCESS ROUTE IN A CLEAN CONDITION TO THE SATISFACTION OF THE AIRPORT MANAGER.
16. THE CONTRACTOR SHALL TEMPORARILY RELOCATE EXISTING AIRPORT SIGNS TO ALLOW COMPLETION OF THE WORK. THE RELOCATION AND REINSTALLATION OF THE SIGNS SHALL BE COORDINATED WITH THE AIRPORT MANAGER.





ENLARGED DETAIL OF ACCESS ROUTE AND TRAILER AREA

100 0 100 200
1"=100'

LEGEND

⊙ AIRPORT MONUMENT

200 0 200 400
1"=200'

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
O	4/16/04		FINAL				
C	3/30/04		DRAFT FINAL				
B	3/23/04		90% DESIGN SUBMITTAL				
A	2/10/04		60% DESIGN SUBMITTAL				

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

North Wind | WESTON SOLUTIONS TEAM

		DATE	CLIENT APPROVALS	DATE
CHECKED	RWM	03/30/04		
DES. ENG.	SW	03/30/04		
PROJ. ENG.	AH	03/30/04		
PROJ. MGR.	BK	03/30/04		
APPROVED	BK	03/30/04		
APPROVED				

SITE DEVELOPMENT PLAN

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2000	0
SCALE 1"=200'	W.O. NO. 13104.002.001	SHT. ___ OF ___	

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NOTES:

1. CONTRACTOR ACCESS TO THE PROJECT SITE IS THROUGH THE GATE SOUTH OF THE TERMINAL BUILDING THEN DIRECTLY NORTH OF THE AIRPLANE HANGERS TO THE LANDFILL. THE CONTRACTOR IS RESPONSIBLE TO IMPROVE AND MAINTAIN THIS ACCESS WAY FOR THE PROPOSED OPERATIONS. AT THE COMPLETION OF CONSTRUCTION, THE CONTRACTOR WILL RETURN THE AREA TO ITS ORIGINAL CONDITION.

2. THE NATURAL GRADES OF THE ORIGINAL HANGING VALLEY, PRIOR TO BEGINNING OF WASTE DISPOSAL, ARE NOT SHOWN ON THIS DRAWING. THE GRADING PLAN SHOWN FOR THE EAST SLOPE WILL BE REVISED AS NEEDED IF NATIVE GROUND IS ENCOUNTERED DURING EXCAVATION. SLOPES ON WASTE WILL BE CONSTRUCTED AS SHOWN, HOWEVER SLOPES ON NATIVE GROUND, IF ENCOUNTERED, WILL BE ASSESSED BY THE ENGINEER AND MAY BE STEEPER THAN SHOWN. NATIVE ROCK WILL NOT BE EXTENSIVELY EXCAVATED. ALL REVISED GRADES WILL BE REVIEWED BY THE ENGINEER.

3. THE CONTRACTOR SHALL FURNISH AN INTERIM SURVEY OF THE SURFACE OF NATIVE SOIL EXPOSED AS A RESULT OF WASTE EXCAVATION FROM THE EAST SLOPE FOR REVIEW BY THE ENGINEER. THE SURVEY SHALL INCLUDE THE EXPOSED NATIVE SOIL SURFACE, THE EXCAVATED WASTE SURFACE, AND THE UNDISTURBED NATIVE SOIL ACROSS THE EAST SLOPE OF THE LANDFILL.

4. THE CONTRACTOR SHALL NOT ORDER/PURCHASE INLET 1 AND 2, AND MANHOLE 1 AND ASSOCIATED PIPE UNTIL WASTE HAS BEEN EXCAVATED FROM THE SOUTH EAST CORNER OF THE LANDFILL, AND THE ENGINEER HAS REVIEWED THE TOPOGRAPHIC SURVEY OF THE EXCAVATED SURFACE. THE CONTRACTOR MUST RECEIVE APPROVAL FROM THE ENGINEER PRIOR TO ORDERING/PURCHASING THIS MATERIAL.

5. CONTRACTOR TO FIELD VERIFY PRESENCE/LOCATION EXISTING WATERLINE AND COORDINATE RELOCATION WITH ENGINEER AND AIRPORT MANAGER.

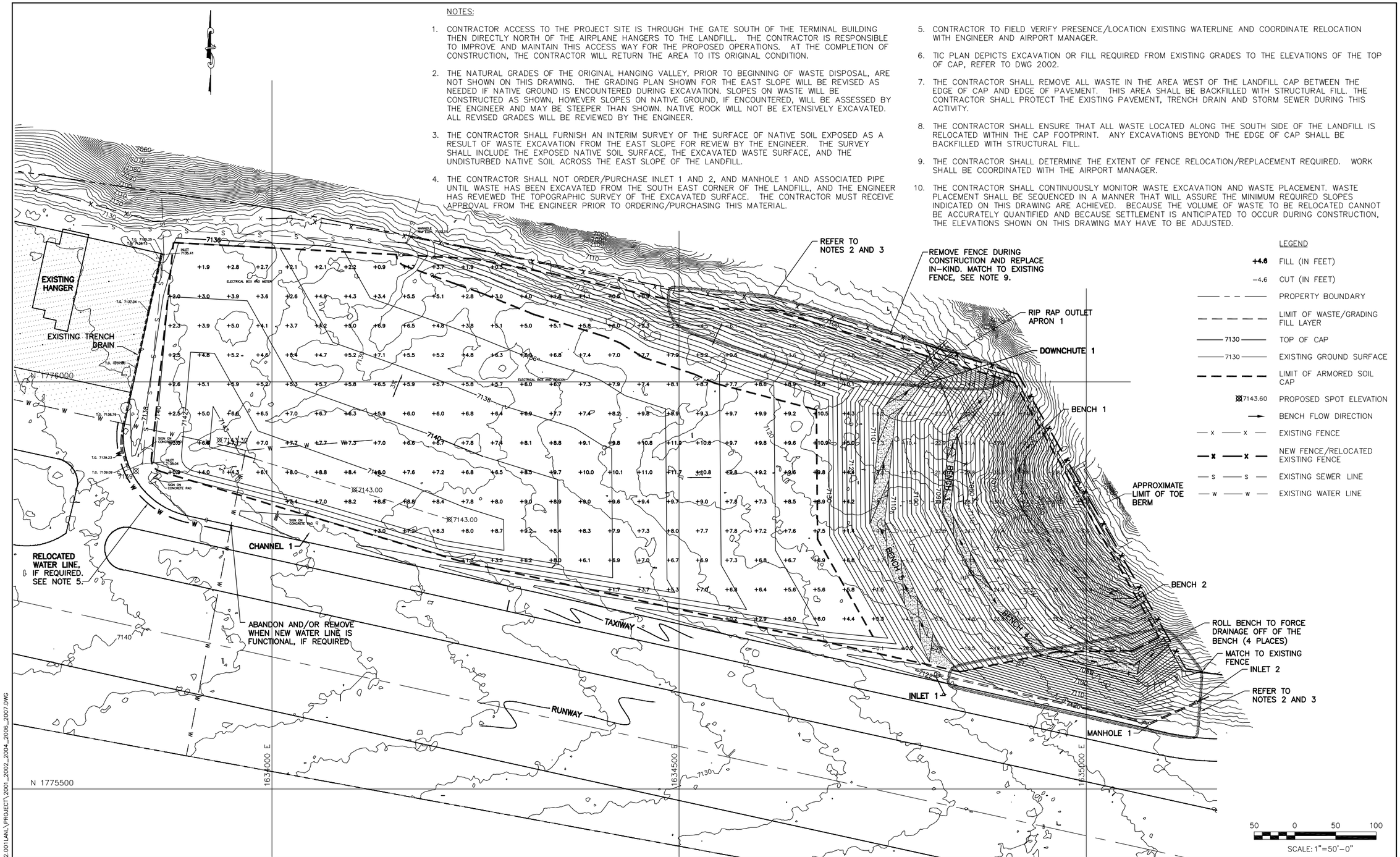
6. TIC PLAN DEPICTS EXCAVATION OR FILL REQUIRED FROM EXISTING GRADES TO THE ELEVATIONS OF THE TOP OF CAP, REFER TO DWG 2002.

7. THE CONTRACTOR SHALL REMOVE ALL WASTE IN THE AREA WEST OF THE LANDFILL CAP BETWEEN THE EDGE OF CAP AND EDGE OF PAVEMENT. THIS AREA SHALL BE BACKFILLED WITH STRUCTURAL FILL. THE CONTRACTOR SHALL PROTECT THE EXISTING PAVEMENT, TRENCH DRAIN AND STORM SEWER DURING THIS ACTIVITY.

8. THE CONTRACTOR SHALL ENSURE THAT ALL WASTE LOCATED ALONG THE SOUTH SIDE OF THE LANDFILL IS RELOCATED WITHIN THE CAP FOOTPRINT. ANY EXCAVATIONS BEYOND THE EDGE OF CAP SHALL BE BACKFILLED WITH STRUCTURAL FILL.

9. THE CONTRACTOR SHALL DETERMINE THE EXTENT OF FENCE RELOCATION/REPLACEMENT REQUIRED. WORK SHALL BE COORDINATED WITH THE AIRPORT MANAGER.

10. THE CONTRACTOR SHALL CONTINUOUSLY MONITOR WASTE EXCAVATION AND WASTE PLACEMENT. WASTE PLACEMENT SHALL BE SEQUENCED IN A MANNER THAT WILL ASSURE THE MINIMUM REQUIRED SLOPES INDICATED ON THIS DRAWING ARE ACHIEVED. BECAUSE THE VOLUME OF WASTE TO BE RELOCATED CANNOT BE ACCURATELY QUANTIFIED AND BECAUSE SETTLEMENT IS ANTICIPATED TO OCCUR DURING CONSTRUCTION, THE ELEVATIONS SHOWN ON THIS DRAWING MAY HAVE TO BE ADJUSTED.



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NO.	DATE	APPR.	REVISION
O	4/16/04		FINAL
C	3/30/04		DRAFT FINAL
B	3/23/04		90% DESIGN SUBMITTAL
A	2/10/04		60% DESIGN SUBMITTAL

NO.	DATE	APPR.	REVISION

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

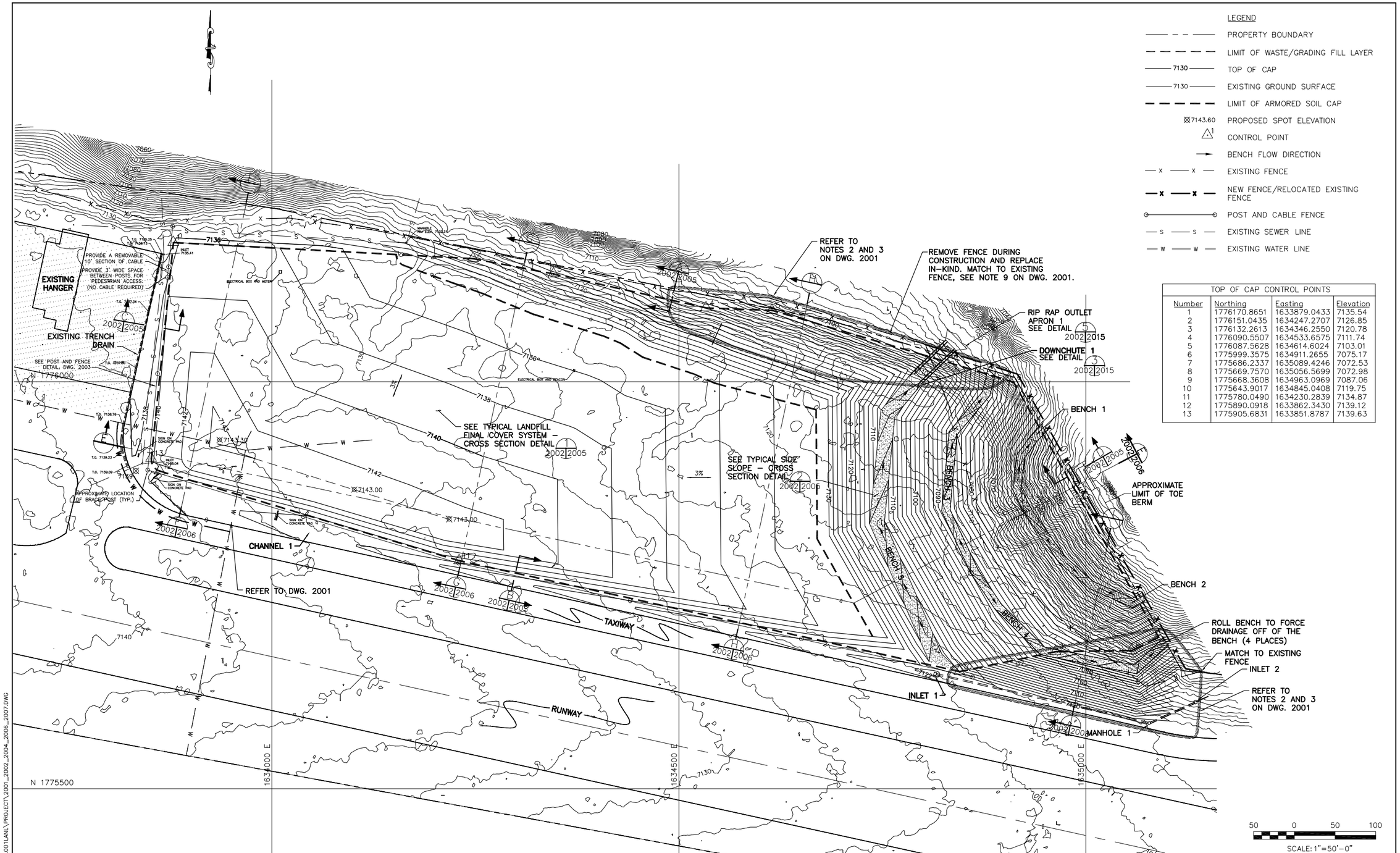
North Wind | WESTON SOLUTIONS TEAM

		DATE
CHECKED	RWM	03/30/04
DES. ENG.	SW	03/30/04
PROJ. ENG.	AH	03/30/04
PROJ. MGR.	BK	03/30/04
APPROVED	BK	03/30/04
APPROVED		

CLIENT APPROVALS	DATE

LANDFILL EXCAVATION TICK PLAN

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2001	0
SCALE	W.O. NO.	SHT. ___ OF ___	
AS SHOWN	13104.002.001		



LEGEND

- PROPERTY BOUNDARY
- LIMIT OF WASTE/GRADING FILL LAYER
- 7130 — TOP OF CAP
- 7130 — EXISTING GROUND SURFACE
- LIMIT OF ARMORED SOIL CAP
- ⊠7143.60 — PROPOSED SPOT ELEVATION
- CONTROL POINT
- BENCH FLOW DIRECTION
- EXISTING FENCE
- NEW FENCE/RELOCATED EXISTING FENCE
- POST AND CABLE FENCE
- EXISTING SEWER LINE
- EXISTING WATER LINE

TOP OF CAP CONTROL POINTS

Number	Northing	Easting	Elevation
1	1776170.8651	1633879.0433	7135.54
2	1776151.0435	1634247.2707	7126.85
3	1776132.2613	1634346.2550	7120.78
4	1776090.5507	1634533.6575	7111.74
5	1776087.5628	1634614.6024	7103.01
6	1775999.3575	1634911.2655	7075.17
7	1775686.2337	1635089.4246	7072.53
8	1775669.7570	1635056.5699	7072.98
9	1775668.3608	1634963.0969	7087.06
10	1775643.9017	1634845.0408	7119.75
11	1775780.0490	1634230.2839	7134.87
12	1775890.0918	1633862.3430	7139.12
13	1775905.6831	1633851.8787	7139.63

NO.	DATE	APPR.	REVISION
O	4/16/04		FINAL
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B	3/23/04		90% DESIGN SUBMITTAL
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LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON SOLUTIONS TEAM

		DATE
CHECKED	RWM	03/30/04
DES. ENG.	SW	03/30/04
PROJ. ENG.	AH	03/30/04
PROJ. MGR.	BK	03/30/04
APPROVED	BK	03/30/04
APPROVED		

CLIENT APPROVALS | DATE

LANDFILL
TOP OF CAP GRADING PLAN

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2002	0
SCALE: AS SHOWN	W.O. NO. 13104.002.001	SHT. ___ OF ___	

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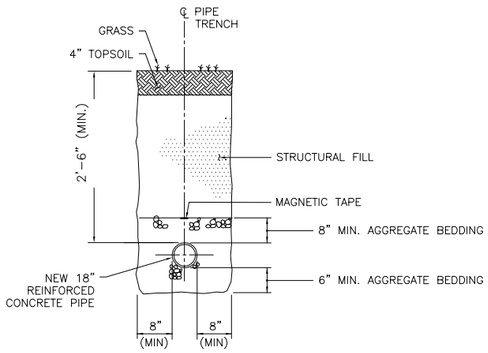
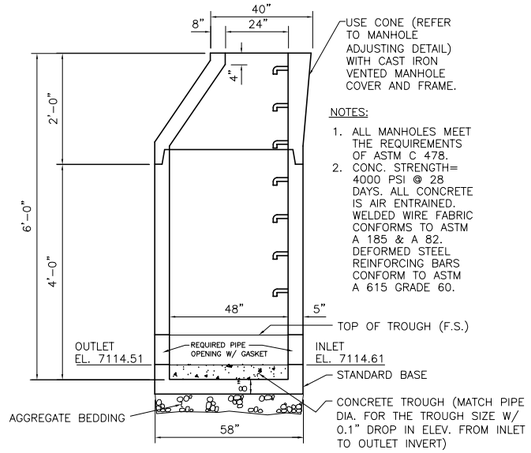
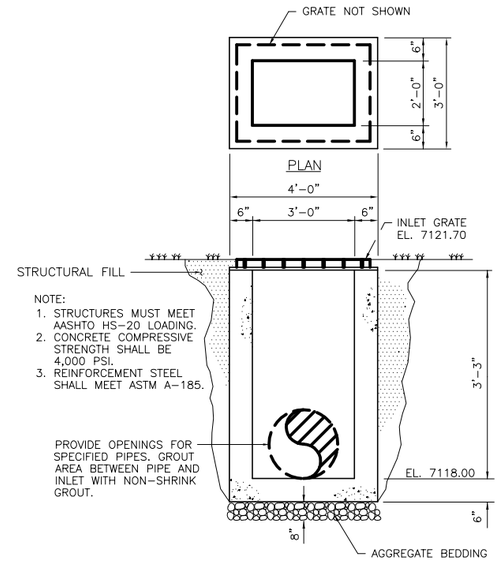


TYPICAL PIPE TRENCH
N.T.S.



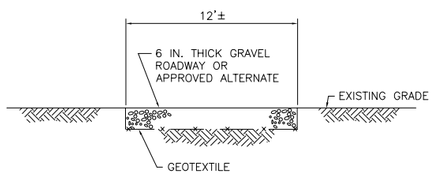
48" DIA. PRECAST MANHOLE 1
N.T.S.



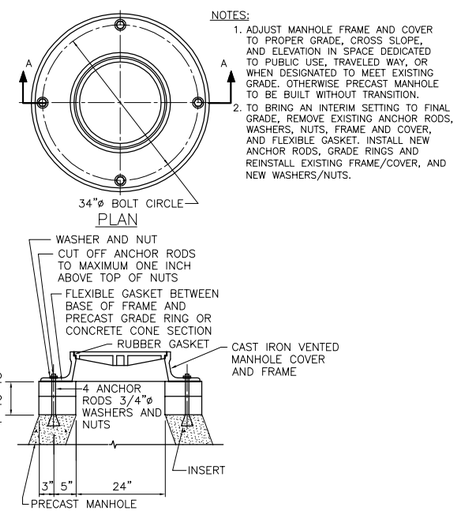
INLET 1
N.T.S.

GENERAL NOTE:

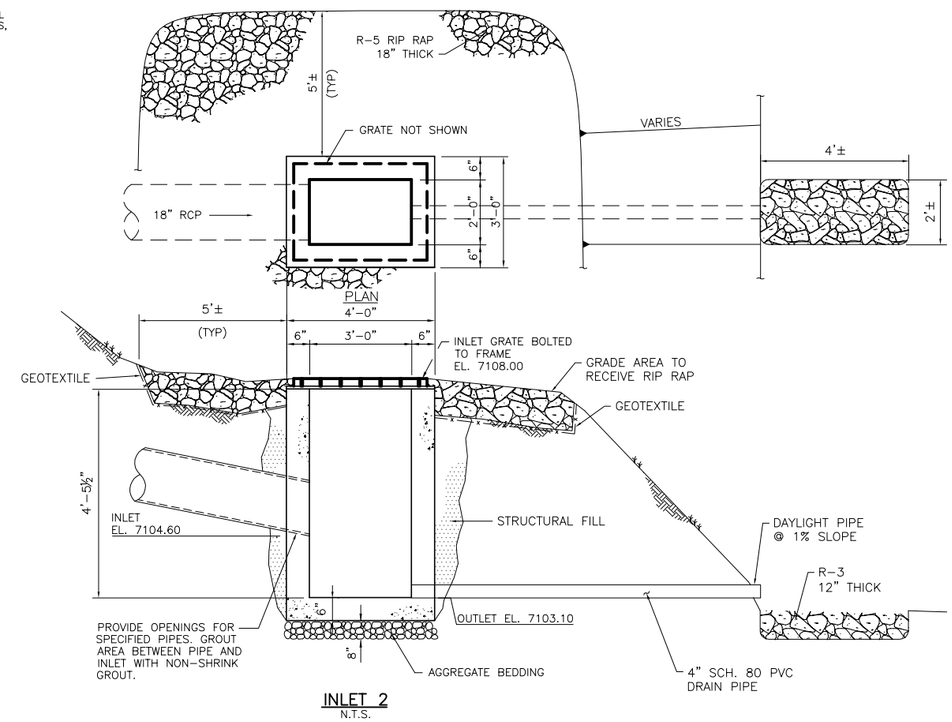
1. PRIOR TO ORDERING CONCRETE PRODUCTS, FIELD VERIFY DIMENSIONS AND OBTAIN WRITTEN APPROVAL FROM THE ENGINEER.



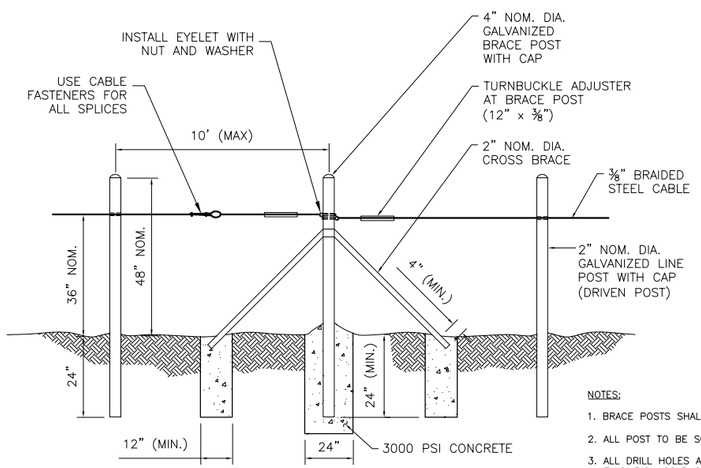
CONTRACTOR ACCESS ROAD CROSS-SECTION DETAIL 3
N.T.S. 2000|2003



MANHOLE ADJUSTING DETAIL
N.T.S.



INLET 2
N.T.S.



POST AND CABLE FENCE
N.T.S.

NOTES:

1. BRACE POSTS SHALL BE INSTALLED AT APPROXIMATE LOCATIONS SHOWN ON DWG. 2002.
2. ALL POST TO BE SCHEDULED 40 (GALVANIZED).
3. ALL DRILL HOLES AND WELDS SHALL BE THOROUGHLY WIRE BRUSHED AND CLEANED AND PAINTED WITH A ZINC-RICH COLD GALVANIZING MATERIAL.
4. ALL HARDWARE TO BE GALVANIZED.
5. INSTALL ONLY ONE CROSS BRACE POST AT END POINTS AND AT OTHER LOCATIONS AS REQUIRED. CROSS BRACES SHALL BE INSTALLED ON TENSION SIDE OF BRACE POSTS.
6. THE CONTRACTOR SHALL PROVIDE ONE ACCESS POINT ALONG THE WEST SIDE OF THE LANDFILL. THE ACCESS POINT SHALL HAVE A REMOVAL SECTION OF CABLE WHICH CAN BE SECURELY HELD IN PLACE AND LOCKED.
7. THE CONTRACTOR SHALL SECURE HIGH VISIBILITY REFLECTIVE SIGNS AND SIGNS READING "KEEP OUT" TO THE CABLE AT REGULAR INTERVALS. THE CONTRACTOR SHALL SUBMIT SIGN DATA AND LAYOUT PLAN TO THE ENGINEER FOR APPROVAL.

NO.	DATE	APPR.	REVISION
0	4/16/04		FINAL
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B	3/23/04		90% DESIGN SUBMITTAL
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LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

North Wind | WESTON SOLUTIONS TEAM

		DATE	CLIENT APPROVALS	DATE
CHECKED	RWM	03/30/04		
DES. ENG.	SW	03/30/04		
PROJ. ENG.	AH	03/30/04		
PROJ. MGR.	BK	03/30/04		
APPROVED	BK	03/30/04		
APPROVED				

GENERAL SITE DETAILS

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2003	0
SCALE N.T.S.	W.O. NO. 13104.002.001	SHT. ___ OF ___	

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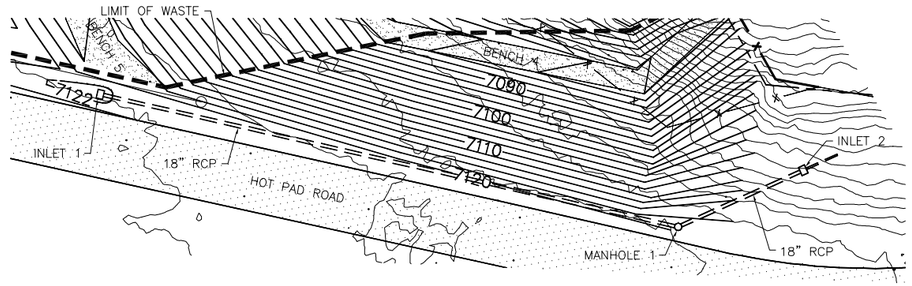
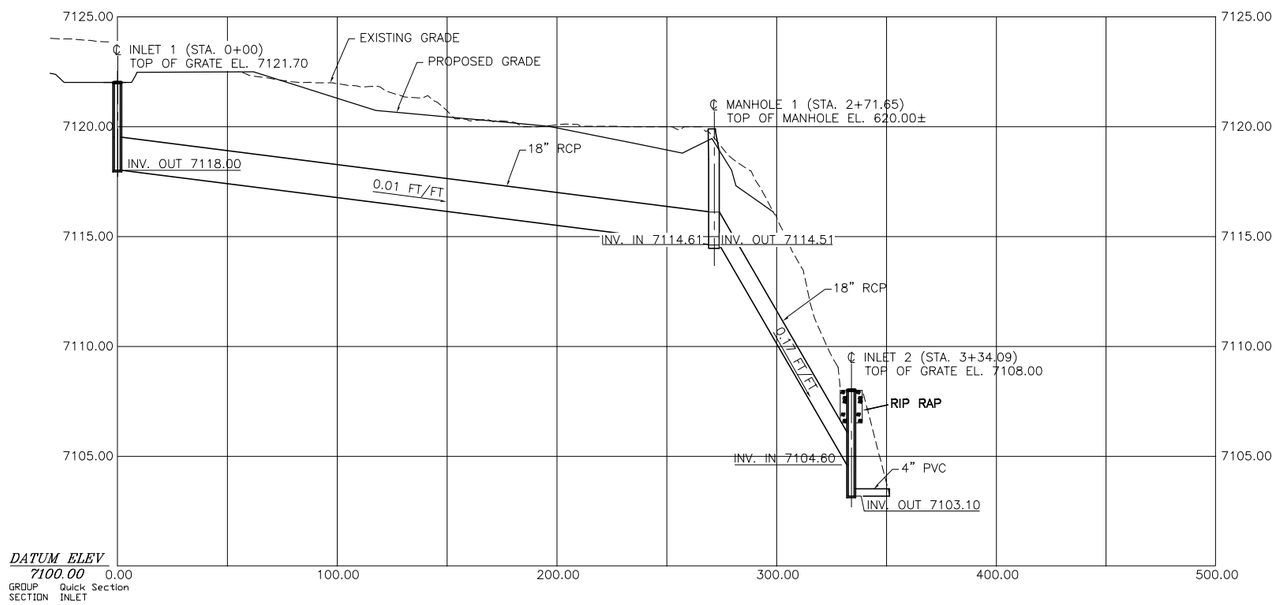


PLAN
1"=30'



STORM SEWER PROFILE

3 0 3 6
VERTICAL: 1"=3'

30 0 30 60
HORIZONTAL: 1"=30'

NOTES:

1. THE CONTRACTOR SHALL NOT ORDER/PURCHASE INLET 1 AND 2, AND MANHOLE 1 AND ASSOCIATED PIPE UNTIL WASTE HAS BEEN EXCAVATED FROM THE SOUTH EAST CORNER OF THE LANDFILL, AND THE ENGINEER HAS REVIEWED THE TOPOGRAPHIC SURVEY OF THE EXCAVATED SURFACE. THE CONTRACTOR MUST RECEIVE APPROVAL FROM THE ENGINEER PRIOR TO ORDERING/PURCHASING THIS MATERIAL.

2. ALL PIPE SHALL BE REINFORCED CONCRETE PIPE (RCP) OR AS OTHERWISE NOTED.

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LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON TEAM

		DATE
CHECKED	RWM	03/30/04
DES. ENG.	SW	03/30/04
PROJ. ENG.	AH	03/30/04
PROJ. MGR.	BK	03/30/04
APPROVED	BK	03/30/04
APPROVED		

CLIENT APPROVALS DATE

LANDFILL STORM SEWER
PLAN AND PROFILE

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2004	0
SCALE: AS SHOWN	W.O. NO.: 13104.002.001	SHT. ___ OF ___	

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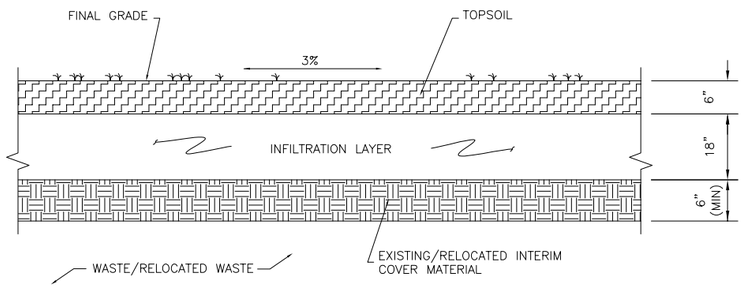
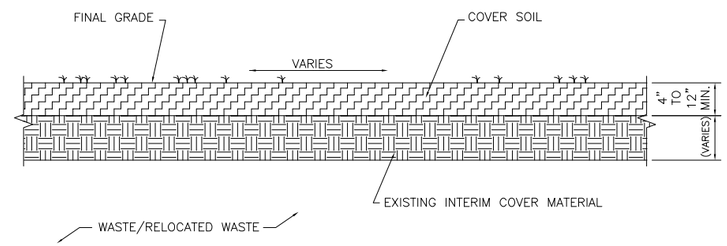


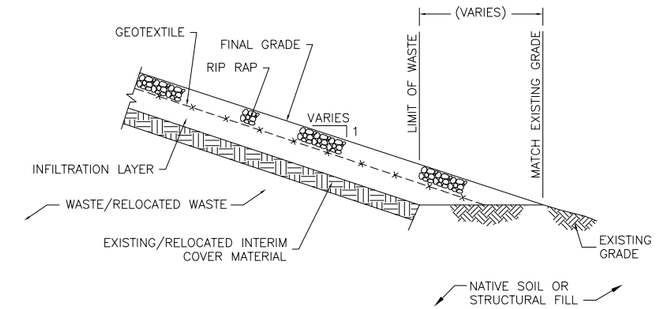
TYPICAL LANDFILL FINAL COVER SYSTEM – CROSS SECTION

DETAIL 1 (2002 | 2005)
N.T.S.



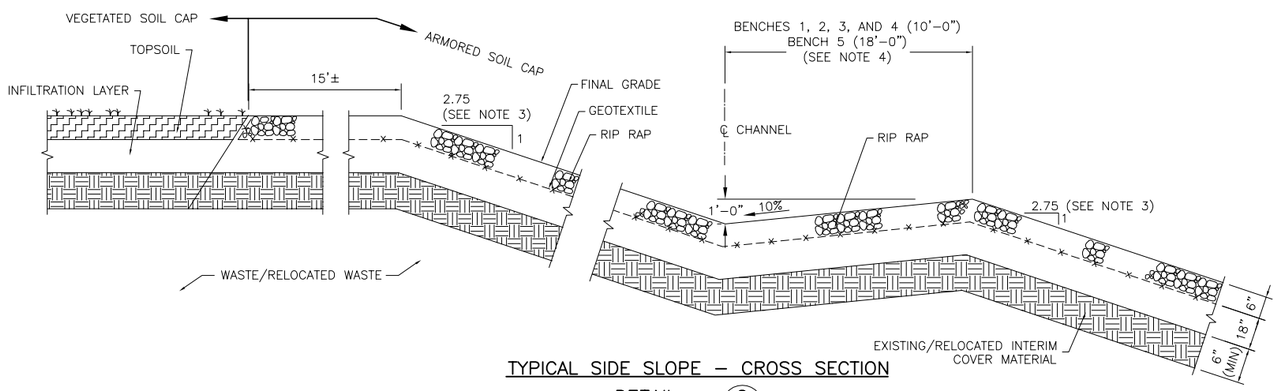
TYPICAL DDA FINAL COVER SYSTEM – CROSS SECTION

DETAIL 4 (2010 | 2005)
N.T.S.



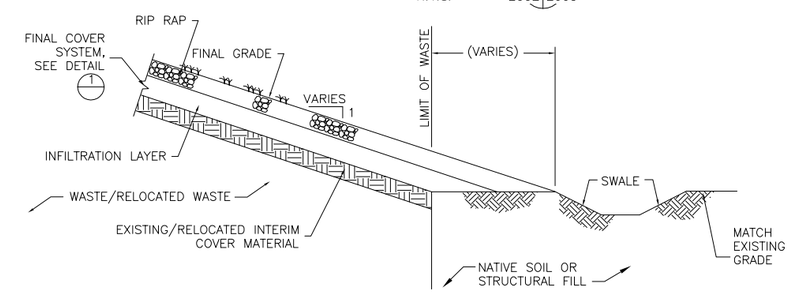
TYPICAL TOE OF SLOPE

SECTION A (2002 | 2005)
N.T.S.



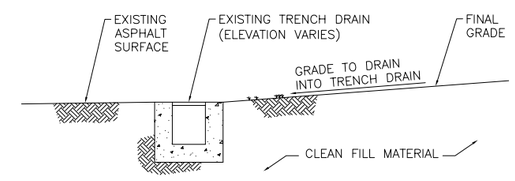
TYPICAL SIDE SLOPE – CROSS SECTION

DETAIL 2 (2002 | 2005)
N.T.S.



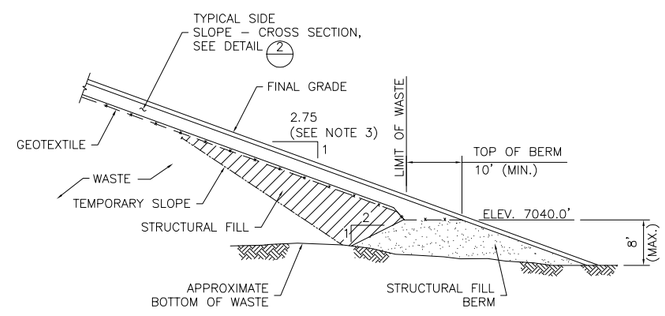
TYPICAL TOE OF SLOPE

SECTION B (2002 | 2005)
N.T.S.



TYPICAL WEST SLOPE

SECTION C (2002 | 2005)
N.T.S.



TOE BERM

SECTION D (2002 | 2005)
N.T.S.

NOTES:

1. TEMPORARY SLOPE WILL BE CUT BACK TO PROVIDE A STABLE AND SAFE WORKING INCLINATION.

GENERAL NOTES:

1. FINAL GRADE DETAILS ARE SHOWN AT 3H:1V SLOPE FOR INFORMATIONAL PURPOSES ONLY. ACTUAL GRADES SHALL BE AS INDICATED ON DRAWING 2002 AND 2010.
2. REFER TO DRAWING 2015 FOR STORMWATER CONTROL DETAILS PERTAINING TO THE SWALE DETAILS.
3. COMPOSITE SLOPE IS 3H:1V WITH BENCHES INCLUDED.
4. PLACE R3 RIP RAP 6" THICK ON BENCHES 1, 2, 3, & 4. PLACE R4 RIP RAP 12" THICK ON BENCH 5.
5. CAPPING DETAILS SHOWN ON THIS SHEET SHOULD ONLY BE USED IN AREAS WHERE WASTE WILL REMAIN AFTER EXCAVATION.

NO.	DATE	APPR.	REVISION
0	4/16/04		FINAL
C	3/30/04		DRAFT FINAL
B	3/23/04		90% DESIGN SUBMITTAL
A	2/10/04		60% DESIGN SUBMITTAL

LOS ALAMOS SITE OFFICE
TA–73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

North Wind | WESTON SOLUTIONS TEAM

CHECKED	RWM	DATE	03/30/04
DES. ENG.	SW		03/30/04
PROJ. ENG.	AH		03/30/04
PROJ. MGR.	BK		03/30/04
APPROVED	BK		03/30/04
APPROVED			

CLIENT APPROVALS | DATE

CAPPING SYSTEM DETAILS

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2005	0
SCALE N.T.S.	W.O. NO. 13104.002.001	SHT. ___ OF ___	

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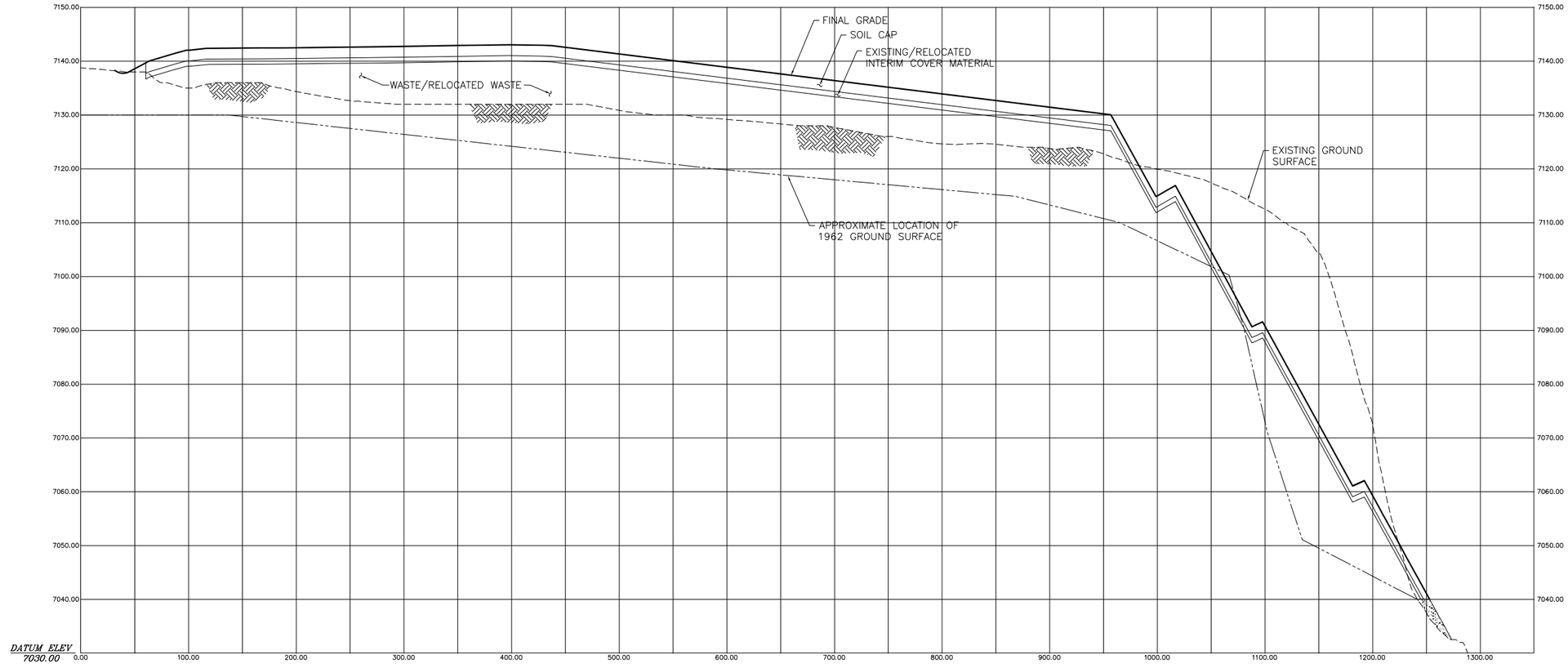
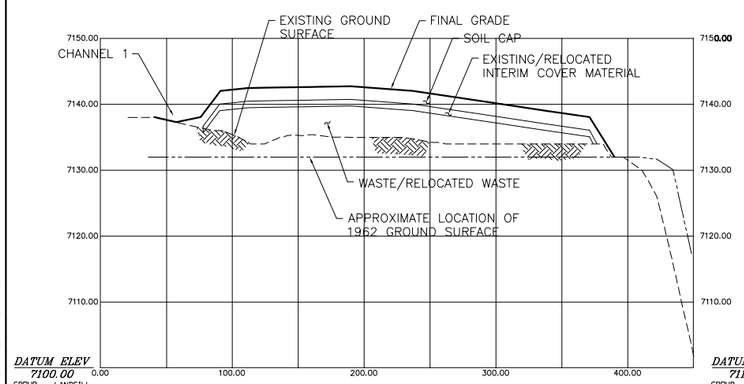


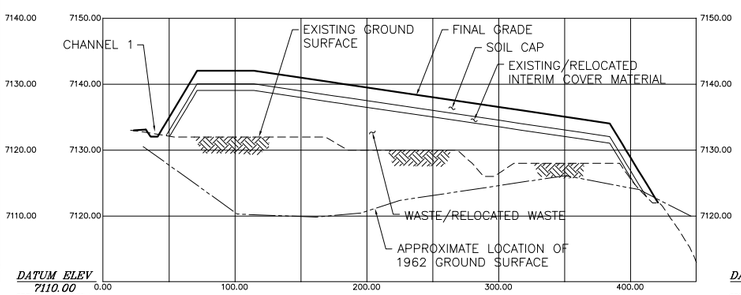
SECTION E
5H:1V 2002 2006

GENERAL NOTE:

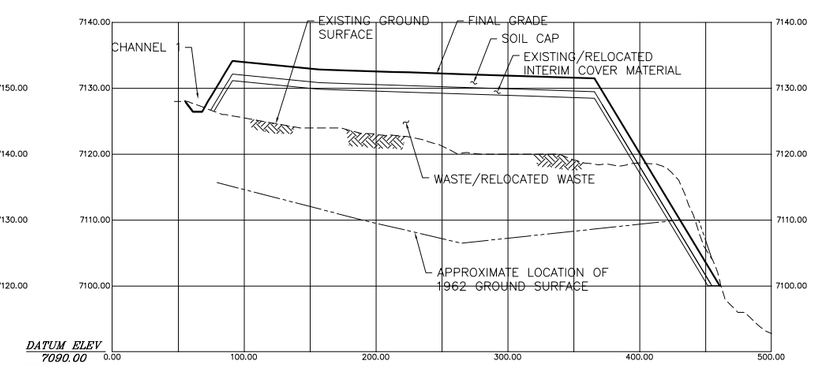
1. THE 1962 SURFACES DEPICTED ON THIS DRAWING SHOULD BE CONSIDERED "FOR INFORMATION ONLY".



SECTION F
5H:1V 2002 2006



SECTION G
5H:1V 2002 2006



SECTION H
5H:1V 2002 2006

10 0 10 20
VERTICAL SCALE: 1"=10'-0"

50 0 50 100
HORIZONTAL SCALE: 1"=50'-0"

NO.	DATE	APPR.	REVISION
0	4/16/04		FINAL
C	3/30/04		DRAFT FINAL
B	3/23/04		90% DESIGN SUBMITTAL
A	2/10/04		60% DESIGN SUBMITTAL

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON SOLUTIONS TEAM

		DATE
CHECKED	RWM	03/30/04
DES. ENG.	SW	03/30/04
PROJ. ENG.	AH	03/30/04
PROJ. MGR.	BK	03/30/04
APPROVED	BK	03/30/04
APPROVED		

CLIENT APPROVALS DATE

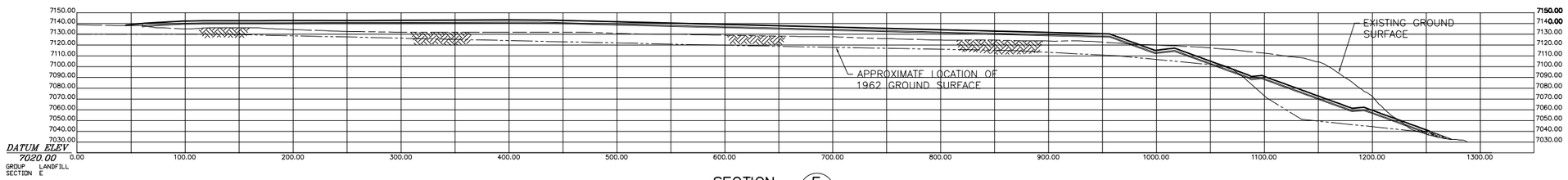
LANDFILL CROSS-SECTIONS
E, F, G AND H
SHEET 1 OF 3

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2006	0
SCALE	W.O. NO.	SHT. ___ OF ___	
AS SHOWN	13104.002.001		

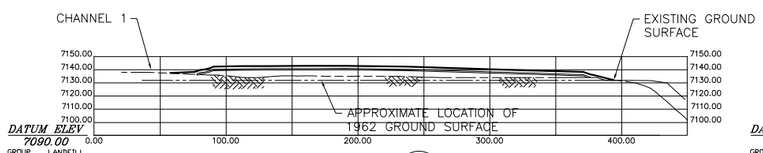
G:\ACADPROJ\13104.002.001LANL\PROJECT\2001_2002_2004_2006_2007.DWG

GENERAL NOTE:

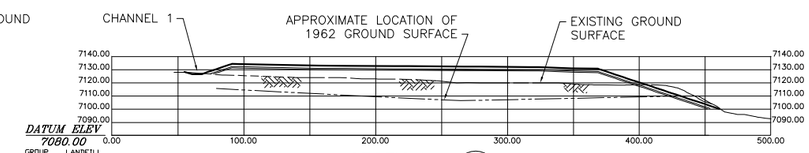
1. THE 1962 SURFACES DEPICTED ON THIS DRAWING SHOULD BE CONSIDERED "FOR INFORMATION ONLY".



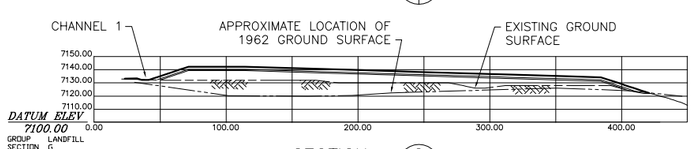
SECTION E
1H:1V 2002 2007



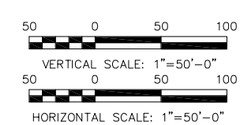
SECTION F
1H:1V 2002 2007



SECTION H
1H:1V 2002 2007



SECTION G
1H:1V 2002 2007



NO.	DATE	APPR.	REVISION
0	4/16/04		FINAL
C	3/30/04		DRAFT FINAL
B	3/23/04		90% DESIGN SUBMITTAL
A	2/10/04		60% DESIGN SUBMITTAL

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON TEAM

CHECKED RWM	DATE 03/30/04	CLIENT APPROVALS	DATE
DES. ENG. SW	03/30/04		
PROJ. ENG. AH	03/30/04		
PROJ. MGR. BK	03/30/04		
APPROVED BK	03/30/04		
APPROVED			

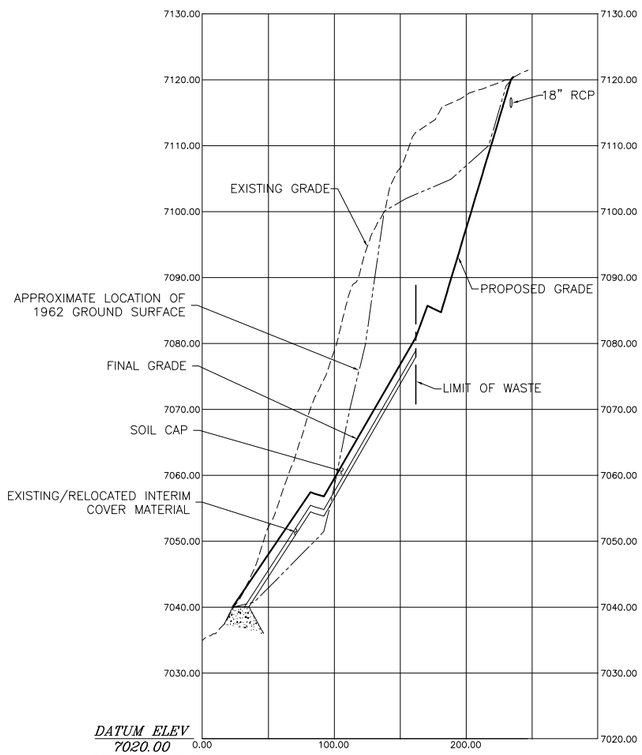
LANDFILL CROSS-SECTIONS
E, F, G AND H
SHEET 2 OF 3

DRAWN GDM	DATE 02/06/04	DWG. NO. 2007	REV. NO. 0
SCALE AS SHOWN	W.O. NO. 13104.002.001	SHT. ___ OF ___	

G:\ACADPROJ\13104.002.001LAN\PROJECT\2001_2002_2004_2006_2007.DWG

NOTES:

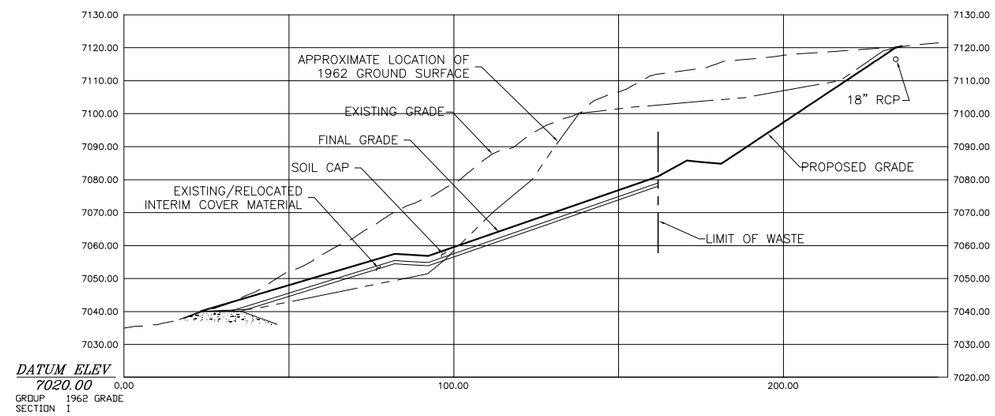
1. THE 1962 SURFACES DEPICTED ON THIS DRAWING SHOULD BE CONSIDERED "FOR INFORMATION ONLY".
2. THE NATURAL GRADES OF THE ORIGINAL HANGING VALLEY, PRIOR TO BEGINNING OF WASTE DISPOSAL, SHOWN ON THIS DRAWING ARE APPROXIMATE. THE GRADING PLAN SHOWN FOR THE EAST SLOPE WILL BE REVISED AS NEEDED IF NATIVE GROUND IS ENCOUNTERED DURING EXCAVATION. SLOPES ON WASTE WILL BE CONSTRUCTED AS SHOWN, HOWEVER SLOPES ON NATIVE GROUND, IF ENCOUNTERED, WILL BE ASSESSED BY THE ENGINEER AND MAY BE STEEPER THAN SHOWN. NATIVE ROCK WILL NOT BE EXTENSIVELY EXCAVATED. ALL REVISED GRADES WILL BE REVIEWED BY THE ENGINEER.



SECTION I
5H:1V 2002 2008

10 0 10 20
VERT. SCALE: 1"=10'-0"

50 0 50 100
HORIZ. SCALE: 1"=50'-0"



SECTION I
1H:1V 2002 2008

20 0 20 40
VERT. SCALE: 1"=20'-0"

20 0 20 40
HORIZ. SCALE: 1"=20'-0"

G:\ACADPROJ\13104.002.001LAN\PROJECT\2008.DWG

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
0	4/16/04		FINAL				
C	3/30/04		DRAFT FINAL				
B	3/23/04		90% DESIGN SUBMITTAL				
A	2/10/04		60% DESIGN SUBMITTAL				

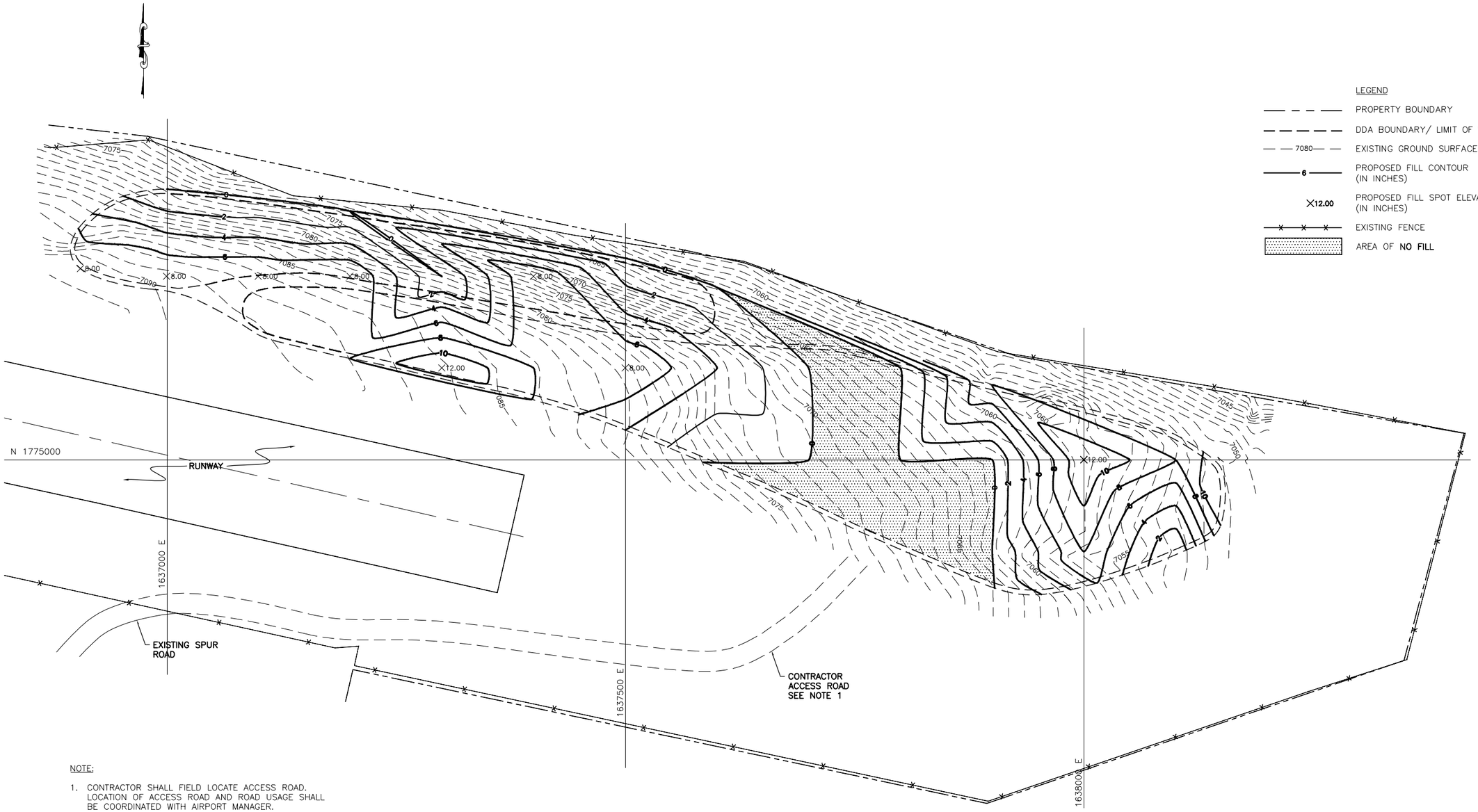
LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON SOLUTIONS TEAM

CHECKED RWM	DATE 03/30/04	CLIENT APPROVALS	DATE
DES. ENG. SW	03/30/04		
PROJ. ENG. AH	03/30/04		
PROJ. MGR. BK	03/30/04		
APPROVED BK	03/30/04		
APPROVED			

LANDFILL CROSS-SECTION I
SHEET 3 OF 3

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2008	0
SCALE AS SHOWN	W.O. NO. 13104.002.001	SHT. ___ OF ___	



NOTE:

1. CONTRACTOR SHALL FIELD LOCATE ACCESS ROAD. LOCATION OF ACCESS ROAD AND ROAD USAGE SHALL BE COORDINATED WITH AIRPORT MANAGER.

50 0 50 100

SCALE: 1"=50'-0"

G:\ACADPROJ\13104.002.001LANL\PROJECT\2009.DWG

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
O	4/16/04		FINAL				
C	3/30/04		DRAFT FINAL				
B	3/23/04		90% DESIGN SUBMITTAL				
A	2/10/04		60% DESIGN SUBMITTAL				

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

North Wind | WESTON SOLUTIONS TEAM

CHECKED	RWM	DATE	03/30/04
DES. ENG.	SW		03/30/04
PROJ. ENG.	AH		03/30/04
PROJ. MGR.	BK		03/30/04
APPROVED	BK		03/30/04
APPROVED			

CLIENT APPROVALS | DATE

DEBRIS DISPOSAL AREA FILL PLAN

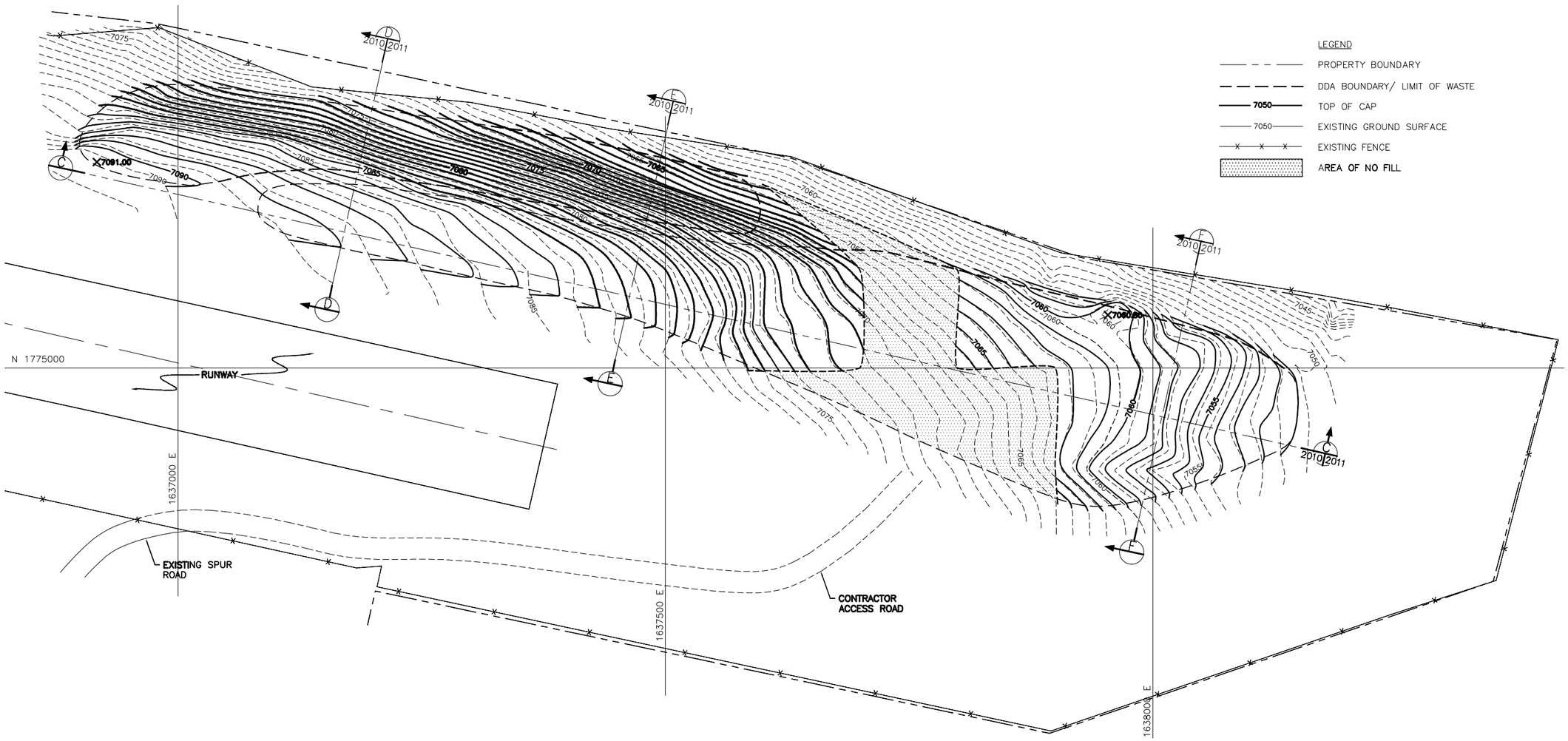
DRAWN: GDM	DATE: 02/06/04	DWG. NO.: 2009	REV. NO.: 0
SCALE: AS SHOWN	W.O. NO.: 13104.002.001	SHT. ___ OF ___	

NOTE:

1. CONTRACTOR ACCESS TO THE PROJECT SITE IS THROUGH THE EXISTING SPUR ROAD. THE CONTRACTOR IS RESPONSIBLE TO IMPROVE AND MAINTAIN THIS ACCESS WAY FOR THE PROPOSED OPERATIONS. AT THE COMPLETION OF CONSTRUCTION, THE CONTRACTOR WILL RETURN THE AREA TO ITS ORIGINAL CONDITION.

LEGEND

- PROPERTY BOUNDARY
- DDA BOUNDARY/ LIMIT OF WASTE
- 7050 TOP OF CAP
- 7050 EXISTING GROUND SURFACE
- EXISTING FENCE
- AREA OF NO FILL



50 0 50 100

SCALE: 1"=50'-0"

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
0	4/16/04		FINAL				
C	3/30/04		DRAFT FINAL				
B	3/23/04		90% DESIGN SUBMITTAL				
A	2/10/04		60% DESIGN SUBMITTAL				

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

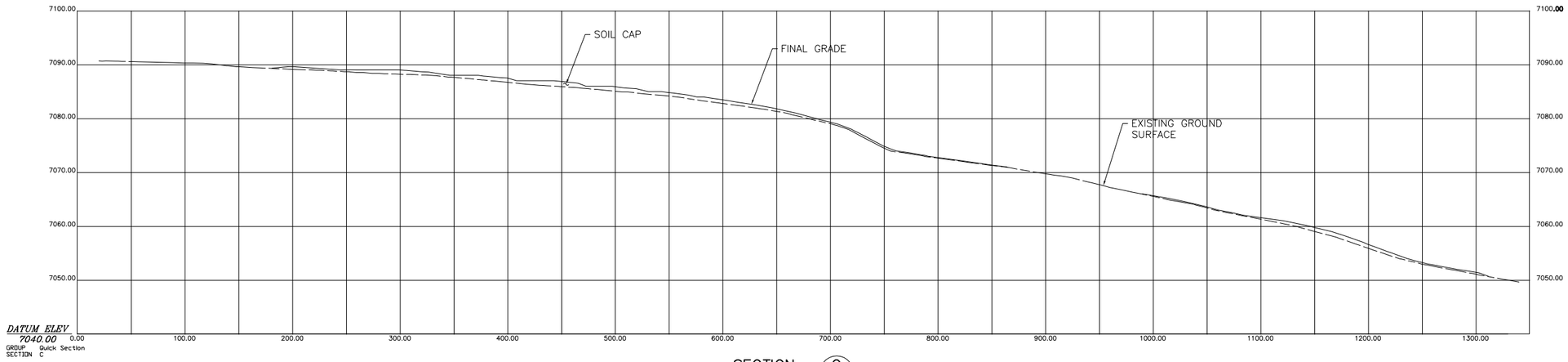
WESTON SOLUTIONS TEAM

		DATE	CLIENT APPROVALS	DATE
CHECKED	RWM	03/30/04		
DES. ENG.	SW	03/30/04		
PROJ. ENG.	AH	03/30/04		
PROJ. MGR.	BK	03/30/04		
APPROVED	BK	03/30/04		
APPROVED				

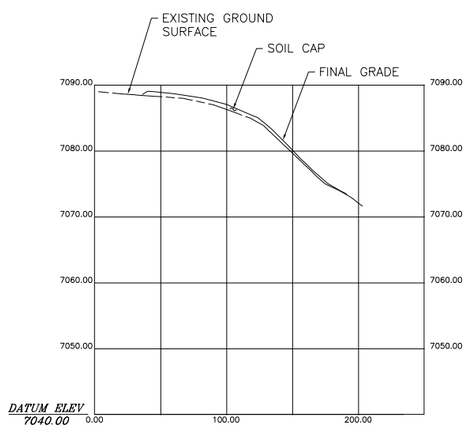
DEBRIS DISPOSAL AREA
TOP OF CAP GRADING PLAN

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2010	0
SCALE: AS SHOWN	W.O. NO.: 13104.002.001	SHT. ___ OF ___	

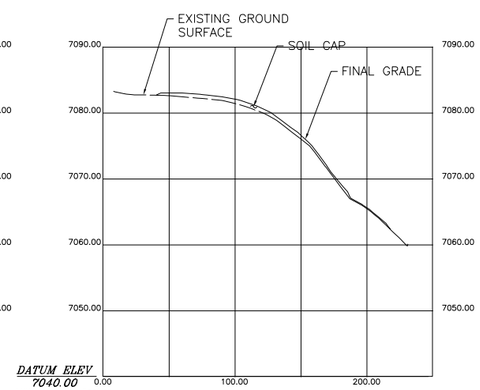
G:\ACADPROJ\13104.002.001LANL\PROJECT\2010_2011_2012.DWG



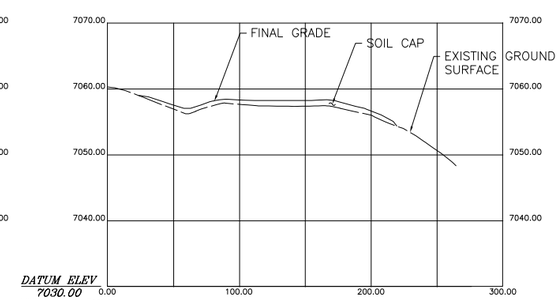
SECTION C
5H:1V 2010 2011



SECTION D
5H:1V 2010 2011



SECTION E
5H:1V 2010 2011



SECTION F
5H:1V 2010 2011

10 0 10 20
VERTICAL SCALE: 1"=10'-0"
50 0 50 100
HORIZONTAL SCALE: 1"=50'-0"

NO.	DATE	APPR.	REVISION
0	4/16/04		FINAL
C	3/31/04		DRAFT FINAL
B	3/23/04		90% DESIGN SUBMITTAL
A	2/10/04		60% DESIGN SUBMITTAL

NO.	DATE	APPR.	REVISION

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

North Wind | WESTON SOLUTIONS TEAM

CHECKED	RWM	DATE 03/30/04	CLIENT APPROVALS	DATE
DES. ENG.	SW	03/30/04		
PROJ. ENG.	AH	03/30/04		
PROJ. MGR.	BK	03/30/04		
APPROVED	BK	03/30/04		
APPROVED				

DEBRIS AREA
CROSS-SECTIONS C, D, E AND F
SHEET 1 OF 2

DRAWN GDM	DATE 02/06/04	DWG. NO. 2011	REV. NO. 0
SCALE AS SHOWN	W.O. NO. 13104.002.001	SHT. ___ OF ___	

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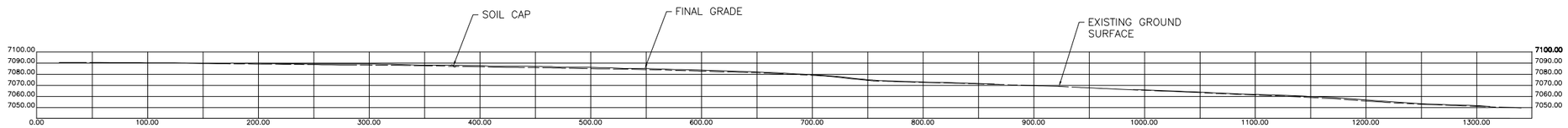
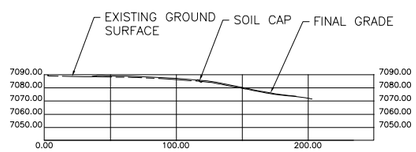
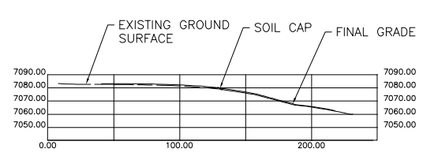


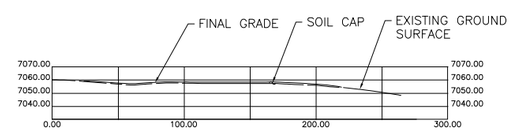
SECTION C
1H:1V 2010 2011



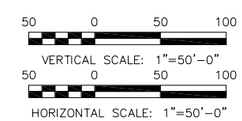
SECTION D
1H:1V 2010 2011



SECTION E
1H:1V 2010 2011



SECTION F
1H:1V 2010 2011



NO.	DATE	APPR.	REVISION
O	4/16/04		FINAL
C	3/30/04		DRAFT FINAL
B	3/23/04		90% DESIGN SUBMITTAL
A	2/10/04		60% DESIGN SUBMITTAL

NO.	DATE	APPR.	REVISION

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON SOLUTIONS TEAM

CHECKED	RWM	DATE	03/30/04	CLIENT APPROVALS	DATE
DES. ENG.	SW		03/30/04		
PROJ. ENG.	AH		03/30/04		
PROJ. MGR.	BK		03/30/04		
APPROVED	BK		03/30/04		
APPROVED					

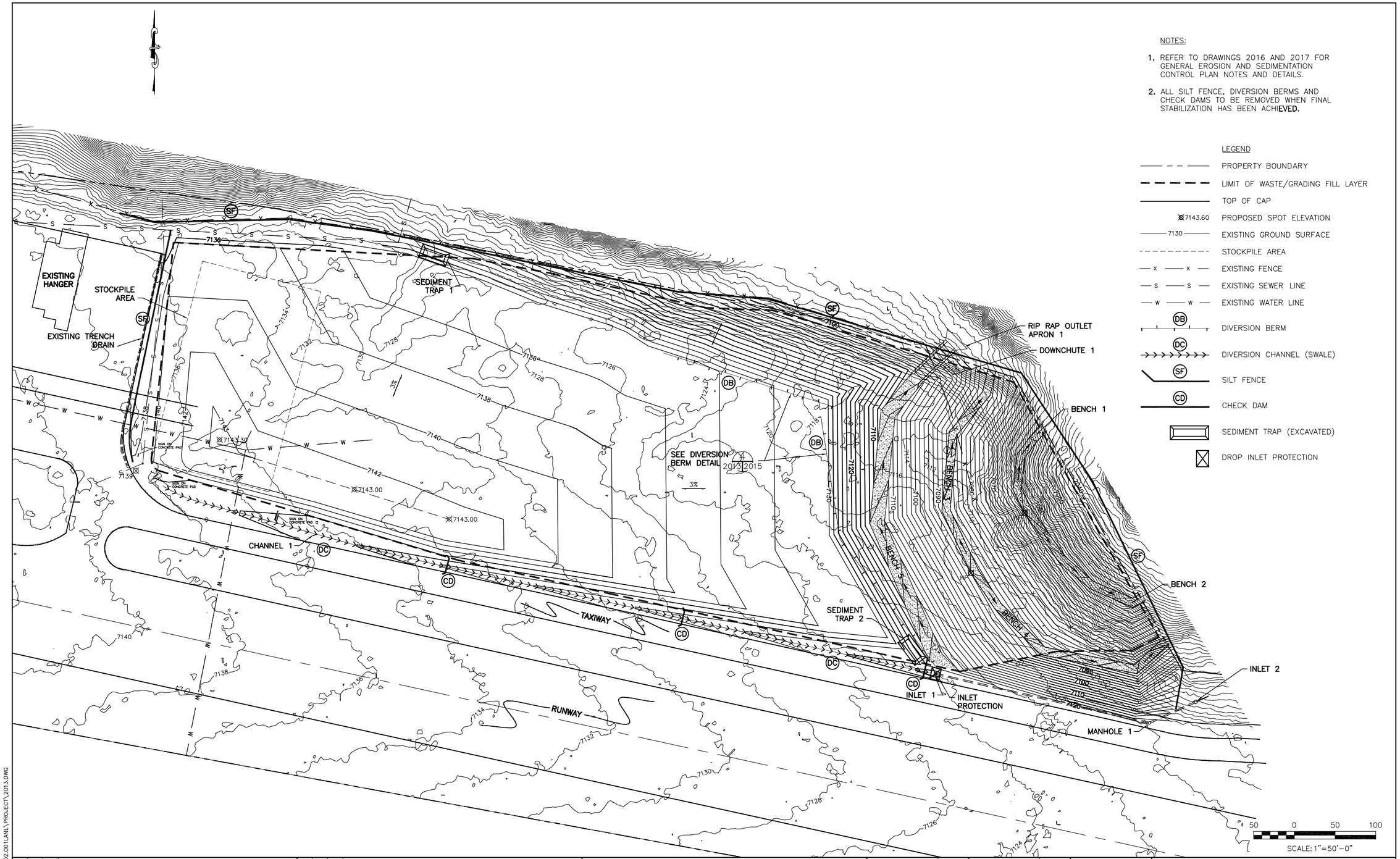
DEBRIS AREA
CROSS-SECTIONS C, D, E AND F
SHEET 2 OF 2

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2012	0
SCALE	W.O. NO.	SHT. ___ OF ___	
AS SHOWN	13104.002.001		

G:\ACADPROJ\13104.002.001LANL\PROJECT\2010_2011_2012.DWG

NOTES:

1. REFER TO DRAWINGS 2016 AND 2017 FOR GENERAL EROSION AND SEDIMENTATION CONTROL PLAN NOTES AND DETAILS.
2. ALL SILT FENCE, DIVERSION BERMS AND CHECK DAMS TO BE REMOVED WHEN FINAL STABILIZATION HAS BEEN ACHIEVED.



LEGEND

- PROPERTY BOUNDARY
- LIMIT OF WASTE/GRADING FILL LAYER
- TOP OF CAP
- 7143.60 PROPOSED SPOT ELEVATION
- 7130 EXISTING GROUND SURFACE
- STOCKPILE AREA
- EXISTING FENCE
- EXISTING SEWER LINE
- EXISTING WATER LINE
- DB DIVERSION BERM
- DC DIVERSION CHANNEL (SWALE)
- SF SILT FENCE
- CD CHECK DAM
- SEDIMENT TRAP (EXCAVATED)
- DROP INLET PROTECTION

NO.	DATE	APPR.	REVISION
O	4/16/04		FINAL
C	3/30/04		DRAFT FINAL
B	3/23/04		90% DESIGN SUBMITTAL
A	2/10/04		60% DESIGN SUBMITTAL

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON SOLUTIONS TEAM

		DATE	CLIENT APPROVALS	DATE
CHECKED	RWM	03/30/04		
DES. ENG.	SW	03/30/04		
PROJ. ENG.	AH	03/30/04		
PROJ. MGR.	BK	03/30/04		
APPROVED	BK	03/30/04		
APPROVED				

EROSION AND SEDIMENTATION CONTROL PLAN
LANDFILL AREA

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2013	0
SCALE	W.O. NO.	SHT. ___ OF ___	
AS SHOWN	13104.002.001		

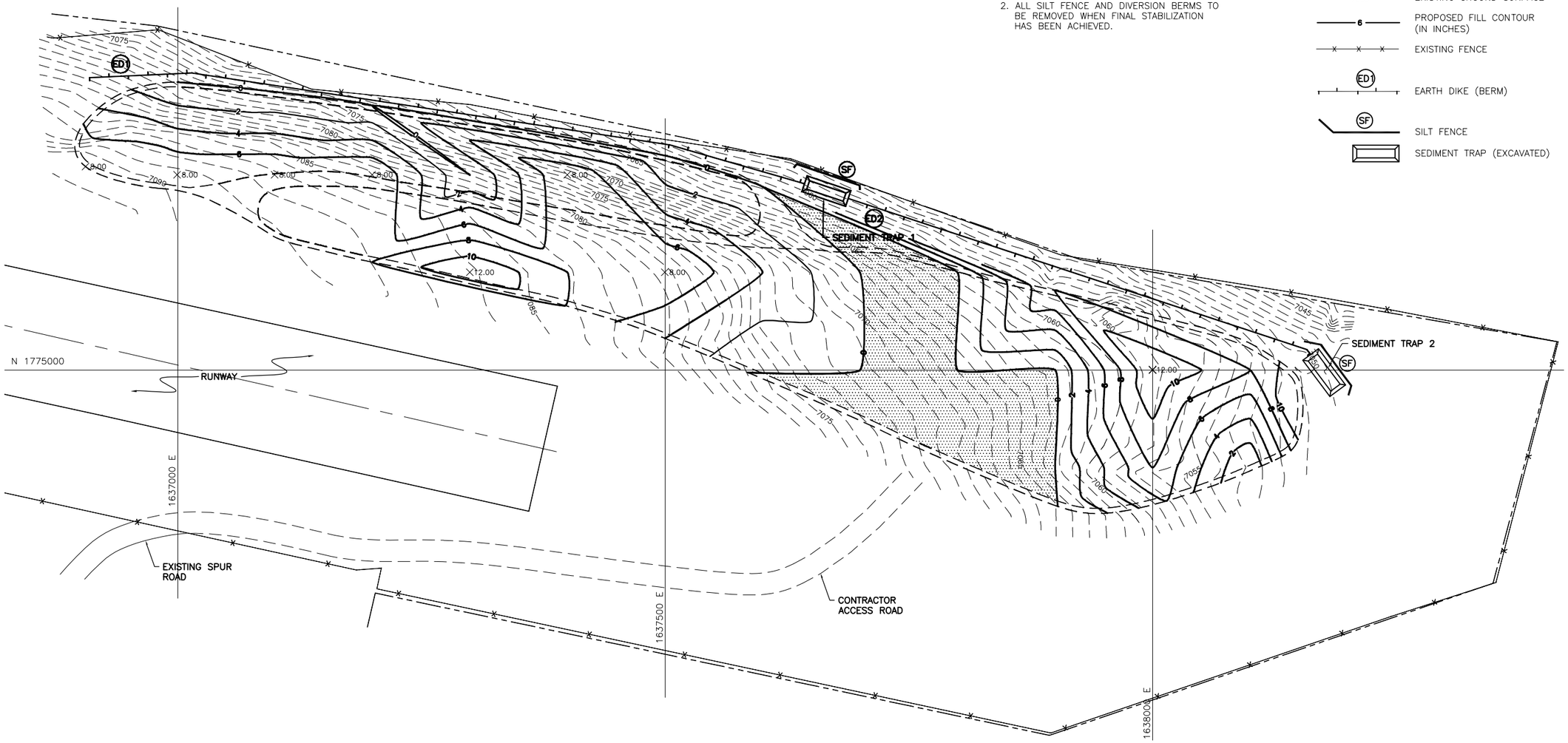
G:\ACADPROJ\13104.002.001LAN\PROJECT\2013.DWG

NOTES:

1. REFER TO DRAWINGS 2016 AND 2017 FOR GENERAL EROSION AND SEDIMENTATION CONTROL PLAN NOTES AND DETAILS.
2. ALL SILT FENCE AND DIVERSION BERMS TO BE REMOVED WHEN FINAL STABILIZATION HAS BEEN ACHIEVED.

LEGEND

- PROPERTY BOUNDARY
- LIMIT OF WASTE/GRADING FILL LAYER
- DDA BOUNDARY
- 7080 EXISTING GROUND SURFACE
- 6 PROPOSED FILL CONTOUR (IN INCHES)
- EXISTING FENCE
- ED1 EARTH DIKE (BERM)
- SF SILT FENCE
- SEDIMENT TRAP (EXCAVATED)



50 0 50 100

SCALE: 1"=50'-0"

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
O	4/16/04		FINAL				
C	3/30/04		DRAFT FINAL				
B	3/23/04		90% DESIGN SUBMITTAL				
A	2/10/04		60% DESIGN SUBMITTAL				

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

North Wind | WESTON SOLUTIONS TEAM

CHECKED	RWM	DATE	03/30/04
DES. ENG.	SW		03/30/04
PROJ. ENG.	AH		03/30/04
PROJ. MGR.	BK		03/30/04
APPROVED	BK		03/30/04
APPROVED			

CLIENT APPROVALS | DATE

EROSION AND SEDIMENTATION CONTROL PLAN DEBRIS DISPOSAL AREA

DRAWN GDM	DATE 02/06/04	DWG. NO. 2014	REV. NO. 0
SCALE AS SHOWN	W.O. NO. 13104.002.001	SHT. ___ OF ___	

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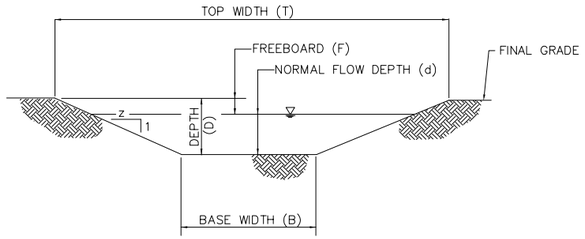
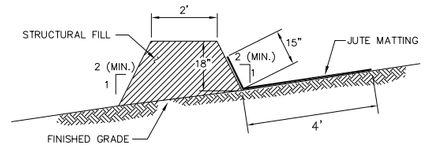


TYPICAL GRASS LINED RUNOFF CHANNEL SECTION

(WORK WITH TABLE 1)

DETAIL 1 (2002 | 2015)

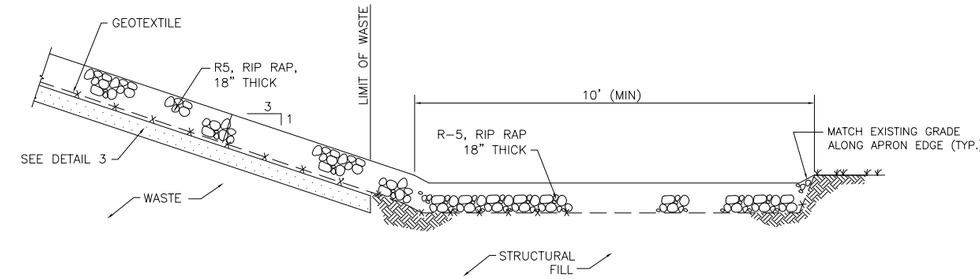
N.T.S.



DIVERSION BERM

DETAIL 4 (2013 | 2015)

N.T.S.



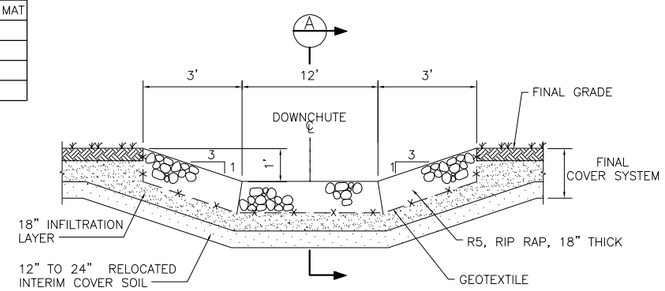
DOWNCHUTE DISCHARGE TO RIP RAP OUTLET APRON

SECTION A

N.T.S.

TABLE 1 :

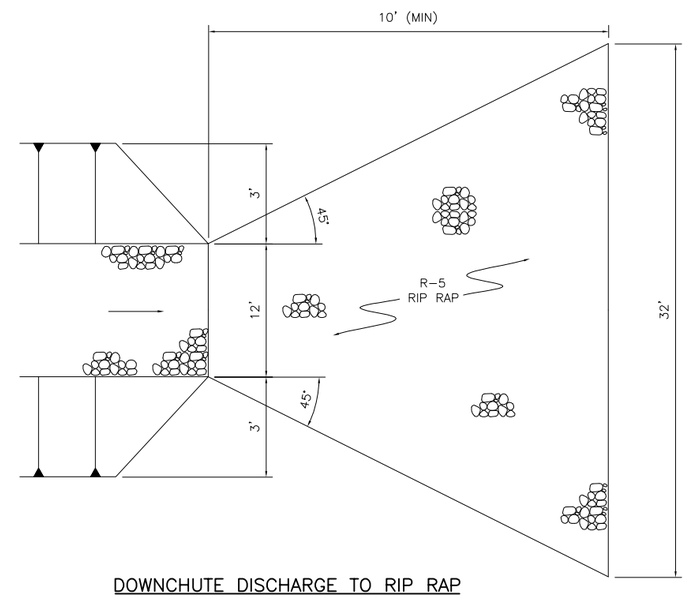
CHANNEL	DESIGN FLOW (CFS)	CHANNEL DIMENSIONS					FLOW CHARACTERISTICS			CHANNEL BED PROTECTION
		BED SLOPE (%)	T (FT)	D (FT)	B (FT)	z	d (FT)	F (FT)	VELOCITY (FPS)	
1	3.5	1.70	8	1	2	3	0.49	0.51	3.09	SYNTHETIC MAT



DOWNCHUTE 1 – SECTION

DETAIL 3 (2002 | 2015)

N.T.S.



DOWNCHUTE DISCHARGE TO RIP RAP OUTLET APRON PLAN

DETAIL 5 (2002 | 2015)

N.T.S.

TABLE 2: SEDIMENT TRAPS SIZING

RUNOFF AREA	REQUIRED STORAGE	STORAGE DEPTH	TOTAL DEPTH (INCL. 1' FREEBOARD)	APPROXIMATE BOTTOM DIMENSIONS		SEDIMENT STORAGE
				WIDTH	LENGTH	
Ac	CF	FT	FT	FT	FT	CF
1	2000	2	3	19.2	38.4	700
2	4000	2	3	28.5	57.0	1400
3	6000	2	3	35.6	71.3	2100
4	8000	2	3	41.6	83.3	2800
5	10000	2	3	46.9	93.9	3500

NOTES:

1. REFER TO DRAWING 2002 FOR DOWNCHUTE SECTION LOCATIONS.
2. FINAL GRADE DETAILS ARE SHOWN AT 3H:1V SLOPE FOR INFORMATIONAL PURPOSES ONLY. ACTUAL GRADES SHALL BE AS INDICATED ON DRAWING 2002 AND 2010.

NO.	DATE	APPR.	REVISION
0	4/16/04		FINAL
C	3/30/04		DRAFT FINAL
B	3/23/04		90% DESIGN SUBMITTAL
A	2/10/04		60% DESIGN SUBMITTAL

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

North Wind | WESTON SOLUTIONS TEAM

		DATE	CLIENT APPROVALS	DATE
CHECKED	RWM	03/30/04		
DES. ENG.	SW	03/30/04		
PROJ. ENG.	AH	03/30/04		
PROJ. MGR.	BK	03/30/04		
APPROVED	BK	03/30/04		
APPROVED				

STORMWATER CONTROL DETAILS

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2015	0
SCALE N.T.S.	W.O. NO. 13104.002.001	SHT. ___ OF ___	

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SOIL EROSION AND SEDIMENTATION CONTROL PLAN

THE CONTRACTOR WILL FULLY COMPLY WITH ALL THE APPLICABLE FEDERAL AND STATE OF NEW MEXICO REGULATIONS AND STANDARDS.

EROSION CONTROL MEASURES

TEMPORARY

TEMPORARY CONTROL MEASURES INCLUDE CONSTRUCTION ENTRANCES, SILT FENCES, CHECK DAMS, INLET FILTERS AND MAINTENANCE OF EROSION AND SEDIMENT CONTROLS. THE CONSTRUCTION ENTRANCE IS A STONE APRON OVER WHICH ALL VEHICLES WILL PASS. SILT FENCE WILL BE USED TO INTERCEPT SHEET RUNOFF. CHECK DAMS WILL REDUCE FLOW VELOCITY IN DIVERSION CHANNELS. MAINTENANCE IS THE REGULAR AND ROUTINE INSPECTION OF THE SEDIMENT AND EROSION CONTROLS, AND THE REPAIR OF THOSE CONTROLS TO PREVENT SEDIMENT FROM LEAVING THE SITE.

PERMANENT

ALL AREAS OF EARTH DISTURBED BY CONSTRUCTION WILL BE SEEDED AND MULCHED IMMEDIATELY AFTER COMPLETION OF CONSTRUCTION. IN THE EVENT THAT SEEDING CANNOT TAKE PLACE IMMEDIATELY DUE TO WEATHER CONDITIONS, MULCH OR HEAVY JUTE MATS WILL BE SPREAD OVER THE DISTURBED AREAS UNTIL SEEDING MAY BE PROPERLY COMPLETED.

MAINTENANCE PROGRAM FOR SEDIMENT AND EROSION CONTROLS

THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING ALL EROSION CONTROL FACILITIES INCLUDING SEDIMENT REMOVAL DURING CONSTRUCTION, AND DURING THE SURCHARGE AND EMBANKMENT CONSOLIDATION PERIOD. ALL DAMAGED FACILITIES WILL BE REPAIRED WITHIN 24 HOURS. WHEN SILT HAS ACCUMULATED TO A DEPTH OF SIX INCHES AGAINST OR AROUND ANY CONTROL FACILITY THE SILT WILL BE REMOVED IMMEDIATELY AND RETURNED TO THE SITE.

THE CONTRACTOR WILL NOT REMOVE ANY CONTROL FACILITY UNTIL DIRECTED BY THE ENGINEER. MATERIALS USED FOR EROSION CONTROL WILL BE DISPOSED OF OFF–SITE WHEN REMOVED. SUCH MATERIALS ARE CONSIDERED PROPERTY OF THE CONTRACTOR.

CONSTRUCTION ENTRANCE

THE STRUCTURE'S THICKNESS WILL BE CONSTANTLY MAINTAINED TO THE SPECIFIED DIMENSIONS BY ADDING ROCK. A STOCKPILE OF ROCK MATERIAL WILL BE MAINTAINED ON THE SITE FOR THIS PURPOSE.

AT THE END OF EACH CONSTRUCTION DAY, ALL SEDIMENT DEPOSITED ON PUBLIC ROADWAYS WILL BE REMOVED BY USE OF A ROAD SWEEPER, WATER, VACUUM OR BROOM AND RETURNED TO THE CONSTRUCTION SITE.

SILT FENCE

THE FENCE INSTALLATION SHALL BE INSPECTED AFTER EVERY PRECIPITATION EVENT. ANY NECESSARY REPAIRS WILL BE MADE IMMEDIATELY.

ACCUMULATED SEDIMENTS WILL BE REMOVED AS REQUIRED TO KEEP THE FENCE FUNCTIONAL. IN ALL CASES REMOVE DEPOSITS WHERE ACCUMULATIONS REACH 1/3 OF THE ABOVE GROUND HEIGHT OF THE FENCE.

ALL UNDERCUTTING OR EROSION OF THE TOE ANCHOR WILL BE REPAIRED IMMEDIATELY WITH COMPACTED BACKFILL MATERIALS.

ADHERE TO ANY MANUFACTURER'S RECOMMENDATION FOR REPLACING SILT FENCE DUE TO WEATHERING.

VEGETATIVE SURFACE STABILIZATION AND SEEDING

ALL SEEDING AND FERTILIZER AND MULCH APPLICATION SHALL BE PER THE TECHNICAL SPECIFICATION, SECTION 02932.

ALL AREAS OF THE LANDFILL NOT COVERED BY THE ARMORED SOIL CAP WILL BE COVERED WITH AN EROSION CONTROL BLANKET, OR MULCH.

FOLLOWING INITIAL SOIL DISTURBANCE OR REDISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED IN ACCORDING WITH:

A. 7 CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, STOCKPILES, AND ALL SLOPES GREATER THAN 2 HORIZONTAL TO 1 VERTICAL (2:1)
B. 14 DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE. THE IN–PLACE SEDIMENT CONTROL MEASURES WILL BE MAINTAINED ON A CONTINUING BASIS UNTIL THE SITE IS PERMANENTLY STABILIZED AND ALL PERMIT REQUIREMENTS ARE MET.

SEDIMENT TRAPS, DIVERSION CHANNELS OR BERMS, AND STOCKPILES MUST BE SEEDED AND MULCHED IMMEDIATELY.

COMPLIANCE WITH STATE AND LOCAL REQUIREMENTS

THE EROSION & SEDIMENT POLLUTION CONTROL REPORT, APPLICATION DOCUMENTS, NARRATIVE(S), CONTRACT PLANS AND SPECIFICATIONS ARE ALL INCLUDED HEREWITH BY REFERENCE AS AN INTEGRAL PART OF THIS CONTRACT. ANY QUESTIONS, COMMENTS, APPROVAL CONDITIONS OR PERMIT REQUIREMENTS CONTAINED WITHIN A REGULATORY REVIEW LETTER FOR THIS PROJECT ARE HEREBY INCLUDED AS AN INTEGRAL PART OF THIS CONTRACT, AND THE CONTRACTOR SHALL FULLY COMPLY WITH ANY APPROVAL CONDITIONS OR PERMIT REQUIREMENTS AS IF THEY WERE INCLUDED HEREWITH IN THEIR FULL TEXT. COPIES OF ALL STATE AND LOCAL REGULATORY AGENCY REVIEWS, COMMENTS, APPROVAL CONDITIONS OR PERMIT REQUIREMENTS MAY BE OBTAINED THROUGH THE LOCAL CONSERVATION DISTRICT OFFICE.

DUST CONTROL

THE CONTRACTOR WILL EMPLOY CONSTRUCTION METHODS AND MEANS THAT WILL KEEP DUST TO THE MINIMUM. THE CONTRACTOR WILL PROVIDE FOR THE SPRAYING OF WATER ON THE PROJECT AREA (INCLUDING STOCKPILES), AND ON ROADS, STREETS AND OTHER AREAS IMMEDIATELY ADJACENT TO THE PROJECT LIMITS, WHEREVER TRAFFIC, OR BUILDINGS THAT ARE OCCUPIED OR IN USE, ARE AFFECTED BY SUCH DUST CAUSED BY HAULING OR OTHER OPERATIONS. THE MATERIALS AND METHODS USED FOR WATER SPRAYING SHALL BE SUBJECT TO THE APPROVAL OF THE OWNER. THE CONTRACTOR SHALL PROVIDE FOR PROMPT REMOVAL FROM EXISTING PAVING ALL DIRT AND OTHER MATERIAL THAT HAVE BEEN SPILLED, WASHED UPON, TRACKED UPON OR OTHERWISE DEPOSITED THEREON BY HIS HAULING AND OTHER OPERATIONS WHENEVER THE ACCUMULATION IS SUFFICIENT TO CAUSE THE FORMATION OF DUST, MUD, INTERFERE WITH DRAINAGE, DAMAGE PAVEMENTS OR CREATE A TRAFFIC HAZARD.

STANDARD EROSION AND SEDIMENTATION CONTROL PLAN NOTES

ONLY LIMITED DISTURBANCE WILL BE PERMITTED TO PROVIDE ACCESS TO SEDIMENT BASINS (IF REQUIRED), INTERCEPTOR CHANNELS, SILT FENCE AND ROCK FILTERS AS INDICATED ON THE PLANS, FOR GRADING AND ACQUIRING BORROW TO CONSTRUCT THESE CONTROLS.

EROSION AND SEDIMENTATION CONTROLS MUST BE CONSTRUCTED, STABILIZED, AND FUNCTIONAL BEFORE GENERAL SITE DISTURBANCE WITHIN THE TRIBUTARY AREAS OF THOSE CONTROLS.

AFTER FINAL SITE STABILIZATION HAS BEEN ACHIEVED, TEMPORARY EROSION AND SEDIMENTATION CONTROL MUST BE REMOVED. AREAS DISTURBED DURING REMOVAL OF THE CONTROLS MUST BE STABILIZED.

STOCKPILE HEIGHTS MUST NOT EXCEED 35 FEET OR VIOLATE AIRPORT CONICAL SURFACES. STOCKPILE MUST BE 2:1 OR FLATTER.

UNTIL FINAL STABILIZATION HAS BEEN ACHIEVED, ALL EROSION AND SEDIMENTATION CONTROLS MUST BE MAINTAINED PROPERLY. MAINTENANCE MUST INCLUDE INSPECTION OF ALL EROSION AND SEDIMENTATION CONTROLS AT LEAST ONCE EVERY 14 CALENDAR DAYS AND WITHIN 24 HOURS OF THE END OF A STORM EVENT OF 0.5 INCHES PRECIPITATION OR GREATER. THE INSPECTION FREQUENCY MAY BE REDUCED TO AT LEAST ONCE EVERY MONTH AFTER ALL EARTH DISTURBING ACTIVITIES HAVE BEEN COMPLETED AND CERTAIN CRITERIA, AS DEFINED IN SECTION 8.1 OF THE SWPPP, ARE MET. ALL PREVENTIVE AND REMEDIAL MAINTENANCE WORK, INCLUDING CLEAN OUT, REPAIR, REPLACEMENT, REGRADING, RESEEDING, REMULCHING, AND RENETTING, MUST BE PERFORMED AS SOON AS POSSIBLE AND BEFORE THE NEXT STORM EVENT. IF MAINTENANCE BEFORE THE NEXT STORM EVENT IS IMPRACTIBLE, MAINTENANCE MUST BE COMPLETED AS SOON AS POSSIBLE.

FINAL STABILIZATION HAS BEEN ACHIEVED WHEN ALL SOIL–DISTURBING ACTIVITIES HAVE BEEN COMPLETED AND A UNIFORM VEGETATIVE COVER WITH A DENSITY OF 70 PERCENT OF THE NATIVE BACKGROUND VEGETATIVE COVER FOR THE AREA HAS BEEN ESTABLISHED ON ALL UNPAVED AREAS AND AREAS NOT COVERED BY PERMANENT STRUCTURES. FINAL STABILIZATION OF AREAS WHERE A ROCK ARMOR HAS BEEN INSTALLED WILL BE ACHIEVED IMMEDIATELY UPON PLACEMENT OF THE ROCK ARMOR.

ALL ROADS AND UTILITIES WILL BE CONSTRUCTED AND STABILIZED BEFORE BEGINNING CONSTRUCTION OF ANY ONSITE STRUCTURES.

THE CONTRACTOR WILL BE RESPONSIBLE FOR THE PROPER CONSTRUCTION, STABILIZATION, AND MAINTENANCE OF ALL EROSION AND SEDIMENTATION CONTROLS AND RELATED ITEMS INCLUDED WITHIN THESE PLANS.

SHOULD ANY MEASURES CONTAINED WITHIN THIS PLAN PROVE INCAPABLE OF ADEQUATELY REMOVING SEDIMENT FROM ONSITE FLOWS PRIOR TO DISCHARGE OR OF STABILIZING THE SURFACES INVOLVED, ADDITIONAL MEASURES MUST BE IMMEDIATELY IMPLEMENTED BY THE CONTRACTOR TO ELIMINATE ALL SUCH PROBLEMS.

PROTECTION (I.E., RIPRAP) FOR DIVERSION CHANNELS, SWALES, OUTLET APRONS AND DESIGNATED SLOPES, SHALL BE IMMEDIATELY INSTALLED UPON CONSTRUCTION OF THE SAME.

SHOULD CONDITIONS ARISE IN THE FIELD WHICH RENDER THE E & S CONTROLS FOR THIS PROJECT INAPPROPRIATE OR INADEQUATE, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER. ADDITIONAL DRAWINGS OF MODIFICATIONS TO EXISTING DRAWINGS REQUIRED WILL BE FURNISHED BY THE CONTRACTOR. THESE REVISIONS SHALL BECOME A PART OF AND A CONDITION OF THE E & S CONTROL PLAN.

NO.	DATE	APPR.	REVISION
0	4/16/04		FINAL
C	3/30/04		DRAFT FINAL
B	3/23/04		90% DESIGN SUBMITTAL
A	2/10/04		60% DESIGN SUBMITTAL

LOS ALAMOS SITE OFFICE
TA–73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON SOLUTIONS TEAM

		DATE
CHECKED	RWM	03/30/04
DES. ENG.	SW	03/30/04
PROJ. ENG.	AH	03/30/04
PROJ. MGR.	BK	03/30/04
APPROVED	BK	03/30/04
APPROVED		

CLIENT APPROVALS | DATE

EROSION AND SEDIMENTATION CONTROL NOTES

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2016	0
SCALE N.T.S.	W.O. NO. 13104.002.001	SHT. ___ OF ___	

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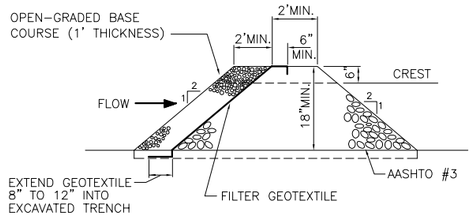
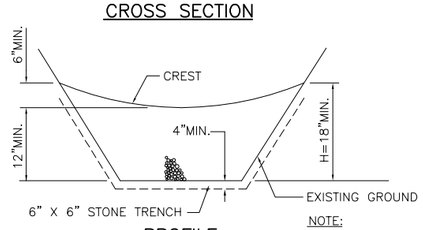


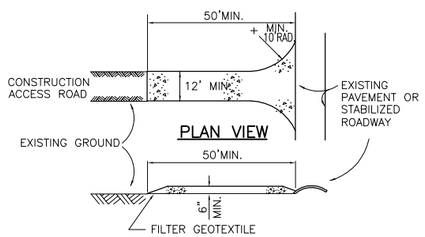
CROSS SECTION



PROFILE

NOTE:
EXTEND ROCK DAM FOR FULL WIDTH OF SWALE OR CHANNEL

CHECK DAM DETAIL



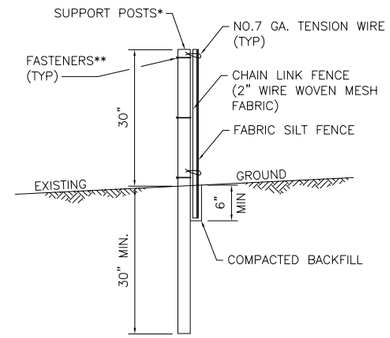
PLAN VIEW

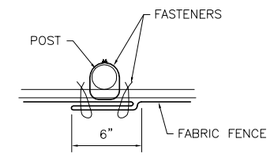
PROFILE

CONSTRUCTION ENTRANCE

CONSTRUCTION SPECIFICATIONS

1. STONE SIZE – AASHTO #3 OR RECYCLED CONCRETE EQUIVALENT
2. LENGTH – NOT LESS THAN 50 FT.
3. THICKNESS – NOT LESS THAN SIX (6) INCHES.
4. WIDTH – TWELVE (12)FT. MIN., BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
5. FILTER GEOTEXTILE – WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY AND INCORPORATED WITHIN THE FILL OPERATIONS.
7. WASHING – WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHTS-OF-WAY.
8. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.





JOINING FENCE SECTION

SILT FENCE

(SUPER SILT FENCE)

N.T.S.

* POSTS SPACED @ 10' MAX. USE 2"x2" WOOD POSTS OR 2½" DIA. GALVANIZED OR ALUMINUM POSTS.

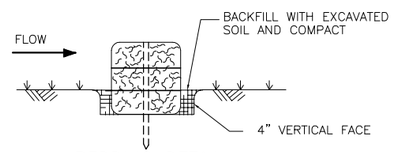
** CHAIN LINK TO POST FASTENERS SPACED @ 14" MAX. USE NO. 6 GA. ALUMINUM WIRE OR NO. 9 GALVANIZED STEEL PRE-FORMED CLIPS. CHAIN LINK TO TENSION WIRE FASTENERS SPACED @ 60" MAX. USE NO. 10 GA. GALVANIZED STEEL WIRE. FABRIC TO CHAIN FASTENERS SPACED @ 24" MAX C TO C.

NO. 7 GA. TENSION WIRE INSTALLED HORIZONTALLY AT TOP AND BOTTOM OF CHAIN-LINK FENCE.

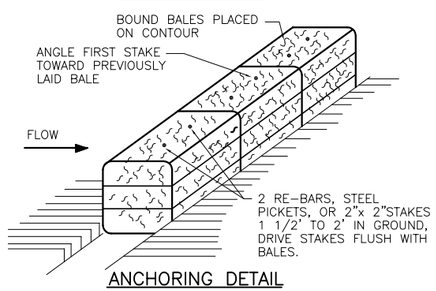
FILTER FABRIC FENCE MUST BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE BARRIER MUST BE EXTENDED AT LEAST 8 FEET UPSLOPE AT 45° TO MAIN BARRIER ALIGNMENT.

SEDIMENT MUST BE REMOVED WHEN ACCUMULATIONS REACH ½ THE ABOVE GROUND HEIGHT OF THE FENCE.

SILT FENCE MAY BE ATTACHED TO THE EXISTING OR RELOCATED/NEW CHAIN LINK FENCE PROVIDING THE REQUIRED EMBEDMENT DEPTH IS ACHIEVED.

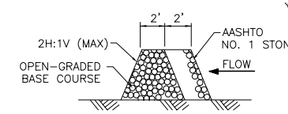


BEDDING DETAIL



ANCHORING DETAIL

STRAW BALE BARRIER



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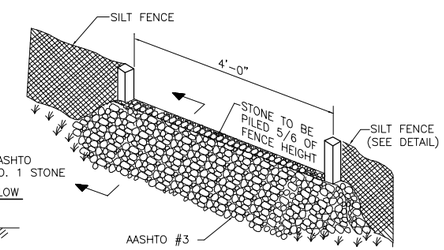

GRAVEL OUTLET DETAIL

N.T.S.

NOTES:

1. GRAVEL OUTLETS TO BE PROVIDED AT ALL EXISTING OR GRADED LOW POINTS, EVERY 250 FEET, (UNLESS OTHERWISE NOTED) AND ALL AREAS OF POTENTIAL CONCENTRATED FLOWS.
2. IF INSPECTION OF SILT FENCE REVEALS UNDERMINING OR OVERTOPPING OF THE FENCE, REMOVE PORTION OF SILT FENCE AND REPLACE WITH A GRAVEL OUTLET.
3. ACCUMULATED SEDIMENTS WILL BE REMOVED WHEN ACCUMULATION REACH 1/3 THE ABOVE GROUND HEIGHT OF THE FENCE.

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
O	4/16/04		FINAL				
C	3/30/04		DRAFT FINAL				
B	3/23/04		90% DESIGN SUBMITTAL				
A	2/10/04		60% DESIGN SUBMITTAL				

LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON SOLUTIONS TEAM

CHECKED	RWM	DATE 03/30/04	CLIENT APPROVALS	DATE
DES. ENG.	SW	03/30/04		
PROJ. ENG.	AH	03/30/04		
PROJ. MGR.	BK	03/30/04		
APPROVED	BK	03/30/04		
APPROVED				

EROSION AND SEDIMENTATION CONTROL DETAILS

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2017	0
SCALE N.T.S.	W.O. NO. 13104.002.001	SHT. ___ OF ___	

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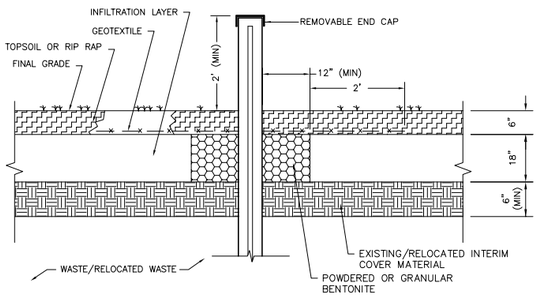
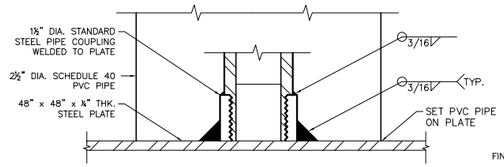


TYPICAL CAP PENETRATION

DETAIL B

N.T.S.



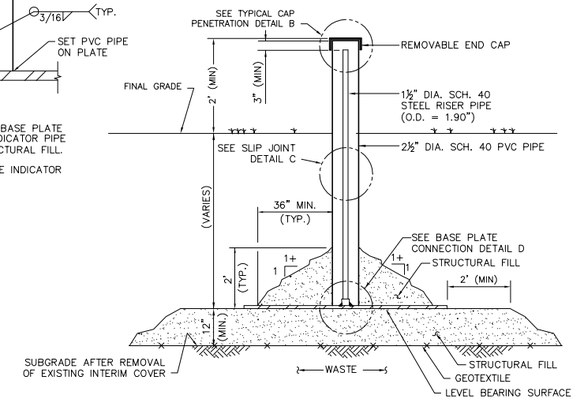
NOTES:

1. MEASURE THE ELEVATION OF THE INSTALLED BASE PLATE AND THE TOP OF THE SETTLEMENT PLATE INDICATOR PIPE PRIOR TO PLACING OUTER CASING AND STRUCTURAL FILL.
2. MEASURE THE ELEVATION OF THE TOP OF THE INDICATOR PIPE AND TOP OF OUTER CASING AFTER ALL INSTALLATION IS COMPLETE.

BASE PLATE CONNECTION

DETAIL D

N.T.S.



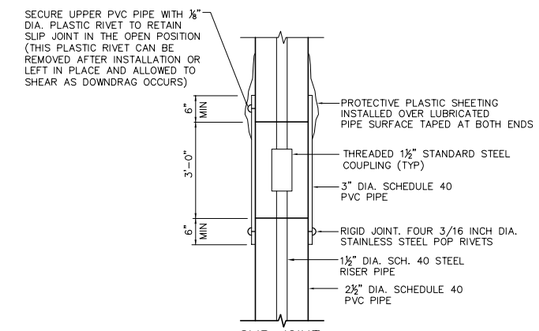
SETTLEMENT PLATE

DETAIL A

N.T.S.

LEGEND

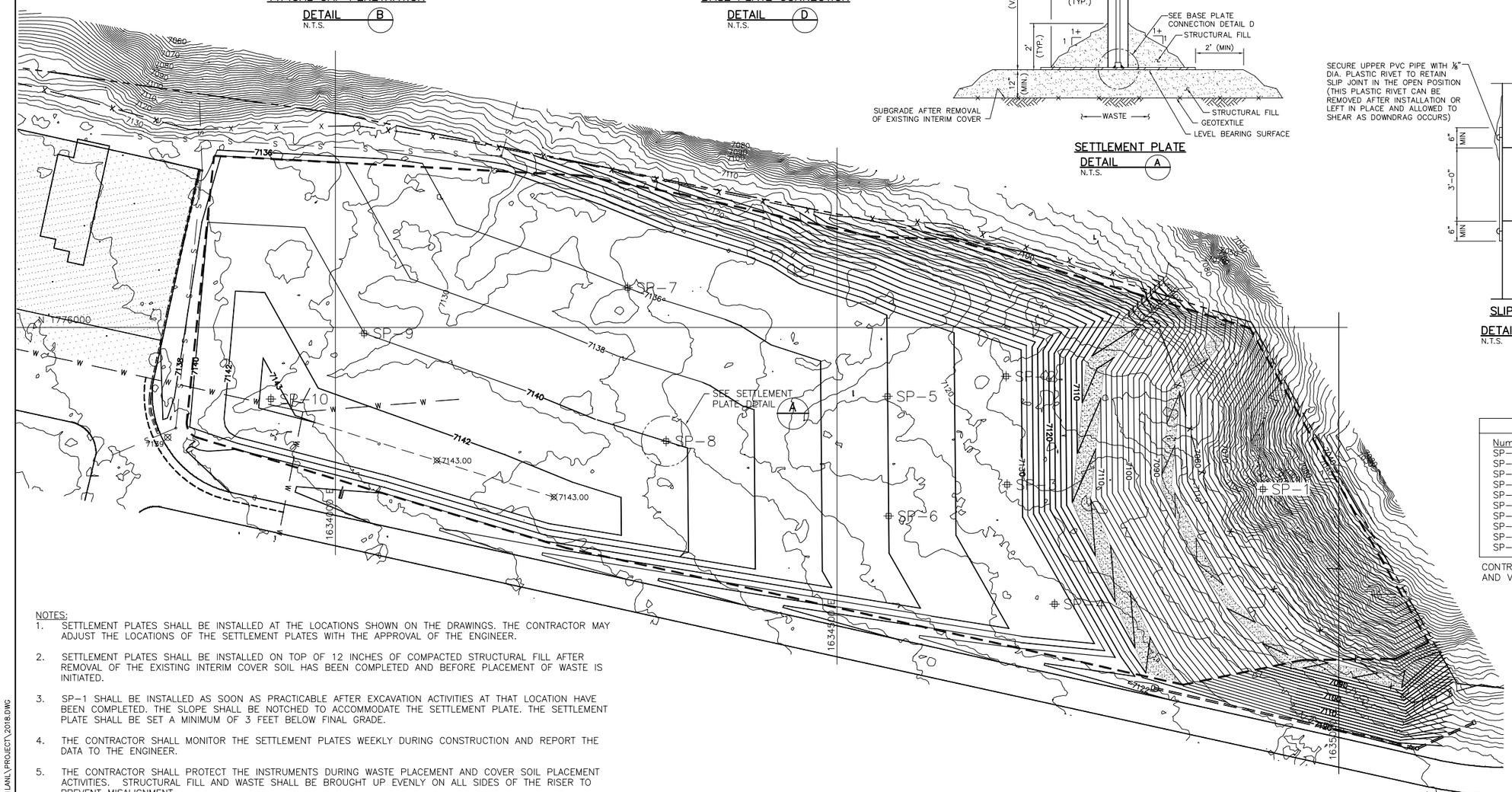
—— – – ——	PROPERTY BOUNDARY
— — — —	LIMIT OF WASTE/GRADING FILL LAYER
—— 7130 ——	TOP OF CAP
—— 7130 ——	EXISTING GROUND SURFACE
⊠7143.60	PROPOSED SPOT ELEVATION
⊕SP-1	SETTLEMENT PLATE
— x —— x —	EXISTING FENCE
— s —— s —	EXISTING SEWER LINE
— w —— w —	EXISTING WATER LINE



SLIP JOINT

DETAIL C

N.T.S.



SETTLEMENT PLATES		
Number	Northing	Easting
SP-1	1775838.4214	1634924.5294
SP-2	1775950.8208	1634668.7111
SP-3	1775843.0050	1634669.6816
SP-4	1775723.9563	1634717.1000
SP-5	1775930.9103	1634550.5522
SP-6	1775811.6730	1634551.6255
SP-7	1776039.1910	1634291.4051
SP-8	1775886.3694	1634329.9856
SP-9	1775993.7611	1634028.9056
SP-10	1775928.2259	1633935.9711

CONTRACTOR SHALL MONITOR HORIZONTAL AND VERTICAL LOCATION OF SP-1.

NOTES:

1. SETTLEMENT PLATES SHALL BE INSTALLED AT THE LOCATIONS SHOWN ON THE DRAWINGS. THE CONTRACTOR MAY ADJUST THE LOCATIONS OF THE SETTLEMENT PLATES WITH THE APPROVAL OF THE ENGINEER.
2. SETTLEMENT PLATES SHALL BE INSTALLED ON TOP OF 12 INCHES OF COMPACTED STRUCTURAL FILL AFTER REMOVAL OF THE EXISTING INTERIM COVER SOIL HAS BEEN COMPLETED AND BEFORE PLACEMENT OF WASTE IS INITIATED.
3. SP-1 SHALL BE INSTALLED AS SOON AS PRACTICABLE AFTER EXCAVATION ACTIVITIES AT THAT LOCATION HAVE BEEN COMPLETED. THE SLOPE SHALL BE NOTCHED TO ACCOMMODATE THE SETTLEMENT PLATE. THE SETTLEMENT PLATE SHALL BE SET A MINIMUM OF 3 FEET BELOW FINAL GRADE.
4. THE CONTRACTOR SHALL MONITOR THE SETTLEMENT PLATES WEEKLY DURING CONSTRUCTION AND REPORT THE DATA TO THE ENGINEER.
5. THE CONTRACTOR SHALL PROTECT THE INSTRUMENTS DURING WASTE PLACEMENT AND COVER SOIL PLACEMENT ACTIVITIES. STRUCTURAL FILL AND WASTE SHALL BE BROUGHT UP EVENLY ON ALL SIDES OF THE RISER TO PREVENT MISALIGNMENT.

50 0 50 100

SCALE: 1"=50'-0"

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
O	4/16/04		FINAL				
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LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILLS
LOS ALAMOS NEW MEXICO

WESTON SOLUTIONS TEAM

CHECKED	RWM	DATE	03/30/04
DES. ENG.	SW		03/30/04
PROJ. ENG.	AH		03/30/04
PROJ. MGR.	BK		03/30/04
APPROVED	BK		03/30/04
APPROVED			

CLIENT APPROVALS | DATE

SETTLEMENT PLATE LAYOUT AND DETAILS

DRAWN	DATE	DWG. NO.	REV. NO.
GDM	02/06/04	2018	0
SCALE: AS SHOWN	W.O. NO. 13104.002.001	SHT. ___ OF ___	

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WESTON SOLUTIONS

Professional Engineering Review and Approval

Engineering Design Package
Los Alamos Site Office TA-73 Airport Landfill
Final, Rev. 0

I hereby certify that these calculations, specifications, and drawings were prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of New Mexico.

Signed and Sealed by:

BERG KESHIAN, JR.
NEW MEXICO
8590
REGISTERED PROFESSIONAL ENGINEER

Berg Keshian, NMPE #8590

4-16-04
Date

NW-ID-2004-039
Final Revision 0

CONSTRUCTION SPECIFICATIONS FOR LOS ALAMOS SITE OFFICE TA-73 AIRPORT LANDFILL

Final Revision 0

April 2004

Prepared for:

North Wind, Inc.
545 Shoup Avenue, Suite 200
Idaho Falls, Idaho 83402

Prepared by:

Weston Solutions, Inc.
6565 Americas Parkway N.E., Suite 200
Albuquerque, New Mexico 87110

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DIVISION 1

GENERAL REQUIREMENTS

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Project is located at the Los Alamos County Airport, located in Los Alamos, NM. North Wind, Inc. has been contracted by the U.S. Department of Energy (DOE) Los Alamos Site Office (LASO) to design and construct a cover system for the Technical Area (TA)-73 Airport Landfill that is compliant with New Mexico Solid Waste Management Regulations (20 *New Mexico Administrative Code* [NMAC] 9.1). On April 1, 2003, the New Mexico Environment Department (NMED) granted conditional approval of the Voluntary Corrective Measures (VCM) Plan for an engineered alternative earthen final cover (NMED 2003).

B. Potential release sites (PRSs) 73-001(a)-99 Airport Landfill (main landfill) and 73-001(b)-99 Debris Disposal Area (DDA) are inactive PRSs and are listed in Table A within Module VIII of Los Alamos National Laboratory (LANL) Hazardous Waste Facility Permit (LANL 1996, 57486.1). Both landfill areas are located within TA-73 on DOE property, immediately north of the Los Alamos County Airport runway, between the runway and the edge of the mesa. The airport is currently operating under the management of Los Alamos County under lease from the DOE.

C. The main landfill area consists of a natural hanging valley into which municipal and LANL sanitary waste was disposed of for approximately 30 years. The west and south sides of the main landfill coincide approximately with the edges of the asphalt tie-down area and the asphalt taxiway to the hot pad, respectively. The north side extends approximately to the chain link security fence along the north side of the airport. To the east, the landfill extends to the end of the hanging valley and pinches out toward the hot pad.

D. The DDA lies east of the main landfill and consists of two roughly parallel trenches excavated to a maximum depth of approximately 35 feet (ft). To the west, the trenches extend to within approximately 150 ft of the windsock. To the east, the trenches extend approximately 800 ft beyond the end of the runway.

E. The main landfill covers a surface area of approximately 11.5 acres (AC). The DDA covers a surface area of approximately 5 AC.

F. Access to PRSs 73-001(a)-99 and 73-001(b)-99 is controlled by a perimeter fence around the entire airport. Access to the tarmac is limited to private airplane owners, operators, passengers, and other individuals with legitimate reasons to be there.

G. The work generally consists of the construction of a cap or cover over the existing 11.5-AC landfill. Waste from the east slope will be pulled back and relocated in order to reduce the excessively steep sideslope. Waste will be excavated from the north and east slopes to achieve an effective inclination of no steeper than 3H:1V. The proposed cover configuration is an 18-inch (in.) infiltration layer and a 6-in. topsoil layer to support native vegetation. The purpose of the cover is to minimize moisture percolation through the landfill refuse to prevent or reduce leaching and downward migration of contaminants. The work at the DDA consists of recontouring and reseeding. Both sites shall be graded to facilitate drainage and minimize erosion.

H. The work to be performed as described in this section is for the Contractor's general information only and is not intended to be a complete list of the work for this project. It is the

Contractor's responsibility to determine the full scope of work required to complete this project on time, within budget, and in compliance with the Contract Documents. The scope of work is indicated by the requirements of each Specification.

I. The work includes, but is not limited to:

1. Construction of facilities and access roads as required for access to the sites.
2. Construction of erosion and sedimentation controls necessary for construction and post-construction.
3. Excavation and relocation of waste material from the north and east slopes of the main landfill and establish a final grade no to exceed an effective 3H:1V slope.
4. Install a rock armor or other suitable material over the east and north slopes of the main landfill.
5. Construction of the earthen cover over the flat portion of the main landfill.
6. Regrade the DDA to eliminate low spots and establish proper drainage.
7. Add topsoil to the DDA as needed to bring the cover thickness over the entire footprint to 12-in, and to achieve the elevations shown on Drawing 2010. This will ensure that the requirement for a minimum of 12-in of soil cover is met, in addition to achieving the final grades needed for drainage, since compaction during construction will result in additional fill being needed to achieve the required elevations.
8. Revegetate denuded and/or disturbed areas at the main landfill and DDA.

J. The Contractor shall use the design documents, to include but not be limited to these Specifications and the Construction Drawings, to construct closure covers at the airport landfills.

K. The Contractor will coordinate work to minimize impacts to airport operations.

L. The Contractor is responsible for operating and maintaining all equipment, materials, systems, structures, and other physical features located within the designated construction boundary in a neat, safe, functional, and protected condition for the duration of the project. This responsibility pertains to all items located on the project site prior to start of the work, items brought onto the site by the Contractor, and items under construction.

1.02 DEFINITIONS

A. The Owner shall mean DOE.

B. The Contractor shall mean North Wind, Inc. Contractor responsibilities are specified in the North Wind, Inc. Project Management Plan for the LASO TA-73 Airport Landfill (PMP), Document number NW-ID-2003-073. Contractor personnel include Project Manager, Construction Manager, and Site Superintendent (SS).

C. The Engineer shall mean the Engineer of Record from Weston Solutions, Inc. The Engineer of Record shall be a Professional Engineer registered in the State of New Mexico in civil engineering. The Engineer of Record may designate someone to act on his behalf (including a North Wind employee), under his supervision. Weston Solutions, Inc. responsibilities are specified in the PMP.

D. The term "airport landfills" refers to both the inactive landfill and the DDA.

E. Where "as shown," "as detailed," "as noted," "as indicated," or words of like meaning are used in the Contractor documents, it shall be understood that reference is being made to the drawings unless otherwise noted.

PART 2 MATERIALS

Not Applicable

PART 3 EXECUTION

3.01 SPECIFICATIONS

The priority of Contract Documents is Specifications to Drawings to Project Scoping Plans. This flow-down means that the Specifications take precedence over the Drawings which take precedence over the ancillary Project Scoping Plans.

3.02 DRAWINGS

A. An index of Project drawings is shown on the Drawings.

B. Dimensions shown on the Drawings take precedence over scaled dimensions. Large-scale details have precedence over smaller scale.

REFERENCES

Los Alamos National Laboratory (LANL), January 1996. "LANL HSWA Module VIII Permit, 1996 Revision (guidance)," Los Alamos, New Mexico. (LANL 1996, 57486)

Los Alamos National Laboratory (LANL), October 2002. "Voluntary Corrective Measure Plan for Potential Release Sites 73-001(a)-99 and 73-001(b)-99," Los Alamos National Laboratory document LA-UR-02-4433, Los Alamos, New Mexico. (LANL 2002, ER2002-0359).

New Mexico Environment Department (NMED), April 2003, "Conditional Approval of Voluntary Corrective Measures (VCM) Plan for Potential Release Sites (PRSs) 73-001(a)-99 and 73-001(b)-99," letter from Vickie Maranville, NMED HWB, to Pete Nanos, Director and Everett Trollinger, Project Manager. (NMED 2003)

END OF SECTION

SECTION 01015

GENERAL CONDUCT OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Coordination of Work.

B. Handling and Storage.

C. Referenced Standards.

1.02 RELATED SECTIONS AND REQUIREMENTS

A. Division 1 - General Requirements

B. Waste Management Plan for LASO TA-73 Airport Landfill (WMP), March, 2004

C. Construction Plan for LASO TA-73 Airport Landfill, March, 2004

1.03 COORDINATION OF WORK

A. The Contractor shall be responsible for the coordination of all work so that the Project can be completed within the time stipulated in the Contract. It is the Contractor's responsibility to review coordination of all work in detail with the Engineer and his other Contractors as necessary to avoid any misunderstanding.

B. The Contractor's Project Manager will serve as the point of contact for all communication.

C. The Contractor shall supervise and direct all work required under this Contract. The Contractor shall be solely responsible for the construction methodology, controls, techniques, sequences, procedures, or construction safety, except as required in Contract documents or in cases where written direction to the Contractor overrides the Contractor's choice. Major changes to the engineering design must be approved by the Engineer and the Owner.

D. The Contractor will restrict access to the site for construction personnel, equipment, and materials to the access-control points at the site.

1.04 HANDLING AND STORAGE

A. The Contractor shall, at the Contractor's expense, handle, haul, and distribute all materials and all surplus supplies on the different portions of the Work as necessary. Contractor shall provide suitable and adequate storage room for materials and equipment during the progress of the Work and be responsible for loss of, or damage to, materials and equipment furnished by the Contractor, until the final acceptance of the Work.

B. All excavated materials, construction equipment, materials and equipment to be incorporated in the Work shall be placed so as not to contaminate, damage, or delay the Work and so that free access can be had at all times to this project, and any other project, and to all installations in the vicinity of the Work.

1.05 REFERENCED STANDARDS

A. Referenced standards used throughout the Contract Documents to specify the quality of materials or workmanship shall refer to the latest edition of such standards that is accepted by the authority having jurisdiction, except where a specific edition is indicated in the Contract Documents.

1.06 WASTE MANAGEMENT

A. It is anticipated that the Contractor will encounter contamination while performing the work. Refer to the WMP for additional information and requirements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01090

ABBREVIATIONS

PART 1 GENERAL

1.01 ABBREVIATIONS

A. Abbreviations used in these Contract Documents shall refer to and designate the following, as applicable:

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
AOS	Apparent opening size
ASTM	American Society for Testing and Materials
BFM	Bonded Fiber Matrix
CA	Construction area
C_c	Coefficient of Gradation
CFR	*Code of Federal Regulations*
CLFMI	Chain Link Fence Manufacturers Institute
COR	Contracting Office Representative
CQCP	Construction Quality Control Plan
C_u	Uniformity Coefficient
CWA	Controlled Work Area
DDA	Debris Disposal Area
DOE	United States Department of Energy
EPA	United States Environmental Protection Agency
FAA	Federal Aviation Administration
FOD	Foreign objects debris
FS	Federal Specifications
GTL	Geotechnical testing laboratory
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
LANL	Los Alamos National Laboratory
LASO	Los Alamos Site Office
MARV	minimum average roll values
NMAC	*New Mexico Administrative Code*
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NSA	National Stone Association
OFZ	Obstacle-free zone
OGBC	Open graded base course
OSHA	Occupational Safety and Health Act
PLS	Pure live seed
PMP	Project Management Plan
PPE	Personal protective equipment
PQAP	Project Quality Assurance Plan
PRS	Potential release site
PVC	Polyvinyl chloride
QA	Quality assurance
QC	quality control
RA	Restricted area
SS	Site Superintendent
SSO	Site Safety Officer
SWPPP	Storm Water Pollution Prevention Plan
TA	Technical Area

USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
UV	Ultraviolet
WMP	Waste Management Plan
VCM	Voluntary Corrective Measure

UNITS OF MEASURE

AC	Acre
cm/sec	Centimeters per second
CY	Cubic yard(s)
dBA	Decibel A-weighted
F	Fahrenhei
ft	Foot (feet)
in.	Inch(es)
lb	Pound(s)
mph	Miles per hour
pcf	Pounds per cubic foot
psi	Pounds per square inch
ft^2	Square foot (feet)

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 GENERAL

1.01 WEEKLY MEETINGS

A. Weekly job meetings shall be conducted with the Engineer, Contractor and other designated parties to evaluate progress on the project to date. These meetings shall be held at Site Trailer at a scheduled time convenient to all parties.

B. It may periodically become necessary to have special meetings to resolve project conflicts in which all parties shall be required to attend.

C. Other items to be reviewed during weekly job meetings are:

1. Health and safety Issues.
2. Project schedule.
3. Coordinate construction activities with operational personnel.
4. Manpower requirements, etc.
5. Coordinate projected progress with other Prime Contractors, as applicable.
6. Review submittal schedules, expedite as required to maintain schedule.
7. Maintaining of quality and work standards.
8. Review any changes for:
   a. Effect on Construction Schedule.
   b. Cost Reductions.
9. Review next week's work items.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01310

CONSTRUCTION SCHEDULES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General Requirements.

B. Form of Schedules.

C. Content of Schedules.

D. Updating.

E. Submittals.

F. Distribution.

G. Coordination.

1.02 RELATED SECTIONS AND REQUIREMENTS

A. Division 1 - General Requirements.

B. Construction Plan for LASO TA-73 Airport Landfill, March 2004

1.03 GENERAL REQUIREMENTS

A. The construction schedule for the entire work is provided in the Contractor's Construction Plan for LASO TA-73 Airport Landfill. The construction schedule shall be revised weekly as necessary.

1.04 FORM OF SCHEDULES

A. Contractor will prepare manually or in computer generated format, a Work Breakdown Structure and Gantt schedule analysis. Exact format to be approved by the Engineer in accordance with 1.07 of this section.

B. Reproducible sheets at 11-in. x 17-in. shall be provided to the Engineer.

1.05 CONTENT OF SCHEDULES

A. Complete sequence of construction by activity.

1. Shop Drawings, Sealants, Concrete Mix Designs, Product Data, Samples and Guarantees.

2. Selection of finishes.

3. Product fabrication and delivery dates.

4. Dates for beginning, and completion of, each construction activity, specifically:

a. Mobilization

b. Site preparation

c. Waste Relocation and rough regrade

d. Landfill cover installation

e. Acceptance Testing

f. Revegetation

g. Demobilization

5. Date(s) for final inspection and acceptance.

B. Identify Work of separate stages, or separate phases, or other logically grouped activities.

C. Projected percentage of completion for each item of Work as of first week of each month.

D. Provide subschedules as necessary to define critical portions of entire schedule.

E. Assign to each scheduled major activity a sum of money, the total of which shall equal the approved contract price.

1.06 UPDATING

A. Show all changes occurring since previous submission of updated schedule.

B. Indicate progress of each activity, show completion dates.

C. Include:

1. Major changes in scope.

2. Activities modified since previous updating.

3. Revised projections due to changes.

4. Other identifiable changes.

D. Provide narrative report, if necessary, to include:

1. Discussion of problem areas, including current and anticipated delay factors and their impact.

2. Corrective action taken, or proposed, and its effect.

3. Effect of change in schedules of other contractors.

4. Description of revisions:

a. Effect on schedule due to change of scope.

b. Revisions in duration of activities.

c. Other changes that may effect schedule.

1.07 SUBMITTALS

A. Submit initial schedules within ten (10) days after the date of contract execution.

1. The Engineer will review schedules and return review copy within ten (10) days after receipt.

2. If required, resubmit within seven (7) days after return of review copy.

B. Submit monthly updated schedule accurately depicting progress to first week of each month.

1.08 COORDINATION

A. Schedules of other subcontractors will be available for inspection at the Engineer's request.

B. Contractor shall coordinate schedules with schedules of subcontractors.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01330

SURVEY DATA

PART 1 GENERAL

1.01 LINES, GRADES, AND MEASUREMENTS

A. The Contractor shall make all measurements and check all dimensions necessary for the proper construction of the Work called for by the Drawings and Specifications. During the execution of the Work, the Contractor shall make all necessary measurements to prevent misfitting in said work, and shall be responsible therefore and for the accurate construction of the Work.

1.02 DIMENSIONS OF EXISTING FEATURES

A. The dimensions and locations of existing structures, topography, and drainage swales are of critical importance in the installation or connection of new work, the Contractor shall verify such dimensions and locations in the field before the construction or fabrication of any structure, material or equipment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01340

SHOP DRAWINGS, SAMPLES, AS-BUILTS, AND OTHER SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General Instruction.

B. Samples.

C. Shop Drawings.

D. Product Data.

1.02 RELATED SECTIONS AND REQUIREMENTS

A. Division 1 - General Requirements.

B. Construction Plan for LASO TA-73 Airport Landfill, March 2004.

C. Health and Safety Plan for LASO TA-73 Airport Landfill (HASP), March 2004

1.03 GENERAL INSTRUCTIONS

A. Within ten working days after the formal execution of the contract, the Contractor or equipment supplier shall submit a Submittal Schedule to the Engineer. The Submittal Schedule shall be a sub-schedule to the Construction Schedule required under Section 01310 Subpart 1.05D, and shall include dates for submittal, approval, fabrication as appropriate, and delivery of the Work. This schedule shall also list samples and other submittals as planned by the Contractor and as required by the Contract Documents. The Engineer will review the schedule in accordance with the provisions of Section 01310 and return either approved or modified copies to the Contractor. Once accepted by the Engineer, the schedule shall be followed throughout the project unless superseded by a new schedule accepted by the parties involved. The Engineer will require ten working days to properly review this schedule. The Engineer will add or delete submittals required for review.

B. Information submitted as a separate submittal or as part of another submittal that has not been listed on the schedule as a required submittal will be scanned briefly by the Engineer. Such extraneous and unrequired information will be marked as "NO ACTION TAKEN" and returned.

C. When Shop Drawings are required by the various technical specification sections or elsewhere in the Contract Documents, the names and addresses of the proposed manufacturers (if different from those listed in the Contract Documents) shall be submitted prior to the submittal of the Shop Drawings so that the Engineer may consider and approve or disapprove the manufacturer and/or the supplier as to his or their ability to furnish a product meeting the requirements of the Contract Documents. This preliminary submittal is subject to final approval of the particular material or equipment. As requested, the Contractor or equipment supplier shall also submit data relating to the materials and equipment he proposes to incorporate into the work, in sufficient detail to enable the Engineer to identify the particular product in question and to form an opinion as to its conformity to the contract requirements. Such data shall be submitted in a manner similar to that specified for Shop Drawings.

D. The normal time allowed for review of Shop Drawings, and other submittals, is two calendar weeks after receipt of the submittal by the Engineer, or other party responsible for the review. Requirements for shorter review periods must be presented in writing by the Contractor.

E. Submittals shall be approved by the Contractor, as shown by the Contractor's approval marked on each copy. Submittals shall not be accepted from subcontractors, suppliers, manufacturers, or representatives. Submittals shall be identified by reference to Contract document number, drawing number, equipment number and specification section number, equipment or material schedule, or room numbers, as appropriate. Submittals shall be numbered consecutively by the Contractor, or equipment supplier, as appropriate. Resubmissions shall use the same number with a suffix added to identify each resubmission (i.e., "A" shall identify the first resubmission).

F. Minimum sheet size: 8-1/2-in. x 11-in.

G. Number of submittals required:

1. Shop Drawings: Submit the number of opaque reproductions, which the Contractor requires, plus four copies which will be retained.

2. As-Built Drawings: Submit one electronic version in AutoCAD 2002 or more recent version and one hard copy suitable for reproduction.

3. Product Data: Submit the number of copies which the Contractor requires, plus four copies which will be retained.

4. Samples: Submit the number stated in each specification section.

5. Certificates: Submit three copies which will be retained.

H. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.

2. The Project title and number.

3. Contract identification.

4. The names of:

   a. Contractor.
   b. Supplier.
   c. Manufacturer.

5. Identification of the product, with the specification section number and other appropriate information.

6. Field dimensions, clearly identified as such.

7. Relation to adjacent or critical features of the work or materials.

8. Applicable standards, such as American Society for Testing and Materials (ASTM) or Federal Specification (FS) numbers.
9. Identification of deviations from Contract Documents.

10. Identification of revisions on resubmittals.

11. 8 in. x 3 in. blank spaces for Contractor and the Engineer's review stamps.

12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

1.04 SCHEDULE OF VALUES

A. For all lump sum work, the Contractor shall submit a Schedule of Values.

B. The Schedule of Values shall be submitted to the Engineer within five (5) days after the Notice-to-Proceed.

C. The Schedule of Values shall be subject to the review and approval of the Engineer.

D. The Schedule of Values shall identify all the major elements of the work and the cost of each element. The total scheduled cost shall equal the contract price.

E. The Schedule of Values shall identify costs for all: mobilization, demobilization, and site preparation; establishment, maintenance and removal of erosion and sedimentation control; construction schedule preparation and updating; as-built documents, as well as: construction activities, generally broken down by structure, location, and specific location.

F. The approved Schedule of Values will form the basis for the values assigned to scheduled activities established in Section 01310.

1.05 SAMPLES

A. If the Engineer so requires, either prior to beginning or during the progress of the work, the Contractor or equipment supplier shall submit samples of materials for such special tests as may be necessary to demonstrate that they conform to the Specifications. Such samples, including concrete test cylinders, shall be furnished, taken, stored, packed, and shipped as directed, at the expense of the Contractor. Except as otherwise specified, the Contractor shall make arrangements for, and pay for, the actual tests.

B. All samples shall be packed so as to reach their destination in good condition, and shall be labeled to indicate the material represented, the name of the building or work and location for which the material is intended, and the name of the Contractor or equipment supplier submitting the sample.

C. To ensure consideration of samples, the Contractor or equipment supplier shall notify the Engineer in writing that the samples have been shipped and shall properly describe the samples in the letter. In no case shall the letter of notification be enclosed with the samples.

D. The Contractor or equipment supplier shall submit data and samples, or place his orders, sufficiently early to permit consideration, inspection, testing, and approval before the materials and equipment are needed for incorporation in the work.

E. When required, the Contractor or equipment supplier shall furnish to the Engineer triplicate sworn copies of manufacturer's shop or Mill tests (or reports from independent testing laboratories) relative to materials, equipment performance ratings, and concrete data.

F. The materials and equipment used on the Work shall correspond with the samples submitted.

1.06 SHOP DRAWINGS

A. The Contractor or equipment supplier, as appropriate, shall submit for approval at least four (4) print copies (plus any additional copies required by the Contractor or subcontractors or equipment suppliers) of Shop Drawings of materials fabricated especially for this contract, and of equipment and materials for which such drawings are specifically requested in the Contract Documents. One copy, plus any additional copies provided, will be reviewed, stamped, and returned to the Contractor.

B. Such drawings shall show the principal dimensions, weights, structural and operating features, performance characteristics and capacities, wiring and piping diagrams, space required, clearances required, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawings. Show location, size, dimensions and embedment depth for anchor bolts. List special tools required to operate, and maintain equipment. Describe tool's purpose. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for this contract.

C. The Contractor or equipment supplier shall be responsible for the prompt submission of all Shop Drawings in accordance with the Shop Drawing Schedule so that there shall be no delay to the work due to the absence or lateness of such drawings.

D. No material shall be purchased or fabricated especially for this Contract until the required Shop Drawings have been submitted and reviewed as conforming to the Contract requirements. All materials and work involved in the construction shall then be as represented by said drawings.

E. Only Shop Drawings which have been checked and corrected by the fabricator should be submitted to the Contractor by the Contractor’s subcontractors and vendors. Prior to submitting Shop Drawings to the Engineer, the Contractor shall check thoroughly all such drawings so that the subject matter thereof conforms to the Drawings and Specifications in all respects. Shop Drawings which are correct shall be marked with the date, checker's name and indication of the Contractor's approval, and then shall be submitted to the Engineer; other drawings shall be returned to the fabricator or subcontractor for correction.

F. The Engineer review of Shop Drawings will follow a general check made to ascertain conformance with the design concept and functional results of the Project and compliance with the information given in the Contract Documents. The Contractor shall be responsible for dimensions to be confirmed and correlated at the job site and for coordination of the work of all trades. The Contractor, or equipment supplier if appropriate, shall also be responsible for information that pertains solely to the fabrication processes or to techniques of construction.

G. The Engineer classifications are as follows:

APPROVED	(___)
APPROVED AS CORRECTED	(___)
REVISE AND RESUBMIT	(___)
REJECTED	(___)
NO ACTION TAKEN	(___)

H. The Contractor or equipment supplier shall make any corrections required by the Engineer and shall return the required number of corrected copies of Shop Drawings until approved.

I. At the time of each submission or resubmission, the Contractor or equipment supplier shall direct specific attention, in writing, to deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents or corrections required by the Engineer on previous submissions.

J. The Contractor's stamp of approval on Shop Drawings and samples shall constitute a representation to the Engineer that the Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers and similar data (or he assumes full responsibility for doing so) and that the Contractor has reviewed or coordinated each Shop Drawing and sample with the requirements of the Contract Documents. Submittals received without this information will be returned without being reviewed by the Engineer.

K. The approval of Shop Drawings and samples shall not relieve the Contractor or equipment supplier from responsibility for any deviations from the requirements of the Contract Documents, unless the Engineer has been notified, in writing, and has given written approval to such deviation, nor shall any approval by the Engineer relieve the Contractor or equipment supplier from responsibility for errors and omissions in Shop Drawings.

1.07 PRODUCT DATA

A. Product data may be submitted instead of Shop Drawings when the information required for Shop Drawings is contained in Manufacturer's standard literature.

B. Manufacturer's standard catalog data, schematic drawings and diagrams:

1. Mark each copy to identify pertinent products or models.

2. Modify drawings and diagrams to delete information which is not applicable to the work.

3. Supplement standard information to provide information specifically applicable to the work.

1.08 CERTIFICATES

A. Types of certificates required are specified in respective Specification Sections.

B. Shop tests: Provide Manufacturer's sworn reports for actual product to be incorporated in the work.

C. Laboratory tests: Provide independent testing laboratory reports for actual product to be incorporated in the work.

D. Certificates of compliance: Provide Manufacturer's sworn statement or independent testing laboratory's report for products similar to those to be incorporated in the work with information indicating compliance with specifications. Test used to show compliance shall have been made within one year of the date of submission, unless approved otherwise by the Engineer.

E. Certified drawings: Provide certified drawings from the manufacturer as required in each specification section.

F. Refer to Section 01400 for certification requirements relative to an alternative to on-site sampling and testing.

1.09 AS-BUILT DOCUMENTS

A. The Site Superintendent will keep a record of all changes approved by the owner and all field changes, including changes to lines and grades.

B. The Contractor shall maintain one current record hard copy of all Specifications, Drawings, Addenda, Change Orders and Shop Drawings at the site. The documents shall be kept current, in good order, an annotated to show all changes made during the construction process and be clearly marked "AS-BUILT Documents." These As-Built documents shall be available for review by the Engineer during all normal working hours.

C. The Contractor shall submit to the Engineer, within 10 days after the completion of contract, one set of the above "AS-BUILT" documents containing all changes, additions or deviations from the original set of Documents that have been incorporated into the Work. The Contractor is responsible for the accuracy of these AS-BUILT documents.

D. The Engineer, within 15 days after receipt of the As-Built documents will produce a final electronic version of the As-Built documents provided by the contractor. The electronic version will be in AutoCAD 2002 or more recent version.

E. The Contractor shall include As-Built Documents in the submitted Schedule of Values.

1.10 PROGRESS PHOTOGRAPHS

A. The Contractor shall take progress photographs throughout the duration of the contract. Photographs shall be taken at weekly intervals or as may be specifically directed by the Owner.

B. Photographs shall be digital and copies produced as 8-in. x10-in. color prints. Digital photographs shall be taken of each process to document status, progress, and quality. Selected digital photographs will be provided with monthly progress reports.

C. Each digital photograph shall contain the date taken and formatted on an electronic file to contain a description, indicating the location, direction, and what is shown.

1.11 HASP

A. Refer to the HASP for requirements regarding environmental health and safety.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor is responsible for quality control and shall establish and maintain an effective Project Quality Assurance Plan for LASO TA-73 Airport Landfill (PQAP).

B. The Construction Quality Control Plan for LASO TA-73 Airport Landfill (CQCP) shall cover all construction operations, both on site and off site and shall be keyed to the proposed construction sequence.

1.02 RELATED SECTIONS AND REQUIREMENTS

A. PQAP, November 2003.

B. CQCP, March 2004.

1.03 MATERIALS CERTIFICATION

A. For certain products, assemblies, and materials, in lieu of on-site sampling and testing procedures, the Engineer will accept from the Contractor the manufacturer's certification, with respect to the product(s) involved, upon the conditions set forth in the following paragraphs:

1. Certification shall state that the named product conforms to the Specifications and that representative samples have been sampled and tested as specified.

2. Certification shall be accompanied with a certified copy of the test results.

3. The certification shall give name and address of the manufacturer and the testing agency, the date of test, and shall set forth the means of identification which will permit field determination of the products delivered to the project as being one product covered by the certification.

4. The certification shall be duplicated with one (1) copy sent with shipment of the covered product to the Contractor and one (1) copy sent to the Engineer.

5. The Contractor shall be responsible for any additional costs for certification and for any costs of sampling and testing.

6. The Engineer reserves the right to require samples and test products to assure compliance with pertinent requirements with respect to fire certification of the products by the manufacturer thereof.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

A. The Contractor’s approved PQAP and CQCP defines the minimum construction requirements to be implemented to ensure that the approved design requirements are met or

exceeded. The quality assurance (QA) team will report to the Contractor's Project Manager on behalf of the Owner.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section covers the installation, maintenance, and operation of all temporary facilities and controls at the site necessary to support the Contractor operations during the course of the Contract. These temporary facilities and controls will be removed at Contract completion, and include, but are not limited to, office trailers, haul roads, drain facilities, decontamination pads, staging areas, access controls, lighting, utilities, and janitorial services.

1.02 PROJECT SIGNS

A. The Contractor shall erect a Project sign board near the Highway 502 entrance to the site. The information on the sign board shall be protected from the weather elements and the information shall be legible at all times. The sign shall be installed at a location approved by the Engineer and Los Alamos County Airport Manager.

1. The Project sign shall be constructed of sturdy and moisture-resistant material.

2. The following information shall be displayed in painted black lettering, clearly visible from 100 ft:

U.S. DEPARTMENT OF ENERGY
LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILL CLOSURE

B. The Contractor shall construct and install a Project Information Board at the entrance to the Temporary Facilities Area.

1. The Project sign shall be constructed of sturdy and moisture-resistant material.

2. The following information shall be displayed in painted black lettering,
   a. Caution: Construction Area.
   b. A list containing the following telephone numbers:
      (1) 911 or other local emergency telephone numbers.
      (2) Location of nearest telephone.
      (3) DOE-LASO Security telephone number.
      (4) DOE Contracting Office Representative (COR) name and telephone number.
      (5) Contractor Project Manager name and telephone number.
   c. Primary and alternative site evacuation routes.
   d. Hospital/emergency route map with written instructions and the route highlighted.
   e. DOE “Whistle Blower Protection Notification” with applicable DOE name and telephone number (provided by DOE).
   f. Davis-Bacon wages for Los Alamos County, NM.
   g. Map showing site contamination.
   h. Equal Employment Opportunity poster.
   i. Occupational Safety and Health Administration (OSHA) poster.
   j. DOE Poster—Contractor Employee Occupational or Health Complaint form (provided by DOE).

1.03 PRECAUTIONS AGAINST WEATHER

A. During adverse weather conditions and against the possibility thereof, the Contractor shall take all necessary precautions so that the Work shall be properly done and be satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building paper shelters, or other approved means.

B. During cold weather (below 40° degrees Fahrenheit [F]), materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will take place and a proper curing, aging, or drying will result. Protected spaces shall be artificially heated by approved means which shall result in a moist or dry atmosphere according to the particular requirements of the work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture shall be warm throughout when used.

1.04 TEMPORARY HEAT

A. If temporary heat is required for the protection of the Work, the Contractor shall provide and install heating apparatus, shall provide adequate and proper fuel, and shall maintain fires as required. Temporary heating apparatus shall be installed and operated in such manner that the finished work will not be damaged thereby. Temporary heating apparatus shall be of the types approved by local codes and ordinances governing the Work.

1.05 WATER SUPPLY

A. Water necessary for operations and fire protection will be obtained from the hydrant shown on the Drawings. The Contractor shall make all arrangements necessary to obtain water.

1.06 ELECTRICAL ENERGY

A. Suitable electrical power necessary to perform the work shall be obtained from sources at the airport, by the Contractor.

B. There shall be sufficient electric lighting, provided by the Contractor, so that all work may be properly conducted when there is not sufficient daylight in the work area.

C. The Contractor shall assume all risks of loss or damage of any kind to any vehicles, machinery, equipment, materials or supplies which it shall provide in doing the work.

1.07 SANITARY FACILITIES

A. The Contractor shall provide adequate sanitary conveniences meeting governing local and state codes and regulations for the use of those employed on the work site. Such conveniences shall be made available when the first employees arrive on the work site and shall be constructed and maintained in suitable numbers and at such points and in such manner as may be required or approved.

B. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. The Contractor shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Government, or on adjacent property.

1.08 ACCESS/CONTAMINATION CONTROL

A. As construction progresses, the Contractor shall maintain contamination control boundaries between clean areas and areas of contamination.

B. Install access-control fencing to restrict, reduce, or eliminate access by the public. Fence type(s) shall be as indicated on the drawings.

C. Contamination-control fencing around contaminated areas shall be, at a minimum, colored, plastic, safety fencing or approved equal 4-ft high. Posts and fabric shall be secure and tight at all times.

D. The Contractor shall maintain site perimeter fences, gates and signs to prevent intrusion by the general public. Maintenance includes keeping fences taut, performing all minor repairs that do not require additional materials, and placement of signs.

E. If the Contractor uncovers any archaeological or historical artifacts or bones of unknown origins during the term of the Contract, the Contractor shall immediately halt operations in the vicinity of such a discovery and immediately notify the Owner. Further work in these areas shall not resume without written authorization from the Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01560

TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Safety and Protection.

B. Protection of the Public.

C. Site Control and Security.

D. Maintenance of Existing Operations.

E. Maintenance of Traffic.

F. Protection of Natural Water Courses.

G. Removal of Debris During Construction.

H. Final Cleaning.

I. Dust Control.

J. Noise Control.

K. Environmental Control.

1.02 RELATED SECTIONS AND REQUIREMENTS

A. Division 1 - General Requirements.

B. WMP.

C. HASP.

D. Storm Water Pollution Prevention Plan for LASO TA-73 Airport Landfill (SWPPP), March 2004.

E. Construction Plan for LASO TA-73 Airport Landfill.

1.03 SAFETY AND PROTECTION

A. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. All employees on the work and other persons who may be affected thereby. Refer to the HASP for site safety and health procedures.

2. All the work and all materials or equipment to be incorporated therein, and any adjacent materials, equipment, or facilities, including that in storage on or off the site.

B. The Contractor shall notify owners of adjacent utilities when implementation of the work may affect them. All damage, injury or loss to any property referred to in paragraph 1.03 A.2 above caused, directly or indirectly, in whole or in part, by Contractor, any subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, shall be remedied by the Contractor at the Contractor's expense.

C. The Contractor shall not load or permit any part of any structure to be loaded with a weight that would endanger its safety.

D. The Contractor shall provide protection of the work from freezing and other elements, which would be harmful to it. The Contractor shall furnish heat or protective shelters or temporary buildings as required for the protection of the work.

E. The Contractor shall take all necessary precautions for the safety of employees on the work, and shall comply with all applicable provisions of Federal, state, and local safety laws and building codes, and Project requirements in order to prevent accidents or injury to persons on, about, or adjacent to the premises where the work is being performed. The Contractor shall erect and properly maintain at all times, as required by the Project and by the conditions and progress of the work, all necessary safeguards and barricades for the protection of employees on the work and the safety of others employed near the work and the public, and shall post danger signs and warning lights warning against the hazards created by dangerous features of the construction including, but not limited to, protruding nails, excavations, scaffolding, stairways, and falling materials.

F. The Contractor shall designate a responsible member of its organization on the work whose duty shall be the prevention of accidents. The name and position of the person so designated shall be reported in writing to the Owner.

G. The Contractor shall immediately report in writing to the Owner, giving full details, all serious accidents which arise out of or in connection with the performance of the work, whether on or adjacent to the site, which cause death, personal injury, or property damage. In addition, if death or serious injury or substantial property damage is caused, the accident shall be reported immediately by telephone or messenger to the Owner. If a claim is made or suit is filed by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Owner, giving full details of the claim.

H. The Contractor shall assume all risks of loss or damage of any kind to any vehicles, machinery, equipment, materials, or supplies which it shall provide in doing the work.

I. The Contractor shall take all precautions to prevent damage to the work by the elements, storms, or by water entering the site of the work directly or through the ground. In case of damage by the elements, storm, or water, the Contractor shall make repairs or replacements or rebuild such parts of the work as the Engineer may require in order that the work may be completed by the Contract Documents. If Contractor believes that additional work done by the Contractor, which arose from causes beyond the Contractor's control, entitles him to an increase in the Contract Price or an extension of the Contract Time, he may make a claim thereof as provided herein.

J. The Contractor shall comply with all insurance requirements stated in the Contract Documents.

K. It is anticipated that the Contractor may encounter contamination while performing the work; refer to the WMP and the HASP for additional information and requirements.

1.04 PROTECTION OF THE PUBLIC

A. The Contractor shall conduct work so as to interfere as little as possible with the operating personnel of the site or those persons that may have business at the site. Wherever necessary or required, and at the Contractor's own expense, the Contractor shall maintain fences, furnish full-time or part-time watchmen, guards, and like protective personnel, maintain lights, and take such additional precautions as may be necessary to protect life and property.

1.05 SITE CONTROL AND SECURITY

A. Site control and security will be maintained at the airport project site during all activities to prevent unauthorized personnel from entering the work area and to maintain airport perimeter security requirements. Entry into and exit out of the airport and construction areas (CA) will be controlled through the appropriate use of barriers, signs, and other measures in accordance with *Code of Federal Regulations* (CFR) 29 CFR 1910.144, "Safety Color Code for Marking Physical Hazards" (CFR 2003e) and 29 CFR 1910.145, "Specifications for Accident Prevention Signs and Tags" (CFR 2003f).

B. Signs that are routinely lost because of high winds and will be replaced as soon as possible the next working day following discovery.

C. Three types of site control designations (areas) will be used to meet Hazardous Waste Operations and Emergency Response (HAZWOPER), construction, and Federal Aviation Administration (FAA) site control requirements. These areas based on the potential hazards, complexity of work tasks, duration of project tasks, location and number of non-project personnel near the project area, and to prevent entry of personnel and equipment into the obstacle-free zone (OFZ). Radiologically controlled areas are not anticipated but could be established if radioactive materials or article are encountered. The three areas are

- CAs (general CA boundary)
- Controlled work area (CWA) (established for higher hazard tasks within the CA)
- Restricted area (RA) (OFZ and other areas where entry is not permitted)

D. The existing airport perimeter fence and gates provide general security and access control. This fence will be maintained during all construction activities and access to the project CA will be controlled. Only authorized project personnel and authorized visitors (visitors must have official business on site, receive HASP orientation briefing, and have proper personal protective equipment [PPE] for the area they will access) will be allowed access to the CA. Project construction and administrative areas (field trailer) will be delineated and posted to prevent inadvertent entry by persons conducting normal airport operations or maintenance tasks.

E. All personnel are required to sign in and out of the site access log located in the field trailer.

F. Where warranted, designated traffic routes may also be established. These areas also will be posted to prevent inadvertent entry by unauthorized personnel. Project personnel will also be prohibited from entering airport operational areas (not turned over for construction activities) to minimize the impact on airport operations and to reduce the likelihood of distributing foreign objects debris (FOD) on the tarmac and taxiway.

G. The CAs at the site will be the primary activity locations (main landfill and DDA). The CA boundary will be delineated using the existing airport perimeter fence and other temporary construction fencing where deemed appropriate. All areas beyond the construction field trailer will be considered a CA for site control purposes (whether delineated and posted or

not) and all training, badging, and PPE requirements apply. The primary access points to the CA will be clearly posted with "Construction Area" or similar caution signs. Only authorized personnel may enter the CA..

H. CWAs will be established to alert personnel within the CA of tasks or activities with increased hazards and to limit the number of workers and equipment in these areas. CWAs will also be used when there is a potential for exposure to site contaminants beyond the immediate work area. CWAs will control the flow of equipment and personnel through the use of established entry/exit points and traffic lanes. The boundary of the CWA may be marked with a combination of stanchions or posts and delineated with rope or ribbon and include warning signs or other demarcation. Only the minimum number of personnel required to safely perform the project tasks will be allowed into the CWA. All personnel who enter the CWA will have adequate training and wear the appropriate level of PPE for the degree and type of hazards present.

I. RAs will be established to prevent access to certain areas during the course of the project. Examples of RAs include the OFZ around the active runway, the area within 6 ft of the unprotected edge of the east slope above the Pueblo Canyon wall, and other areas designated throughout the course of the project. Entry into RAs is prohibited without authorization from the Site Safety Officer (SSO), SS, and Construction Manager. Entry will not be authorized without a compelling reason and only after other options not requiring entry have been considered and deemed not feasible by the SSO, SS and Construction Manager. If the OFZ must be entered, then coordination with airport operations personnel prior to entry is also required.

J. Additional PPE, communications equipment, and materials may be required for entry into RAs. A separate personnel control log will be maintained by the SS for entry into RAs and access will be limited to only essential personnel. Name of individuals entering along with time of entry and exit will be documented. The two-person rule (buddy system) will be required for all RA with the second person positioned immediately outside the RA and entering only when required.

1.06 MAINTENANCE OF THE EXISTING OPERATIONS

A. Airport surfaces shall be swept and washed as needed.

B. The Contractor must plan and implement construction activities to ensure daily airport operations are not impacted. Operation of the other facilities cannot be interrupted, stopped, or rerouted, unless approved by the Los Alamos County Airport Manager.

C. Failure of the Contractor to comply with the requirements of this Paragraph 1.05 will be considered a sufficient cause for the Owner to shut down the work. The Contractor will not be entitled to any extra compensation resulting from such a shutdown.

1.07 MAINTENANCE OF TRAFFIC

A. The Contractor shall carry on all work so that other site traffic will have access to all existing gravel roads, driveways, and facilities.

1.08 PROTECTION OF NATURAL WATERCOURSES

A. The Contractor shall use all care possible to prevent sedimentation and other pollution of waters during construction. Prohibited practices include, but are not limited to:

1. Dumping of soil material into streams or on stream.

2. Operating of equipment in streams.

3. Pumping of silt-laden water from trenches, containment sumps, or other excavations into streams.

4. Disposing of debris in streams and surrounding areas.

B. All erosion and sediment control work shall comply with Section 02930 of these Specifications, the Contractor's approved SWPPP and all applicable requirements of governing authorities having jurisdiction. The Contractor shall provide the necessary strawbales, silt sacks, silt fence, and/or other temporary erosion-control measures to contain all work activities. The Engineer may require additional erosion control measures should conditions warrant.

C. Erosion control measures shall be established at the beginning of construction and maintained during the entire period of construction. On-site areas that are subject to severe erosion, and off-site areas that are especially vulnerable to damage from erosion and/or sedimentation are to be identified by the Contractor and will receive special attention.

D. All land-disturbing activities are to be planned and conducted so as to minimize the size of the area to be exposed at any one time and to minimize the length of the time of exposure.

E. Surface water runoff originating upgrade of exposed areas should be controlled to reduce erosion and sediment loss during the period of exposure.

F. All land-disturbing activities are to be planned and conducted so as to minimize off-site sedimentation damage.

1.09 REMOVAL OF DEBRIS DURING CONSTRUCTION

A. During its progress, the work and the adjacent areas affected thereby, shall be kept clean and all rubbish, surplus materials, and unneeded construction equipment shall be properly removed and all damage repaired at the expense of the Contractor.

B. Airport taxiways and runways shall be kept free of debris. They will be swept or washed free of debris, as needed.

C. Where materials or debris has washed or flowed into or has been placed in watercourses, ditches, gutters, drains, catch basins, or elsewhere as a result of the Contractor's operations, such material or debris shall be entirely removed and properly disposed of during progress of the work, and the watercourses, ditches, gutters, drains, catch basins, and other facilities kept in neat, clean and functioning conditions.

1.10 FINAL CLEANING

A. On or before the completion of the work, the Contractor shall, unless otherwise directed in writing by the Owner, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic material and material containing organic matter in, under, and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by the Contractor's operations in a neat and satisfactory condition.

B. The Contractor shall restore or replace, subject to the approval of the Owner, any property damaged by the Contractor's work, equipment, or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. Suitable materials, equipment,

and methods shall be used for such restoration as approved by the Owner, or as required elsewhere in the Contract Documents.

1.11 DUST CONTROL

A. During the progress of the work, the Contractor shall conduct operations and maintain the area of activities so as to minimize the creation and dispersion of dust.

B. The Contractor shall control dust within the construction boundaries shown on the Drawings. Dust suppression shall include all roadways, stockpiles, and other areas.

C. Dust suppression activities shall be conducted as necessary.

D. The Contractor shall take necessary measures to eliminate dust. Visible dust is not allowed. The Contractor may use techniques that include, but are not limited to the use of a water truck and other methods described in the Contractor's Construction Plan to control dust on excavations and access roads.

E. Water for dust control sprinkling shall be clean, free of salt, oil, and other injurious materials.

1.12 NOISE CONTROL

A. Noise may not exceed 65 decibel A-weighted (dBA) at the site boundary during construction.

B. All work that would generate noise that could affect adjacent facilities is to be conducted during hours as designated by the Owner.

C. The Contractor is to review any excessively noisy activities with the Owner in sufficient time to permit a complete evaluation of the effects of such noise on the operations at the site and on adjacent facilities before the work is started.

1.13 ENVIRONMENTAL CONTROL

A. The Contractor is responsible for controlling all emissions into the environment in order to comply with all regulatory requirements.

B. Any accidental emissions must be reported in accordance with the WMP.

1.14 CONTAMINATED MATERIAL SPILLS

A. To avoid fuel spills during refueling, an assigned individual will always be present during refueling, and will be aware of the location and operation of the shut-off valve of the fuel tanker. Small equipment such as generators or pumps will be placed over bermed heavy mil plastic. If refueling spills or leaks occur, the bermed plastic will contain the pollutants until proper cleanup and disposal. Drip pans may also be used for refueling, or for placement under equipment that is leaking or has the potential to leak.

B. A spill kit containing a first aid kit, airhorn, PPE for cleanup activities, shovel, leather gloves, and appropriate absorbents (e.g., pillows, tubes, sand or vermiculite, pads, paper towels, etc.) will be readily available to control and contain spills. Site personnel will be trained in the use of the spill kit and in spill notification procedures.

C. Spills of non-petroleum products (e.g., fertilizers) will be minimized by proper handling of containers. To the extent possible, transfer of material from large storage containers to small application containers will occur at the materials storage area.

D. The SS shall report all spills or unauthorized discharges, regardless of amount, to the Contractor's Project Manager, the Contractor's Construction Manager, and the LANL Office of Emergency Management Response (S-8). Refer to the WMP for notification phone numbers. This notification will occur as soon as possible after the discharge, but in no event more that 24 hours after the discharge. The following information will be reported:

- The name, address, and telephone number of the person or persons in charge of the facility, as well as the owner or operator of the facility
- The name and address of the facility
- The date, time, location, and duration of the discharge
- The source and cause of discharge
- A description of the discharge, including its chemical composition
- The estimated volume of the discharge
- Actions taken to mitigate immediate damage from the discharge

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600

MATERIALS AND EQUIPMENT, PRODUCT OPTIONS, AND SUBSTITUTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General Material and Equipment Requirements.

B. Procedures for Substitutions.

1.02 RELATED SECTIONS AND REQUIREMENTS

A. Division 1 - General Requirements.

1.03 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

A. Unless otherwise indicated on the Drawings or Specifications, only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor, or equipment supplier as appropriate, to be incorporated in the work shall be subject to the inspection and approval of the Engineer. No material shall be processed for, fabricated for, or delivered to the work without prior approval of the Engineer.

B. For the purpose of indicating the standards of type, quality, design, and performance of materials and equipment to be provided under this contract, various materials and equipment are named in the Contract Documents, as commercial brands or equal.

C. The manufacturer(s) named are listed as the approved vendor, or equipment supplier if appropriate, in preparing the Bid. The list is based on the Engineer's knowledge of or experience with the various manufacturers and does not represent that the manufacturers listed will meet the detailed requirements of the Specification. It is the responsibility of the Contractor, or equipment supplier if appropriate, in preparing the Bid to inform and be satisfied that the manufacturer selected for each item of equipment or material will meet the detailed requirements of the Contract Documents, whether the manufacturer selected is one of the named manufacturers or not.

1.04 PRODUCT OPTIONS AND SUBSTITUTIONS

A. The Contract Documents have been prepared using particular items of equipment and material in order to provide a complete set of plans and specifications. These are the materials and manufacturer that will not be substituted unless approved by the Engineer. As-Built drawings shall be maintained by the installing contractor showing the materials actually installed.

B. The following procedures will be followed relative to substitutions:

1. The General Contractor as part of the Bid shall submit a list of requested and approved substitutions which shall be accompanied by the following information:

a. Catalog cuts of the proposed equipment.

b. Other drawings and manufacturer's information as necessary to fully describe the equipment or material as intended for its specific use in this project.

c. For major equipment that is an integral part of the process, the submittal shall include a letter from the manufacturer certifying that the recommended substitution will meet the performance requirements for that piece of equipment.

d. Identification of changes required in the installation of the substituted equipment or material compared to the information presented in the Contract Documents.

2. The Engineer shall briefly review the requested substitution and determine the acceptability of the substituted equipment or material. This brief review will not relieve the Contractor of the responsibility for the proper functioning of the equipment or material. The Engineer will retain the right of final decision as to the acceptability of the substitution.

3. Substitutions cannot be made after the contract has been awarded without approval of the Engineer.

4. The Contractor will maintain accurate "As-Built" drawings showing the equipment or materials as actually installed.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Closeout Procedures.

B. Final Cleaning.

C. Project Record Documents.

D. Warranties.

1.02 RELATED SECTIONS

A. Division 1 - General Requirements.

B. PMP.

1.03 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for inspection by the Owner.

B. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.04 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean interior and exterior surfaces exposed to view.

C. Clean site, sweep paved areas, rake clean landscaped surfaces.

D. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.05 PROJECT RECORD DOCUMENTS

A. Maintain on-site, one set of the following record documents; record actual revisions to the Work:

1. Contract Drawings.

2. Specifications.

3. Written or verbal instructions.

4. Modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.

B. Store Record Documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.

3. Changes made by Addenda and Modifications.

E. Record Documents, As-Built Drawings, and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

2. Field changes of dimension and detail.

3. Details not on original Contract Drawings.

F. Submit documents to the Owner with claim for final Application for Payment.

1.07 WARRANTIES

A. Provide notarized copies.

B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.

C. Provide Table of Contents and assemble in a ring binder with durable plastic cover.

D. Submit prior to final Application for Payment.

E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

DIVISION 2

SITE WORK

SECTION 02005

SURVEYING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section shall include:

1. Project as-built surveys as required herein and elsewhere in the Technical Specification.

2. Surveys during the life of the project as directed by the Engineer, and surveys required to measure the quantities of completed work for determining the value of partial payments as described in other sections of these Specifications.

3. Pre-construction and construction topographic surveys.

B. The survey work shall be performed under the direction of a Land Surveyor registered in New Mexico who shall be subcontracted by the Contractor for the life of the Contract to perform the QA survey work to be performed under this item. The Contractor's QA Surveyor shall be independent from the Contractor and approved by the Engineer. Topographic, cross-sectional, and grade verification surveys will include the development by the QA Surveyor of topographic drawings for the use by the Engineer in verifying field conditions, measurement of quantities, and adjusting the design as necessary.

1.02 RELATED SECTIONS AND REQUIREMNTS

A. CQCP.

B. Construction Plan for LASO TA-73 Airport Landfill.

1.03 SUBMITTALS

A. Prior to commencement of work under this item, the Contractor shall submit the name, address, and telephone number of the QA Surveyor that will perform this work on the Project.

B. The Contractor shall organize the placement of the components of the landfill cover systems into manageable areas of work. The Contractor shall submit to the Engineer the pre-construction surveys before commencing excavation, fill placement, or cover system work. Additional topographic surveys of the completed work shall be submitted with each payment request and shall be a condition precedent to the Engineer's approval of the Contractor's request for partial payment. Topographic surveys and as-built surveys to be developed include the following:

1. Pre-construction topographic survey plan shall depict the existing conditions within the limits of work prior to earth disturbance at both the DDA and main landfill.

2. The Contractor, at a minimum, shall also prepare construction topographic and as-built surveys for each of the following surfaces as shown on the Contract Drawings and described in the Technical Specifications.

(a) Subgrade surface after removal of existing interim cover material (main landfill).

(b) Surface of excavated/placed waste material (main landfill).

(c) The top surface of the relocated interim cover material (main landfill).

(d) The top surface of the infiltration layer (main landfill)

(e) The final grade surface (main landfill and DDA).

3. The Contractor shall, at a minimum, prepare construction topographic surveys for other areas within the limit of work (but beyond the landfill surface) for each of the following surfaces as shown on the Drawings and described in the Technical Specifications:

(a) The final grades of all permanent stormwater management structures (to include all related pipe locations, sizes, and invert elevations).

(b) The location (by Plan Sheet coordinates) and grade elevations (to the nearest 0.10 ft) for the landfill settlement plates. Data shall be submitted on a weekly basis.

4. The coordinate system requirements for deliverables are North American Datum 83 and North American Vertical Datum 088.

5. All topographic survey plans shall be prepared at a scale of 1 in. = 30 ft with a 2- ft contour interval, unless otherwise directed by the Engineer.

C. The Contractor shall compile all topographic surveys performed for work during the course of the Contract into composite plans for the respective surfaces of each area surveyed. The composite plans shall be prepared at a scale of 1 in. = 30 ft with 2-ft contour intervals (with spot elevations at all tops and toes of slopes) and shall be submitted to the Engineer no later than 15 working days after the scheduled completion date for the Construction.

D. For all work under this item, the Contractor shall submit disk copies of the topographic survey plans in AutoCAD 2002 (or latest version) format with executable files along with two (2) prints for each survey plan required.

E. The Engineer reserves the right to require the submittal of copies of any or all survey field notes from the Contractor.

F. Tolerance on construction shall be ±0.15 ft every 100 ft with no compounding of tolerances. All minimum and maximum slopes shall be maintained.

PART 2 MATERIALS

Not Applicable.

PART 3 EXECUTION

3.01 SURVEYING

A. The Contractor shall locate, protect, and verify survey control points established from local elevation and coordinate datum prior to starting site work and preserve these points during construction. These controls will be permanent monuments used throughout construction and post-construction for any needed topographic, radial stakeout, and benchmark

elevations. The Contractor shall promptly report to the Engineer lost, relocated or destroyed control points. The Contractor shall maintain complete and accurate field notes for all control points and survey points as work progresses.

B. The Contractor shall perform and update the as-built surveys throughout the life of the Contract as necessary and at the end of the project.

C. The Contractor shall determine the elevation of each settlement plate on a weekly basis throughout the life of the Contract. The Contractor may elect to obtain survey data from the settlement plates on a more frequent basis. Weekly measurements shall be obtained each Friday and submitted to the Engineer for review within 24 hours.

D. For all survey work, survey points shall be obtained using a 50-ft grid. Additional points shall be surveyed at toe and top of slopes and as necessary to provide accurate topography in areas where slopes vary between the above noted grid points. All point elevations shall be accurate to a tenth of a foot. All pipe invert elevations shall be accurate to a hundredth of a foot.

E. Initial Staking will include angle points for fence relocation at the northeast end of the main landfill and centerline cut and fills for proposed access routes.

F. Upon completion of survey work the Contractor shall submit to the Engineer the deliverables (including plans, drawings, electronic disks, and survey notes), in accordance with subsection 1.02.

G. All deliverables under this item shall be signed and sealed by the QA Surveyor.

END OF SECTION

SECTION 02100

CLEARING AND STRIPPING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this Section includes all requirements for the clearing and stripping of all areas within the Contract Limit of Work in accordance with the Documents.

1.02 DEFINITIONS

A. Clearing is the removal from the ground surface and disposal, within the contract limit of disturbance, of brush, shrubs, other vegetation, rubbish, and debris (natural and man-made).

B. Stripping is the removal and stockpiling, within the contract limit of disturbance or as provided for by the Engineer, of all topsoils and cover soils that are above the limits of waste including matted roots, and organic materials.

PART 2 MATERIALS

Not Applicable.

PART 3 EXECUTION

3.01 GENERAL

A. Do not start earthwork operations in areas where clearing and stripping is not complete. Comply with erosion, sediment control, and storm management measures specified in the SWPPP and Section 02930 (Erosion and Sediment Control).

3.02 CLEARING

A. Clear all items to the limits necessary to perform construction activities and shred all cleared and grubbed material for use in topsoil applications. The Contractor is responsible to dispose of cleared and grubbed materials in accordance with State and Federal guidelines.

B. Burning of any material shall not be permitted on the Site.

3.03 STRIPPING

A. Cut existing vegetation on the main landfill as close to the existing ground surface as possible. Remove material from the ground surface and use it as mulch for temporary stabilization.

B. Disk the first 6 to 8 in. of cover soils, including stubble vegetation. Thoroughly mix the soils with the vegetative matter.

C. Remove the completed disked material and stockpile as topsoil.

D. Do not over excavate the topsoil material.

E. Assure the topsoil is segregated from the waste and cover soils.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section includes requirements for excavation; subgrade preparation; placement and compaction of structural fill and other soil or aggregate materials, including low-permeability soil; grading; items associated with the backfilling of pipe/utility trenches; filling for roads, channels, etc. as required; and performing laboratory and field testing of earthwork materials, as shown on the Drawings or as directed by the Engineer.

1.02 RELATED SECTIONS AND REFERENCES

A. Section 02100 – Clearing and Stripping

B. Section 02270 – Channel Protection

C. Section 02750 – Stormwater Management and Discharge

D. Section 02930 – Erosion and Sediment Control

E. SWPPP, March 2004.

F. CQCP, March 2004.

G. Construction Plan for LASO TA-73 Airport Landfill, March 2004.

H. New Mexico Department of Transportation (NMDOT) Specifications for Highway and Bridge Construction, 2000 Edition.

1.03 DEFINITIONS

A. Definitions pertinent to the earthwork requirements of this project include:

1. Trench backfill – suitable soils, as defined in PART 2 – MATERIALS, used for backfill of pipe/utility trenches and associated in-line structures.

2. Structural fill – suitable soils used for subgrade preparation, site grading or soils otherwise placed in a controlled manner upon or within which a structure, roadway, or cover system is to be supported. Also includes suitable soils used for subbase and protective cover soil within the final cover system.

3. Common borrow – suitable soils meeting the material requirements specified herein and provided from locations within the limits of the site property. Common borrow, to the greatest extent practicable, within the limits of construction methods, engineering judgment and design and in accordance with these Specifications shall be used for site construction.

4. Foreign borrow – suitable material meeting the material requirements specified herein and provided from sources outside the limits of the site property. Foreign borrow will be used to supplement common borrow material as needed.

5. Infiltration layer soils –Infiltration layer soil for use within the main landfill cover system shall be foreign borrow, environmentally-clean and free of organic material, frozen material, wood, or foreign trash, or other objectionable materials which may be decomposable, compressible, or which cannot be properly compacted, and shall not contain reclaimed materials.

6. Topsoil – suitable material meeting the material requirements specified herein; and provided from sources outside the limits of the site property.

7. Existing/relocated interim cover – defined as structural fill, and common borrow and provided from location within the limits of the site properly suitable soils.

8. Unsuitable material – unsuitable material not meeting the requirements set forth herein for structural fill soil or as otherwise determined by the Engineer to be inappropriate and/or unacceptable for use. Unsuitable material shall be disposed of by the Contractor.

9. Environmentally-clean – soil purchased from commercially available sources will be certified to be clean by the seller. The Engineer reserves the right to require additional chemical testing by the Contractor, at no cost to the Engineer, of proposed foreign borrow material to verify its environmental cleanliness should the borrow site history suggest the possible presence of contamination. The Engineer also reserves the right to inspect the foreign borrow site at any time prior to or during construction activities.

10. Noncalcareous – soil or aggregate that, when tested in accordance with ASTM D3042 for soils and ASTM D4373 for aggregates, possesses no more than a 5% loss of weight (dry basis) for aggregates or a maximum carbonate content of 15%.

11. Subgrade – excavation bottom or existing grade, as specified herein, prepared to receive soil fill or aggregate materials.

1.04 QUALITY CONTROL

A. General

1. Unless otherwise indicated, all laboratory and field testing shall be performed by an independent geotechnical testing laboratory (GTL) employed by the Contractor, with test materials furnished by the Contractor under the direction of the Engineer. The GTL proposed by the Contractor shall be reviewed and approved by the Engineer. The laboratory shall, at a minimum, be in compliance with ASTM D3740 Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rocks as Used in Engineering Design and Construction.

2. The Contractor shall test materials as set forth in the applicable referenced sections and as required herein.

B. Preconstruction Material Testing Requirements

1. The Contractor shall arrange for an inspection by the Engineer of each proposed foreign and common borrow source prior to the commencement of earthwork operations. During said inspection, the Subcontractor shall provide any equipment necessary to excavate test pits throughout the limits of the proposed source so as to provide the Engineer with a thorough inspection of the type(s) and uniformity of material(s) throughout the proposed source. Upon the Engineer's visual inspection and preliminary acceptance of a proposed borrow

source, the Contractor shall collect representative samples of the borrow soils for subsequent geotechnical testing in accordance with Table 02200-1 and as directed by the Engineer.

2. The Contractor is required to submit representative samples of each proposed foreign and common borrow material to the GTL at the minimum frequencies specified in Table 02200-1. The physical property tests shall be completed for each sample and the material approved prior to use of the material at the site. The Contractor shall complete all testing on infiltration layer materials prior to delivery to the site at the frequency specified in Table 02200-1. Infiltration layer material must be pre-approved prior to delivery to the site. Additional quality control testing will be performed on samples of delivered material. If, during the course of construction, an alternative borrow source is used, the material must be pre-approved by the Engineer in accordance with the requirements of this Specification prior to delivery to the site.

3. When a material is approved for use as infiltration layer soil, additional testing shall be performed in accordance with Table 02200-1 to correlate acceptable in-place dry density and moisture content to required permeability properties. The resulting lab data shall be used to develop a window within which the density and moisture content of the tested in-place soil should fall, using the method described in Daniel and Benson (1990) and incorporated in the Construction Plan, Appendix A, "Sampling and Analysis Plan for Borrow Sources for the Department of Energy, Los Alamos Site Operations, TA-73 Airport Landfill Project". By doing so, a reasonable level of assurance can be expected that permeability of the in-place soil will meet the requirements for hydraulic conductivity.

Table 02200-1
Material Quality Control
*Minimum Preconstruction Testing Requirements

Property	Test Method	Structural Fill Frequency	Infiltration Layer Frequency	Topsoil Frequency
Particle Size Analysis w/Hydrometer[1]	ASTM D421/D422	10,000CY	5,000CY	5,000 CY
Atterberg Limits	ASTM D4318	10,000 CY	5,000CY	---------
Organic Content	ASTM D2974	10,000 CY	---------	5,000 CY
Moisture Content	ASTM D2216	10,000 CY	5,000CY	5,000 CY
Standard Proctor Compaction	ASTM D698	10,000 CY	5,000CY	---------
Permeability[2]	ASTM D5084	---------	5,000CY	---------
pH	ASTM D4972	---------	---------	5,000 CY
Nitrogen (TKN)	EPA 351.3	---------	---------	5,000 CY
Phosphorus, Orthophosphate (as P)	EPA 9056A	---------	---------	5,000 CY

[1]Provide USCS designations for Structural Fill and Infiltration Layer samples and USDA classification for topsoil samples.
[2]Permeability tests for infiltration layer soil shall be conducted on remolded samples compacted to at least 95% degree of compaction as determined from ASTM D698 within -1% to +2% of optimum moisture content, unless preconstruction testing demonstrates a change in the requirement. The permeability test shall be performed under a confining stress of between 0.5 and 2.0 psi, with the lowest value being preferred and a hydraulic gradient of 1.0.

Preconstruction
Minimum Testing Acceptance Criteria

Property	Test Method	Structural Fill	Infiltration Layer	Topsoil
Particle Size Analysis w/Hydrometer	ASTM D421/D422	See 2.01.A.2.c, d, e	1/4 in maximum particle size	---------
Atterberg Limits	ASTM D4318	LL ≤ 40; PI ≤ 12	---------	---------
Organic Content	ASTM D2974	≤ 6%	---------	> 1%
Standard Proctor Compaction	ASTM D698	Dry density ≥ 105 pcf	---------	---------
Permeability	ASTM D5084	---------	$K \leq 1x10^{-5}$ cm/s	---------
pH	ASTM D4972	---------	---------	5.5 – 7.6
USDA Classification	Via ASTM D421/D422	---------	---------	Sandy loam, loam, silty loam, sandy clay loam
Nitrogen (TKN)	EPA 351.3	---------	---------	None; used to guide amendment
Phosphorus, Orthophosphate (as P)	EPA 9056A	---------	---------	None; used to guide amendment

4. The results of this preconstruction testing program shall be submitted to the Engineer for approval at least two (2) weeks prior to use of these soils at the site. Physical specimens of all proposed foreign borrow materials shall also be submitted to the Engineer, if requested. The Engineer shall have the authority to reject any and all soils that are believed to be inappropriate for earthwork construction.

5. The frequency of conformance testing of each approved soil material shall be in accordance with Table 02200-1 or at anytime that a significant change in physical properties of the proposed fill materials is observed by the GTL or the Engineer. The results of this on-going conformance testing shall be reviewed and approved by the Engineer prior to use of that material for which the testing was completed.

C. Field Quality Control Testing Requirements

1. The Contractor shall provide all horizontal and vertical controls necessary for all earthworks as well as associated grid layout and staking using benchmarks and monuments, if any, shown on the Drawings and required by these Specifications.

2. Placing soil material and performing earthworks will be subject to periodic QA inspection by the Engineer. The GTL shall provide continuous quality control (QC) inspection including field moisture and density tests during the compaction of each lift of soil in accordance with Table 02200-2. The Contractor shall also provide labor and equipment to prepare smooth surface spot locations as designated by the independent GTL or the Engineer on which to perform field tests.

Table 02200-2
Field Quality Control
Minimum Testing Requirements

Property	Test Method	Structural Fill Frequency	Infiltration Layer Frequency
Field Dry Density	ASTM D2922-direct transmission method	10,000 SF	2/Ac/Lift
Field Moisture Content	ASTM D3017	10,000 SF	2/Ac/Lift
Particle Size Analysis (Sieve only)	ASTM D421/422	---------	2500 CY
Standard Proctor	ASTM D698	---------	5000 CY

Field Quality Control
Minimum Testing Acceptance Criteria

Property	Test Method	Structural Fill	Infiltration Layer
Field Dry Density	ASTM D2922	≥98% Standard Proctor	Acceptable range will be established based on results of preconstruction testing
Field Moisture Content	ASTM D3017	± 3% Optimum	Acceptable range will be established based on results of preconstruction testing
Particle Size Analysis (Sieve Only)	ASTM D421/422	---------	Acceptable range will be established based on results of

			preconstruction testing

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3. Following the placement and compaction of each lift of soil, said lift shall be tested to determine the in-place compacted dry density and moisture content of the in-place soils, and to determine conformance of these data with the project specifications, before subsequent lifts are placed. The testing results from the infiltration layer shall also show that in-place density and moisture content fall within the permeability window determined for the infiltration layer soils as described in Subsection 1.04.B.3. Tests outside of the window shall be considered failing unless otherwise approved by the Engineer. Deficient areas shall be recompacted in accordance with approved techniques as stated herein.

   The GTL shall perform in-place field density and moisture tests of each compacted lift in accordance with the following approved methods:

   a. ASTM D2922 and D3017 (Moisture Content and Density of Soil and Soil-Aggregate in Place by Nuclear Methods).

4. For each placed lift, one field moisture-density test shall be performed by the GTL for each 100 lineal ft of trench backfill and narrow above-grade fills, for every 10,000 square feet (ft^2) of structural fill soil and 2 every AC of infiltration layer soil placed and compacted. The field moisture-density testing frequency shall be increased, if deemed necessary by the Engineer.

5. Any test resulting in penetration of the infiltration soil layer shall be repaired using granular or powdered bentonite.

1.05 SUBMITTALS

A. Delivery Tickets

1. Delivery tickets showing the following information with each load of foreign borrow fill material used shall be submitted to the SS:

   a. Location of borrow source.

   b. Name and location of supplier.

   c. Type and amount of material delivered.

B. Certified Test Reports

1. The Contractor shall submit to the Engineer the source, estimated quantity, and testing results of all soil material to be used. Acceptance of the soil material from any location shall not be construed as approval of an entire location, but only insofar as the soil material continues to meet the Specification requirements.

2. The Contractor shall submit two (2) certified copies of each report of laboratory test results to the Engineer at least two (2) weeks before use of any soil materials.

3. The Contractor shall submit Certificates of Compliance in accordance with Section 01340 for soil and aggregate materials stating that the materials are environmentally-clean and satisfy all material requirements of these Specifications.

PART 2 MATERIALS

2.01 SOIL MATERIALS

A. Structural Fill Soil

1. Structural fill shall be approved common or foreign borrow material consisting of soil having a uniform mixture of durable natural materials. Common borrow generated by site excavation activities required to achieve design subgrade elevations shall be used as structural fill to the maximum extent possible.

2. Structural fill soil shall be environmentally-clean, and free of frozen material, wood, trash, or other objectionable materials which may be decomposable, compressible or which cannot be properly compacted, and:

a. Shall classify as SC, SM, SW, ML, CL, or CL-ML according to the Unified Soil Classification System (USCS), unless otherwise specified herein or approved by the Engineer for use to construct a specific work element. Structural fill shall not be gap-graded or uniformly graded, as determined by the Engineer.

b. Liquid limit shall not exceed 40 and plasticity index shall not exceed 12.

c. Material shall have a uniformity coefficient, (C_u) greater than 6.

d. Material shall have a coefficient of gradation, (C_c) between 1 and 3.

e. Material shall not contain particles larger than:

- 2 in. for trench backfill.
- 0.5 in. for the 12-in. lift of structural fill soil adjacent to any geosynthetic materials.
- 4 in. for structural fill used in embankment or other fills.

f. Material shall have a maximum dry density of not less than 105 pounds per cubic foot (pcf) as determined by ASTM D698.

g. Material may have a maximum organic contents of 6% as measured by ASTM D2974.

3. Common borrow shall be screened and otherwise processed by the Contractor as required to achieve the maximum particle size specified.

4. Structural fill shall have physical properties which permit its ready spreading and compacting and minimize particle segregation.

5. Snow, ice, and frozen soil shall be strictly excluded from structural fill materials.

6. The moisture content of soils being placed as structural fill shall be near optimum conditions so as to provide the specified compaction and ensure a stable embankment.

7. Recycled materials shall be unacceptable for use as structural fill.

8. Existing site cover soils may be used as structural fill.

B. Infiltration Soils

1. Infiltration layer soil for use within the main landfill cover system shall be foreign borrow, environmentally-clean and free of organic material, frozen material, wood, or foreign trash, or other objectionable materials which may be decomposable, compressible, or which cannot be properly compacted, shall not contain reclaimed materials, and shall satisfy the following:

   a. Maximum particle size of 1/4 in.

   b. Maximum permeability of $1x10^{-5}$ centimeters per second (cm/sec) when compacted to 95% of its maximum dry density (ASTM D698) at a moisture content between -1% and +2% wet of its optimum moisture content and within the acceptable moisture-density window as discussed in Section 1.04.B.3, unless otherwise approved by the Engineer.

C. Topsoil

1. Topsoil shall be sandy loam, silty loam, or sandy clay loam as classified by the United States Department of Agriculture (USDA). Gradation analysis (sieve and hydrometer; ASTM D421/422) shall be completed to allow proper USDA classification of the material. Topsoil shall be fertile and friable surface soil of good and uniform quality. Topsoil shall not contain subsoil materials. Topsoil shall be free of refuse, hard clods, woody vegetation, stiff clay, construction debris, boulders, stones larger than 2 in., hydrocarbons, petroleum materials or chemicals toxic to plants, other miscellaneous or otherwise unstable or undesirable materials, and other deleterious inclusions. Testing of topsoil shall be at the frequencies shown on Table 02200-1. The contractor shall be allowed to make topsoil by adding organic amendments and fertilizers to meet the requirements of this section.

2. Topsoil shall have a minimum organic content of 1% by weight. The organic content of soils shall be determined by the Engineer-approved laboratory utilizing the method described in the ASTM D2974.

3. Topsoil shall have a pH value within a range of 5.5 to 7.6.

4. Apply slow release fertilizers to minimize deficiencies in topsoil, based on prequalification testing results. Organic fertilizers such as Biosol Mix, Biosol, Osmocote, composted manure or other products approved by the Engineer or his designee may be used. If composted manure is to be applied, test the nutrient content and interpret before it is used. If wood chips are used, chips shall have a relatively large surface area to volume ratio to be more easily broken down in the soil. Incorporate wood chips at low rates (0.5 ton/ AC) in order to assure the Carbon to Nitrogen ratio in soil is at favorable conditions for plant germination and growth. If higher rates are used, add nitrogen fertilizer to assure nutrient availability to plants.

2.02 AGGREGATE BEDDING MATERIALS

A. Pipe bedding material for polyvinyl chloride (PVC) pipe shall be noncalcareous aggregate meeting the requirements of NMDOT Section 304.21 for Class Open Graded Base Course (OGBC) outside the limits of the lining system. Slag will not be permitted.

B. Pipe bedding material for all other pipe shall be noncalcareous aggregate meeting the requirements of NMDOT Section 304.21 for Class OGBC. Slag will not be permitted.

C. Bedding material for precast and cast-in-place structures shall be noncalcareous aggregate meeting the requirements of NMDOT Section 304.21 for Class OGBC. Slag will not be permitted.

PART 3 EXECUTION

3.01 EXCAVATION

A. General

1. Excavations shall be completed to the lines and grades indicated on the Drawings and as required in these Specifications. It shall be the Contractor's responsibility to separate and protect excavated material that is suitable for structural fill (i.e., common borrow) from contamination by unsuitable excavated material or other sources. Determination of suitable material shall be preliminarily based on visual observations by the Contractor with concurrence by the Engineer. Final determination of suitable material shall be based on the results of the specified testing program and/or the professional judgment of the Engineer. The Contractor shall make his own determinations relative to subsurface conditions within the vicinity of the landfill and any areas that may yield suitable common borrow materials.

2. The Contractor shall maintain all excavation and fill operations free of water by ditching, sumps, pumping, or other methods approved by the Engineer. Runoff and other water shall be conveyed in ditches and channels to the site perimeter stormwater management system as specified herein.

B. Removal and Placement of Excess and Unsuitable Soil Materials

1. Excess soil materials generated by site excavations, and materials deemed unsuitable by the Engineer which are encountered either beneath, contiguous to or within the proposed limits of excavation or fill placement, shall be removed, transported to, and placed at a stockpile area and kept separate from other soil materials. Unsuitable materials shall be placed within the landfill in accordance with Sections 02260 and 02266.

2. Excess (but otherwise suitable) soil materials shall be segregated from and not contaminated with unsuitable soil materials.

3. Excavated boulders and other inert oversized material shall be handled as specified in Section 02266.

C. Unauthorized Excavation

1. Where unauthorized excavations are made below indicated elevations under channels, footings, pipes, structures, or outside trench limits, restore the area to proper elevations with structural fill materials that are placed and compacted, as specified herein, at no additional cost to the Engineer.

D. Sheeting, Shoring, And Bracing

1. Method, design and adequacy of all temporary sheeting, shoring, and bracing systems, when applicable, shall meet the requirements of OSHA 29 CFR Part 1926

and are the responsibility of the Contractor. All damage related to or caused by improperly designed or constructed retention systems shall be repaired by the Contractor. The design and method of the sheeting, shoring, and bracing shall provide means for its removal as backfill progresses, unless otherwise indicated on the Drawings or directed by the Engineer.

2. Provide sheeting and shoring or other appropriate retention measures as required to ensure safe working conditions; maintain required excavation dimensions for proper construction; and to prevent accidents, cave-ins, and damage to adjacent structures, facilities, and surfaces.

3. Sheeting, shoring, and bracing shall be placed so as not to interfere with the construction and shall be entirely independent of all footings, pipes, and structures.

4. Remove sheeting, shoring, bracing, and all forms concurrently with backfilling operations. Such removal shall be accomplished in a manner that precludes settlement of the backfill, cave-in of the excavation sides, and prevents damage to adjacent surfaces. Voids left or caused by the removal shall be promptly filled.

E. Trench Excavation

1. Excavate trenches, when required, to the width and depth dimensions indicated on the Drawings. Provide uniform, continuous support for pipe or structure on required bedding. Remove rock, when encountered, to a minimum depth of 6 in. below the pipe and to the same depth below the bell. In general, the trench bottom shall be excavated to conform with the shape and dimensions of the proposed pipe or structure. If the shape of the trench cannot be preserved or the trench varies from the shape of the structures, the space between the desired trench dimensions and the bottom of the excavation, as made, shall be filled with compacted aggregate backfill. Allowance shall be made for the placement of granular bedding, where specified. Materials at the bottom of the trench deemed unsuitable by the Engineer shall be removed and replaced with compacted aggregate backfill. Depth and width of removal shall be as directed by the Engineer. Damage caused to existing facilities by the Contractor's operations shall be repaired or replaced at no expense to the Engineer.

2. Unless otherwise specified herein or authorized by the Engineer, trench excavation shall proceed no more than 300 ft in advance of the placing of backfill. The Engineer may require backfilling and subsequent re-excavation of trenches left open for an unreasonable amount of time in advance of pipe installation. Trenches left open overnight, or during periods when the Contractor's forces are not present, shall be so protected or enclosed and appropriately marked as to cause no danger to the public or others.

3. Sides of trenches from a point 1 ft above the top of the pipe to the bottom of the trench shall be practically plumb. Bell holes shall be excavated in the bottom of the trench wherever necessary to permit the proper assembling of joints.

3.02 FILL AND BACKFILL CONSTRUCTION

A. General

1. Excavations shall be backfilled with structural fill or other common borrow approved for use by the Engineer. Trench backfill, satisfying the requirements of Paragraph 2.01.A.2, shall be used to backfill around electrical conduit and surface water runoff conveyance piping up to finish grade.

2. Backfill around a structure or pipe shall be brought up evenly on all sides so that no unbalanced pressure shall be imposed on the structure or pipe.

3. Do not place, spread, or compact fill material or backfill material while it is frozen or thawing; or place upon frozen or thawing ground; or during unfavorable weather conditions. When the Work is interrupted by rain, fill operations shall not be resumed until field tests indicate that the water content and density of the exposed fill are within the limits specified. A compacted layer that has been rained on or frozen shall be removed, reworked, or recompacted by a method approved by the Engineer before the next layer is placed thereon.

4. Thoroughly mix each lift before compaction to ensure uniform distribution of water content. Distribute particles of permissible sizes throughout the fill material.

5. Placement of soil materials on underlying geosynthetics shall not proceed at an ambient temperature below 32°F or above 104°F, unless otherwise specified or approved by the Engineer. Equipment used for placing soil shall not be driven directly on the underlying geosynthetics. A minimum thickness of 12 in. of soil material is required between tracked equipment with a maximum ground pressure of 15 pounds per square inch (psi) and the underlying geosynthetics, unless otherwise specified. A minimum thickness of 3 ft of soil material is required between rubber-tired vehicles and the underlying geosynthetics.

6. Soils used at the site shall be continuously visually inspected by the Contractor's quality control personnel during construction to check that it is consistent with the soil previously used at the site. If changes in material or source occur, the quality control personnel shall inform the Engineer immediately and reject any work performed by the Contractor using the new material until the pre-construction QA/QC procedures (as outlined in the CQCP) are executed and approved by the Engineer at the expense of the Contractor.

7. The Contractor shall minimize desiccation and cracking of soil layers to the extent feasible. The Contractor shall be responsible to repair any desiccation or other damage to soil between testing and acceptance.

8. The finished surface of the structural fill layer component of the liner system shall be free of debris, roots, sticks, or any other foreign matter so as to provide for an acceptable bearing surface for the overlying geosynthetics, where applicable.

9. The Contractor shall maintain all excavation and fill operations free of water by ditching, sumps, pumping, or other methods approved by the Engineer. Each layer of fill material shall be placed so that the surface is free-draining. Runoff and other water shall be conveyed in ditches and channels to the site perimeter stormwater management system as specified herein.

B. Subgrade Preparation

1. Areas where fill material is to be placed shall have all vegetation, root matter, and topsoil removed. Following this activity, the subgrade within the limits of fill material placement shall be proofrolled on-grade using a heavy-duty roller (preferably sheepsfoot) with a minimum weight of 10 tons. A minimum of four passes of the

roller shall be completed over the entire area. Proof-rolling in this manner shall be completed over the entire landfill area to provide for a stable and uniform subgrade surface, unless otherwise approved by the Engineer.

2. Following completion of proof-rolling, the entire area will be visually inspected by the Engineer. Should any loose or otherwise unstable zones be detected by the visual inspection, these areas shall be recompacted using a roller with as many passes as are necessary to densify these materials to the satisfaction of the Engineer. If these materials cannot be densified sufficiently by the additional proofrolling, they shall be undercut down to stable materials.

3. For undercuts, the exposed subgrade shall be proofrolled on-grade until sufficiently stable, as determined by the Engineer. (If the undercut zones are of minimal areal extent, hand-operated compaction equipment may be used to densify these areas.) Unsuitable materials undercut during subgrade preparation activities shall be transported to and placed at the stockpile area under the direction of the Engineer and disposed of in the landfill.

C. Material Storage

1. Deposit excess excavated material at the materials on-site stockpile areas. Stockpile(s) shall be graded in such a manner so as to prevent erosion and sedimentation.

D. Placing Structural Fill Materials

1. Prior to placing fill material, all soils to be used for construction shall be tested by the GTL approved by the Engineer, as specified in Subsection 1.03.C. Materials must be approved by the Engineer prior to their use.

2. Place fill material in uniform lifts of not more than 12 in. in loose (uncompacted) thickness. Spread each layer uniformly and evenly. Perform compaction using equipment and methods approved by the Engineer. The Contractor shall use equipment appropriate for obtaining the compaction criteria specified herein.

3. Unless otherwise indicated in these Specifications or approved by the Engineer, the fill shall be placed in a uniform compacted lift of 12 in. Each lift shall be spread evenly and compacted to the specified in-place dry density.

4. Prior to commencing compaction, structural fills shall be brought to within an acceptable range of their specified optimum moisture content per ASTM D698 by either aerating the material if it is too wet or spraying the material with water if it is too dry. Acceptable moisture contents shall be as specified in Table 02200-2, unless otherwise approved by the Engineer, and shall be controlled by the Contractor in order to meet the compaction requirements specified herein. Each placed lift of structural fill used to achieve prepared subgrade elevations and in berms and embankments shall be compacted to at least 98% of the maximum dry density as determined by the Standard Proctor compaction test (ASTM D698), unless otherwise approved by the Engineer.

5. Continue all filling operations until the fill has been brought up to the finished slopes and grades shown on the Drawings, making proper allowances for thickness of topsoil, channel lining, roadway aggregate, etc.

6. Place all fill materials so that surfaces shall be sloped to drain at all times so as to prevent excessive moisture accumulation from rainwater.

7. Compaction by large rollers or heavy equipment shall not be permitted within 5 ft of structures. Accordingly, compaction in these areas shall be performed using hand-operated vibratory-plate or small walk-behind compactors. Fill materials compacted using this equipment shall be placed in maximum 6-in. loose lifts, unless otherwise specified herein.

E. Placing Infiltration Layer Soil

1. Place infiltration layer soil material in uniform lifts of not more than 12 in. in loose (uncompacted) thickness. Spread each layer uniformly and evenly. Perform compaction using equipment and methods approved by the Engineer. The Contractor shall use equipment appropriate for obtaining the compaction criteria specified herein.

2. Unless otherwise indicated in these Specifications or approved by the Engineer, the fill shall be placed in a uniform compacted lift of 12 in. Each lift shall be spread evenly and compacted to the specified in-place dry density.

3. Prior to commencing compaction, infiltration layer fills shall be brought to within an acceptable range of their specified optimum moisture content per ASTM D698 by either aerating the material if it is too wet or spraying the material with water if it is too dry. Acceptable moisture contents shall be as specified in Table 02200-2, unless otherwise approved by the Engineer, and shall be controlled by the Contractor in order to meet the compaction requirements specified herein. Each placed lift of infiltration layer fill shall be compacted to a dry density (ASTM D698) and moisture content within the acceptable moisture-density window as discussed in Section 1.04.B.3, unless otherwise approved by the Engineer.

4. Following compaction, in-place moisture and density testing will be performed at a frequency as specified in Table 02200-2. The Engineer may elect to reduce the test frequency if it has been demonstrated that the required density can consistently be achieved. In no case will the test frequency be reduced to less than one test per 40,000 ft^2 per lift, or one test per day that infiltration layer soil is placed and compacted.

5. Equipment operation shall be as required in Subsection 3.02.A.5.

F. Placing Trench Backfill

1. Unless otherwise noted or directed by the Engineer, placing trench backfill shall conform to requirements specified above for placing and compacting structural fill, except as modified below:

   a. Place and compact granular bedding in accordance with the Drawings. Place and compact granular bedding to a minimum thickness of 6 in. under precast and cast-in-place structures.

   b. For all other pipes, compact approved trench backfill materials to minimum thickness above the top of pipe with manual tampers. Place backfill in thin horizontal lifts not exceeding a loose thickness of 6 in.

   c. Utilize such compaction equipment that will not damage the pipe and pipe joints. Pipe and pipe joints damaged by the Contractor's operations shall be removed and replaced at no cost to the Engineer.

d. Trench backfill shall be placed in uniform lifts of not more than 6 in. in loose thickness.

3.03 TOPSOIL

A. Six inches of topsoil shall be placed on the landfill final cover system and at thicknesses required on the DDA to achieve a 12-in. cover soil thickness, and other disturbed areas of the site as designated on the Drawings. The spreading shall be performed in such a manner that seeding can proceed with little additional soil preparation or tillage. Irregularities in the surface resulting from topsoil placement or other operations shall be corrected so as to prevent the formation of depressions where water will pond. Topsoil shall not be placed when the subgrade surface is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to the proposed seeding program. Topsoil should not be overly compacted either deliberately or inadvertently.

B. The Contractor shall provide the necessary temporary erosion and sediment control, drainage, dust control, and safety measures during construction at no additional cost.

C. Stockpiled topsoil materials shall be placed in SS-approved areas. The stockpiled materials shall be placed and graded for proper drainage and shall not be placed near the edge of side slopes.

D. Mud, snow, ice, or frozen earth shall not be incorporated in the topsoil.

E. Placement of topsoil shall be performed as soon as possible after placement of the infiltration layer. After topsoil placement and finish grading, no heavy equipment, trucks, etc. shall be permitted to travel on these completed areas. The Contractor shall, through mechanical raking, and hand grading with rakes and shovels, grade all areas around fences, pipes, and other structures in preparation for final seeding. Only low ground pressure equipment may be used for seeding. Seeding will be performed in accordance with Section 02932.

F. The Contractor shall pay all costs, fees, etc. to rectify any deficiencies in placement of the topsoil layer, to the acceptance of the Construction Manager, including those deficiencies resulting from weather, erosion, etc., during the time period between placement of the topsoil layer and proper development of the vegetative cover.

3.04 FINISH GRADING

A. Perform grading operations so that the fill areas are well-drained at all times. Maintain drainage ditches and keep them open and free from soil, debris, and leaves until final acceptance of the Work. Finish all grading on neat, regular lines conforming to the lines, grades, and contours shown on the Drawings, or if not shown, in accordance with the criteria set forth herein. Perform grading work in proper sequence with all other associated operations.

B. Grade all areas disturbed during the Work of the Contract. At trench locations, excavated and filled areas, and adjacent transition areas, grade so that finished surfaces are at the proposed grade or are approximately at the grades existing prior to being disturbed. Adjust as required to provide positive drainage.

C. Finished grades of all surfaces shall be constructed within the tolerances specified. As-built surveys completed by the Contractor shall document that the approved finished surface does not deviate from the design by more than the allowable tolerance.

D. As-built surveys shall be completed by the Contractor as required in Section 02005.

E. All specified minimum thicknesses and slopes shall be achieved for the respective earthen material of the landfill cover system.

3.05 LOW-PERMEABILITY SOIL MAINTENANCE AND REPAIR

A. Fine-grained, low-permeability soils are susceptible to desiccation and subsequent cracking in warm weather conditions. The Contractor shall be responsible for maintaining optimum moisture (or slightly above) conditions within installed protective cover soil throughout the entire construction. Should the soil crack or separate, the Contractor shall add the necessary moisture to the material in order to properly scarify, recompact, and retest what might have once been an acceptable lift of material. Prior to placement of additional lifts of soil or geosynthetics, the surface will be inspected and approved by the Engineer immediately before placement.

B. The Contractor shall repair all erosion scars on any compacted lift of soil due to excessive rainfall.

C. The Contractor shall backfill any holes within the compacted lifts during the construction with granular or powdered bentonite (i.e., moisture/density test holes, Shelby tube holes, grade stakes, etc.).

D. If a defective area is discovered in the low-permeability soil layer, the Engineer will immediately determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the Engineer will determine the extent of the defective area by additional tests, observations, a review of records, or other appropriate means. If the defect is related to adverse site conditions, such as overly wet soils or surface desiccation, the Engineer shall define the limits and nature of the defect. The Contractor shall correct the deficiency to the satisfaction of the Engineer, at no cost to the Engineer. All retests, as required by the Engineer, must verify that the defect has been corrected prior to additional work in this area.

3.06 DEWATERING AND DRAINAGE

A. To preclude surface water ponding in excavations, provide and maintain dewatering systems of sufficient capacity to remove water while each excavation is performed. Sediment-laden water shall be directed to a diversion channel and/or sediment trap as described in the Contractor's SWPPP. The Contractor is responsible for compliance with all required United States Environmental Protection Agency (EPA), DOE, and NMED stipulations as stated in other section of these Specifications and the SWPPP.

B. Methods of dewatering excavations shall be at the Contractor's discretion. Continuous investigations and checks shall be made by the Contractor to ensure that the dewatering system employed is functioning properly and is not causing damage or settlement to adjacent surfaces or structures. The system shall be modified as required, and any damage caused by the system shall be the responsibility of the Contractor to repair or restore.

C. Provide necessary temporary surface drainage and keep same operating to the satisfaction of the Engineer until permanent drainage or finish grading has been completed. Do not allow damming or ponding of water in gutters or storm drains.

END OF SECTION

SECTION 02260

ON-SITE WASTE EXCAVATION AND TRANSPORT

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes the requirements for the on-site transport of excavated materials from one area of the airport landfill to another area of the same landfill. This section is not applicable to the DDA.

1.02 RELATED SECTIONS AND REFERENCES

A. Section 02100 – Clearing and Stripping.

B. Section 02200 – Earthwork.

C. SWPPP, March 2004.

D. CQCP, March 2004.

E. Construction Plan for LASO TA-73 Airport Landfill, March 2004.

PART 2 MATERIALS

2.01 GENERAL

A. The Contractor shall provide all materials and equipment required for the excavation, transport and handling of waste and soil materials within the boundaries of the site.

PART 3 EXECUTION

3.01 EXCAVATION

A. The Contractor shall conduct excavation of site materials as shown on the Drawings.

B. Contour maps are provided to the Contractor for his use in determining the “cuts” necessary to minimize over-excavation of the waste and mixture of cover soils into the waste. It is suggested that the Contractor stake the cut excavations in the field and perform “test pitting” as necessary to verify the thickness designated on the contour maps.

C. Prior to the excavation of any waste materials, test pits shall be excavated to determine the horizontal limits of waste. Pits shall be spaced at 100 ft on center on the north, south and west sides of the landfill and the delineated edge of waste marked in the field and surveyed for inclusion on the project as-builts. All relocated waste shall be placed within these limits to ensure coverage by the final cover system.

3.02 TRANSPORTATION

A. The Contractor shall transport the waste materials to the fill areas shown on the Drawings. Vehicles shall be operated in a safe and controlled manner.

3.03 MATERIAL PLACEMENT

A. The Contractor shall place excavated waste from the site in the fill areas as shown on the Drawings and in accordance with Section 02266 specifications.

3.04 CONTROL OF DUST, ODORS, AND SPILLS

A. The Contractor shall implement measures to strictly control dust, odors, and spills during the on-site transport of excavated materials. The gates of hauling vehicles shall be sealed tightly to prevent the release of materials during transport and vehicles will not be overloaded so that the waste material rolls off the tops of loaded vehicles. If a spill occurs, the Contractor shall promptly clean up the material. The Contractor shall use covers/tarps to prevent the release of dusts and odors from trucks, scrappers, etc., as necessary.

END OF SECTION

SECTION 02266

LANDFILL WASTE PLACEMENT PROCEDURES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Capping of the airport landfill includes the relocation of waste from the north and east slopes and consolidation of this waste on the flat portion of the landfill within the existing limit of the waste (footprint).

B. The toe of the east slope will be relocated approximately 10 ft westward (as defined on the Drawings) to allow the inclusion of the landfill cap while maintaining a buffer zone between the edge of the cap and the canyon wall. A portion of the east slope will be backfilled with structural fill to allow this area to be tied into the native soil.

C. This section includes requirements for the main landfill only.

1.02 RELATED WORK

A. Section 02200 – Earthwork.

B. Section 02930 – Erosion and Sediment Control.

C. SWPPP, March 2004.

D. CQCP, March 2004.

E. Construction Plan for LASO TA-73 Airport Landfill, March 2004.

1.03 SUBMITTALS

A. Topographic survey as described in subsection 1.04.A. Survey shall be prepared and submitted with Contractor's application for payment of waste relocation.

1.04 MEASUREMENT

A. Contractor shall perform a topographic survey of the finished surface of relocated waste for use in calculating the volume of waste moved. The survey shall be compared to the pre-construction survey required by Section 02005.

PART 2 MATERIALS

2.01 GENERAL

A. The Contractor shall provide all materials and equipment to place, spread, and compact the waste and soil materials within the landfill. The Contractor shall provide the number and type of equipment required to ensure that the site closure and development is completed within the contracted schedule.

PART 3 EXECUTION

3.01 GENERAL

A. All relocated waste shall be placed within the limits shown on the Drawings or as otherwise defined by the Engineer based on the findings of test pit excavations.

3.02 PLACEMENT AND COMPACTION

A. The excavated material shall be spread with dozers or similar earthmoving equipment under controlled lift and compaction construction. Waste shall be placed in layers up to 12 inches and compacted with a roller compactor with a minimum weight of 10 tons and a minimum of 4 passes except as noted below.

B. Large pieces shall be isolated and filled around with soil or other smaller wastes in order to minimize voids.

C. Large, flat pieces shall be placed flat and filled around on all sides with soil/waste. Enough horizontal space between slabs in the same lift shall be maintained for compaction equipment to operate.

D. At least one ft of waste/soil shall separate large, flat pieces. No direct stacking will be permitted.

E. Other wastes shall be compacted until they are visually observed to be dense, stable and unyielding, or as directed by the Construction Manager, and as per the minimum requirements stated in 3.02.A above.

F. Special care shall be taken when excavating waste approximately 10 ft east of the storm drain located along the western edge of the landfill. Wastes excavated around existing pipe and inlet structures shall be replaced with clean structural fill soils in accordance with Section 02200. Any damage to existing structures designated to remain in this area shall be repaired by the Contractor at no cost to the Engineer.

3.03 CONDITION AREAS

A. Should excavated waste material that is saturated be placed within the landfill, the Contractor shall set aside an area to dry said wastes.

B. The area to dry these soils shall not be within 5 ft of the final grades for the cover system or within 50 horizontal ft of the final side slope grades.

C. The Contractor shall spread the saturated material in thin lifts and dry the material by racking, tilling, liming, mixing in dry soil, or other approved methods.

D. Areas used to dry saturated material will not be stacked upon each other for more than two consecutive loose lifts.

3.04 PREPARATORY GRADE

A. An allowance for the dimensions of the cover system shall be incorporated into the grading.

B. Landfill outslopes will be stabilized with riprap as shown on the Drawings.

END OF SECTION

SECTION 02270

CHANNEL PROTECTION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section includes furnishing all labor, materials, tools, and equipment necessary for providing protection for slopes, ditches, channels, and riprap outlet protection to the configuration and extents indicated in accordance with the Contract Documents.

1.02 SUBMITTALS

A. In accordance with Section 01340, submit a Certificate of Compliance before delivery of materials for the items listed below:

1. Stone.
2. Geotextiles and fasteners.
3. Erosion control blankets.
4. Erosion control mats.

1.03 QUALITY CONTROL

A. General

1. Unless otherwise indicated, all laboratory and field testing shall be performed by an independent geotechnical testing laboratory (GTL) employed by the Contractor, with test materials furnished by the Contractor under the direction of the Engineer. The GTL proposed by the Contractor shall be reviewed and approved by the Engineer. The laboratory shall, at a minimum, be in compliance with ASTM D3740 Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rocks as Used in Engineering Design and Construction.

2. The Contractor shall test materials as set forth in the applicable referenced sections and as required herein.

B. Field Quality Control Testing Requirements

1. The frequency of conformance testing of each approved channel protection material shall be in accordance with Table 02270-1 or at anytime that a significant change in physical properties of the proposed fill materials is observed by the GTL or the Engineer. Acceptance criteria are defined in Table 02270-2. The results of this on-going conformance testing shall be reviewed and approved by the Engineer prior to use of that material for which the testing was completed.

2. The Contractor shall provide all horizontal and vertical controls necessary for all channel protection as well as associated grid layout and staking using benchmarks

and monuments, if any, shown on the Drawings and required by these Specifications.

3. Placement of channel protection materials will be subject to periodic QA inspection by the Engineer. The GTL shall provide quality control (QC) inspection in accordance with Table 02270-1 and 02270-2. The Contractor shall also provide labor and equipment as needed by the independent GTL or the Engineer with which to perform field tests.

Table 02270-1
Field Quality Control
Minimum Testing Requirements

Property	Test Method	Frequency
Gradation	ASTM D-5519[1]	5,000 cy

[1]ASTM D-5519-94, "Standard Test Method for Particle Size Analysis for Natural and Man-Made Riprap Materials".

PART 2 PRODUCTS

2.01 STONE FOR OUTLET AND CHANNEL PROTECTION

A. Stone shall meet the requirements of NMDOT Section 602.221.

B. Stone for riprap shall be composed of a well-graded mixture of stone size such that the material size, based on a gradation analysis, is consistent with Table 02270-1 entitled "Stone Riprap Gradation."

Riprap shall be reasonably well-graded from the smallest to the largest size specified and shall be controlled by visual inspection.

C. No broken concrete shall be used on this project.

D. Riprap shall be National Stone Association (NSA) Gradation of R3, R4, and R5.

Table 02270-2

Stone Riprap Gradation

NSA No.	Graded Rock Size (in.)		
	Max.	D_{50}	Min.
R-3	6	3	2
R-4	12	6	3
R-5	18	9	5

2.02 EROSION CONTROL MATTING

A. Channel beds and newly graded sideslope protection shall utilize synthetic erosion control mats as required.

B. Temporary grass stabilization seed mixture shall meet the requirements of Section 02932.

2.03 GABIONS

A. Gabions shall conform to NMDOT Section 602.25.

PART 3 EXECUTION

3.01 RIPRAP

A. Place geotextile loosely over the prepared subgrade. Overlap the geotextile panels a minimum of 18 in.. Place and shingle panels parallel to the flow and slope. Anchor panels with securing pins inserted through the geotextile, along, but not closer than 2 in. to each edge and at distances required to prevent displacement before or during construction. Stagger overlaps perpendicular to the flow a minimum of 5 ft. Geotextiles damaged or displaced before, during, or after placement shall be replaced or repaired by the Contractor at no cost to the Engineer.

B. Place riprap on subgrade or geotextile material to its full specified thickness and to the extent shown on the Drawings. Placement shall be in one operation in such a manner as to not disturb underlying material. End dumping of rock upon the geotextile shall not be permitted. The rock will be lightly compacted with dozer tracks to set the riprap. It is anticipated that minimal dust control and no moisture conditioning will be required for the riprap placement. Final grades will be surveyed to confirm that final east and north slope elevations match the design specifications and provide measurements for as-built records.

C. The larger stones shall be well distributed and compact. Hand placing or rearranging of individual stones by mechanical equipment may be required to secure the required results.

D. Riprap shall be placed starting at the toe of slope and proceeding upslope.

E. Equipment operations shall meet the requirements of 02200 Part 3.02A.5.

3.02 GABIONS

A. Gabion placement shall conform to manufacturer's instructions and NMDOT Section 602.34.

3.03 EROSION CONTROL MATS

A. Erosion control mats for channel protection, where indicated on the Drawings or ordered by the Engineer, shall be installed in strict accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 02500

GRAVEL ROADS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section includes requirements for constructing gravel roads where indicated, including the provision of subgrade as required, in accordance with Contract Documents. Access roads will be constructed to the DDA and main landfill, as shown on the Drawings.

1.02 SUBMITTALS

A. The Contractor shall submit a Certificate of Compliance in accordance with Section 01340 certifying the materials meet the material requirements of this Section as specified herein, before delivery of the materials.

B. For gravel road construction, the Contractor shall submit a certified report from a geotechnical testing laboratory. This report shall include the following data:

1. Material source and vendor.
2. Laboratory and date of testing.
3. A certificate of material compliance.
4. Particle size analysis.

PART 2 MATERIALS

2.01 GRAVEL

A. Gravel for road construction shall be crushed stone that is clean, durable, angular, noncalcareous fragments of rock. No slag will be accepted. Recycled concrete may be used.

B. Noncalcareous aggregates are those materials that, when tested in accordance with ASTM D3042 possesses no more than 5% loss of weight (dry basis).

PART 3 EXECUTION

3.01 TEMPORARY GRAVEL ROADS

A. When temporary roads are required, materials and placement shall be as specified herein. Contractor shall be responsible to maintain the temporary road in a condition acceptable to the Engineer until permanent surface(s) are placed. Should temporary roads become defective and create an emergency, the Contractor shall commence repair to rectify the situation within 1 hour after notification by the Engineer, or the Engineer may arrange to have the work performed by others and deduct the costs thereof from monies owed the Contractor.

Temporary driveways and pads for Contractor trailers shall be at a minimum thickness of 6 in., and compacted with the surface of the completed replacement at the same grade as the surrounding surface.

3.02 PERMANENT GRAVEL ROADS

A. Perform grading operations so that the excavation and/or structural fill will be well drained at all times. Maintain drainage ditches and keep them open and free from soil, debris, and leaves until final acceptance of the work. Finish all grading on neat, regular lines conforming to the sections, lines, grades, and contours shown on the Drawings; if not shown, perform in accordance with the criteria set forth herein. Perform grading work in proper sequence with all other associated operations.

B. Prepare the subgrade in accordance with Section 02200. Bring the entire subgrade to the proper elevation prior to installation of any permanent roadways. Provide necessary temporary surface drainage and keep the same operating to the satisfaction of the Engineer until permanent drainage or finish grading has been completed. Do not allow damming or ponding of water.

C. After subgrade elevations are achieved, install woven geotextile in accordance with Section 06020 and the manufacturer's recommendations. In general, unroll fabric in the direction of construction traffic. Do not end dump aggregate or drive any equipment directly on the geotextile. Spread the aggregate with a lightweight, less than 8 psi contact pressure, tracked bulldozer. The bulldozer should blade into the load with a slightly upward motion. Compact aggregate with two to three passes of a 10-ton smooth drum vibratory roller.

D. In areas where bituminous pavement is being replaced, coordinate construction activities.

3.03 PAVED ROADS AND RAMPS

A. The Contractor shall be responsible for the maintenance, repair and potential replacement of paved roads and ramps damaged as a result of its operations.

END OF SECTION

SECTION 02720

STORM DRAIN SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section includes requirements to construct a storm drain system completed in place to the limits indicated in accordance with the Contract Documents.

1.02 QUALITY CONTROL

A. Test materials as set forth in the applicable referenced Specifications and as required herein.

B. Requirements for inspection and testing of concrete inlets, culverts, manholes, and end sections, as required, are specified in Section 03400.

C. As part of the QA effort, the Engineer may inspect and test all pipe, fittings, and joint material upon delivery to the site or at the factory. The Engineer may perform, on a continual basis, plant certification and in-process inspections at no cost to the Contractor.

1.03 SUBMITTALS

A. Certificates of Compliance

1. Submit Certificates of Compliance and shop drawings before delivery of materials in accordance with Section 01340 for pipe, precast concrete (manholes, inlets, etc.), and fittings furnished by the Contractor under this section. Certificates shall include the Engineer's name; job location; the Contractor's name, types, classes, and strengths of pipe; and the pipe manufacturer's name. Certificates of Compliance for concrete and masonry materials are specified in Section 03400.

B. Invoices

1. A packing list or invoice shall accompany every shipment and shall contain the following information: Engineer's name, type and class of pipe, length, and other pertinent information.

C. Installation and Repair Recommendations

1. Submit manufacturer's recommended installation and repair methods and procedures for pipe and structures. Repairs shall be performed by the manufacture using specifically trained personnel and shall proceed only after approval of the Engineer and in his presence.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery of pipe shall be coordinated with installation or shall be unloaded with proper equipment along the line of work, outside trench limits near as practicable to point of final placement, facing in proper direction, and properly wedged secure. It shall be stored away from brush, poison oak, or ivy, and in an accessible area for inspection.

B. Pipe and appurtenances shall be unloaded and handled with a crane or backhoe of adequate capacity equipped with appropriate slings to protect the material from damage. If damage occurs and is deemed repairable, it shall be repaired as directed by the Engineer in accordance with the manufacturer's recommendations. If damage is not repairable in the opinion of the Engineer, such pipe will be rejected and shall be removed and replaced at the Contractor's expense.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Pipe product shall conform to NMDOT Section 570.

Pipe between structures or between the structure and terminus shall be of the same size and material and shall be furnished by the same manufacturer. Each pipe length and fitting shall be clearly marked with the manufacturer's name or trademark and pipe type or strength.

2.02 JOINTING MATERIAL (CONCRETE PIPE)

A. Mortar for pipe joints shall conform to NMDOT Section 570.322.

2.03 GRANULAR BEDDING MATERIAL

A. Granular bedding material for pipe and structures is specified in Section 02200. Detail for bedding the pipe is shown on the Drawings.

2.04 CONCRETE INLETS

A. Concrete precast units shall meet the requirements of NMDOT Section 623.

B. Concrete strengths for inlets are specified in Section 03400.

2.05 FRAMES, GRATES, AND COVERS

A. Frames, grates, and covers shall meet the requirements of ASTM A48-83, Gray Iron, Class 35.

B. Design wheel loading shall be HS-20 for all grating.

C. Grating will be heavy duty type and bolted down type.

D. Grating shall be an "opened type", such as Neenah Foundary Company, Type A or Type P, or an approved equal.

PART 3 EXECUTION

3.01 INSTALLATION OF STORM DRAIN

A. Inspection of Delivered Materials

1. Pipe, fittings, inlets, and manholes delivered to the work site will be inspected prior to installation. Nonaccepted and damaged materials shall not be installed, but shall be removed or repaired, if repairable, as directed by the Engineer.

B. Handling of Pipe and Fittings

1. Pipe and appurtenances shall be handled with a crane or backhoe of proper capacity, equipped with appropriate slings to protect the exterior of the pipe.

2. Foreign matter shall be cleaned and removed from each pipe, fitting, and appurtenances before placing in the trench. Should foreign matter be observed in previously installed pipe, fittings, or appurtenances, cease work until foreign matter is removed. Open ends of pipes and fittings shall be closed with a cap or plug when work is not proceeding.

C. Excavation

1. Trench excavation and backfill shall be performed as specified in Section 02200. Pipe between structures or between structure and terminus shall be of the same size and material and shall be furnished by the same manufacturer. Before pipe installation, excavate sufficient trench in advance so that reasonable changes in line and grade can be made where the location of existing structures vary from that shown and then to ensure that no unforeseeable obstructions exist. Work required by failure to take such precautions shall be performed at no cost to the Engineer.

D. Bedding

1. Provide granular bedding in accordance with the Drawings and Section 02200. Provide encasement and/or concrete cradle where indicated. The entire length of each pipe shall be placed on firm bedding.

E. Placement

1. Prior to pipe installation, bring bedding material to grade along the entire length of pipe to be installed. Install pipe to a true uniform line and grade as indicated with continuous bearing of barrel on bedding material.

2. Install pipe upgrade with the bell or groove (for concrete pipe) pointing in the direction of upstream. Place each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to prevent sudden offsets in the flow lines. Unless otherwise specified, opening of joints more than half the depth for concrete pipe will not be permitted.

3. Place sufficient backfill on each section of pipe as it is installed to hold it firmly in place.

3.02 JOINTS

For reinforced concrete pipe, clean joint surfaces immediately before jointing. Joints on PVC shall be gasket collar type, constructed of the same material as the pipe, and installed according to the manufacturer's recommendations.

A. Mortar Joints

1. Assemble mortar joints to ensure complete filling of the joint all around. Mortar shall be used within 1 hour after addition of water. All joints of pipe to concrete structures shall be mortared closed.

3.03 CONCRETE MANHOLE AND INLETS

A. Excavation

1. Perform excavation to the line and grade shown on the drawings and as specified in Section 02200.

2. Location and depth as shown on the Drawings, or as directed by the Engineer.

B. Installation

1. Manholes and inlets shall be furnished and installed at the location and in accordance with the details shown on the Drawings.

2. All manholes and inlets shall be set on a crushed stone base, at least 6 in. deep, in accordance with Section 02200, to proper grade and properly leveled and aligned.

3. All lifting holes shall be sealed tight with rubber plugs and cement mortar.

4. A mechanical, flexible, tight gasket shall be provided for pipe connections at manholes and inlets that meet the requirements of ASTM C923.

5. All manholes and inlets shall be painted outside with a coal tar epoxy or approved equal.

6. All manholes and inlets shall be free of visible leakage. Each manhole will be visually inspected and any leaks found shall be repaired in a satisfactory manner as approved by the Engineer.

3.04 FRAMES, GRATES, AND COVER

A. Install in accordance with manufacturer's recommendations.

B. All frames and grates shall be bolted down securely to prevent any movement of the grate(s).

END OF SECTION

SECTION 02750

STORMWATER MANAGEMENT AND DISCHARGE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes the requirements for the management and discharge of waters collected during and post construction activities.

1.02 RELATED SECTIONS

A. SWPPP, March 2004.

B. Section 02930 – Erosion and Sediment Control.

C. Section 02937 – Sedimentation Basins.

PART 2 MATERIALS

Not Applicable

PART 3 EXECUTION

3.01 STORMWATER MANAGEMENT

A. Controls to be used by the Contractor shall conform to the approved details stated in the Contractor's SWPPP.

END OF SECTION

SECTION 02930

EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section includes furnishing all labor, materials, tools, and equipment needed to install, operate, and maintain erosion and sediment controls as shown on the Drawings and specified herein.

1.02 RELATED SECTIONS

A. SWPPP, March 2004.

B. Construction Plan for LASO TA-73 Airport Landfill, March 2004.

1.03 STORMWATER POLLUTION PREVENTION

A. Prior to initiating earth-moving activities, implement the soil erosion and sedimentation controls as shown on the Drawings and detailed in the Contractor's SWPPP.

B. Fines and related costs resulting from failure to provide adequate protection against soil erosion and sedimentation are the obligation of the Contractor.

1. Silt, sediment, and mud leaving the site will be construed as damage to neighboring property and evidence of negligence on the part of the Contractor.

2. Damages to any property outside of the project limits due to negligence by the Contractor shall be rectified and/or restitution shall be paid by the Contractor.

C. Erosion and sedimentation control measures employed will be subject to approval and inspection by governing agencies having jurisdiction over such work.

The temporary control provisions proposed shall be coordinated with the project schedule, sequence of construction, and temporary and permanent site facilities to assure economical, effective and continuous erosion control throughout the construction and post construction period with no violation of the federal, state, and local regulations. The drainage area to sediment basins shown on the Design Calculations shall not be exceeded.

D. The Engineer may limit the active area of earthwork operations in progress commensurate with the Contractor's capability in controlling erosion and sediment-laden runoff.

1.04 SUBMITTALS

A. Samples: Submit samples of materials being used when requested by the Engineer including names, sources, and descriptions.

1.05 QUALITY CONTROL

A. All erosion and sediment control work shall comply with applicable requirements of governing authorities having jurisdiction. The Specifications and Drawings are not comprehensive, but rather convey the intent to provide complete slope protection and erosion control for both the Engineer and adjacent property.

B. Erosion control measures shall be established at the beginning of construction and maintained during the entire period of construction. On-site areas that are subject to severe erosion, and off-site areas that are especially vulnerable to damage from erosion and/or sedimentation are to be identified and receive special attention.

C. All land-disturbing activities are to be planned and conducted to minimize the size of the area to be exposed at any one time and the length of the time of exposure.

D. Surface water runoff originating upgradient of exposed areas should be controlled to reduce erosion and sediment loss during the period of exposure.

E. All land-disturbing activities are to be planned and conducted so as to minimize off-site sedimentation damage.

PART 2 MATERIALS

2.01 STRAW BALES

A. Straw bales, if used, shall be either wire-bound or string-tied with bindings around sides rather than over and under.

2.02 CRUSHED STONE

A. Crushed stone for stabilized construction entrance(s) shall be American Association of State Highway and Transportation Officials (AASHTO) #3.

2.03 SILT FENCE

A. Prefabricated silt fence shall meet the following requirements:

1. Silt fences shall be prefabricated.

2. The geotextile for the fencing shall meet the following requirements:

Property	Test Value(1)	Test Method
Grab Tensile Strength	90 lbs	ASTM D4632
Burst Strength	190 psi	ASTM D3786
Puncture Resistance	40 lbs	ASTM D4833
Permittivity	>0.1 sec^{-1}	ASTM D4491
AOS	>30 US sieve	ASTM D4751
UV Resistance (500 hr.)	70%	ASTM D4355

[1]Minimum average roll values (MARV)

3. Posts shall be metal or hard wood.

4. The geotextile height shall be a minimum of 3 ft and shall be provided with a tensioning cord.

2.04 GEOTEXTILES

A. Filter geotextile shall meet the requirements for geotextiles contained in Section 06020.

2.06 EROSION CONTROL MATS

A. Erosion control mats shall be American Excelsior Co., type Hi-velocity Curlex Blanket; PPS Packaging Co. type Super Duty Blanket; or approved equal.

2.07 EROSION CONTROL BLANKET

A. Erosion control blanket material shall be XCELL type regular blanket (0.98 #/sy), Curlex blanket type (0.97 #/sy), or approved equal.

PART 3 EXECUTION

3.01 STRAW BALE BARRIERS

A. Excavation shall be to the width of the bale and the length of the proposed barrier to a minimum depth of 4 in.

B. Bales shall be placed in a single row, lengthwise on proposed line, with ends of adjacent bales tightly abutting one another. In swales and ditches, the barrier shall extend to such a length that the bottoms of the end bales are higher in elevation than the top of the lower middle bale.

C. Staking shall be accomplished to securely anchor bales by driving at least two stakes or rebars through each bale.

D. The gaps between bales shall be filled by wedging straw in the gaps to prevent water from escaping between the bales.

E. Any straw bales which become clogged or otherwise deteriorate shall be properly maintained or replaced as necessary at no additional cost to the Engineer.

3.02 STABILIZED CONSTRUCTION ENTRANCE

A. Specifications include:

1. Stone Size: AASHTO #3.

2. Length: As effective, but not less than 50 ft.

3. Thickness: Not less than 6 in. in dry areas and 12 in. in wet areas.

4. Width: Not less than full width at all points of ingress or egress, but not less than 20 ft.

5. Washing: When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way or landfill entrance road. When washing is required, it shall be done on any area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch, or watercourse through use of sand bags, gravel, boards, or other approved methods.

6. Maintenance: The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto the landfill entrance road or public right-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout or any measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto the transfer station access road or public

right-of-way must be removed immediately by the Contractor at no cost to the Engineer.

3.03 SILT FENCING

A. A 6-in. by 6-in. trench shall be excavated along the alignment of the silt fence. Excavated material shall be stockpiled on the upside of the trench.

B. Fence posts shall be positioned on the downstream side of the fence and driven into the ground. Fence posts shall be spaced no more than ten (10) ft apart.

C. The fabric flap shall be laid in the trench and backfilled with material stockpiled from excavation. The backfill shall be tamped into place.

D. The Contractor shall join fence sections together as recommended by the manufacturer and as approved by the Engineer to prevent silt from escaping through the adjoining sections.

E. The Contractor shall maintain silt fences (removing and disposing of silt, repairing fence which falls down, and replacing damaged fence, etc.) throughout the duration of the Contract at no additional cost to the Engineer. Silt shall be disposed of in such a manner that it will not erode from the site and shall be placed within the stockpile.

3.04 DUST CONTROL

3.05 SOIL STABILIZATION

A. Following initial soil disturbance or redisturbance, permanent or temporary stabilization shall be completed in accordance with: a) 7 calendar days as to the surface of all perimeter controls, dikes, swales, ditches, perimeter slopes, stockpiles, and all slopes greater than 2 horizontal to 1 vertical (2:1) and b) 14 days as to all other disturbed or graded areas on the project site. The in-place sediment control measures will be maintained on a continuing basis until the site is permanently stabilized and all permit requirements are met.

3.06 CHANNELS (Temporary), SLOPES (Temporary), AND STOCKPILES

A. All channels, swales, ditches, stockpiles, etc. shall be stabilized with permanent or temporary seeding, in accordance with Section 02932 immediately upon reaching an interim grade.

B. The channel beds shall be covered with an erosion control mat. The erosion control mat shall be installed as recommended by the manufacturer of the blanket.

C. Where slopes require temporary stabilization, the Contractor shall install erosion control blankets, as directed by the Engineer.

3.07 MAINTENANCE

A. Inspection

1. Erosion and sediment control will be inspected by the Contractor the next working day after rainfall events in excess of 0.5 in. and prior to forecasted storms.

2. At a minimum, the Contractor will perform inspections of the erosion and sediment control system once every 14 calendar days and following storm events of 0.5 in. to assure the integrity of the system.

B. Repair

1. All erosion swales and gullies in excess of 6 in. deep will be filled and compacted to their original condition and reseeded as required.

2. Erosion and sediment control structures (i.e., silt fencing) will be replaced as required to assure the integrity of the system.

3.08 SEDIMENT TRAPS

A. The Contractor is solely responsible to construct and maintain the proposed sediment traps and their effluent upon commencing any earth disturbance activity.

B. The Engineer reserves the right to require upgrades to existing traps or installation of additional structures should any discharge released not meet quality standards.

END OF SECTION

SECTION 02932

SEEDING, MULCHING, AND RESTORATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work to be performed under this section shall include furnishing and installing all seed, fertilizer, mulch, mulch binder, erosion mats, and initial watering of seeded areas wherever existing site surface soils will be placed as topsoil shown on the Drawings or as directed by the Engineer. This work shall also include maintaining seeded areas as shown on the Drawings until accepted by the Engineer.

B. The areas to be seeded under this item shall include all areas designated by the Engineer and as described on the Drawings as the Limit of Disturbance. All areas outside of specified limits where the vegetative growth has been injuriously disturbed or destroyed by the Contractor shall be restored and seeded in accordance with these specifications by the Contractor at his own expense.

1.02 RELATED SECTIONS

A. LANL Master Construction Specification, Section 02936, Seeding.

1.03 SUBMITTALS

A. The Contractor shall submit the following items:

1. Catalog data, including sources of supply for amendments, mulch, tackifier, fertilizer, and erosion control blankets.

2. Certification substantiating that material complies with specified requirements. Submit certified seed bag tags and copies of seed invoices identified by project name.

3. Installation instructions, including proposed seeding schedule. Coordinate with specified maintenance periods to provide maintenance from date of final acceptance. Once schedule is accepted, revise dates only with Engineer approval after documentation of delays.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications:

1. Perform work by a single firm experienced with the type and scale of work required and having equipment and personnel adequate to perform the work satisfactorily.

B. Material Quality Control:

1. Provide seed mixture in containers showing species percentages in seed mix; test information including, purity, germination and noxious and restricted weeds; net weight; date of packaging; and location of packaging.

2. Furnish seed labeled in accordance with the requirements of federal and New Mexico statutes and regulations governing seed labeling. Such resulting requirements include but are not necessarily limited to: Federal Seed Act and Amendments, rules and regulations established by the USDA; the New Mexico Seed Law; and all resulting regulations or restrictions established by New Mexico State University or other authorized entity.

3. In addition, ensure seed mix and its application comply with the requirements of all other federal and New Mexico statutes and regulations governing seeds, plants, and weeds. These requirements include but are not necessarily limited to: the Noxious Weed Control Act and all rules, regulations, or control measures by a noxious weed control district embracing Los Alamos County, New Mexico; and the Harmful Plant Act.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver packaged materials in sealed containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site. Opened or wet seed shall be rejected and returned to the responsible party.

PART 2 MATERIALS

2.01 SEED

A. Obtain native grass seed from sources whose origin would ensure site adaptability. Plant sources from New Mexico or surrounding states are preferred.

B. Obtain shrub and wildflower seed from sources whose origin would ensure site adaptability. Plant sources from New Mexico or surrounding states are preferred.

C. Cover crops (e.g., annual barley, oats, winter rye, etc.) may be used only as a temporary stabilization measure and shall not be used in conjunction with a perennial seed mix.

D. Furnish certification, showing origin of seed and pure live seed (PLS) content as determined by a certified authority. Provide bags of seed that are tagged and sealed in accordance with the State Department of Agriculture or other local certification authority within the state of origin. The tag or label shall indicate analysis of seed and date of analysis, which shall not be more than 9 months prior to delivery date. Seed may be premixed by the seed dealer and appropriate data indicated on the bag label for each variety.

E. Seed mixture shall be:

Develop seed mixture from the following guidelines. Choose a minimum of five grass species from the list. Should wildflowers be included in the mix, use a ratio of 80 to 90% grasses and 10 to 20% wildflowers. Choose 3 to 5 species from the forb and wildflowers list. These species are applicable for both undeveloped and urban-interface areas.

NATIVE PERENNIAL MIX

Common Name	**Scientific Name**	**% of Mix**
Grasses		
Blue grama*	*Bouteloua gracilis*	5 – 10%
Galleta grass*	*Hilaria jamesii*	5- 10%
Mutton grass	*Poa fendleriana*	10-15%
Sideoats grama*	*Bouteloua curtipendula*	10-15%
Arizona fescue†	*Festuca arizonica*	10 – 15%
Prairie junegrass†	*Koeleria macrantha*	5 – 10%
Bottlebrush squirreltail*	*Elymus elymoides*	15 – 20%
Little bluestem†	*Schizachyrium scoparium*	10 – 15%
Indian ricegrass*	*Oryzopsis hymenoides*	10 – 15%
Mountain brome†	*Bromus marginatus*	10 – 15%
Sand dropseed*	*Sporobolus cryptandrus*	1 - 8%
Thickspike wheatgrass	*Agropyron dasystachyum*	20 – 25%
Needle and Thread grass*	*Stipa comata*	5 – 10%
New Mexico needlegrass*	*Stipa neomexicana*	10 - 15%
Sheep fescue	*Festuca ovina*	10 – 15%
Forbs/ Wildflowers		1%
Firewheel	*Gaillardia pulchella*	2%
Evening primrose	*Oenothera caespitosa*	1%
Gooseberry leaf Globemallow	*Sphaeralcea grossulariafolia*	1.5%
Scarlet gilia	*Ipomopsis aggregata*	1%
Plains aster	*Aster bigelovii*	1%
Western yarrow	*Achillea millefolium*	½%
Fringed sage	*Artemisia frigida*	1%
Forbs/Wildflowers		
Blue flax	*Linum perenne lewisii*	4%
Scarlet bugler	*Penstemon barbatus*	2%
Palmer penstemon	*Penstemon palmeri*	2%
Prairie coneflower	*Ratibida columnifera*	1%
Showy golden-eye	*Heliomeris multiflora*	1%
Purple geranium	*Geranium caespitosum*	5%

*Species particularly suited for especially dry sites.
†Species particularly suited for higher elevations (above 7000 ft).

2.02 STRAW MULCH

A. Straw shall be stalks from oats, wheat, rye, barley, or rice that are free from noxious weeds, mold, or other objectionable material. At least 65% of the herbage by weight of

each bale of straw shall be 10 in. in length or longer. Rotted, brittle, or molded straw is not acceptable. Straw from introduced grasses is acceptable if cut prior to seed formation. If possible, provide marsh grass composed of mid to tall native grasses (usually tough and wiry grass and grass-like plants found in the lowland areas within the Rocky Mountain Region).

2.03 HYDRAULIC MULCH/TACKIFIER

A. Provide mulch material consisting of 100% virgin wood fibers manufactured expressly from whole wood chips, such as Eco-Fibre, Conwed, etc. Process chips in such a manner as to contain no growth or germination inhibiting factors. Do not produce fiber from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants. Provide materials free from contaminants such as lead paint, varnish, or other metal contaminants. Hydraulic mulch shall contain non-toxic dye to assist in visually determining even distribution. Mulch material shall meet the following specifications:

Parameter	Value
pH at 3% consistency	4.5 +/- 0.5
Ash content	0.8% +/- 0.2%
Moisture holding capacity	1250 (grams water/100 grams oven dry fiber)
Moisture content	12% +/- 3% (Wet weight basis)

B. Combine mulch with an organic plantago-based tackifier, such as M-binder, etc., that has no growth or germination inhibiting factors and is nontoxic. Apply the uniform mixture to the seeded area.

C. Bagged mulch/tackifier mix that is homogenous within the unit package may also be used. Tackifier shall adhere to the fibers during manufacturing to prevent separation during shipment and to avoid chemical agglomeration during mixing in the hydraulic mulching equipment.

2.04 BONDED FIBER MATRIX

A. Provide Bonded Fiber Matrix (BFM) composed of natural color, long-strand wood fiber, produced by therm-mechanical defribration of wood chips and joined together by a high-strength non-toxic adhesive, such as Eco-Ageis, etc. The product shall be composed of 90% wood fiber, 9% blended hydrocolloid-based binder, and 1% mineral activators, all by total weight. The BFM shall be 100% biodegradable and non-toxic to fish and wildlife, and it shall not contain any synthetic fibers.

2.05 AMENDMENTS / SOIL ADDITIONS

A. Fertilizer: Apply slow-release organic fertilizers such as Biosol Mix, Biosol, Osmocote, composted manure, or approved equal to minimize deficiencies of the topsoil. If composted manure is to be applied, test the nutrient content and interpret before it is used.

B. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth.

C. Sand: Clean, washed, and free of toxic materials.

D. Wood chips: Wood chips shall have a relatively large surface area to volume ratio to be more easily broken down in the soil. Incorporate wood chips at low rates (0.5 ton/ AC) in

order to assure the carbon to nitrogen ratio in soil is at favorable conditions for plant germination and growth. If higher rates are used, add nitrogen fertilizer to assure nutrient availability to plants.

PART 3 EXECUTION

3.01 PREPARATION

A. Preparation of the Seedbed.

1. Prepare seedbed to a maximum depth of 4 in. by tilling with a disc harrow or chiseling tool. Uproot all competitive vegetation during seedbed preparation and work soil uniformly, leaving surface rough to reduce surface erosion. Remove large clods and stones, or other foreign material that would interfere with seeding equipment.

2. Do not till on ground that is already loose to a depth of 2 in. or more that has undergone regrading and fill.

3. Do not do work when moisture content of soil is unfavorable or ground is otherwise in a non-tillable condition. To minimize dust problems for adjoining areas, do not till when wind speeds exceed 10 miles per hour (mph).

4. The extent of seedbed preparation shall not exceed the area on which the entire seeding operation can be accomplished within a 24-hour period.

B. Soil Amendments/Additions

1. Uniformly apply slow-release organic fertilizer to prepared seedbed in accordance with manufacturer recommended rates.

C. Prepare seedbed again if prior to seeding, the Engineer determines that rain or some other factor has affected prepared surfaces and that it may prevent seeding to proper depth.

D. On excessively steep slopes (steeper than 2:1), hydraulic/broadcast seeding may be appropriate. If seeding in this fashion, multiply application rate of seed by a factor of 2.

E. If cover crop has been established in area to be seeded, mow cover crop early in growing season before cover crop is ready to drop seeds.

3.02 APPLICATION OF SEED

A. Do not seed during windy weather, or when topsoil is dry, saturated, or frozen.

B. Equip seed boxes used for drill and broadcast seeding with an agitator.

C. To prevent stratification of seed mix, do not run seed box agitators while seeding is not being performed.

D. If seed mix is transported to site in a seed box or other equipment that subjects mix to shaking or similar movement that has the potential to cause stratification, remix seed prior to application.

E. Calibrate seeding equipment in presence of the Construction Manager to determine that equipment setting is appropriate to distribute seed at the specified rates.

F. Unless otherwise shown on Drawings, seed areas disturbed by or denuded by construction operations or erosion.

G. Use markers to ensure that no gaps will exist between passes of seeding equipment.

H. If cover crop has been established, mow the crop and drill seed perennial seed mix into the crop stubble.

I. When drill seeding, plant seed mix at a rate of 20 to 25 PLS lb/AC. Uniformly apply prescribed mix over area to be seeded as follows:

1. Accomplish seeding operations, where practical, by drilling in a direction across slope.

2. Plant seeds approximately 1/4 in. deep.

3. Do not exceed 4 in. distance between drilled furrows. If furrow openers on drill exceed 4 in., drill area twice to obtain a 4-in. distance between furrows.

4. Seed with grass wheels, rate control attachments, seed boxes with agitators, and separate boxes for small seed.

J. When broadcast seeding, plant seed mix at a rate of 32 to 37 PLS lbs/AC.

1. Where it is not practical to accomplish seeding by drilling, mechanically broadcast seed by use of a hydraulic mulch slurry blower, rotary spreader, or a seeder box with a gear feed mechanism. If seeding is done with a slurry blower, use highest pressure and smallest nozzle opening that will accommodate the seed.

2. Immediately following seeding operation, lightly rake seedbed or loosen with a chain harrow to provide approximately 1/4 in. of soil cover over most of the seed.

3. If hydraulically applying mulch as part of the broadcast seeding process, use a two-step process. Apply seed with a tracer (200 to 300 lb/AC) amount of mulch across entire seeded area. Once seed is applied, apply full complement of mulch (to equal 2,000 lb/AC). This shall allow seed to be in good contact with soil surface and not suspended in mulch matrix.

4. Prohibit vehicles and other equipment from traveling over the seeded areas.

3.03 STRAW MULCH

A. For locations that have not been hydraulically mulched, immediately following

raking/chaining operation, add straw mulch to seeded areas.

1. Apply straw mulch at a minimum rate of 1.5 tons per AC of air-dry material. Spread straw mulch uniformly over area either by hand or with a mechanical mulch spreader to achieve 80% ground cover. When spread by hand, tear bales of straw apart and fluff before spreading. Depth of applied straw mulch shall not exceed 3 in. Do not mulch when wind velocity exceeds 10 mph.

2. Wherever use of crimping equipment is practical, place mulch in manner noted above and anchor it into the soil to a minimum depth of 2 in.. Use a crimper or heavy disc such as a mulch tiller, with flat serrated discs at least ¼-in. in thickness, having dull edges, and spaced no more than 9 in. apart. Provide discs of sufficient diameter to prevent frame of equipment from dragging the mulch. Where practical, perform crimping in two (opposite) directions. Do not use Sheep's Foot Rollers, heavy equipment tracks, and standard disc cultivators for crimping.

3. If straw mulched areas cannot be anchored by crimping, use hydraulic mulch wood fibers with tackifier. Mix slurry in a tank with an agitation system and spray under pressure uniformly over the soil surface. Keep all materials in uniform suspension throughout the mixing and suspension cycle when using hydraulic mulching equipment. Mix 100 lb of wood fiber with 150 lb of tackifier to anchor straw mulch. Apply mixture at a rate of 250 lb/AC.

4. Use both horizontal and vertical movements in the applicator to achieve an even application of the slurry material.

3.04 HYDRAULIC MULCHING/TACKIFIER

A. Immediately following raking/chaining operation, apply hydraulic mulch fibers with tackifier to seeded areas. Mix slurry in a tank with an agitation system and spray, under pressure, uniformly over soil surface. Apply mulch evenly across landscape at a rate of 2,000 lb/AC.

Use both horizontal and vertical movements in applicator to achieve an even application of slurry material. Keep all materials in uniform suspension throughout mixing and suspension cycle when using hydraulic mulching equipment.

When using plantago based tackifier as mulch, apply tackifier at a rate of 100 lb/AC. When applied alone for dust control, apply tackifier at a rate of 150 lb/AC.

Prohibit foot/vehicle traffic from hydraulically mulched areas.

3.05 EROSION CONTROL BLANKET

A. Place blankets over native grass seeding immediately following the raking/chaining operation.

B. When using single netted products for 3:1 or flatter slopes, place blanket with netting on top and the wood/ straw fibers in contact with soil over entire seeded area.

C. For slope installations, the following guidelines shall be used:

1. Begin at top of slope and anchor its blanket in a 6 in. deep by 6-in. wide trench. Backfill trench and tamp earth firmly.

2. Unroll blanket downslope in direction of water flow.

3. Overlap edges of adjacent parallel rolls 2 to 3 in. and staple every 3 ft.

4. When blankets are spliced, place blankets end over end (shingle style) with 6-in. overlap. Staple through overlapped area, approximately 12 in. apart.

5. Lay blankets loosely and maintain direct contact with soil – do not stretch.

6. Staple blankets sufficiently to anchor blanket and maintain contact with soil. Place staples down the center and staggered with the staples placed along the edges. Moderate slopes (2:1 – 3:1) require 1 to 2 staples per square yard. Gentle slopes require 1 staple per square yard. Use a common row of staples on adjoining blankets.

D. Use wood stakes on tuff slopes, in place of wire staples. Use same installation rate as for staples. Drive stakes in perpendicular to slope and leave 2 in. exposed above soil grade.

3.06 BONDED FIBER MATRIX

A. Hydraulically apply BFM over seeded area (or apply seed with a tracer amount, 200 to 300 lb/AC) immediately following raking/chaining operations and in accordance with manufacturer's specified procedures. Hydraulically apply BFM as a viscous mixture. Upon drying, it shall form a continuous, porous, and erosion-resistant mat. Upon drying, matrix shall not inhibit germination and growth of plants in and beneath the layer. Matrix shall retain its form despite re-wetting.

B. Apply matrix uniformly across area and apply in multiple directions to ensure a 100% soil surface coverage.

C. Apply at a rate of approximately 3,500 lb/AC in a manner that achieves uniform coverage of all exposed soils.

D. Prohibit vehicle traffic on hydraulic BFM applications.

3.07 WATERING

A. Where temporary watering is required for seeded areas, provide temporary water system which may be a sprinkler system, or a water truck with a spray boom or any other method satisfactory to distribute a uniform coverage of clean water (free or oil, acid, salt, or other substances harmful to plants) to previously seeded and mulched areas.

B. If a temporary sprinkler system is used, keep all pipe connections tight to avoid leakage and loss of water, and to prevent washing or erosion of growing areas. Maintain sprinklers in proper working order during watering.

C. Do not drive trucks with spray systems on seeded areas and ensure water force does not cause movement of mulch or seed on the ground.

D. Water revegetated areas.

E. Apply water at a maximum of 0.5 in. per hour for 2 hours. Additional applications of water may be made as designated by the Engineer. Water source will be approved by the SS, prior to use.

3.08 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Maintain seeded areas for not less than 60 days after final acceptance of work and longer as required to achieve final stabilization as described in Section 3.10 ACCEPTANCE.

C. Reseed void areas greater than 6 ft^2 or repetitive voids greater than 2 ft^2 amounting to more than 10% of any area that appears the growing season following installation.

D. Keep revegetated areas free of noxious weeds until acceptance by the Engineer. Contact the Engineer prior to application of any control measure.

3.09 CLEANUP AND PROTECTION

A. After completion of work, clear site of excess soil, waste material, debris, and objects that may hinder maintenance and detract from neat appearance of site.

B. Protect work and materials from damage due to seeding operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged work as directed.

3.10 ACCEPTANCE

A. Seeded areas will be reviewed for acceptance by the Engineer when final stabilization has been achieved. Final stabilization is defined as “All soil-disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap or geotextiles) have been employed.”

B. In the event that all other work required by the Contract is completed before final stabilization is achieved or because seasonal limitations prevent seeding, partial acceptance of the work shall be made with final acceptance delayed until satisfactory vegetative growth has been established.

END OF SECTION

SECTION 02980

CHAIN LINK FENCE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section shall consist of furnishing and erecting temporary construction fence in accordance with these specifications and the details, lines and grades shown on the plans or as established by the Engineer.

B. Existing fence can be relocated and reused in its entirety as construction fencing as shown on the plans, and described herein.

1.02 QUALITY ASSURANCE

A. The fencing height will comply with the FAA Landing and Taxiway obstruction requirements. The final site fencing requirements will be coordinated with the Los Alamos County Airport Manager and the Owner.

The work and material under this section shall conform with the recommended practice outlined in the following standard and as required by this specification.

1. American National Standards Institute (ANSI)/ASTM A123 – Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

2. ANSI/ASTM F567 – Installation of Chain-Link Fence.

3. ASTM A116 – Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.

4. ASTM A120 – Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless, or Ordinary Uses.

5. ASTM A121 – Zinc-Coated (Galvanized) Steel Barbed Wire.

6. ASTM A153 – Zinc-Coating (Hot-Dip) on Iron and Steel Hardware.

7. ASTM A392 – Zinc-Coated Steel Chain-Link Fence Fabric.

8. ASTM A428 – Weight of Coating on Aluminum-Coated Iron or Steel Articles.

9. ASTM A491 – Aluminum-Coated Steel Chain Link Fence Fabric.

10. ASTM A569 – Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality.

11. ASTM A585 – Aluminum Coated Steel Barbed Wire.

12. ASTM C94 – Ready-Mixed Concrete.

13. ASTM F573 – Residential Zinc-Coated Steel Chain Link Fence Fabric.

14. ASTM F668 –PVC Coated Steel Chain Link Fence Fabric.

15. Chain Link Fence Manufacturers Institute (CLFMI) – Product Manual.

16. FS RR-F-191 – Fencing, Wire and Post Metal (and Gates, Chain Link Fence Fabric, and Accessories).

1.03 SUBMITTALS

A. Submit copies of the manufacturer's latest published literature and data on fabric, posts, accessories, fittings, and hardware for chain link fence.

B. Submit shop drawings showing details of each element. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

C. Submit two samples of fence fabric, illustrating construction and finish for chain link fence.

D. Each roll of fabric shall carry a tag showing the kind of base metal, or plastic, the kind of coating, the gauge of the wire, the length of fencing or fabric in the roll, and the name of the manufacturer. Posts, wire, and other fittings shall be identified as to manufacturer, kind of base metal, and kind of coating.

PART 2 MATERIALS

2.01 WIRE (Fabric)

A. New fabric wire shall be of a similar height and material to the existing fence and shall have a base metal of steel with a tensile strength of 75,000 lbs per square in. and galvanized in conformance with the requirements of ASTM A392, Class II. Wire will be of 9-gauge and have a nominal diameter of 0.148 in. being woven in a 2-in. mesh. Fence to be coated to match existing fencing.

2.02 POSTS, RAILS, GATES, AND BRACES

A. Posts, rails, gate(s), and braces shall be of galvanized steel conforming to the requirements of ASTM F1083 and shall also conform to the requirements listed in Table 02980-1. Braces shall be provided for each gate, corner, pull, and end post and shall consist of a brace extending to each adjacent line post at midheight of the fabric and a rod not less than 3/8-in. in normal diameter, or equivalent, from line post back to gate, pull or end post, with a turnbuckle or equivalent, for adjustment as shown on plans.

B. Top rails shall be lengths not less than 10 ft and shall be fitted with expansion couplings for connecting the lengths into a continuous run. Couplings shall be not less than 6 in. long, shall allow for expansion and contraction of the rail, and shall be approved by the Engineer.

TABLE 02980-1

POSTS AND RAIL SIZES AND WEIGHTS

Use and Section	O.D. In.	Weight/Lb/Ft.
Gate Posts	4.00	9.11
Corner Posts	2.875	5.79
End Posts, Pull Posts	2.875	5.79
Intermediate Posts	2.375	3.65
Top Rail and Postbrace	1.660	2.27
Gate Rails (Frame)	1.90	2.72

2.03 WIRE TIES AND TENSION WIRE

A. All wire fabric ties, wire ties, hog rings, and tension wire shall be zinc-coated steel core wire. Tension wire shall have a minimum tensile strength of 80,000 psi. Zinc coating shall be .30 oz. per square foot. Tension wire shall be 6-gauge.

2.04 MISCELLANEOUS FITTINGS AND HARDWARE

A. Miscellaneous fittings and hardware shall be zinc-coated steel, wrought iron, malleable iron, or pressed steel and shall be equal to materials specified in FS RR-F-191/4B.

2.05 GATES

A. Structural members of gates shall be fully welded on all sides and faces of joints at exposed edges. Surplus welding material shall be removed. Gates shall be swing gates or sliding gate as indicated on plans and specifications. Gates shall include all hardware and appurtenances including latches, plunger pins, etc.

B. Hinges for gate(s) shall be the pin type and shall be heavy-duty, malleable iron. Shop drawings will be required with the hinges being subject to the Engineer's approval.

2.06 CONCRETE

A. Concrete for setting posts shall have a minimum compressive strength of 3,000 psi and conform to NMDOT standards.

PART 3 EXECUTION

3.01 CLEARING FENCE LINE

A. The site of the fence shall be sufficiently cleared of obstructions, and surface irregularities shall be graded so that the fence will conform to the general contour of the ground. All holes shall be filled with common borrow or excavated material at the direction of the Engineer. When required, the Contractor shall grade the ground surface so that the fence elevation shall conform to existing or future structures. The fence line shall be cleared to a minimum width of 10 ft on each side of the centerline of the fence. This clearing shall consist of the removal of all stumps, brush, rocks, trees, or other obstructions which will interfere with proper construction of the fence. Stumps to be removed shall be grubbed or excavated. All holes remaining after the clearing and grubbing operations shall be refilled with suitable soil, gravel, or other material acceptable to the Construction Manager and shall be compacted properly with tampers.

Disturbed areas shall be seeded and mulched as directed by the Engineer and as specified in Section 02932.

3.02 CONSTRUCTION FENCE

A. Construction fence shall consist of new fence, as specified, and may be existing fence labeled as “to be removed’ or “to be relocated.” The existing fence may be reused and installed as construction fence to the lines and grades shown on the plans.

1. Line posts shall be spaced not more than 10 ft on centers in the line of fence. End or pull posts shall have a 500-ft maximum spacing.

2. End posts shall be installed in concrete foundations as shown on drawings. Line posts shall be installed in earth foundations. Concrete foundations shall extend one (1) in. above the ground at the posts, with a slope to match existing grade at the foundation’s edge. All posts shall be set vertical, true to alignment, and securely embedded in earth or concrete foundations as required.

3. After the concrete has been allowed to cure for 2 days, for the end posts, fabric, braces, and rails shall be attached. The fabric shall be attached to the posts and rails at a sufficient number of points to ensure a firm, rigid, and unyielding attachment, and shall be a maximum of two (2) in. clear of the pavement or ground surface. The fabric shall be stretched between posts so that no bends or loose places in fabric will result. Lengths of fabric shall be spliced by bringing the fabric ends close together and weaving in a picket in such a way that it engages each individual mesh of the fabric ends. Brace rails and truss rods shall be provided at all fence corners and ends.

4. The bottom of the fence shall be placed a uniform distance above the finished ground surface except where allowance is made for the irregularities in the ground contour.

3.03 GROUNDING

A. Fence shall have at least one ground for every 500 ft of fence, at end posts, and on each side of gates. The ground shall consist of a 5/8-in. diameter copper-clad rod driven a minimum of 8 ft into the earth and attached to the fence by a copper wire and grounding clips to obtain a maximum resistance of 25 ohms and in accordance with the plans and as approved by the Engineer.

3.04 CLEANING UP

A. The Contractor shall remove from the vicinity of the completed work all tools and equipment belonging to him or used during construction. All piles of soil shall be leveled and all brush or debris of any nature shall be removed from the site.

END OF SECTION

DIVISION 3

CONCRETE

SECTION 03400

PRECAST CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes requirements for providing precast concrete structures including storm drain structures, manholes, and other specified miscellaneous structures to the size, shape, and extent in accordance with the contract documents.

1.02 QUALITY CONTROL

A. Precast concrete shall be supplied by a qualified firm with a minimum of 2 years of continuous operation experience.

B. Contractor shall not place the order for precast structures until order is reviewed and approved by Owner's engineer.

C. The manufacturer or supplier shall provide the Owner, prior to delivery of precast structures for an order, a Certificate of Compliance with the Contractor's name, section sizes, footage, or number of pieces required to fill the order.

D. The Owner reserves the right to inspect and test all precast structures, fittings, and joint material after delivery to the site or at the factory. The manufacturer or supplier shall furnish materials for the tests and labor as required to assist the Owner with the tests.

E. Only approved precast concrete structures shall be shipped to the contract site.

1.03 SUBMITTALS

A. Contractor's drawings.

B. Submit the following Contractor's drawings in accordance with Section 01340:

1. Shop drawings showing complete details, pertinent calculations, design loads, materials, strengths, sizes and thicknesses, joint and connection design, and details for all precast structures.

C. Installation methods for precast sections:

1. This submittal may be waived when the manufacturer has his recommended methods on file with the Owner.

D. Test reports:

1. Submit manufacturer's certified test reports.

1.04 DELIVERY, STORAGE AND HANDLING

A. Precast structures are considered suitable for handling to transport to the contract site after the concrete has cured to minimum strength of 80% of the design strength.

B. Delivery of precast structures shall be coordinated with installation or shall be unloaded with proper equipment along the line of work, outside work limits as near as practicable to point of final placement. They shall be stored off the ground on wood blocks, pallets, or other appropriate means away from brush, poision oak or ivy, and in an accessible area for inspection. Excavated material shall not be placed over or against the stored precast structures.

C. Precast structures and appurtenances shall be unloaded and handled with a crane, backhoe, or equipment of adequate capacity, equipped with appropriate slings and lifting devices to protect the material from damage.

D. If damage occurs and is deemed repairable, it shall be repaired as directed by the Owner in accordance with approved manufacturer's recommendations. If damage is not repairable in the opinion of the Owner, such items of material will be rejected and shall be removed and replaced at the Contractor's expense.

PART 2 MATERIALS

2.01 PRECAST CONCRETE MANHOLE(S) SECTIONS

A. General

1. Precast concrete sections shall conform to NMDOT Section 662.2. Furnish in lengths of 1-ft minimum, except not more than one 1-ft section shall be used in a manhole. Precast manhole cone section shall have bolt inserts provided. Inserts shall be embedded a minimum of 3 in., accommodate 9.75-in.-diameter bolts, and shall be No. 444 Star Threaded Inserts as manufactured by Heckman Building Products Corporation, Liberator as manufactured by Pennsylvania Insert Corporation, Bolt Slot Insert System as provided by Atlantic Concrete Products Company, inserts as provided by the Strut Service Company, or equal. Inserts shall be provided with plugs for transporting from plant to contract site.

2. Each concrete section shall be clearly marked on the inside near the top with the following information where applicable: ASTM Specification designation, manhole setting number (bases only), date of manufacture, and name or trademark of manufacturer. Markings may be engraved or stenciled with waterproof paint or ink in minimum 1-in.-high letters.

3. Precast concrete grade rings shall meet requirements of ASTM C478, except the minimum strength of the concrete shall be 5,000 psi using Type II cement. Rings shall be drilled with holes 1.5 to 2-in.-diameter to accommodate frame anchor bolts. Grade rings with cracks or fractures passing through the height of the ring and any continuous crack extending for a length of 3 in. or more will be rejected. Planes of the surfaces of the ring shall be within the limits of plus or minus 0.25-in. of horizontal and vertical.

4. Steps shall be a minimum 1-ft wide with a 1-ft center to center spacing, drop front type, and meet the requirements of ASTM C478.

B. Gasket Connectors

1. Each manhole precast section shall be fitted with an "O" ring type gasket that conforms to NMDOT Section 662.25.

2.02 BITUMINOUS COATING

A. All exterior surfaces of precast structures shall be coated with bitumastic material.

B. The bituminous coating shall conform to NMDOT Section 662.26.

2.03 GRATE AND FRAME

A. Manhole covers shall conform to NMDOT Section 662.27.

B. Castings shall be suitable for AASHTO HS-2O loading.

PART 3 EXECUTION

3.01 PRECAST CONCRETE STRUCTURES

A. Concrete section shall be installed in accordance with the manufacturer's written assembly instructions.

B. Install cast iron frame and cover on each structure, as detailed on the Drawings. Adjust the frame and cover to proper grade by using precast concrete grade rings or brick masonry when the structure is in a space dedicated for public use, a traveled way, or when designated to meet existing grade. Transition shall be a minimum of 4 in. and a maximum of 18 in. high. Otherwise, the structure shall be built without transition. Frames shall be adjusted to within 0.5 ft of final graded area.

C. Provide precast concrete grade rings, 3 in. through 6 in. thick. If required to meet proper grade, one split grade ring 2 in. thick may be used provided that this does not exceed the maximum transition heights. Precast concrete grade rings shall be set in full beds of mortar not less than 0.25 in. or more than 1.25 in. thick. Horizontal circumferential and vertical mortar joints, inside and outside, shall be pointed the full width. Depth of pointing shall not exceed 0.375 in. The mortar shall be cured a minimum of 6 hours prior to the backfilling and setting of the manhole frame. Place manhole frame and cover in a bed of mortar not less than 1 in. thick.

D. Concrete sections shall be protected from damage while in storage at the plant, while in transit, and at the contract site. They shall be handled with the proper size equipment, using only appropriate lifting holes or eyes. Joint ends of the sections shall be kept clean and placed on wooden blocks, pallets, or other appropriate material, but never on the ground. If damage is evident, it shall be repaired or the section rejected, as directed by the Owner. Thoroughly clean joint surfaces, remove all debris and foreign matter, and keep joint surfaces clean during assembly.

3.02 BACKFILLING

A. After the structure has been properly bedded, selected material from the excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along sides of the structure in layers not exceeding 10 in. in compacted depth. The backfill shall be brought up evenly on all sides for the full height of the structure. Care shall be taken to ensure thorough compaction of the fill under the haunches of any pipe exiting/entering the structure. The remainder of the excavation shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 6 in.. Tests for density will be made as necessary to ensure conformance to the compaction requirements

specified in Section 02200. Where it is necessary in the opinion of the Owner, any sheeting or portions of bracing used shall be left in place and the contract will be adjusted accordingly.

END OF SECTION

DIVISION 6

GEOSYNTHETICS

SECTION 06020

GEOTEXTILES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The Work includes the manufacture, supply, delivery, testing, storage, and installation of nonwoven geotextiles to be used for filtering and separation media within the drainage and cover systems as indicated on the Contract Drawings. The Contractor shall supply all equipment, tools, labor, supervision, materials, and quality control required to complete the Work in accordance with the Contract Documents.

1.02 QUALITY CONTROL

A. Manufacturer Qualifications

1. The geotextile manufacturer(s) shall be specialist(s) in the manufacturing of polyester, polyethylene, and/or polypropylene geotextile (as applicable), and shall have produced and manufactured a minimum of 5 million ft^2 of said geotextiles that were used in successful installations.

B. Materials Testing

1. Quality control testing of materials shall be as set forth in the applicable referenced Specifications and as required herein. Testing of the geotextiles shall be in accordance with Subsection 2.01.B.

C. Laboratory Testing

1. Unless otherwise indicated, testing shall be performed by the manufacturer.

D. Visual Inspection During Installation

1. During placement of the geotextiles, the Contractor shall carry out visual inspections of the material surface. Any faulty areas relating to material integrity, uniformity, rips or tears, sewing incompleteness, and seam overlap shall be repaired by the Contractor using pre-approved techniques and in accordance with manufacturer recommendations. Such repairs shall be reported to the Owner by means of a daily QC log. At any point in the Work, if the daily QC log has not been submitted, the Owner has the right to stop work at the expense of the Contractor until the daily QC log is submitted.

1.03 SUBMITTALS

A. Certified Test Reports

1. Certified test reports for a minimum of two (2) samples tested in accordance with the standards and testing methods specified herein shall be submitted to the Owner for approval for each geotextile proposed for this project prior to material delivery. The material manufacturer and Contractor must satisfy the Owner that the materials they offer to furnish and install shall meet every aspect of the requirements listed in Table 06020-1 and as stated in PART 2, MATERIALS. The Contractor shall transmit to the

Owner all information given to them by the manufacturer or supplier prior to approval for furnishing and installing any such material.

Table 06020-1

Physical and Mechanical Properties of Geotextiles

Property	Test Method	Required Value [1]
Visual Inspection	--	Packaging, visible defects
Mass per Unit Area	ASTM D5261	12 oz/yd^2
Puncture Strength	ASTM D4833	170 lbs
Apparent Opening Size	ASTM D4751	$\leq$ No. 100 Sieve
Grab Tensile Strength	ASTM D4632	300 lbs
Grab Elongation	ASTM D4632	> 50 %
Tear Strength	ASTM D4533	115 lbs
Burst Strength	ASTM D3786	550 psi
Permittivity	ASTM D4491	$\geq$ 0.25 sec^2
UV Resistance[3] (@500 Hours)	ASTM D4355	> 70 % strength retained

[1] MARV.
[2] For information only, not a required property.
[3] Manufacturer's certification required which states product exceeds required value for typical roll values.

B. Installation And Repair Recommendations

1. Within three (3) weeks after award of the Contract, submit manufacturer's recommended installation procedures for the sewing of the geotextiles and procedures for repair. All sewing shall be performed by trained personnel of the Contractor or their subcontractors; the geotextile installer must be approved by the Owner. The Contractor may also be requested to submit training or experience records of the installer personnel to the Owner for approval.

C. The Contractor shall submit to the Owner for approval within three (3) weeks after award of the Contract the following information:

1. Contractor's daily QC log format to be used during geotextile installation. This log shall document the daily progression of geotextile installation from delivery to final acceptance. The daily log shall designate these construction activities that influence the integrity of the geotextile during installation. The log, at a minimum, shall include entries and detailed documentation of the following:

a. Weather (temperature, winds, precipitation).

b. Repairs and replacements.

c. Document the roll number and location of each roll when placed.

d. Quantity of material installed that day; quantity installed to date.

D. Laboratory test results shall be submitted as the Work progresses.

E. Sewing equipment information, stitch type, and density proposed for use at the project shall be submitted to the Owner for review prior to placement of geotextile in the field.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site only after the required submittals have been approved by the Owner. Storage and handling of the materials shall conform to the manufacturer's recommendations and shall be done in such a manner as to prevent damage to any part of the Work. The Contractor shall provide labor and equipment to properly unload material upon arrival at the site. The material shall be stored in a reasonably level, smooth, and well-drained area that is away from sharp objects or rocks that may puncture the material, away from brush, oil, grease, or fuels, and in an accessible area for inspection. Individual rolls shall be stored with safe walking space and clearance between them to allow full view for inspection purposes. To prevent ultraviolet degradation of the material, the protective wrapper on each geotextile roll shall not be removed until the material is ready for use. Any rolls that are delivered without protective wrappers shall be rejected by the Owner at no cost to the Owner. Any rolls of geotextile that will not be installed within 21 days following delivery to the site shall be covered with tarps to protect the rolls from the elements.

PART 2 MATERIALS

2.01 GEOTEXTILES

A. Nonwoven geotextiles shall be provided to meet the minimum physical and mechanical properties outlined in Table 06020-1 and as designated on the Drawings. The properties shown represent the MARV for the installed materials, unless otherwise indicated.

B. Geotextiles shall be tested by the manufacturer prior to shipment to ensure that the physical and mechanical properties of the finished product are in accordance with these Specifications. The required material properties, test methods, values, and units are presented in Table 06020-1. Test frequencies shall be one (1) of each test for every 100,000 ft^2 of geotextile produced for this project or as noted in Table 06020-1.

PART 3 EXECUTION

3.01 INSTALLATION RESPONSIBILITY

A. The Contractor shall be responsible for installing the geotextiles and all components and details associated with these materials.

3.02 GEOTEXTILE PLACEMENT

A. Geotextiles shall be placed by the Contractor at the locations and to the limits shown on the Drawings. All seams placed on slopes of 4H:1V or greater shall be overlapped a minimum of twelve (12) in.. All other seams shall be overlapped a minimum of eight (8) in. Seams on slopes shall be oriented with the slope. End-of-roll seams shall be offset a minimum of 5 ft between adjacent roll ends. Cross-slope seams shall be avoided as much as possible.

B. A minimum of 12 in. of the aggregate/soil shall be placed onto the geotextiles and spread in advance of construction equipment not exceeding 15 psi contact pressure. When contact pressures exceed 15 psi, construction equipment shall be limited to operating on 36 in. of aggregate/soil above geosynthetics. The material shall be spread in the same direction as the fabric is seamed. Extreme care shall be required by the Contractor so that the equipment operator pushes the soil materials ahead without damage to the geotextile. At no time shall construction equipment be permitted to track directly on the geotextile. Any damage to the fabric or other geosynthetics shall be repaired by the Contractor (using approved methods) at no expense to the Owner.

C. During periods of high winds, sandbags, or other methods approved by the manufacturer(s) shall be used by the Contractor to temporarily secure any exposed geotextile in place.

3.04 COVERING GEOTEXTILES

A. All geotextiles shall be covered within 21 calendar days, following removal of their protective wrapping and their placement in the field, to protect them from ultraviolet (UV) degradation. The Contractor shall stage construction activities to accomplish the schedule. Any geotextile left exposed longer than the 21 calendar days shall, at the Owner's direction, be removed and replaced at no cost to the Owner.

END OF SECTION

NW-ID-2004-001
Revision 1

CONSTRUCTION PLAN
FOR LOS ALAMOS SITE OFFICE
TA-73 AIRPORT LANDFILL

April 2004

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DOCUMENT APPROVAL PAGE

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Approval Signatures

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Revision Log

Revision	Date	Reason for Revision
Draft	02/12/04	Not applicable; first draft of document
Revision 0	03/15/04	Document revised to reflect DOE/LASO comments of 03/01/04
Revision 1	04/15/04	Document revised to correct minor formatting errors, further define construction traffic control measures in Section 9.9, and append a detailed construction schedule as Appendix C.

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1.0 INTRODUCTION

This Construction Plan describes methods and protocols that North Wind, Inc. (North Wind) will use to manage construction activities at the U.S. Department of Energy (DOE) Los Alamos Site Office (LASO) Technical Area (TA)-73 Airport Landfill, henceforth referred to as the Airport Landfill project. The Construction Plan provides background information, a summary of planned construction activities, a description of required inspections with acceptance criteria, quality assurance (QA) and quality control (QC) methods, and health and safety controls. The plan also describes operation, maintenance, and monitoring requirements during the construction and post-construction phases, and training and certification requirements.

2.0 SITE DESCRIPTION AND OPERATIONAL HISTORY

The site description and operational history is documented in the Los Alamos National Laboratory (LANL) Voluntary Corrective Measure Plan (LANL 2002, 74007.2). The following text provides a summary of the site description and operational history.

The Airport Landfill consists of two potential release sites (PRS). PRS 73-001(a) is an inactive municipal landfill, hereinafter referred to as the main landfill. PRS 73-001(d) is an inactive debris disposal area (DDA), hereinafter referred to as the DDA. Both PRSs are inactive solid waste management units and both are listed in Table A within Module VIII of LANL's Hazardous Waste Facility Permit (LANL 1996, 57486). The PRSs are located within TA-73 on DOE property adjacent to the Los Alamos Airport, as shown in Figure 2.1-1. The main landfill is east of the existing airport hangars and the DDA is north and east of the end of the runway. Figure 2.1-2 shows the location of the PRSs in TA-73.

In 1943, DOE began using the hanging valley north of the airport runway as the main landfill. Garbage was collected twice a week from LANL and Los Alamos and burned on the edge of the hanging valley. Heavy equipment was then used to push the burned residues and ash into whichever landfill disposal area was being used at the time. This intentional burning ceased in 1965 when Los Alamos County assumed operation of the landfill. The county continued to operate the landfill until June 30, 1973.

The DDA was used from 1984 to 1986 to bury debris excavated from the western portion of the main landfill. This material was excavated and replaced with clean fill to prepare the western portion of the landfill for the construction of airplane hangars and tie-down areas. Since the wastes placed in the DDA came from the main landfill, both areas contain similar types of debris. In 1986, the DDA was covered with soil and hydroseeded.

3.0 SCOPE OF WORK

As described in the DOE Savannah River Operations Office (SR) Statement of Work (SOW) for the Airport Landfill (DOE 2003), the project mission consists of designing and constructing an appropriate cover over the main landfill and recontouring and reseeding of the DDA. Final design drawings and specifications for the main landfill and DDA will comply with the provisions of the SOW.

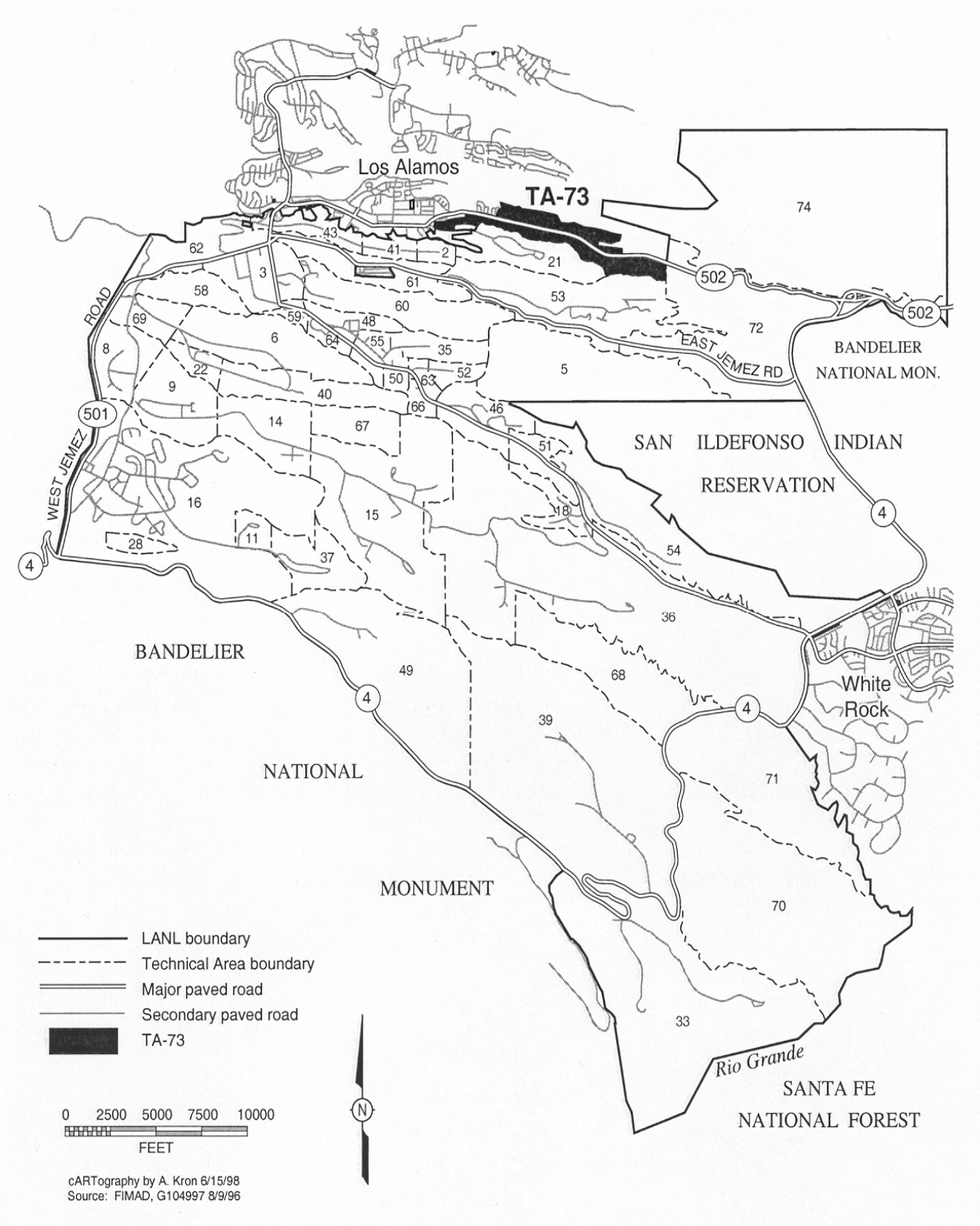

Figure 2.1-1. Location of TA-73

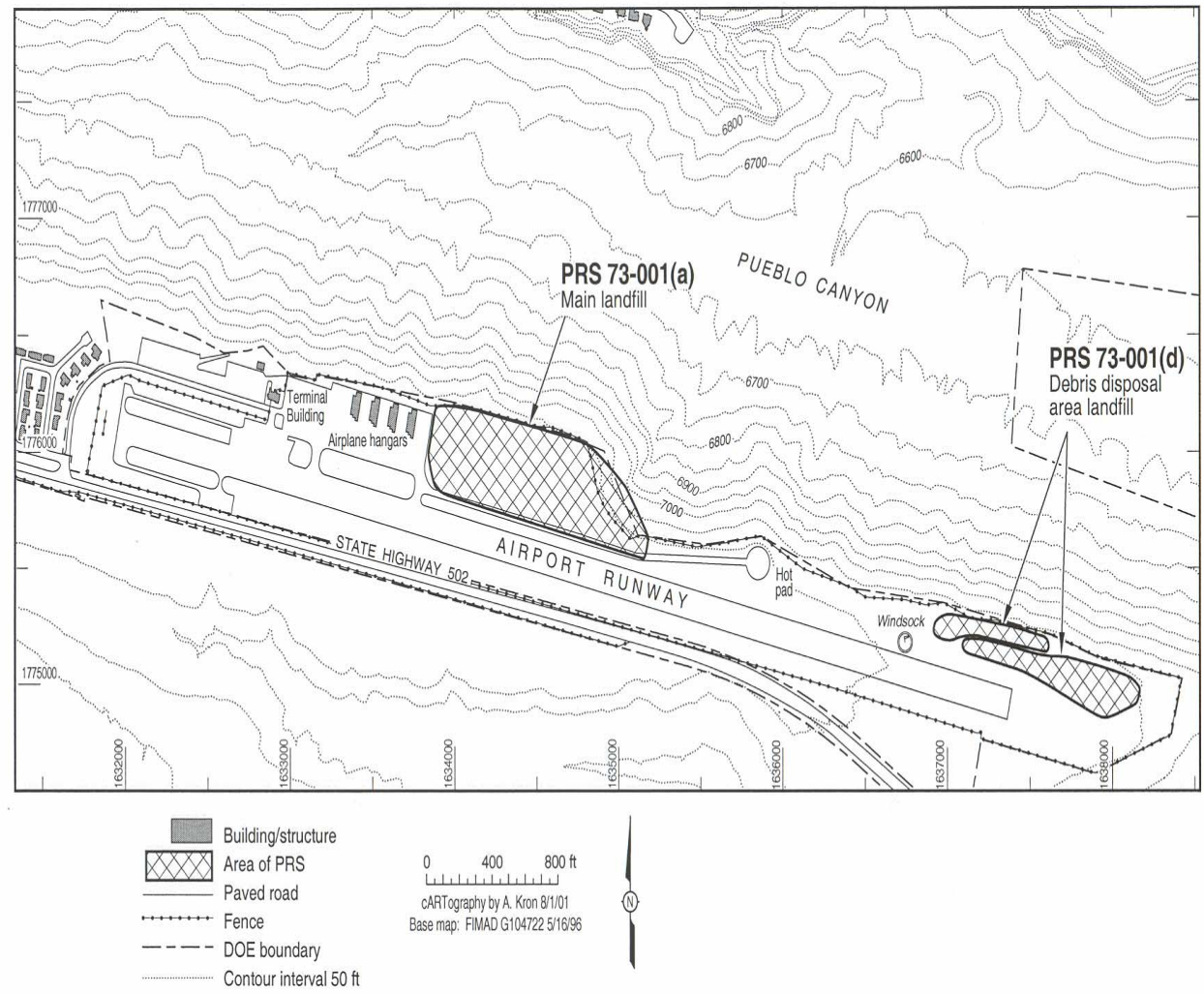

Figure 2.1-2. Location of Potential Release Sites at TA-73

4.0 CONSTRUCTION MANAGEMENT

This section describes construction management protocols that will be used by North Wind to ensure that activities described in this Construction Plan are safely completed within their respective budgets and schedules. Additional project management information is provided in the Project Management Plan for LASO TA-73 Airport Landfill (PMP) (North Wind 2004f).

North Wind is the prime contractor for work required under the DOE SOW (DOE 2003). Subcontractors include Weston Solutions, Inc. (WESTON) and Los Alamos Technical Associates. The customer for the project is the DOE-LASO Environmental Management Program. The Airport Landfill project organization chart is provided in the PMP (North Wind 2004f).

4.1 Key Personnel, Responsibilities, and Interfaces

The key personnel, responsibilities, and interfaces are described in the following subsections. During construction activities all staff, regardless of affiliation, will take direction from the North Wind Project Manager (PM) through the appropriate supervisor or manager.

4.1.1. Program Manager

The Program Manager (PrM) is responsible for ensuring that the contract is managed within the established contract value and schedule constraints.

4.1.2. Project Manager

The PM is ultimately responsible for the successful completion of the project. This includes, but is not limited to:

- Ensuring project activities are conducted safely and in compliance with applicable laws, regulations, directives, and procedures.
- Ensuring adherence to the project cost and schedule and maintaining project-level change control
- Overseeing the development and maintenance of the project records management system and the project configuration management system
- Providing day-to-day direction to project personnel and coordinating the resolution of technical issues
- Communicating project progress to the customer and management

The PM reports to the PrM. The PM takes technical direction from the DOE-LASO Contracting Office Representative (COR) and may interface with the DOE-SR Contracting Officer (CO) on contractual issues. The PM will also interface as needed with the Design Supervisor (Section 4.1.3) and the Construction Manager (CM) (Section 4.1.4).

4.1.3. Design Supervisor

The North Wind Design Supervisor works with the CM and others during construction when field changes are encountered and to provide authority to any design change as agreed upon. The Design Supervisor reports to the PM and interfaces with the CM and WESTON design engineers.

4.1.4. Construction Manager

The North Wind CM is responsible for managing all construction activities. This includes oversight of planning and daily work activities, verifying construction work activities are compliant with the final design, preparing and submitting reports, and verifying that construction quality assurance and control measures are implemented. In addition, the CM is responsible for assuring that site worker health and safety requirements are met and that personnel are adequately trained. The CM reports to the PM and directs the Site Superintendent (SS) (Section 4.1.5). The CM is the designated Construction QA Manager. In this capacity, the CM interfaces with the QC Field Engineer (Section 4.1.7).

4.1.5. Site Superintendent

The North Wind SS is responsible for daily work activities and works directly with field construction crews and support staff. This is a fulltime, onsite position. On a regular basis, the SS:

- Provides overall safety oversight on a daily basis, ensuring unsafe work practices are not allowed

- Inspects the site on a daily basis to identify unsafe work conditions
- Conducts weekly safety meetings with the work crews
- Directs construction crews to ensure construction is compliant with design specifications
- Ensures QC hold or witness points are recognized
- Works with onsite QC personnel to ensure installed components of the final cover meet QC specifications
- Ensures erosion controls are properly constructed, inspected, and maintained
- Prepares and delivers a Plan of the Day to work crews, to coordinate daily work activities
- Notifies the CM of any changes in field conditions that impact the design remedy and stops work as necessary until a satisfactory resolution is reached
- Routinely communicates progress to the CM and project management
- Interacts with site visitors, airport management, the client, and regulators as needed to ensure work progresses smoothly

The SS reports to the CM and directs field personnel and subcontractors. The SS interfaces with the Site Safety Officer (SSO) on a daily basis.

4.1.6. Site Safety Officer

The North Wind SSO will ensure that the project is conducted according to the Health and Safety Plan for LASO TA-73 Airport Landfill (HASP) (North Wind 2004c). The HASP implements government regulations, DOE directives, and Integrated Safety Management (ISM) policy. The SSO will be a fulltime onsite worker during construction. The SSO will implement the ISM program requiring site personnel take every reasonable step to reduce or eliminate the possibility of injury, illness, or accidents, and to protect the workers and environment during project activities. The SSO reports to the Project Health and Safety Manager. The SSO interfaces with the SS on a daily basis and with the CM as needed.

4.1.7. Quality Control Field Engineer

The QC Field Engineer will be responsible for conducting QC activities in accordance with the Construction Quality Control Plan for LASO TA-73 Airport Landfill (CQCP) (North Wind 2004a). The QC Field Engineer will be onsite as needed, particularly during placement of cover materials when compaction testing is required. The QC Field Engineer reports to the CM and interfaces with the SS.

4.2 Reporting

The CM will provide weekly updates on construction progress to the PM, using progress reports from the SS. The update will detail construction progress and activities for the week, description of any nonconformances, weekly crew size, possible health or safety concerns, and other significant work tasks during the week. The PM will forward this information to the DOE-LASO COR following receipt of the update. Additional reporting details are found in the PMP (North Wind 2004f).

4.3 Schedule

The project baseline schedule is found in the PMP (North Wind 2004f). A detailed construction schedule is attached as Appendix C to this document.

5.0 CONSTRUCTION ACTIVITIES

The following subsections describe construction activities at the main landfill and DDA, in approximate chronological order. The construction schedule in Appendix C further delineates the sequence of activities, and identifies critical path tasks.

The construction activity narrative is not intended to reiterate project specifications and drawings, but to give a practical approach to constructing the final remedy at the Airport Landfill. The detailed requirements of the work are specifically defined in the approved construction specifications and drawings and should be referenced along with this narrative. Project plans (e.g., this Construction Plan) implement design drawings, and drawings implement design specifications. Thus, the flow-down is specifications to drawings to plans. The exception is the HASP (North Wind 2004c); in no instance will work be performed unsafely, regardless of specifications or drawings.

5.1 Procurement

General methods for procurement of materials and services are addressed in the Project Quality Assurance Plan for LASO TA-73 Airport Landfill (PQAP) (North Wind 2004g), including methods for procuring quality-affecting materials and services. Purchase order documents will be prepared for each vendor supplying materials and subcontractors supplying services with the terms of the purchase clearly detailed. Delivery of materials and services will be scheduled based on project sequence to minimize storage and risk of loss or damage.

Procurement of materials and services will be finalized upon issuance of the Notice to Proceed (NTP) from DOE. At this point, subcontract SOWs and purchase orders will be prepared and materials and services will be procured. However, due to long lead times involved in procurement of certain materials, particularly borrow source soils, purchase orders should be prepared and submitted as soon as possible.

5.1.1. Materials

Materials to be purchased include but are not limited to riprap, aggregates, cover soil, topsoil, geotextiles, chain link fencing, silt fence, potable and non-potable water, straw bales, metal drainage pipe, signage, traffic control items, utility relocation items, and general safety equipment (e.g., personal protective equipment, fire extinguishers). Each of these items will be installed permanently on the site or are considered a project consumable.

5.1.2. Services

Services to be retained include heavy equipment rental, surveying, electrician, independent quality control testing, an offsite geotechnical testing laboratory, equipment maintenance needs, fence installation, medical examinations, hydroseeding, and field trailer setup. In addition, waste streams identified in the Waste Management Plan for LASO TA-73 Airport Landfill (WMP) (North Wind 2004k) will be disposed of by a waste contractor.

5.2 Mobilization

Mobilization activities include mobilizing required equipment and personnel, constructing access roads, setting up the temporary field trailers, taking delivery of initial materials, and locating and marking existing underground utilities. In addition, a pre-construction meeting will be conducted with site workers to review the project objectives and requirements, site-specific safety precautions and airport protocol. Non-routine workers such as truck drivers and day laborers will not attend this pre-construction meeting. Instead, they will be provided with a pre-job briefing, the contents of which will be determined by the SS and/or SSO.

At a minimum, the pre-construction meeting will address the following topics:

- Introduction of project team
- Organization chart and lines of authority and communication
- Project scope and objectives
- Identification of subcontractors and suppliers
- Use of equipment and facilities
- Project schedule and work hours
- Reporting and record keeping requirements
- Correspondence, including oral versus written protocol
- Project plans and specifications, and location of documents
- Site access and security procedures, particularly regarding Los Alamos Airport
- Job safety and health, including overview of HASP (North Wind 2004c)
- QA/QC protocol
- Equipment maintenance and daily checks
- Material handling, delivery, and storage
- Temporary utilities, communications and housekeeping

5.2.1. Assemble Construction Documents

The Phase II Work Plan for LASO TA-73 Airport Landfill (North Wind 2004d) is the primary scoping document for the project. The Phase II Work includes by reference or incorporation:

- Final construction specifications, drawings, and engineering calculations
- This Construction Plan
- CQCP (North Wind 2004a)
- Post-Closure Care and Monitoring Plan for LASO TA-73 Airport Landfill (PCMP) (North Wind 2004e)

In addition to the Phase II Work Plan, the following documents direct applicable construction activities:

- HASP (North Wind 2004c)
- PQAP (North Wind 2004g)
- PMP (North Wind 2004f)
- Storm Water Pollution Prevention Plan for LASO TA-73 Airport Landfill (SWPPP) (North Wind 2004j)
- WMP (North Wind 2004k)
- North Wind corporate and project implementing procedures

A set of the above project documents will remain in the office trailer for planning and scheduling. Another set will be provided to the SS for his working use. A set of final construction drawings will be located in the office trailer for red-lining changes for as-built drawings. The main project schedule will be displayed on the wall for quick reference and weekly progress tracking. Project documents will be controlled in accordance with North Wind Quality Assurance Procedure (QAP)-05, Document Control (North Wind 2003c).

Forms and records generated during the course of the project will be completed, filed, and managed in accordance with:

- QAP-16, Control of Quality Records (North Wind 2003d)
- Project Work Instruction (PWI)-4201-001, Project Files (North Wind 2003a)
- PWI-4201-002, Field Activities Documentation (North Wind 2003b)
- PWI-4201-005, Field Change (North Wind 2004i)

Forms and records will be photocopied as soon as possible; one set of records will be retained in the field office and the other set will be returned to the North Wind Idaho Falls office for permanent storage in the project files. At the close of the project, all generated records will be submitted to the DOE-LASO COR.

5.2.2. Conduct Construction Readiness Assessment

A construction readiness assessment will be conducted in accordance with PWI -4201-004, Readiness Assessment (North Wind 2004h). A readiness checklist will be completed that provides formal documentation that the project is ready to start, and may be modified to account for the final design requirements. At a minimum, the checklist will include:

- Safety basis documented
- NTP issued
- Plans and procedures prepared and issued, and available onsite
- Training conducted and documented
- Equipment procured, inspected, and approved for use

- Permits obtained
- Underground utility survey completed and utilities marked
- Support facilities installed and useable
- All stakeholders notified, including Los Alamos County Airport
- Security measures (including signage) implemented
- Subcontractors procured and available as required
- SWPPP (North Wind 2004j) implemented, including filing of Notice of Intent with the U.S. Environmental Protection Agency (EPA)
- Material storage area developed
- Project record keeping system in place
- Initial site photographs taken
- Required wage and employment signage posted

5.2.3. Construct Access Roads

Access roads will be constructed to the DDA and main landfill, as shown in final design drawings. The roads will be constructed by clearing brush and vegetation to native soils and adding appropriate road base. After the base course is finished (including compaction and watering), a 6-inch (in.) lift of gravel will be applied.

The main landfill access road will be from State Highway 502 through the main airport gate and along a designated corridor across the airport tie-down pad to the hangars. The road will then parallel the existing perimeter fence north of the hangars and terminate at the project staging area. Existing concrete water troughs on the north side of the hangars will be removed and replaced by underground piping or culverts to direct water flow across the entire width of the new road.

Access to the DDA will be from State Highway 502 through an existing gate at the east end of the runway. The existing road approach will be upgraded as needed and approximately 800 feet (ft) of new road will be developed to accommodate soil delivery in belly dump trucks. This road will be built with one lane but will include turn-outs for two-way traffic. Any imported material that spills or get tracked on the tarmac must be regularly swept or washed off.

Both access roads will be left in place for airport use and post-construction activities. Traffic control associated with use of the access roads for delivery of borrow material is discussed in Section 9.9.

5.2.4. Install Temporary Field Trailers

Two temporary field trailers and a tool van will be installed at the project staging area, located at the northwest corner of the site near the east hangar. One trailer will be designated as the field office and will have adequate desk space for three people. This trailer will also be used to file project documents (including records). The second trailer will be designated as a lunch/break room and will be also be used for safety and progress meetings with the crew. The tool van will be used for storage of hand tools, safety equipment, and other miscellaneous equipment.

Temporary electrical utilities will be run to both trailers and phone line(s) will be installed to the office trailer. Drinking water and potable hand washing water will be available in both trailers.

5.2.5. Survey DDA and Main Landfill

A local subcontractor will be retained for surveying. Initial site control points will be established from local elevation and coordinate datum. These controls will be permanent monuments used throughout construction and post-construction for any needed topographic, radial stakeout, and benchmark elevations. Monuments will be protected against damage, defacing, or loss.

A topographic map will be developed prior to construction .Baseline cross-sections identified on the grading plan will be marked on a 50-ft grid interval. Cut/fill and finished grade stakes will be placed, and referenced to the grid. Intermediate grade checks between grid points may be performed, as needed. Initial staking will include angle points for fence relocation at the northeast end of the main landfill and centerline cut and fills for proposed access routes.

5.2.6. Mobilize Heavy Equipment to Site

Heavy equipment will be screened and inspected by the SSO for radiological contamination before being allowed onsite. Heavy equipment will access both the main landfill and DDA via the main landfill access road, described in Section 5.2.3. Equipment will be unloaded in the staging area, east of the hangars and asphalt tarmac. Off-road equipment will be delivered to the site by transport, and DOT-approved equipment will be driven to the site. At a minimum, the following equipment is expected to be used during construction activities:

- D-7 or D-8 dozer (2 units)
- 4000-gallon water truck
- 5- to 7-cubic yard (cy) front-end loader
- 70-ton dragline unit with minimum 2.5-cy bucket
- 65,000-lb tracked excavator

When in use, heavy equipment will be inspected initially, then on a daily basis. The SS or operator will conduct the inspection, using the applicable North Wind Construction Safety Checklists in Appendix B.

5.2.7. Identify Underground Utilities

Underground utilities will be located by contacting New Mexico One Call Systems Inc. at 1-800-321-2537 at least five days prior to excavation. The utility survey area will include proposed excavation areas with a 200-ft buffer, and will be marked on the ground with white paint or stakes. Utilities identified within the survey area will be marked on the ground with the colors noted below. Utilities will then be exposed at 100-ft intervals throughout the survey area by potholing with hand shovels or a hydraulic unit. Utilities will be marked with the following paint colors, as recommended by One Call Systems. To avoid confusion and misidentification, the following colors are reserved and are not to be used for other activities such as surveying.

- Blue - water
- Green - sewer

- Orange - communications
- Red - electric
- Yellow – gas

The location of identified utilities will be transferred to a site base map and utility markings will be repainted as necessary. These measures will protect against the need for re-surveying if the initial markings are obliterated during construction.

5.3 Site Preparation

The following sections identify activities that will be performed before excavation or construction activities commence at the main landfill or DDA.

5.3.1. Install Fencing

A new section of perimeter chain link fence will be installed along and outside the toe of the east slope and along a portion of the north side of the main landfill. The location and specifications of the fencing will be detailed in final design drawings and specifications. Fencing will be installed by a subcontractor, using augers and/or jackhammers. Concrete needed for poles will be carried down the slope in buckets.

After the new fence is installed, the existing fence through the middle of the east slope will be removed. Any fencing in the construction area opened temporally will be closed and secured at the end of the workday. These measures will retain security and access to the airport at all times. The removed fencing material will be recycled or sold for salvage, if possible.

5.3.2. Install Storm Water Controls

Prior to earth-disturbing activities at the DDA or main landfill, erosion and runoff controls identified in the SWPPP (North Wind 2004j) and final design documents will be installed. This will include installation of silt fences, drainage channels and check dams, sediment traps, inlet filters, culverts, and berms.

Silt fences will be installed with a small trencher to anchor the fabric into the ground and then backfilling. Drainage channels will be constructed with a dozer or grader blade and compacted with the wheeled loader. Check dams and sediment traps will be installed with a small backhoe excavator. Inlet filter and culvert beds will be dug with an excavator to grade and the components will be installed by heavy equipment. Berms will be constructed with a loader placing imported gravel material as specified and compacted with the loader tires and gas-powered tamper as needed.

5.3.3. Abandon Monitoring Wells

Some of the existing soil gas monitoring wells in the main landfill will be abandoned. Well casings will be stripped of any readily removable instrumentation and tubing prior to closure. If any stainless steel vapor port tubing must be abandoned, the tubing will be cut off 3 to 4 ft below grade and the top few inches bent over to pinch the tubing closed. Casings will be sounded with a tag line (assuming that no instrumentation remains in the well) and the amount of bentonite required for backfill will be estimated based on well diameter and depth. Well casings will be backfilled with bentonite powder or chips to displace any methane that may be present. As the well is backfilled, the depth of the well will be continually sounded with the tag line to verify that bridging is not occurring. If bridging becomes an issue, a tremie pipe may be used.

After backfilling, the casing will be cut off approximately 3 to 4 ft below final grade. Approximately 1 ft of bentonite will be placed over the cut-off casing and the remaining excavation will be backfilled with soil.

Appropriate health and safety monitoring will be conducted during abandonment to detect the presence of possibly flammable gases (e.g, methane). If such gases are present, they will be allowed to fully vent before cutting off the casing. A hot work permit will be obtained prior to using gas cutting torches.

5.3.4. Abandon/Relocate Utilities

It may be necessary to abandon or relocate some existing utilities. The utility owner will be contacted and details will be discussed for the desired relocation or abandonment. Procedures to abandon or relocate the utility will be defined and approved prior to performing the work. A formal request will be made for the utility be shut down before excavation.

If the utility is relocated with heavy equipment, a spotter must be present at all times. The relocated utility will be replaced according to the utility owner's installation specifications, as appropriate. The HASP (North Wind 2004c) provides health and safety precautions if an unidentified utility is cut or ruptured.

5.4 Construction of DDA

The DDA will be constructed to include a minimum of 12 in. of topsoil over existing waste, a final grade of about 3 percent for promote runoff, and vegetation with native plants. To accomplish this, penetration testing will be performed prior to mobilization. The testing will be on a grid over the DDA and will identify the depth to waste and amount of cover soil required to meet the 12-in. minimum. This approach minimizes disturbance to portions of the DDA with adequate soil cover, reduces costs for imported soil, and preserves existing vegetation.

5.4.1. Pre-Construction Survey

Based on results of penetration testing, grade control and final fill elevations at the DDA will be laid out on 50-ft grids or smaller based on the size of the area requiring topsoil. Surveying will be conducted similar to that described in Section 5.2.5. Intermittent grade checks may be performed, as necessary.

5.4.2. Rough Regrade

Brush or trees will be grubbed only from those areas requiring additional topsoil, and will be chipped onsite and stockpiled for mixing with topsoil. A dozer will be used to shape portions of the DDA to achieve the required slope. Shaping will be limited to filling depressions and voids and establishing a surface that can be driven on by belly dump trucks delivering topsoil.

5.4.3. Add Topsoil

Topsoil for the DDA final cover will be delivered on site by belly dump trucks, and the topsoil will be dumped where needed. To the extent possible, trucks will not be driven on exposed waste or on undisturbed areas of the DDA. Topsoil will be watered and leveled by a dozer to the required elevation. The final contour will be graded with a dozer or motor patrol, filling voids and feathering edges of material to match existing contours.

5.4.4. Survey Final Grade

Final DDA grades will be surveyed by the surveyor to confirm that the final elevation matches design specifications and to provide measurements for as-built records.

5.5 Construction of East and North Slope of Main Landfill

Construction of the east and north slopes of the main landfill generally consists of salvaging existing soil cover, excavating existing landfill waste to establish a nominal 3H:1V grade, and applying a riprap armor. The following subsections provide specific details of slope construction subtasks.

5.5.1. Soil Salvage

Existing soil will be salvaged to the extent possible from the main landfill slopes as well as the central portion of the landfill. Cover soil from the northern half of the main landfill and the east slope will be removed by dozing into an elongated pile or windrow extending east to west, about in the center of the landfill. Once the northern half is brought to grade with the relocated waste, the salvaged soil can be readily dozed over the debris and incorporated into the final cover. A similar process will be used on the southern half of the main landfill.

5.5.2. Pre-Excavation Survey

The east and north slopes of the main landfill will be slope staked to delineate the limits of earthwork and breakpoints for the toe, benches, and top of cuts. Reference stakes will be set to allow the operators to monitor and control the grades during excavation.

5.5.3. Relocate Waste

The excavation and relocation of landfill waste will be completed with a combination of dozers, loader, and possibly a dragline. The upper portions of the east slope will be excavated with dozers and the lower portions may be excavated by a dragline.

Dozers will excavate in layers while establishing the 3H:1V slope as the dozing progresses. A berm will always result on the outside face of the slope to act as a catch for rolling debris or rock and provide a safety margin. As waste is excavated, it will be pushed to the lip of the slope(s). From there, another dozer will push the waste to its final destination. The exception is waste destined for the western portions of the landfill (i.e., more than about 300 ft from the top cuts of the slopes) which will be shuttled with a front end loader.

A dragline may be used to excavate the lowest portions of the east slope and limited portions of the north slope. Typical dragline production on this slope is estimated to be less than 50 cy per hour, based on a 2.5-cy bucket and 50-ton crane. The excavated debris will be dragged up the slope and set aside for other equipment to take to the fill locations.

As discussed in Section 5.5.1, waste will be relocated first to the northern half of the main landfill, where it will be covered with salvage soil. After the northern half is filled and covered, soil will be salvaged from the southern half of the main landfill and the process repeated. This activity will provide a partial or complete subgrade for the infiltration layer, depending on the amount of salvage soil available and the physical characteristics of the debris fill.

During waste excavation and relocation, dust control will be continuously provided with the water truck, as discussed in Section 9.6. Much of the water may need to be sprayed with a hose since some portions of the slope cannot be reached by the water truck. Some types of relocated municipal solid waste (e.g., paper products, loose plastic, ash) may be an airborne nuisance during windy conditions. Other waste may be considered hazardous to the general public. These materials will be contained by covering them with soil, rock, matting, or other suitable means, such as salvaged chain link fence. The CM will determine

when and if these controls are necessary to ensure blowing debris does not obstruct airways, leaves the site, or creates undesirable plumes or clouds.

5.5.4. Establish Subgrade and Survey

Subgrading will be completed with the dozer to create the rough template for the three proposed benches and to better define the required 3H:1V slope, as detailed in the design drawings. Salvage soil or other material will be added to provide a subgrade suitable for installation of the infiltration layer (Section 5.5.5). A structural fill berm will be installed along the toe of the east slope to provide a stable and safe working inclination.

Once debris is excavated from the east and north slopes, surveys of the slope faces will be completed for as-built records and to support eventual cover depth. Elevation and the limits of the debris will be documented by the surveyor.

5.5.5. Add Infiltration Layer

The infiltration layer consists of a nominal 18 in. of low permeability imported soil. The infiltration layer will be constructed with two nominal 9-in. lifts, though the actual lift thickness may be more to account for compaction. Material for the first lift will be delivered and dumped at the top of the slopes and a dozer will push it downward onto the slopes. Once roughed into place over the entire slopes, compaction will be obtained with a sheepsfoot roller pulled behind a dozer. Water will be applied with a hose and nozzle capable of spraying from the top of the slopes to the toe.

After compaction, lifts will be scarified to a depth of several inches with an appropriate attachment (e.g., harrow rake or disker), pulled by a dozer. Scarification provides a good binding surface between lifts, and also provides a good binding surface for the geotextile (Section 5.5.6).

5.5.6. Add Geotextile and Riprap

Geotextile will be added over the entire surfaces of the slope faces as a protective liner between the infiltration layer and riprap. After the geotextile is placed, a nominal 6 in. of processed riprap (crushed, screened, or sorted for angularity) will be installed. The rock will be imported, dumped, and placed in a manner similar to the infiltration layer, but lightly compacted with dozer tracks to set the riprap. It is anticipated that minimal dust control and no moisture conditioning will be required for the riprap placement.

5.5.7. Survey Final Grade

Final grades will be surveyed to confirm that final east and north slope elevations match the design specifications and provide measurements for as-built records.

5.6 Relocate Waste and Backfill at Southeast Corner of Main Landfill

An additional area in the southeast corner of the main landfill will be excavated, as shown on the grading plan. All waste will be excavated from this area and relocated to the top of the main landfill, as discussed in Section 5.5.3. If natural ground (i.e., bedrock) is encountered before design grades are reached, the slope will be finished off evenly and no further excavation will be required.

After the waste has been removed, an infiltration layer, geotextile, and riprap will be added in a manner similar to that discussed in Sections 5.5.5 and 5.5.6. The area will require high compaction as it is adjacent to the taxiway shoulder.

5.7 Construction of Main Landfill Cover

The main landfill cover will consist of a nominal 18 in. of imported low permeability soil (infiltration layer) and 6 in. of imported topsoil. Placement of the cover requires compaction, depth verification, and dust control. The following subsections provide details about the subtasks of constructing the main landfill cover.

5.7.1. Establish Subgrade and Survey

If needed, additional salvage soil or other suitable material will be added over the top of the main landfill to provide a subgrade suitable for installation of the infiltration layer (Section 5.7.2). Subgrading will be completed with the dozer to create the rough template for the approximate 3 percent top slope, as detailed in the design drawings.

After the subgrade is established, surveys of the main landfill will be completed for as-built records and to support eventual cover depth. Elevation and the limits of the debris will be documented by the surveyor. Grade hubs will be placed on a 50-ft grid pattern to achieve lift elevation.

5.7.2. Install Infiltration Layer

The infiltration layer consists of a nominal 18 in. of low permeability imported soil. The infiltration layer will be constructed with two nominal 9-in. lifts, though the actual lift thickness may be more to account for compaction. The imported soil will be delivered on site by trucks with back-end dump trailers. The soil will initially be dumped at the west end of the landfill and pushed onto the landfill with a dozer, working the material to the east. As the materials are being placed and compacted to the east, the trucks will also continue to move east with each delivery. This procedure will keep the trucks on clean compacted imported soil at all times. After the first lift is placed, the procedure will be reversed and the material will be worked from east to west using the procedure described above.

As the material is being worked, water will be added by the water truck to control dust and achieve optimum moisture before compaction. Compaction will be obtained with sheepsfoot rollers. Moisture conditioning and compaction testing will be an ongoing process during each lift.

After compaction, the lift will be scarified to a depth of several inches with an appropriate attachment (e.g., harrow rake or disker), pulled by a dozer. Scarification provides a good binding surface between lifts, and at the interface between the top of the infiltration layer and topsoil (Section 5.7.3).

5.7.3. Install Topsoil

Following acceptance testing of the infiltration layer (Section 5.8), a 6-in. topsoil cover will be placed. Methods will be similar to those described in Section 5.7.2. The exception is that compaction will not be desired beyond that of the dozer tracks. Topsoil that gets overly compacted due to wheeled equipment will be loosened by disking or with a dozer. In most cases, topsoil delivery will involve the belly dump trucks driving on the previous cover soil and not the topsoil. Once the topsoil is roughed in with the dozer, a grader or dozer will be used for filling voids and feathering edges of materials to match existing contours. Erosion control measures (straw mulch) will be applied intermittently as the topsoil placement takes place.

5.8 Acceptance Tests

Each lift of the infiltration layer will be tested by the QC Field Engineer for compaction and grades, as described in the CQCP (North Wind 2004a). Preliminary real-time test results will be provided to the SS

before placement of the next lift. This ensures the lift was properly compacted before placement of subsequent lifts.

5.9 Revegetation

Revegetation of the DDA and main landfill will be accomplished by hydroseeding, due to the length of the project and the amount of revegetation required. Temporary erosion controls will be implemented so that the seed, fertilizer and mulch can be applied to the DDA and main landfill under one mobilization. All areas of the project are accessible to typical hydroseeding equipment capable of spraying over 100 ft from the truck and using hoses to access any remote locations.

Hydroseeding with an added tackifier will be used for revegetation. Compacted or tracked topsoil will be loosened before hydroseeding. Completely covering the disturbed areas with a tackifier and hydroseed will help with dust control until vegetation has been established. A temporary sprinkling system or watering by truck may be required until vegetation has been established.

5.9.1. DDA

The DDA will be completed first; thus, temporary erosion controls will be implemented until the main landfill is completed. These controls will consist of applying straw with a blower at a rate specified per ton of straw per acre of ground. The straw will then be crimped into the soil using a straight disk crimping attachment. Periodic watering will be utilized for dust control. These measures will comply with the SWPPP (North Wind 2004j) and installing temporary controls will permit a single site mobilization by the hydroseed subcontractor.

Work areas within the DDA will be constructed as shown on design drawings. The original vegetation will be maintained to the extent possible by limiting heavy equipment and truck traffic to areas that will be reworked.

5.9.2. Main Landfill

The flatter areas of the main landfill will be revegetated in the same manner as the DDA. However, the east and north slopes will have slopes in excess of 3H:1V and therefore may require an erosion control blanket to aid in establishing revegetation. If used, the blanket will be installed by laborers with installer-recommended anchoring and stapling.

Temporary watering can be from the same hydrant as used to fill the water truck. Irrigation piping can be run on the surface of the main landfill with sprinkler heads. The more remote areas will likely require a periodic water application with a water truck and hose reel.

5.10 DOE Inspection and Acceptance

At the completion of construction, DOE will perform the final inspection and acceptance of the project. North Wind will submit a written document stating that the work was performed to project specifications and is ready for a final inspection. Following the inspection, any nonconforming or variant items will be promptly remedied and the final acceptance will then be requested.

5.11 Demobilization

Demobilization consists of removing temporary facilities and utilities. Equipment will be transported offsite and the staging area will be dismantled. Good housekeeping will be performed and all trash and

construction debris will be disposed of. Temporary fencing, cones, lighting, or other controls will be removed.

6.0 MEETINGS AND INSPECTIONS

A weekly job site meeting will be scheduled at a recurring day and time so all those involved can schedule accordingly. The meeting will update the past week progress, planned events for the current week, current issues, health and safety issues, and overall schedule status. Attendees will vary depending on ongoing activities, but will generally include a DOE representative, CM, Superintendent, and subcontractor personnel. Meeting minutes will be recorded and distributed.

Site inspections may be initiated by DOE, QA/QC needs, HASP enforcement, or other conditions. Inspections will occur on a random schedule or may occur at decision or hold points. Site access by non-project personnel (i.e., independent inspectors) is described in the HASP (North Wind 2004c). At a minimum, inspectors and site visitors will be logged in by the SS, briefed on health and safety issues and protocol (e.g., daily tailgate safety briefing), and will be issued appropriate safety gear, as required.

The CQCP (North Wind 2004a) identifies required inspection hold points for installation of landfill cover components (e.g., infiltration layer and topsoil).

Installed items that may potentially be suspect/counterfeit items (S/CI) will be inspected in accordance with the PQAP (North Wind 2004g) and DOE Guide 440.1-6, “Implementation Guide for Use with Suspect/Counterfeit Items Requirements of DOE O 440.1, Worker Protection Management; 10 CFR 830.120; and DOE 5700.6c, Quality Assurance” (DOE 1997). In addition, items used during construction activities that may cause injury or fatalities if failure occurs (e.g., ratchet straps/tie down assemblies, fasteners, bridal slings, hoisting slings) will also be inspected on a regular basis in accordance with the PQAP and DOE Guide 440.1-6.

7.0 QUALITY CONTROLS

Quality controls specific to construction activities are addressed in the CQCP (North Wind 2004a). The PQAP (North Wind 2004g) provides overall project QA methods.

8.0 HEALTH AND SAFETY CONTROLS

Health and safety controls and emergency procedures are addressed in the HASP (North Wind 2004c).

9.0 OPERATION, MAINTENANCE, AND MONITORING REQUIREMENTS

This section addresses operation, maintenance, and monitoring (OMM) activities to be performed during construction and/or post-construction phases. The construction phase is the time period from mobilization of construction equipment to demobilization, and will last about six months. The post-construction phase is the time period from demobilization to final stabilization. For this project, final stabilization is defined as placement of the riprap slope on the east and north edge of the main landfill, and the point of time at which the remainder of the main landfill and the DDA has achieved at least 70 percent vegetation.

Upon final stabilization, a Notice of Termination (NOT) will be filed with the EPA. This phase, while uncertain due to inability to forecast 70 percent vegetation, is expected to last six to 12 months. After final stabilization has occurred, this contract is considered complete and post-closure care and monitoring will be the responsibility of DOE. OMM during post-closure is addressed in the PCMP (North Wind 2004e). The post-closure period begins at filing of the NOT and lasts for up to 30 years.

Overall project requirements, including requirements for OMM during construction and post-construction phases, are defined in the Design Basis Document for LASO TA-73 Airport Landfill (North Wind 2004b). Some OMM activities to meet those requirements during construction and post-construction phases have been addressed as follows:

- The CQCP (North Wind 2004a) for inspection and testing of construction materials and procedures
- the SWPPP (North Wind 2004j) for runoff controls, maintenance of the vegetated cover and protection of archaeological resources
- the ancillary NEPA documentation for protection of protected species
- the HASP (North Wind 2004c) for protection of human health, and monitoring of soil gas releases during construction, including methane

Additional OMM requirements not specified in the above documents that apply to the construction and post-construction phases have been identified. These requirements, including citations for regulatory requirements, are listed below.

9.1 Fire Prevention

"Provide adequate means to prevent and extinguish fires (*New Mexico Administrative Code* [NMAC] 20.9.1.400.B.7)."

All vehicles working on the construction site will be required to have fire extinguishers in the cab or elsewhere on the vehicle.

9.2 Sanitary Facilities

"Provide toilet and hand washing facilities for workers (29 *Code of Federal Regulations* [CFR] 1926)."

Facilities will be provided in the staging area, located near the access road at the northwest corner of the main landfill.

9.3 Access Roads

"Maintain access roads."

All access roads required for OMM will be maintained as needed.

9.4 Noise Levels

"Noise may not exceed 65 dBA during construction (Los Alamos County [LAC] 18-73)."

Noise levels at the landfill during construction will be lower than for airport operations, based on published noise levels for planned construction equipment and aircraft using the airport. Noise will be mitigated to the extent feasible by minimizing operational duration of high-noise level equipment. Noise levels will be addressed in an environmental assessment conducted by DOE.

9.5 Work Hours

"Excavation may take place only during the hours from 7 AM to 6 PM (LAC-34-54)."

Excavation of waste will be limited to these hours.

9.6 Dust Control

"Excavated material must be maintained to minimize disruption of traffic and to keep dirt or dust from spreading or flying (LAC-34-46)."

Dust will be controlled by frequent watering. Dirt access roads, disturbed areas, and materials stockpiles will be watered at a frequency determined by the CM, dependent on weather conditions, area of disturbance, traffic patterns, and nature of soil. Water will be applied such that the soil is wet but not saturated or muddy, and that air quality is maintained. At a minimum, watering will occur whenever dust and suspended sediment significantly obscures vision, threatens air quality, or becomes a public nuisance. Prior to clearing and grubbing, portions of the landfill and DDA may also be watered to prevent generating excess dust.

During construction, a 4000-gallon (minimum quantity) water truck will be used to control dust on excavations and access roads, and to condition fill material before compaction. The truck will be equipped to apply a front spray, back spray and/or a pumped hose and nozzle spray. Water is available from a hydrant at the northwest corner of the hangar facilities. The hydrant will be fitted with a metering device to measure volume used. Access roads will be gravel surfaced, and sprayed as necessary to prevent visible dust. During the peak of soil delivery, the supplier may be required to assist with dust control of the haul routes.

Some types of relocated municipal solid waste (e.g., paper products, loose plastic, ash) may be an airborne nuisance during windy conditions. These materials will be contained by covering them with soil, rock, matting, or other suitable means, such as salvaged chain link fence. The CM will determine when and if these controls are necessary to ensure blowing debris does not obstruct airways, leaves the site, or creates undesirable plumes or clouds.

9.7 Site Security

"Prevent unauthorized entry by 24 hr surveillance system, fencing or signage during construction (NMAC 20.9.1.400.B.4; 40 CFR 265.14); Have worksites fenced or maintained in a manner to safeguard property and the public (LAC 10-75)."

Fencing and signage will be maintained during construction. Temporary fences will be used in areas where permanent fences must be removed to complete construction. Any area where fencing and signage must be removed will be guarded until replaced. All personnel entering the site are required to receive DOE Get Employee Trained training.

There is a gate across the DDA access spur from State Highway 502. The gate will be staffed by a laborer for security when trucks are hauling materials to the site. The monitor will open the gate and notify site workers of incoming loads for logistical and safety purposes.

Additional information is provided in the HASP (North Wind 2004c).

9.8 Airport Coordination

Construction activities will be conducted inside the fence line of the Los Alamos Airport that has an active runway and taxiway, storage of aircraft on the tarmac, and in hangers. Construction activities will be coordinated with airport operations personnel and any operations that may effect runway operations, reduce the tarmac footprint for aircraft storage, or remove or open fence areas or gates, will be

communicated during the pre-job briefing with airport personnel. The SS will continue to provide updates to the airport operations personnel during the course of the project.

Although the construction plans for activities in the DDA and main landfill areas are not anticipated to impact active runway operations, the following practices will be followed to reduce hazards to aircraft and construction personnel:

- A construction fence or high visibility rope and barricades to will be used to delineate construction work zones and as temporary fencing
- Airport boundary security fence and gates will be maintained; temporary gates will be equipped with hardware that will allow them to be locked and secured during nonworking hours
- The dragline boom will be marked with flagging or equivalent to provide increased visibility for aircraft
- Vehicle and equipment operators will be briefed during the pre-job briefing on established, traffic routes, prohibited driving areas of the airport, and other relevant airport safety information; this information will be updated and communicated at the daily construction briefing when changes to established routes or other pertinent information needs to be communicated to project personnel
- Radio communication between the SS and airport operations personnel will be established (as required airport operations); if necessary as directed by airport personnel, all site activities shall be suspended to accommodate air traffic
- Vehicle and equipment operators will be monitored by the SSO and SS to ensure compliance with established vehicle traffic routes and requirements

Other applicable requirements from the DOT and Federal Aviation Administration (FAA), Advisor Circular, AC No. 150/5370-2E, “Operational Safety on Airports during Construction” (FAA 2003) will be complied with. Additional information is provided in the HASP (North Wind 2004c).

9.9 Construction Traffic Control

Traffic control will be established prior to start of construction. Elements of the traffic control will include the following:

- A Traffic Control Plan will be prepared.
- A Traffic Permit will be prepared for approval by the Los Alamos County and the New Mexico DOT.
- Flaggers and signs will be in place along State Highway 502. This work will be subcontracted to qualified companies that provide such services.
- Inspection records for delivery truck brakes will be requested from the borrow source supplier.
- Truck routes will be approved as part of the Traffic Permit.

Large commercial vehicles (such as industrial haul and water trucks) and equipment will be used for hauling of fill materials and other supplies. Designated traffic lanes and routes will be established for this equipment when operating on the project site. Established vehicle traffic lanes and routes will be clearly communicated to all personnel and drivers during the pre-job briefing and will be marked and delineated where feasible to prevent inadvertent entry or crossing by personnel or other equipment.

Entry to and exit from the airport landfill site will be controlled. Only established and approved gates will be used. A spur from State Highway 502 gate adjacent to the DDA area will be used to facilitate fill material delivery. The spur will be marked, required signs posted, and flagger control used in accordance with the U.S. Department of Transportation (DOT), “Manual on Uniform Traffic Control Devices” (DOT 2003) and Los Alamos County requirements.

Highway signs will be erected on State Highway 502 at the ingress/egress to the main landfill and DDA, in accordance with DOT (DOT 2003). The signs will warn approaching traffic of construction activities. A minimum of two flagmen will be posted at the DDA ingress/egress to control traffic. The need for flagmen at the main landfill will be assessed, in consultation with airport personnel. The flagmen will have two-way radio contact (or alternate electronic devices) with the SS.

Heavy truck traffic delivering borrow source material will be limited to the hours of 9am through 3pm Monday through Friday. If congestion on State Highway 502 becomes a problem during the week, truck deliveries may be scheduled for the weekend. Trucks will arrive in a convoy of about 10 trucks, and the lead truck will radio the SS ahead of arrival to ensure flagmen are on the scene.

Additional information is provided in the HASP (North Wind 2004c).

9.10 Housekeeping

“Control litter, disease vectors and odors (NMAC 20.9.1.400.B.12).”

Wind dispersal and odors will be controlled through dust control measures described in Section 9.6. Disease vectors, e.g. birds and rodents, will be controlled if needed, however due to the relatively brief duration of waste excavation and relocation this will likely not be needed.

10.0 TRAINING AND CERTIFICATION

Training and certification of key personnel will be commensurate with assigned tasks. In general, training will be conducted according to the PQAP (North Wind 2004g), the PMP (North Wind 2004f), and the HASP (North Wind 2004c). At a minimum, project personnel completing construction activities will be required to read and understand the project documents listed in Section 5.2.1 and will comply with training and certification requirements shown in Table 6.2-1 of the HASP (North Wind 2004c).

During construction, the PM may identify additional training and/or certification necessary for the successful completion of the project. This training may take the form of on-the-job training, additional required reading, documented classroom learning, or hands-on demonstration of required skills. The HASP (North Wind 2004c) identifies required training specific to health and safety issues.

All health and safety training, QA training, radiological worker training, medical surveillance of site workers, and project-specific training will be current and will be documented and tracked by the North Wind Training Coordinator, as provided in QAP-18, “Training” (North Wind 2003e).

The following subsections describe training and certifications necessary to perform key functional activities.

10.1 Site Access

All personnel entering the site are required to receive DOE Get Employee Trained training.

10.2 Heavy Equipment Operation

Personnel operating heavy equipment will have demonstrated ability in the operation of the particular equipment and will demonstrate proficiency to the satisfaction of the CM. Truck drivers transporting landfill material (e.g., borrow soil) will have a Commercial Driver's License. The crane operator(s) will be trained and/or certified according to applicable State of New Mexico regulations.

10.3 Health and Safety

The North Wind Corporate Health and Safety Director will be a Certified Industrial Hygienist. Site health and safety officer(s), managers, and site workers will be trained and certified commensurate with activities and associated hazards. Health and safety training and certifications will be specified in the HASP (North Wind 2004c).

10.4 Measuring and Test Equipment

Personnel who use measuring and test equipment (M&TE) will be trained to use the particular device. This may be formal classroom training or may consist of documented on-the-job training. M&TE users will ensure that equipment is calibrated to nationally recognized standards (e.g., National Institute for Standards and Technology), and that calibration is current. If no nationally recognized standards exist, the basis for calibration will be documented. M&TE users also ensure equipment is of the proper type, range, accuracy, and that it is uniquely identified and traceable to its calibration date.

10.5 Surveyors and Engineers

Surveyors and engineers will be licensed in the State of New Mexico. The CQCP (North Wind 2004a) provides additional details.

10.6 Auditing

North Wind personnel conducting internal audits or field surveillances will be trained in accordance with QAP-17.1, "Qualification and Certification of Auditing Personnel" (North Wind 2002).

11.0 REFERENCES

The following list includes all of the documents cited in this Construction Plan. The parenthetical information following each reference provides the author, publication date, and LANL Environmental Restoration identification number (as applicable). This information is also included in the text citations and can be used to locate documents on this list.

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Appendix A
Acronyms

Acronyms

CFR	*Code of Federal Regulations*
CM	Construction Manager
CO	Contracting Officer
COR	Contracting Office Representative
CQCP	Construction Quality Control Plan
cy	Cubic yard(s)
DDA	Debris Disposal Area
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
ft	Foot (feet)
HASP	Health and Safety Plan
in.	Inch(es)
ISM	Integrated Safety Management
LAC	Los Alamos County
LANL	Los Alamos National Laboratory
LASO	Los Alamos Site Office
M&TE	Measuring and test equipment
NMAC	*New Mexico Administrative Code*
NOT	Notice of Termination
NTP	Notice to Proceed
OMM	Operation, maintenance, and monitoring

PCMP	Post-closure Care and Monitoring Plan
PM	Project Manager
PMP	Project Management Plan
PQAP	Project Quality Assurance Plan
PrM	Program Manager
PRS	Potential release site
PWI	Project Work Instruction
QA	Quality assurance
QAP	Quality Assurance Procedure
QC	Quality control
S/CI	Suspect/counterfeit item
SOW	Statement of Work
SR	Savannah River Operations Office
SS	Site Superintendent
SSO	Site Safety Officer
SWPPP	Storm Water Pollution Prevention Plan
TA	Technical Area
WMP	Waste Management Plan

Appendix B
North Wind Construction Safety Checklists

North Wind, Inc.
Construction Division

Motor Patrol
Weekly Safety and Preventive Maintenance Inspection

Equipment No. _____ Hour Meter Reading _____ Date Checked _____

Item	Check One Only			Explain Deficiencies
	O.K.	N/A	Repair	
Backup Alarm				
Body, Frame, Cab: no dents, or damage				
Check blade and turntable area for debris				
Bucket- pins, teeth and no cracks				
Cab is clean-No debris to obstruct operator				
Cab rollers				
Cooling system fluid level				
Engine oil level				
Fire extinguisher-Inspected and dated				
Fuel system-adequate fuel, no leaks				
Gauges and Instruments				
Grease fittings and wear points				
Hydraulics- Fluid level, no leaks				
Leak-oil, anti-freeze, transmission				
Lights				
Mirrors- no cracks, aimed properly				
Seat belts- available and functional				
Signs-load charts, operating signals				
Steps, guard rails and hand holds				
Visual inspect tires low air,cuts,bulges				
Transmission/Converter, Leaks, Levels				
Walk around vehicle, look for obstructions				
Windows- clean, no cracks				
Window wipers and washer fluid				

Additional Items or Information

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Turn in at the end of the week to the Construction Coordinator at the Kellogg office.

_____
Signature

North Wind, Inc.
Construction Division

Dump Truck
Weekly Safety and Preventive Maintenance Inspection

Equipment No. _____ Hour Meter Reading _____ Date Checked _____

Item	Check One Only			Explain Deficiencies
	O.K.	N/A	Repair	
Backup Alarm				
Body, Frame, Cab: no dents, or damage				
Check air pressure gauge for excessive leaks if air brake equipped				
Visually inspect box for cracks				
Cab is clean-No debris to obstruct operator				
Check hinge point on box for cracks				
Cooling system fluid level				
Engine oil level				
Fire extinguisher-Inspected and dated				
Fuel system-adequate fuel, no leaks				
Gauges and Instruments				
Grease fittings and wear points				
Hydraulics- Fluid level, no leaks				
Leak-oil, anti-freeze, transmission				
Lights,turn signals,brake lights				
Mirrors- no cracks, aimed properly				
Seat belts- available and functional				
Signs-load charts, operating signals				
Steps, guard rails and hand holds				
Visual inspect tires low air,cuts,bulges				
Transmission/Converter, Leaks, Levels				
Walk around vehicle, look for obstructions				
Windows- clean, no cracks				
Window wipers and washer fluid				

Additional Items or Information

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Turn in at the end of the week to the Construction Coordinator at the Kellogg office.

_____
Signature

North Wind, Inc.
Construction Division

Roller-Compactor
Weekly Safety and Preventive Maintenance Inspection

Equipment No. _____ Hour Meter Reading _____ Date Checked _____

Item	Check One Only			Explain Deficiencies
	O.K.	N/A	Repair	
Backup Alarm				
Body, Frame, Cab: no dents, or damage				
Check for missing drum cleanout teeth				
Bucket- pins, teeth and no cracks				
Cab is clean-No debris to obstruct operator				
Cab rollers				
Cooling system fluid level				
Engine oil level				
Fire extinguisher-Inspected and dated				
Fuel system-adequate fuel, no leaks				
Gauges and Instruments				
Grease fittings and wear points				
Hydraulics- Fluid level, no leaks				
Leak-oil, anti-freeze, transmission				
Lights				
Mirrors- no cracks, aimed properly				
Seat belts- available and functional				
Signs-load charts, operating signals				
Steps, guard rails and hand holds				
Track frames, idlers, drive sprockets				
Transmission/Converter, Leaks, Levels				
Walk around vehicle, look for obstructions				
Windows- clean, no cracks				
Window wipers and washer fluid				

Additional Items or Information

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Turn in at the end of the week to the Construction Coordinator at the Kellogg office.

_____
Signature

North Wind, Inc.
Construction Division

Water Truck
Weekly Safety and Preventive Maintenance Inspection

Equipment No. _____ Hour Meter Reading _____ Date Checked _____

Item	Check One Only			Explain Deficiencies
	O.K.	N/A	Repair	
Backup Alarm				
Body, Frame, Cab: no dents, or damage				
Check air pressure gauge for excessive leaks if air brake equipped				
Check and secure all hoses to truck				
Cab is clean-No debris to obstruct operator				
Cab rollers				
Cooling system fluid level				
Engine oil level				
Fire extinguisher-Inspected and dated				
Fuel system-adequate fuel, no leaks				
Gauges and Instruments				
Grease fittings and wear points				
Hydraulics- Fluid level, no leaks				
Leak-oil, anti-freeze, transmission				
Lights,turn signals,brake lights				
Mirrors- no cracks, aimed properly				
Seat belts- available and functional				
Signs-load charts, operating signals				
Steps, guard rails and hand holds				
Visual inspect tires low air,cuts,bulges				
Transmission/Converter, Leaks, Levels				
Walk around vehicle, look for obstructions				
Windows- clean, no cracks				
Window wipers and washer fluid				

Additional Items or Information

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Turn in at the end of the week to the Construction Coordinator at the Kellogg office.

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Signature

North Wind, Inc.
Construction Division

Dozer D-8R
Weekly Safety and Preventive Maintenance Inspection

Equipment No. _____ **Hour Meter Reading** _____ **Date Checked** _____

Item	Check One Only			Explain Deficiencies
	O.K.	N/A	Repair	
Backup Alarm				
Body, Frame, Cab: no dents, or damage				
Check blade, cutting edges for cracks and excessive wear				
Check engine bay for excessive oil or fuel leaks				
Cab is clean-No debris to obstruct operator				
Cab rollers				
Cooling system fluid level				
Engine oil level				
Fire extinguisher-Inspected and dated				
Fuel system-adequate fuel, no leaks				
Gauges and Instruments				
Grease fittings and wear points				
Hydraulics- Fluid level, no leaks				
Leak-oil, anti-freeze, transmission				
Lights				
Mirrors- no cracks, aimed properly				
Seat belts- available and functional				
Signs-load charts, operating signals				
Steps, guard rails and hand holds				
Track frames, idlers, drive sprockets				
Transmission/Converter, Leaks, Levels				
Walk around vehicle, look for obstructions				
Windows- clean, no cracks				
Window wipers and washer fluid				

Additional Items or Information

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Turn in at the end of the week to the Construction Coordinator at the Kellogg office.

_____
Signature

North Wind, Inc.
Construction Division

EXCAVATOR
Weekly Safety and Preventive Maintenance Inspection

Equipment No. _____ Hour Meter Reading _____ Date Checked _____

Item	Check One Only			Explain Deficiencies
	O.K.	N/A	Repair	
Backup Alarm				
Body, Frame, Cab: no dents, or damage				
Boom angle indicator				
Bucket- pins, teeth and no cracks				
Cab is clean-No debris to obstruct operator				
Cab rollers				
Cooling system fluid level				
Engine oil level				
Fire extinguisher-Inspected and dated				
Fuel system-adequate fuel, no leaks				
Gauges and Instruments				
Grease fittings and wear points				
Hydraulics- Fluid level, no leaks				
Leak-oil, anti-freeze, transmission				
Lights				
Mirrors- no cracks, aimed properly				
Seat belts- available and functional				
Signs-load charts, operating signals				
Steps, guard rails and hand holds				
Track frames, idlers, drive sprockets				
Transmission/Converter, Leaks, Levels				
Walk around vehicle, look for obstructions				
Windows- clean, no cracks				
Window wipers and washer fluid				

Additional Items or Information

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Turn in at the end of the week to the Construction Coordinator at the Kellogg office.

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Signature

Appendix C
Construction Schedule

Act ID	Description	Orig Dur	Rem Dur	Early Start	Early Finish
4.0	Construction	181d	181d	30JUL04 *	19APR05
4.1.	Construction Management	181d	181d	30JUL04	19APR05
4.1.1	Notice To Proceed	1d	1d	30JUL04	30JUL04
4.1.2	Notify NMED of Intent to Construct	1d	1d	30JUL04	30JUL04
4.1.3	Procurement	33d	33d	02AUG04	16SEP04
4.1.4	Prepare and Let Materials Subcontracts	33d	33d	02AUG04	16SEP04
4.1.5	Prepare and Let Services Subcontracts	33d	33d	02AUG04	16SEP04
4.2	Construction Health & Safety	181d	181d	30JUL04	19APR05
4.3	Construction QA/QC	181d	181d	30JUL04	19APR05
4.4	Mobilization	21d	21d	17SEP04	15OCT04
4.4.1	Assemble Construction Controlled	7d	7d	17SEP04	27SEP04
4.4.2	Construction Readiness Assessment	2d	2d	28SEP04	29SEP04
4.4.3	Start Construction	1d	1d	30SEP04	30SEP04
4.4.4	Set-up Temporary Office Trailer	3d	3d	01OCT04	05OCT04
4.4.5	Install Trailer Utilities	5d	5d	06OCT04	12OCT04
4.4.6	Survey Landfill & DDA Areas	2d	2d	06OCT04	07OCT04
4.4.7	Mobilize Equipment to Site	3d	3d	13OCT04	15OCT04
4.5	Site Preparation	11d	11d	08OCT04	22OCT04
4.5.1	Demolish Existing Fence	4d	4d	08OCT04	13OCT04
4.5.2	Install New Fence	8d	8d	08OCT04	19OCT04
4.5.3	Install Erosion Control Measures	5d	5d	08OCT04	14OCT04
4.5.4	Construct New Access Road	4d	4d	08OCT04	13OCT04
4.5.5	Abandon Existing Soil Gas/Monitoring Wells	10d	10d	08OCT04	21OCT04
4.5.6	Abandon/Relocate Utilities	10d	10d	08OCT04	21OCT04
4.5.7	Site Preparation Complete	1d	1d	22OCT04	22OCT04
4.6	DDA Construction	34d	34d	25OCT04	13DEC04
4.6.1	Construction Survey	2d	2d	25OCT04	26OCT04
4.6.2	Construct Access Road	5d	5d	14OCT04	20OCT04
4.6.3	Rough Re-grade DDA	3d	3d	27OCT04	29OCT04
4.6.4	Add Topsoil to Final Grade	5d	5d	01NOV04	05NOV04
4.6.5	Grade to Final Contour	2d	2d	08NOV04	09NOV04
4.6.6	Survey Final Grade	1d	1d	10NOV04	10NOV04
4.7	Main Landfill Construction	100d	100d	01NOV04	28MAR05
4.7.1	Main Landfill-East Slope Construction	36d	36d	01NOV04	22DEC04
4.7.1.1	Construction Survey	2d	2d	01NOV04	02NOV04
4.7.1.2	Relocate Waste (30,000cy)	35d	35d	03NOV04	23DEC04
4.7.1.3	Work Slope to Final Grade (16,500cy)	20d	20d	28DEC04	26JAN05
4.7.1.4	Relocate Waste from SE Corner	5d	5d	25OCT04	29OCT04
4.7.1.5	Survey	2d	2d	27JAN05	28JAN05
4.7.1.6	Add 6" Soil Lift to Slope	5d	5d	31JAN05	04FEB05
4.7.1.7	Add 6" Bedding to Slope	5d	5d	07FEB05	11FEB05
4.7.1.8	Add Rip-Rap to Slope	5d	5d	14FEB05	18FEB05

Start date	**30SEP03**
Finish date	**22JUN05**
Data date	**30SEP03**
Run date	**24MAR04**
Page number	**1A**

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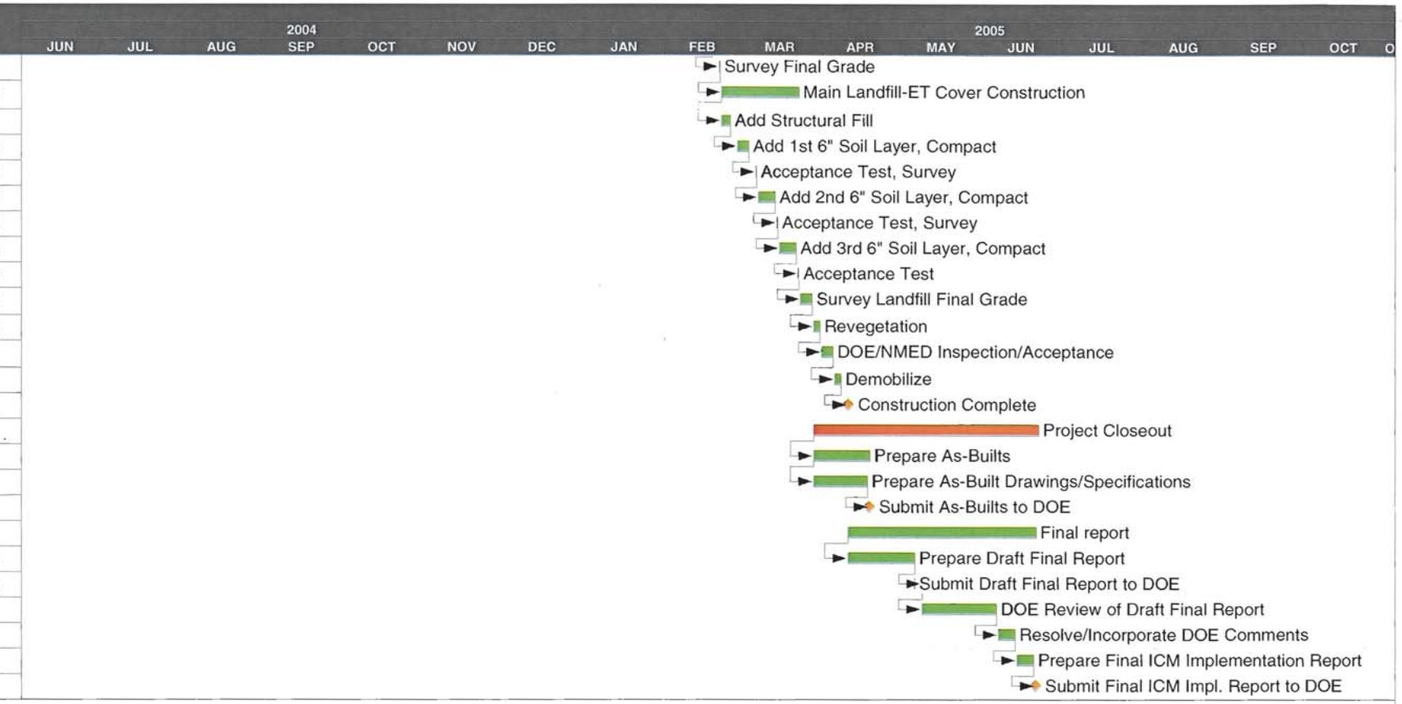
Los Alamos Site Office
TA-73 Airport Landfill Project -Construction Schedule

North Wind, Inc.

- **Early bar**
- **Progress bar**
- **Critical bar**
- **Summary bar**
- **Start milestone point**
- **Finish milestone point**

Act ID	Description	Orig Dur	Rem Dur	Early Start	Early Finish
4.7.1.9	Survey Final Grade	1d	1d	21FEB05	21FEB05
4.7.2	Main Landfill-ET Cover Construction	22d	22d	22FEB05	23MAR05
4.7.2.1	Add Structural Fill	4d	4d	22FEB05	25FEB05
4.7.2.2	Add 1st 6" Soil Layer, Compact	5d	5d	28FEB05	04MAR05
4.7.2.3	Acceptance Test, Survey	1d	1d	07MAR05	07MAR05
4.7.2.4	Add 2nd 6" Soil Layer, Compact	5d	5d	08MAR05	14MAR05
4.7.2.5	Acceptance Test, Survey	1d	1d	15MAR05	15MAR05
4.7.2.6	Add 3rd 6" Soil Layer, Compact	5d	5d	16MAR05	22MAR05
4.7.2.7	Acceptance Test	1d	1d	23MAR05	23MAR05
4.7.2.8	Survey Landfill Final Grade	3d	3d	24MAR05	28MAR05
4.8	Revegetation	3d	3d	29MAR05	31MAR05
4.8.1	DOE/NMED Inspection/Acceptance	3d	3d	01APR05	05APR05
4.9	Demobilize	3d	3d	06APR05	08APR05
4.9.1	Construction Complete	0	0	11APR05	
5.0	Project Closeout	60d	61d	29MAR05 *	22JUN05
5.1	Prepare As-Builts	16d	16d	29MAR05	19APR05
5.1.1	Prepare As-Built Drawings/Specifications	15d	15d	29MAR05	18APR05
5.1.2	Submit As-Builts to DOE	0	0	19APR05	
5.2	Final report	51d	51d	11APR05 *	21JUN05
5.2.1	Prepare Draft Final Report	20d	20d	11APR05	06MAY05
5.2.2	Submit Draft Final Report to DOE	0	0	09MAY05	06MAY05
5.2.3	DOE Review of Draft Final Report	20d	20d	09MAY05	06JUN05
5.2.4	Resolve/Incorporate DOE Comments	5d	5d	07JUN05	13JUN05
5.2.5	Prepare Final ICM Implementation Report	5d	5d	14JUN05	20JUN05
5.2.6	Submit Final ICM Impl. Report to DOE	0	0	21JUN05	



Start date	30SEP03
Finish date	22JUN05
Data date	30SEP03
Run date	24MAR04
Page number	2A

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TA-73 Airport Landfill Project -Construction Schedule

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Early bar
Progress bar
Critical bar
Summary bar
Start milestone point
Finish milestone point

NW-ID-2004-027
Revision 0

POST-CLOSURE CARE AND MONITORING PLAN FOR LOS ALAMOS SITE OFFICE TA-73 AIRPORT LANDFILL

April 2004

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DOCUMENT APPROVAL PAGE

Document Number: NW-ID-2004-027 Revision: 0

Document Title: Post-closure Care and Monitoring Plan for Los Alamos Site Office TA-73 Airport Landfill

Approval Signatures

Name	Signature	Date	Title
Jeffrey Lanford	for	4/12/04	North Wind Project Manager
Robert Enz		4/12/04	U.S. Department of Energy, LASO

Revision Log

Revision	Date	Reason for Revision
Draft	03/30/04	Not applicable; first draft of document
Revision 0	04/15/04	Document revised to incorporate DOE/LASO comments of 04/05/04

NW-ID-2004-027 i April 2004

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1.0 INTRODUCTION

This Post-closure Care and Monitoring Plan (PCMP) addresses post-closure care and monitoring for the U.S. Department of Energy (DOE) Los Alamos Site Office (LASO) Technical Area (TA)-73 Airport Landfill, hereinafter referred to as the Airport Landfill project. This PCMP identifies post-closure care and monitoring requirements for the landfill, and describes activities to meet those requirements. A tentative inspection and reporting schedule is also provided.

Background information for the Airport Landfill project is provided in the Los Alamos National Laboratory (LANL) document "RFI Report for Potential Release Sites 73-001(a,b,c,d) and 73-004(d), Airport Landfill Areas" (LANL 1998, 63070). The closure cover design and supporting information will be provided in the Phase II Work Plan for LASO TA-73 Airport Landfill (North Wind 2004e).

The selected remedy for the Airport Landfill project has been prescribed by the New Mexico Environment Department (NMED) (NMED 2003). The cover will be a *Resource Conservation and Recovery Act* (RCRA) Subtitle D municipal landfill cover as described in *New Mexico Administrative Code* (NMAC) 20.9.1.500 (NMAC 2001). Since the TA-73 landfill is unlined, this design also meets applicable NMAC 20.4.1.600 (RCRA Subtitle C) (NMAC 2003) requirements.

2.0 REQUIREMENTS

The selected remedy for the Airport Landfill project is an NMED-prescribed municipal waste landfill cover as described in NMAC 20.9.1, "Solid Waste Requirements." The design concept consists of a 6-inch (in.) topsoil layer with a vegetated surface, overlying an 18-in. infiltration barrier layer of soil compacted to a saturated hydraulic conductivity (Ksat) of less than 1E-05 centimeters per second (cm/sec). Since the landfill is unlined and is underlain by earthen materials with Ksat values ranging from 1E-03 to 1E-05 cm/sec (LANL 1998, 63070), this cover design is less permeable than any underlying layer and therefore also meets applicable RCRA Subtitle C requirements (NMAC 2003) with respect to controlling infiltration.

The post-closure care and monitoring requirements identified in the Design Basis Document for LASO TA-73 Airport Landfill (North Wind 2004c), are summarized in Table 2.0-1 and discussed in this section. NMAC 20.9.1.500.B (NMAC 2001) states that the owner/operator must "submit a post-closure care and monitoring plan which shall include but not be limited to maintenance of cover integrity, maintenance and operation of the leachate collection system, operation of the methane and ground water monitoring systems." NMAC 20.9.1.500.B.2.b (NMAC 2001) states that "Reports of monitoring performance and data collected shall be submitted to the Secretary within 45 days from the end of each calendar year."

Post-closure monitoring to establish compliance with the 1E-05 cm/sec performance standard is not required under RCRA regulations. As discussed in the Construction Quality Control Plan for LASO TA-73 Airport Landfill (North Wind 2004a), quality control testing and inspections will be performed on the various landfill cover components, particularly the low-permeability infiltration layer, to assure that the infiltration layer is installed and compacted to meet the 1E-05 cm/sec. In addition, samples will be collected from the infiltration layer material at the offsite borrow source and analyzed to ensure the material meets the performance standard before delivery to the site.

Table 2.0-1
Summary of Post-closure Care and Monitoring Requirements

Citation	Requirement	Method of Compliance
20 NMAC 9.1.500[1] NMAC 20.4.1.600[2] (40 CFR 265.118)[3]	Post-closure care and monitoring plan	PCMP
20 NMAC 9.1.500[1] NMAC 20.4.1.600[2] (40 CFR 265.310)[4]	Maintain cover integrity	Annual inspection and maintenance of cover
20 NMAC 9.1.500[1] NMAC 20.4.1.600[2] (40 CFR 265.310)[4]	Maintain and operate leachate collection system	Leachate collection system not required
20 NMAC 9.1.500[1] NMAC 20.4.1.600[2] (40 CFR 265.310)[4]	Maintain and operate methane collection/monitoring system	Methane collection/monitoring system not required
20 NMAC 9.1.500[1]	Groundwater monitoring	Groundwater monitoring not required
20 NMAC 9.1.500[1]	Reporting	Annual monitoring report
NMAC 20.4.1.600[2] (40 CFR 265.310)[4]	Prevent run-on and run-off from eroding or otherwise damaging the final cover	Annual inspection and maintenance of surface water controls
NMAC 20.4.1.600[2] (40 CFR 265.310)[4]	Protect and maintain surveyed benchmarks	Annual inspection and maintenance of survey benchmarks
DOE-LASO and Los Alamos County requirements	Maintain access roads to main landfill and Debris Disposal Area	Annual inspection and maintenance of access roads

[1] Source: NMAC 2001
[2] Source: NMAC 2003
[3] Source: CFR 2003a
[4] Source: CFR 2003b
NMAC = *New Mexico Administrative Code*
CFR = *Code of Federal Regulations*

The post-closure plan prepared under 40 *Code of Federal Regulations* (CFR) 265.118 (CFR 2003a) must include:

- A description of planned groundwater monitoring activities;
- A description of planned maintenance activities; and
- The name, address, and telephone numbers of the person or office to contact during the post-closure period.

The scope of the activities addressed under the RCRA Subtitle C post-closure care plan for an interim status, unpermitted landfill are defined in 40 CFR 265.310 (CFR 2003b): “After final closure, the owner or operator… must:

- Maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion or other events;
- Maintain and monitor the leak detection system…;
- Maintain and monitor the ground-water monitoring system…;
- Prevent run-on and run-off from eroding or otherwise damaging the final cover; and
- Protect and maintain surveyed benchmarks used in complying with §265.309."

The TA-73 landfill does not include a leachate collection system, therefore this requirement does not apply. The TA-73 landfill does not have dedicated groundwater monitoring wells because the depth to groundwater is over 1200 feet (ft), therefore this requirement does not apply. The requirement for methane monitoring does not apply because 1) the landfill was not active after November 8, 1987; and 2) engineering calculations (North Wind 2004d) indicate that gas concentrations will not exceed 25 percent of the lower explosive limit for methane in structures and at the property boundary. Groundwater and vapor monitoring are therefore not required.

The focus of this PCMP is therefore monitoring and maintenance of cover integrity, surface water run-on and run-off controls, survey benchmarks, access roads; and recordkeeping and reporting.

3.0 POST-CLOSURE MONITORING AND MAINTENANCE

Post-closure monitoring for cover integrity will include inspections of the cover, and maintenance and repair of deficiencies. No frequency is specified in the requirements; however annual inspections are specified in this plan. An inspection report will be completed for each inspection. The inspection report will contain at a minimum:

- Name of inspector and inspection date and time
- Weather information at the time of the inspection
- Condition of the cover system, storm water control features, survey benchmarks and access roads
- Settlement plate monitoring results for the preceding period
- Incidents of noncompliance with the Final National Pollutant Discharge Elimination System General Permit for Storm Water Discharges From Construction Activities, (FR 2003) or the Storm Water Pollution Prevention Plan for LASO TA-73 Airport Landfill (SWPPP) (North Wind 2004f); noncompliances, if any, will be identified during the inspections mandated by the SWPPP
- Location(s) of discharges of sediment or other pollutants from the site
- Corrective actions required
- Signature of inspector

Inspection records and documentation of corrective actions will be retained in the project file and provided with the annual report. Inspection and maintenance tasks are described below.

3.1 Cover System

Annual cover inspection will include site walkovers looking for and documenting the conditions described below. Specific deficiencies will be corrected as described below.

Erosional damage and cracks

Rill erosion and/or cracking result in loss of topsoil from the cover and potential damage to the underlying low-permeability soil layer. The inspector will look for run-off rills on the cover and side slopes. Cracks and/or rills deeper than about four in. will be filled and compacted using topsoil and equipment appropriate to the scale of the erosional features and as per construction Specification 02200, Earthwork (North Wind 2004b). Excessive compaction shall not be used unless repair of the underlying low-permeability soil layer is required.

Animal burrows

Animal burrows can breach the cover, allowing exposure of waste; and can allow preferential flow pathways through the cover to develop, resulting in increased infiltration. All animal burrows greater than about four in. in depth shall be filled and compacted using topsoil and equipment appropriate to the scale of the erosional features and as per construction Specification 02200, Earthwork (North Wind 2004b) Excessive compaction will not be used unless repair of the underlying low-permeability soil layer is required.

Subsidences

Subsidence of underlying waste can result in depressions in the surface cover, allowing for ponding and increased infiltration of water. All subsidences greater than about one ft in depth relative to the surrounding grade shall be filled and compacted as per construction Specification 02200, Earthwork, (North Wind 2004b) using topsoil and equipment appropriate to the scale of the subsidence feature. Excessive compaction will not be used unless repair of the underlying low-permeability soil layer is required.

Condition of vegetation

The condition of surficial vegetation shall be noted. Areas greater than about 10,000 square ft lacking vegetation shall be reseeded, fertilized and/or watered as needed to reestablish vegetation, as per construction Specification 02932, Seeding, Mulching and Restoration (North Wind 2004b).

3.2 Storm Water Control System

Annual storm water control system inspections will include all areas of the site, as described in the SWPPP (North Wind 2004f). Inspectors will look for evidence of, or the potential for, pollutants entering the storm water conveyance system. Discharge locations identified in the site plans will be inspected to determine whether erosion controls are effective in preventing significant impact to Pueblo Canyon.

Qualified personnel knowledgeable in the principles and practice of erosion and sediment controls will perform inspections and maintenance for the following:

- Condition of sediment basins - inspect for fill height of sediments, presence of vegetation or debris, condition of berms and outlets, etc. The basins and outlets will be maintained by removing excess sediment and/or debris as needed to maintain proper function. Berms will be repaired as needed to maintain storage capacity of the basin.

- Condition of outlet chutes, perimeter drains/berms, terrace drains, culverts and drop inlets - inspect for presence of sediments, breaches in berms, presence of vegetation or debris, etc. Sediments, vegetation or debris retarding storm water runoff will be removed as needed. Breaches in berms or chutes will be repaired using the appropriate materials.

Inspection records and documentation of corrective actions will be retained in the project file and provided with the annual report.

3.3 Survey Benchmarks

Annual inspections will include locating and documenting the condition of permanent survey benchmarks annually. Benchmarks will be maintained in a clearly visible condition.

3.4 Settlement Plates

Settlement plates will be used to monitor and assess long-term settlement of the landfill cover surface, and of any horizontal movement of the east slope. Details of the settlement plate construction are shown on Design Drawing 2018. Ten plates shall be installed at the locations shown on the drawing.

The monitoring schedule for the settlement plates during the post-closure period shall be as follows:

- Monthly for six months with data collected at regular intervals, e.g. once every 4 weeks.
- At the end of six months, the need for any additional measurements and their frequency will be determined by the Engineer based on the amount of movement recorded.

The inspector shall look for and document the following in the field logbook:

- The elevation of each settlement plate will be determined and recorded. Readings will be plotted against time starting with the first reading.
- The slope between adjacent settlement plate locations will be calculated and compared to the slope between those points immediately after construction. It is important to evaluate the slope of the cap between meaningful locations, i.e., the slope should be evaluated more-or-less perpendicular to the grade lines.
- The horizontal location of SP-1, located at the top of Bench 1 on the east slope, will also be recorded to monitor potential horizontal movement of the slope. The amount of movement should be minimal. The Engineer shall assess the implications of the recorded movements.

3.5 Access Roads

Annual access road inspections will include looking for and documenting subsidence, caving, cracking, severe ruts or other conditions that would limit or prevent use of the road for access by vehicles or equipment required to maintain and monitor the landfill.

4.0 RECORD-KEEPING AND REPORTING

A project file containing records of all inspections and maintenance performed will be maintained by North Wind. An annual report with the inspection and maintenance records for the preceding year will be prepared and provided to the Secretary within 45 days from the end of each calendar year. All project records will be submitted to DOE upon completion of the landfill cover construction.

5.0 SCHEDULE

Inspections for years 1 through 5 of the post-closure period are tentatively scheduled for the first two weeks of June each year, so that the condition of vegetation can be inspected and corrected as needed early in the growing season. All other deficiencies should be corrected at the earliest opportunity and before the end of the calendar year, in order to be completed during the reporting period.

Settlement plates shall be monitored monthly for 6 months after the start of the post-closure period, with data collected at regular intervals, e.g. once every 4 weeks. At the end of 6 months, the need for any additional measurements and their frequency will be determined by the Engineer based on the amount of movement recorded.

6.0 REFERENCES

The following list includes all of the documents cited in this PCMP. The parenthetical information following each reference provides the author, publication date, and LANL Environmental Restoration identification number (as applicable). This information is also included in the text citations and can be used to locate documents on this list.

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North Wind, Inc. (North Wind), April 2004. "Phase II Work Plan for Los Alamos Site Office TA-73 Airport Landfill," Revision 0, North Wind, Inc. document NW-ID-2004-031, Idaho Falls, Idaho. (North Wind 2004e)

North Wind, Inc. (North Wind), April 2004. "Storm Water Pollution Prevention Plan for Los Alamos Site Office TA-73 Airport Landfill," Revision 1, North Wind, Inc. document NW-ID-2004-005, Idaho Falls, Idaho. (North Wind 2004f)

Appendix A
Acronyms

Acronyms

CFR	*Code of Federal Regulations*
cm/sec	Centimeters per second
DOE	U.S. Department of Energy
ft	Foot (feet)
in.	Inch(es)
Ksat	Saturated hydraulic conductivity
LANL	Los Alamos National Laboratory
LASO	Los Alamos Site Office
NMAC	*New Mexico Administrative Code*
NMED	New Mexico Environment Department
PCMP	Post-closure Care and Monitoring Plan
RCRA	*Resource Conservation and Recovery Act*
SWPPP	Storm Water Pollution Prevention Plan
TA	Technical Area