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Date: February 28, 1996
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SUBJECT: RESUBMITTAL OF REMEDIAL ACTION FOR SOLID WASTE MANAGEMENT UNIT (SWMU) 1-001(d), HILLSIDE 138

To Distribution:

Enclosed please find a good copy of the final report for the remedial action for SWMU 1-001(d), Hillside 138, reference EM/ER:96-053, dated February 9, 1996. I apologize that the enclosure that was previously submitted was missing every other page.

Sincerely,

Gloria M. Norris

Gloria M. Norris

GMN/am

Enclosure: Remedial Action Plan

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Remedial Action Plan for

Solid Waste Management Unit
1-001(d)
Hillside

Field Unit 1

Environmental Restoration Project

February 1996

A Department of Energy
Environmental Cleanup Program

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1.0 INTRODUCTION

This remedial action plan addresses Potential Release Site (PRS) 1-001(d) within Aggregate F, also referred to as Hillside 138. It is located in former Technical Area (TA)-1, along the northern perimeter of Los Alamos National Laboratory (hereafter referred to as the Laboratory), in Los Alamos, New Mexico. PRS 1-001(d) consists of the location of former Septic Tank 138 and the associated hillside and outfall into Los Alamos Canyon and is included in the Laboratory's Hazardous and Solid Waste Amendments (HSWA) permit.

Results of sampling efforts indicate that soils located on Hillside 138 contain elevated levels of collocated mercury, lead, plutonium, and cesium. Subsequent human health screening and risk assessments indicate that there are no unacceptable risks associated with exposure to human health at this site. As a result, this PRS is currently proposed for no further action (NFA) under the Resource Conservation and Recovery Act (RCRA). However, the remedial actions proposed in this plan address New Mexico Water Quality Bureau concerns. These concerns are based on the fact that residual contaminants are present in sediments adjacent to a storm water drainage that flows into Los Alamos Canyon such that storm water flowing from the site may cause water quality violations. The remedial action at this site will focus on implementing storm water and pollution controls, removing soils with elevated concentrations of contamination, and monitoring storm water downgradient of the site.

1.1 Site Type and Description

PRS 1-001(d), the hillside component of Aggregate F, is located southeast of the Los Alamos Inn along the north rim of Los Alamos Canyon. Past discharges from the Septic Tank 138 outfall flowed over the canyon rim and down Hillside 138. Hillside 138 (immediately below the canyon rim) consists of the upper outfall and bench area, a steep cliff, the lower outfall and bench area, a second cliff, and a gradual slope to the bottom of the canyon (Fig. 1-1). Storm water runoff (sheet flow) from the site flows southeasterly across an abandoned Laboratory patrol road and joins a storm water drainage channel originating from a mesa top parking lot. The future land use will be very limited at this site due to the nature of the steep cliffs and narrow benches associated with Los Alamos Canyon; the area may potentially be used for recreational hiking.

The mesa consists of Bandelier Tuff (composed of ash, ash-fall pumice, and rhyolitic tuff) and is exposed on the upper outfall and bench area and on the canyon wall. Soil/sediment exists on the upper outfall and bench area in 0 to 6-in. deep "pockets"; the soil/tuff interface ranges from 0 to 36 in. on the lower outfall and bench area. Depth to the main aquifer is approximately 1,000 feet below the mesa top.

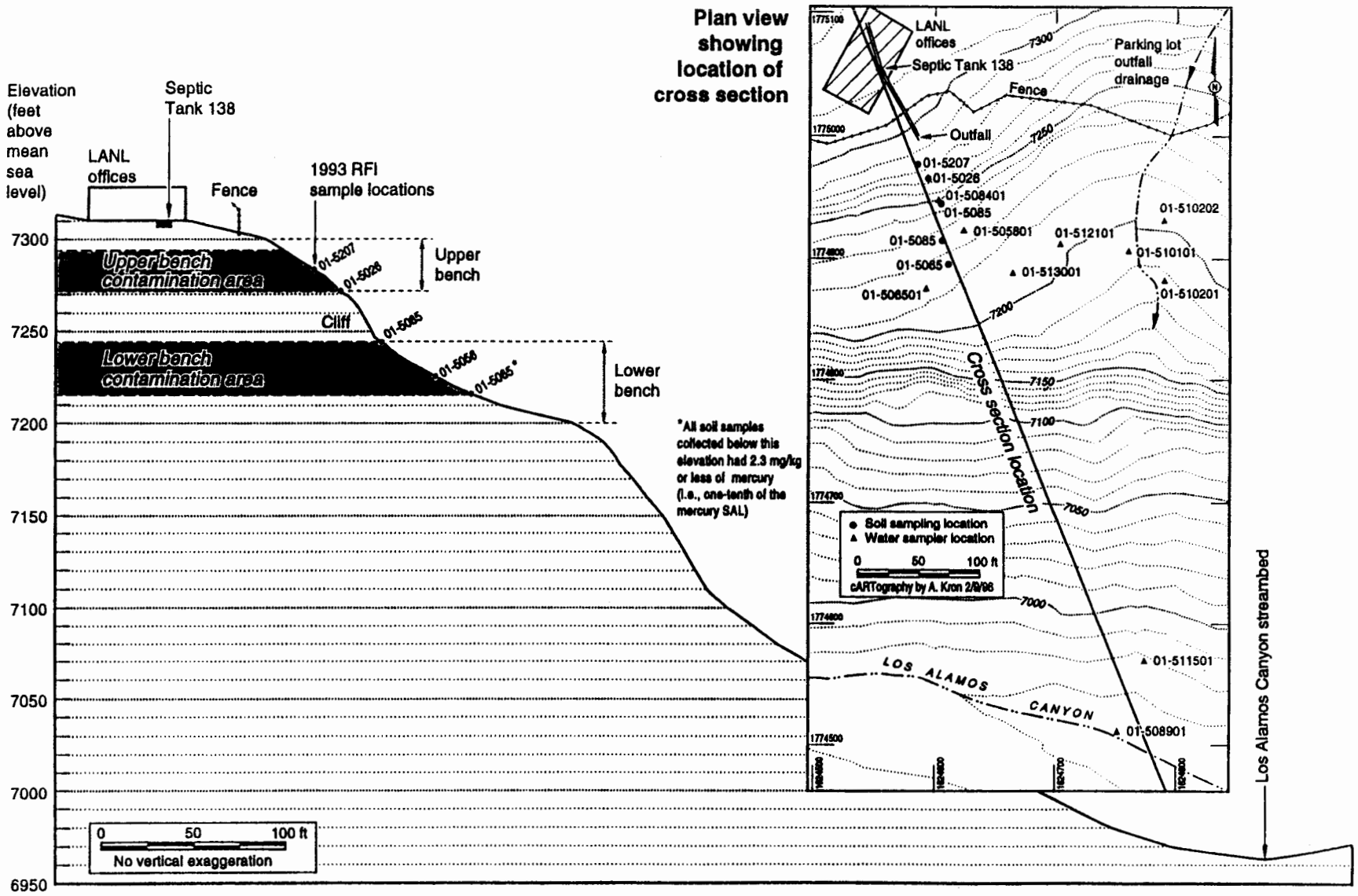

Fig. 1-1. Cross section of Hillside 138.

1.1.1 Operational History

Septic Tank 138 served buildings K, Y, and V within former TA-1. The associated outfall was located southeast of Building Y and discharged over the rim of Los Alamos Canyon onto Hillside 138. Building K was used as a chemical stockroom and contained a still for repurifying mercury. Building Y contained a cryogenics and physics laboratory that handled tritium, deuterium, uranium-238, and polonium-210. Building V housed the original uranium and beryllium machine shop at TA-1. Buildings K, Y, and V were decommissioned in April 1954, June 1956, and February 1959, respectively. Septic Tank 138 was removed in October 1975.

1.1.2 COPCs and Rationale for Proposed Cleanup

This remedial action plan was developed to address the concern that mercury at this site has the potential to be transported downslope to the Los Alamos Canyon watercourse. This concern is based on August 1995 storm water samples collected by the Agreement in Principle (AIP) section of the New Mexico Environment Department (NMED) during an unusually severe "2-in. per hour" storm event. These storm water samples contained low levels of mercury. Additionally, one of the storm water samples collected in a separate June 1995 storm event, and split with AIP staff, contained a slightly elevated level of lead. Therefore, in accordance with "good management practices," excavation of contaminated soils at Hillside 138 will be conducted to minimize the potential for contaminants to enter the main watercourse in Los Alamos Canyon. This plan also includes elements of storm water controls and monitoring to minimize the potential for mobilization and transport of contamination in the drainage, not to exceed levels identified in the State of New Mexico Standards for Interstate and Intrastate Streams for wildlife.

2.0 SITE CHARACTERIZATION

2.1 Soil Sampling

The objective of the 1992 and 1993 RCRA facility investigation (RFI) at Hillside 138 was to determine the presence or absence of radiological and/or hazardous contaminants. The ultimate goal was to determine whether this site posed a risk to human health or the environment. The RFI Report (Annex 7.1) provides a detailed description of the 1992 and 1993 sampling activities, associated data, and results of the human health screening and risk assessments and the ecotoxicological screening assessment; a brief summary of this information is outlined below. Annex 7.1 does not include Annex C, the RESRAD and risk calculations, the results of which are contained in section 4.2 of the RFI report.

In 1992, surface and subsurface soil samples were collected from the upper and lower outfall areas, the defined bench area, and the drainages associated with Hillside 138. Samples submitted to a fixed laboratory were analyzed for radiological constituents (isotopic uranium, isotopic plutonium, and gamma spectrometry), metals, and semivolatile organic compounds (SVOCs). Additional surface and subsurface soil samples were collected in 1993 to further characterize the lateral and vertical extent of identified contamination on Hillside 138. Samples submitted to a fixed laboratory were analyzed for radiological constituents (isotopic plutonium and cesium-137) and a subset of metals (antimony, mercury, lead, and chromium). RFI soil sampling locations are shown on Fig. 2-1.

Assessment of the extensive amount of soil sampling data collected on Hillside 138 identified the following chemicals of potential concern (COPCs): mercury, lead, plutonium-238, plutonium-239/240, and cesium-137. The results of the human health screening and risk assessments indicate that the two areas of comparatively high concentrations of mercury, plutonium, lead, cesium-137, plutonium-238, and plutonium 239/240 do not pose an unacceptable risk to human health. The results suggest that potential exposure to COPCs in soil should not result in adverse noncarcinogenic health effects or an unacceptable radiation dose to recreational users. Results from the RFI are described in detailed in the RFI Report (Annex 7.1).

2.2 Storm Water Sampling

In addition to soil sampling, ten single-stage water samplers were installed along Hillside 138 as part of the 1993 RFI. Two water samplers were installed in the lower outfall area for Septic Tank 138, three water samplers were installed in the lower bench area for Hillside 138, and the remaining five water samplers were installed in the primary drainage pathway for Hillside 138. The NMED has also conducted storm water sampling at the bottom of Hillside 138 during June and August 1995. RFI single-stage sampler and approximate NMED AIP sampling locations are shown on Fig. 2-2. Storm water sampling results are summarized in Table 2-1.

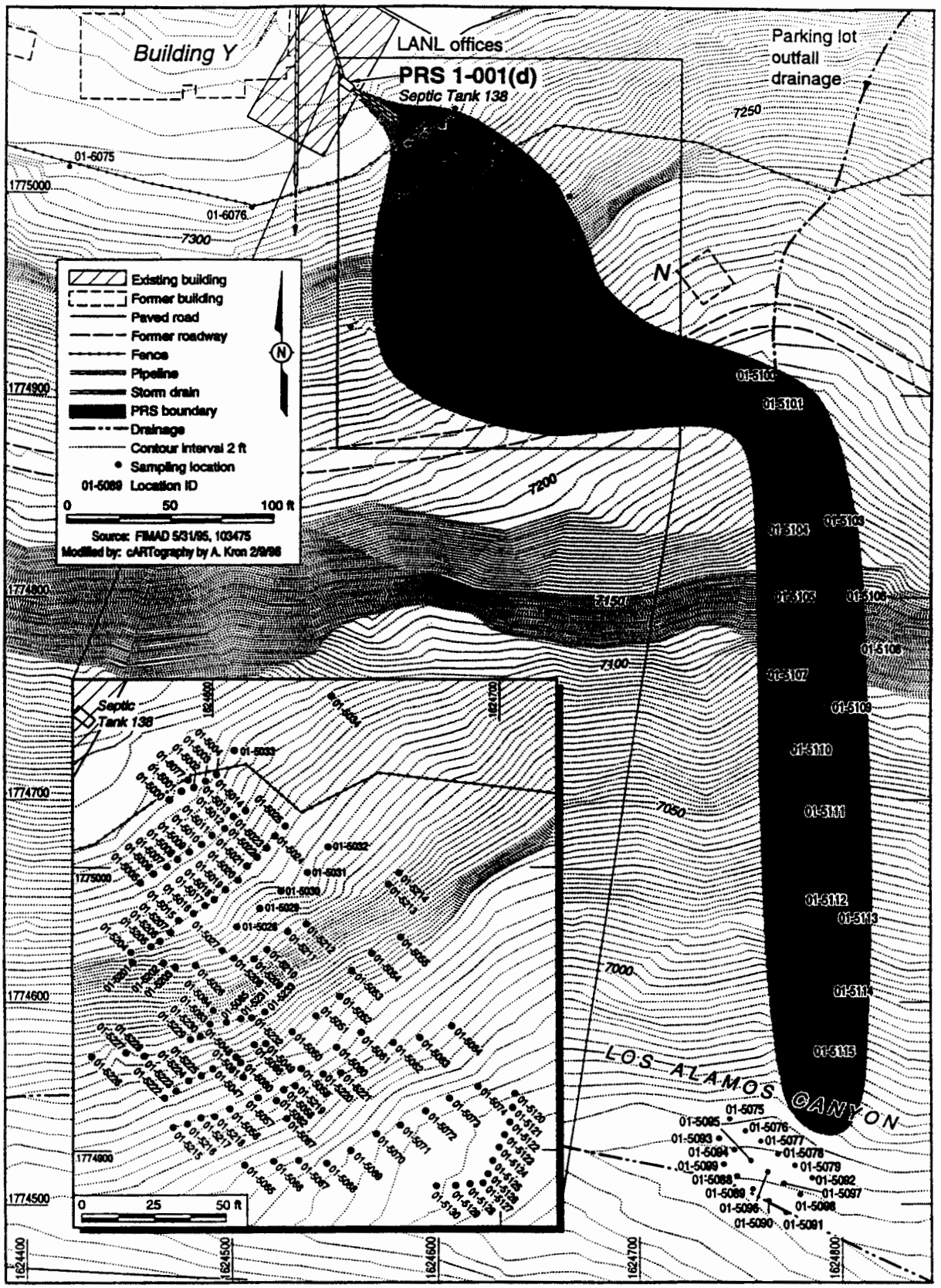

Fig. 2-1. Hillside 138 soil sampling locations.

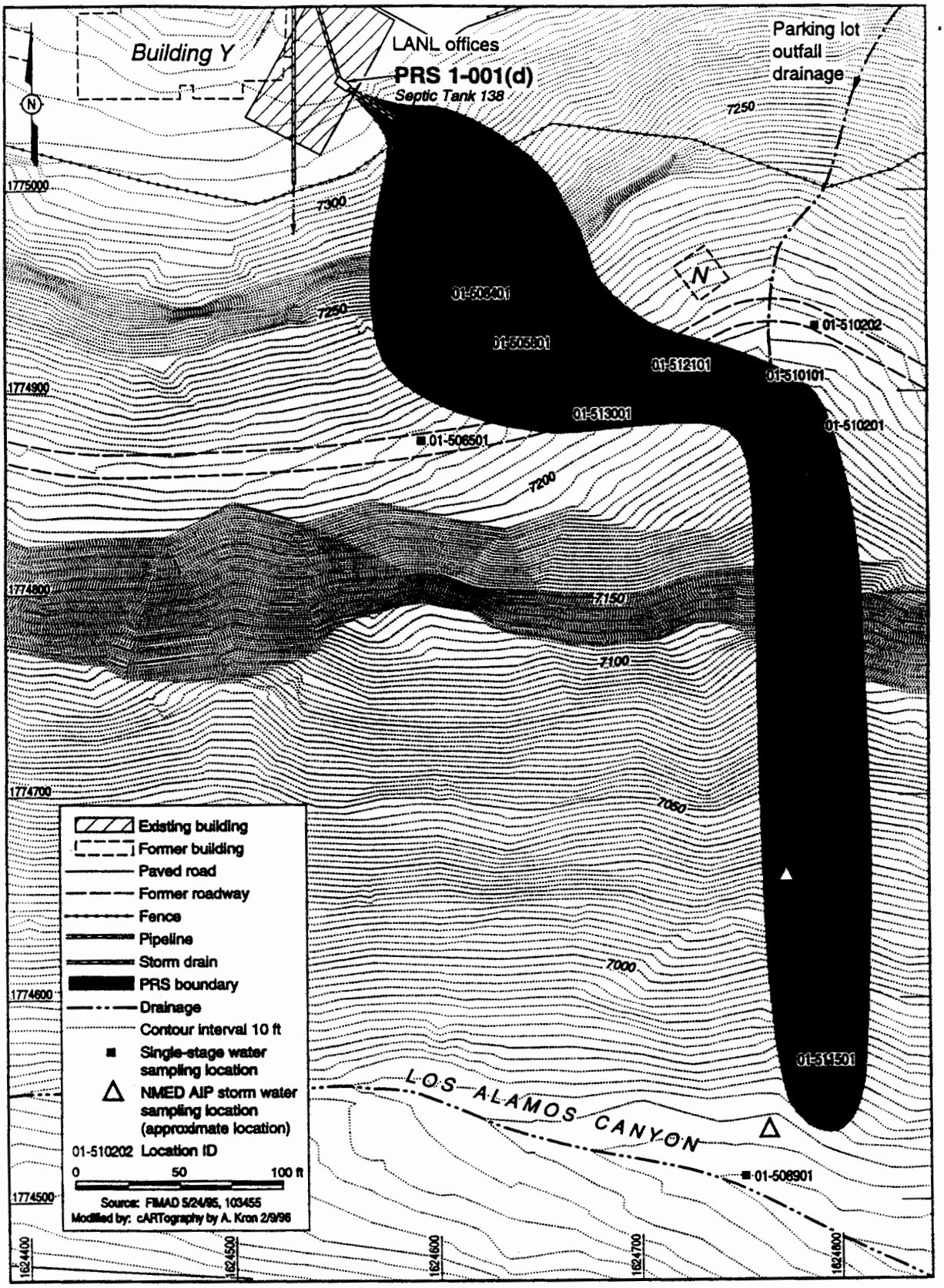

Fig. 2-2. Hillside 138 single-stage storm water and NMED AIP sampling locations.

TABLE 2-1

STORM WATER SAMPLING RESULTS

LOCATION	MERCURY (µg/L)	LEAD (mg/L)	DATE/AREA
01-508401	NS[a]	NS	-/lower outfall
01-505801	21.5	0.430	8-4-93/lower outfall
01-506501	0.3	0.033	8-30-93/bench
01-513001	2.3	0.022	8-4-93/bench
01-512101	0.6	0.018	8-4-93/bench
01-510101	2.5	0.051	8-9-93/bench
01-510201	<0.2[b]	0.032	8-4-93/drainage
01-510202	<0.2	0.045	8-4-93/drainage
01-511501	<0.2	0.020	8-4-93/drainage
01-508901	<0.2	0.057	8-4-93/drainage
1-1049-41-1-ES/ 95-06-235-01a	<0.2 composite 1,3,5	<0.003	6-26-95/AIP-drainage
1-1049-41-1-ES/ 95-06-235-04	<0.2 grab	<0.003	6-26-95/AIP-drainage
65 0113051	0.53	0.0097	8-29-95/AIP-drainage uphill
65 0113043	0.48	<0.005	8-29-95/AIP-drainage

[a] NS = Not sampled (sample not collected).
[b] A "<" symbol indicates that this analyte was not detected; the value shown is the detection limit.

The storm water samples collected in August 1993 were compared to the SAL for mercury in water (2 µg/L) in the Aggregate F RFI Report. The samples exceeding the SAL were in the contaminated areas on the bench (01-505801 and 01-513001), and at the top of the drainage which could receive runoff from the contaminated bench areas (01-510101). Samples below the SAL and above the detection threshold were on the bench (01-506501 and 01-512101). Lead exceeded the SAL at the same locations where mercury exceeded the SAL. All of the samples in the defined drainage channel were below the detection limit (0.2 µg/L). The interpretation of these 1993 data were that mercury and lead were not impacting the Los Alamos Canyon stream, but there remains a possibility that mercury (and lead) below the detection limit are entering the canyon stream. The same interpretation could be applied to the June 1995 AIP storm water data. The August 1995 storm was especially severe (about 2 in. of rain in an hour), and the very turbid water was an indication of mobilized sediments. (The sample collection was a bit risky due to the lightning activity in the vicinity, so the monitoring program in this plan uses automated samplers, rather than having personnel in the field collecting grab samples.)

It is important to note that storm water samples analyzed in 1993 as part of the RFI, were collected from single-stage samplers located directly in the lower contaminated bench area and directly below this area. Due to the nature of single-stage samplers, a large fraction of these water samples consisted of sediment. Therefore, mercury results reported in Table 2-1 are more indicative of contaminant levels in soils adjacent to the drainage and not in storm water flowing down Hillside 138.

2.3. Nature and Extent of Contamination

Statistical analyses delineated two topographically distinct areas of comparatively high concentrations of COPCs (Fig. 1-1 and Fig. 2-3). Appendix B of the RFI Report (Annex 7.1) contains details of how the areas were defined from the detected concentrations. The statistical analyses also revealed that there is a very high correlation among the COPCs, indicating substantial collocation of COPCs at the site. These correlation analyses for COPCs are found in Annex 7.2.

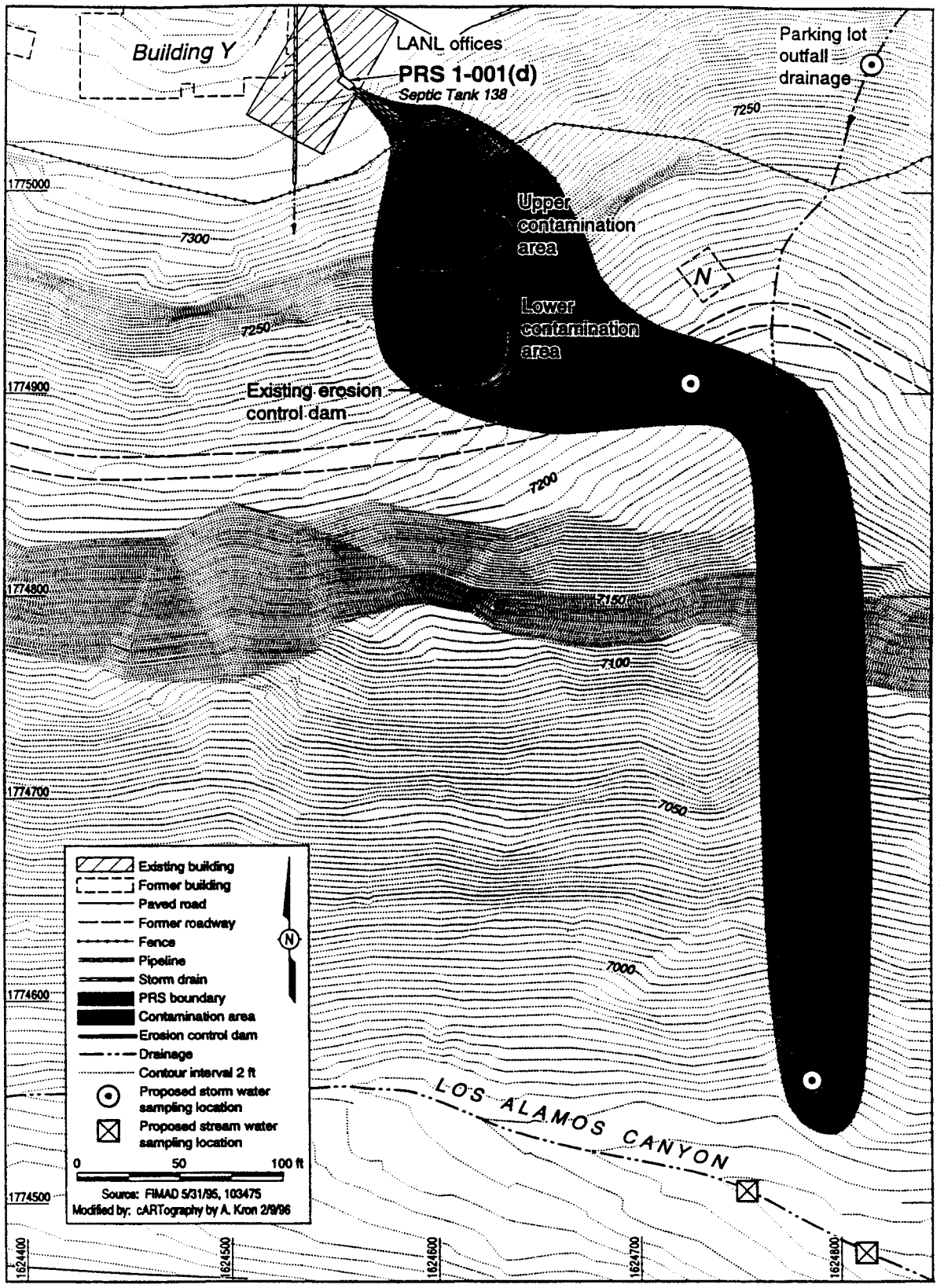

Fig. 2-3. Locations of contamination areas, erosion controls, and proposed monitoring.

Using the statistical data presented in Annex 7.3, in which cleanup levels are presented for reducing the mean concentrations by an order of magnitude, the approximate weight of mercury that would be removed has been estimated. The amount of soil that would be removed from the upper area is approximately 30 cubic ft, containing about 275 g of mercury. The amount of soil that would be removed from the lower area is approximately 65 cubic ft, containing about 200 g of mercury. These numbers are rough approximations that were obtained by assuming that two-thirds of the areas are exposed rock, and that the depth of material to be removed is 3-in. in the upper area, and 4-in. in the lower area. The upper and lower remediation areas were estimated at 360 and 570 square ft., respectively. If both areas are remediated the total waste volume is estimated at 3.5 cubic yds. However, this proposal is for remediating only the lower area, for the reasons given below.

3.0 PROPOSED REMEDY

Remedial action at Hillside 138 will consist of developing and implementing a Storm Water and Pollution Prevention Plan (SSWP), removing contaminated soil, and monitoring storm water runoff from the site. Initial pollution prevention controls were implemented in January 1996 via the installation of straw bales (erosion control dams) downgradient of the area of contamination on the lower outfall area (Fig. 2-3).

Soil containing mercury will be removed from the identified area of contamination on the lower outfall area, as guided by a Field Instrument for Detection of Low-Energy Radiation (FIDLER). As previously outlined, statistical analyses indicated high correlation among the COPCs at the site, supporting the hypothesis of COPC collocation. Statistical analyses were also used to compare FIDLER screening results with fixed laboratory results to determine whether correlation exists so that field screening can be used to direct cleanup activities (Annex 7.2). High correlation exists between:

1. the FIDLER data and the plutonium-239/240 data, and is sufficiently high that the FIDLER can be used to predict locations of high plutonium-239/240 activities at this site;

2. plutonium-239/240 data and mercury data, and is sufficiently high that the FIDLER can, through the intermediary plutonium-239/240, be used to control the cleanup of mercury on the lower bench area;

3. lead and mercury data, and is sufficiently high that cleanup of mercury contaminated soils will also capture any lead that may be present.

The plutonium-239/240 data are extremely highly correlated with the FIDLER data (a correlation coefficient of 0.92 and an observed significance level that is extremely small). This indicates that the FIDLER may reasonably be used to direct cleanup of plutonium-239/240. The correlation between plutonium-239/240 and mercury is approximately 0.83, with an observed significance level that is extremely small. Two linear regression models from these correlations can be combined to yield a relationship between mercury and FIDLER data. Additionally, the correlation between mercury and lead is 0.91, confirming the collocation of these CPOCs. Therefore, a FIDLER can be used to provide real-time information regarding mercury and lead levels or areas where mercury and lead may be present. Confirmatory samples will be collected and submitted for off-site laboratory analysis to verify the correlation, which will used to assure that the cleanup level is achieved.

This proposal does not include remediating the upper contaminated bench area for two reasons. In order to work safely on the upper area, the workers would have to be in harnesses, and the LANL safety representative has recommended that the scrub oak and other vegetation that would interfere with the safety lines be removed. Because vegetation on the upper bench stabilizes sediments, removing the vegetation would increase the rate at which contamination remaining after remediation would migrate to the lower contaminated bench area. The other reason is that there is very little material that could be removed effectively by digging because there is only a shallow layer of dirt on the tuff outcrop, and some contamination is expected to be out of reach in the rock joints and crevasses. This contaminated bench area is not likely to release the mercury to the drainage for decades if it is not disturbed. There is no run-on of storm water, and the mercury that is transported would have a long residence time in the lower contaminated bench area. Tables 4, 5, and 6 in Annex 7.2 show that soil samples from the areas below the lower contaminated bench have levels of mercury between two and three orders of magnitude lower than levels observed in the two contaminated bench areas above; hence the rate of transport is extremely low.

3.1 Description of Proposed Remedial Action

The area of contamination on the lower bench will be delineated using the 1992-1993 field and fixed laboratory data and a new radiological survey using a FIDLER. The approach will be as follows:

- re-survey the 1992-1993 sample locations that had elevated levels of mercury and plutonium;

- conduct a real-time radiological survey using a FIDLER at each of the former sample locations that meet the above criteria;
- based on the statistical correlation established between this FIDLER screening and fixed laboratory results for plutonium and fixed laboratory results for mercury, those locations which correspond to FIDLER readings ≥ the site-specific cleanup level for mercury will be considered part of the remediation unit; and
- all soil with elevated concentrations of collocated mercury/plutonium above the site-specific cleanup level will be removed within the remediation unit boundary.

Upon completion of the FIDLER survey, a statistical analysis will be performed to determine the correlation between laboratory and screening data to identify a cleanup screening level for the FIDLER at this site.

Real-time radiological monitoring will determine if the soils are above or below the pre-determined cleanup level and allow for screening activities and removal activities to occur simultaneously. All of the contaminated soils and debris at Hillside 138 lie on a steep hillside and associated benches which restrict the use of conventional excavation equipment and processes. The removal of contaminated soils on the lower bench will be accomplished by using hand trowels and shovels. Dust will be suppressed during excavation activities using a fine mist sprayer as appropriate. Soil will be placed into reinforced bags that will be hoisted to the canyon rim using a static track line, containment diaper, pulley, and two control lines managed from the upper and lower bench areas. The bagged soil will then be transported via bucket or backpack to the waste staging area where it will be placed into suitable containers for transport to TA-54 for disposal. Soil removal will continue until the real-time radiological cleanup level is achieved.

To verify the correlation between the location of mercury and plutonium-239/240, a minimum of three confirmatory samples will be collected and submitted for off-site laboratory analysis for mercury in accordance with EPA SW 846 methodology.

3.2 Basis for Cleanup Levels

The proposed cleanup level for mercury that achieves an order of magnitude reduction of mercury levels on the lower bench is 39 mg/kg; cleanup level calculations are presented in Annex 7.3.

3.3 Site Restoration and Erosion/Storm Water Controls

When field-screening and confirmation sample results indicate that the lower bench has been remediated in accordance with this plan, the excavated area will be returned to the original grade. Short-term erosion control measures, such as erosion control dams, will be used to prevent transport of sediment to the drainage pathway leading to Los Alamos Canyon during the remediation phase. Final stabilization measures will be identified in the SWPP Plan. The SWPP Plan will be submitted to NMED AIP staff for review and will be implemented prior to any field activities.

3.4 Monitoring

To monitor the effectiveness of this plan implementation, five automated storm water samplers will be installed directly below the parking lot, downgradient of the remediated area on the lower bench, within the drainage, and at the bottom of Hillside 138 (Fig. 2-3). Storm water and stream water samples will be collected over a period of one year or for five storm events as detected by the samplers. The samples will be analyzed for mercury and lead in accordance with EPA SW 846 methodology specified for water samples in 40 CFR 136. Inspection activities and frequency for storm water and erosion control measures will be outlined in the SWPP Plan. If the samples indicate that the remediation has not been effective within one year, further monitoring and/or other control activities will be implemented, and in the SWPP Plan amended.

4.0 WASTE MANAGEMENT

4.1 Estimated Types and Volumes

The analytical results from the 1992 and 1993 soil samples show that elevated levels of collocated mercury, lead, cesium-137, plutonium-238, and plutonium-239/240 exist at the site. Toxicity Characteristic Leaching Procedure (TCLP) analyses were conducted on samples with the highest mercury and lead concentrations; results indicate that the soil excavated from the site will not constitute a characteristic toxic waste regulated by RCRA. The excavated soil will be classified as Low Level Waste (LLW) because of the elevated radioactivity.

The majority of waste materials generated during implementation of this plan will be in the form of mercury- and plutonium-contaminated soils. Other waste materials will include personal protective equipment (PPE) and dry decontamination wipes. No liquid decontamination waste will be generated. The nature and volumes of wastes expected to be generated by proposed remedial action are summarized in Table 4-1.

TABLE 4-1

ANTICIPATED WASTE VOLUMES

ITEM	TYPE	ANTICIPATED VOLUME
PPE/decontamination wipes	Solid - potential LLW	1/3 cubic yard (one 55-gallon drum)
Contaminated soils	Solid - LLW	2.5 cubic yards (one B25 box)

4.2 Method of Management and Disposal

Contaminated soils, PPE, and decontamination wipes will be stored in a waste management staging area during soil removal activities. At the completion of removal activities, these wastes will be transported to the appropriate LANL facility for final disposal. The likely Laboratory disposal facility is Area G ,TA-54.

5.0 DESCRIPTION OF CONFIRMATION/VERIFICATION SAMPLING

Upon completion of removal of the contaminated soils, a radiological field screening survey of the remediation unit will be performed using the FIDLER to verify contamination levels are below the cleanup level. Any remaining areas of elevated radioactivity within the remediation unit will be flagged, and additional soil removal activities will be performed until readings fall below the cleanup level described in Section 3. Although the correlation between analytical results for mercury (and lead) and plutonium and screening results from the FIDLER are high, three to five confirmation samples will be collected and submitted for fixed laboratory analysis of mercury and lead to verify the correlation and the cleanup.

6.0 ESTIMATED TIME TO COMPLETE ACTION AND UNCERTAINTIES

Remedial action consisting of soil removal activities is estimated to require five working days to complete. Automated storm water samplers will require three to four weeks to install. Maintenance of erosion control and monitoring devices will be discussed in the SWPP Plan.

Several factors are present which may effect the time period for being able to propose the site for NFA. These include the release of mercury from the contaminated bench areas to the drainage area and the potential that soil excavation may temporarily mobilize the residual mercury. It is anticipated that the latter will be managed by site restoration and erosion control dams. The mercury that is resident in the drainage channel will flush out over time and the monitoring program will be used to determine if there will be a need for storm water control at the bottom of the drainage.

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7.0 ANNEXES

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7.1 RFI Report for Solid Waste Management Units TA-1, Aggregate F

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7.2 Correlation Analyses for Plutonium, Mercury, and Field Screening Data for Hillside 138

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7.3 Calculation of Mercury Cleanup Levels for Hillside 138

8.0 STORM WATER POLLUTION PREVENTION PLAN

The Stormwater Pollution Prevention Plan will be submitted at a later time for compliance with surface water regulations.

February 9

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