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CHARACTERIZATION SUMMARY OF THE AREA 1 PHASE II TRAP RANGE

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO



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LIST OF ACRONYMS AND ABBREVIATIONS

A1PII	Area 1 Phase II
ASCOC	Area-Specific Contaminant of Concern
BTV	benchmark toxicity value
FEMP	Fernald Environmental Management Project
FRL	final remediation level
kg	kilogram
L	liter
mg	milligram
OSDF	On-Site Disposal Facility
OU5	Operable Unit 5
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
STP	Sewage Treatment Plant
TCLP	Toxicity Characteristic Leaching Procedure
WAC	waste acceptance criteria

1.0 INTRODUCTION

This Characterization Summary describes, and defines the extent of, lead contamination in soil at the Fernald Environmental Management Project (FEMP) Trap Range. The Trap Range lies in the southeast quadrant of the Fernald Environmental Management Project (FEMP), southeast of the Sewage Treatment Plant (STP) Access Road in the area designated as Area 1, Phase II (A1PII). FEMP employees used the range for recreational purposes from the mid-1950s until 1988, resulting in surface deposition of the lead shot and clay fragments.

Two major investigations were performed in the Trap Range to determine the nature and extent of contamination, as well as to obtain information to define the stabilization and excavation limits. The first investigation was conducted under the Operable Unit 5 (OU5) Remedial Investigation/Feasibility Study (RI/FS), and the second was the Pre-Design Investigation for Lead Delineation in the A1PII Trap Range (DOE 1997). A third round of sampling and analysis was also performed for certification of soils adjacent to the Trap Range.

Based on the RI/FS (Section 2), the Trap Range was identified as an area with lead-contaminated soil above a final remediation level (FRL) of 400 mg/kg, and the Benchmark Toxicity Value (BTV) was defined as 200 mg/kg. The Trap Range soil was also identified as the only A1PII material with the potential to be characteristically hazardous waste under the Resource Conservation and Recovery Act (RCRA); RCRA characteristic waste is prohibited from placement in the On Site Disposal Facility (OSDF). Additional sampling and analysis was determined to be necessary to define the limits of the lead contaminated soil and to determine the characteristics of the material. The pre-design investigation (Section 3.0) at the Trap Range obtained data that defined the 400 mg/kg limit. Pre-design sampling and analysis indicated that some lead contaminated soil in the Trap Range was RCRA characteristic. Certification sampling and analysis (Section 4) confirmed the horizontal limit of lead contaminated soil.

The concentrations of arsenic, an alloying agent commonly used to control hardness in lead, also exceeded the 12 mg/kg FRL in some locations. All of the above-FRL arsenic contamination is bounded by the above-FRL lead contamination.

The data in this report were used to prepare remediation design documents for the Trap Range. The remediation design includes stabilizing the characteristically hazardous soil in the Trap Range (to render it non-hazardous) and excavating soil with lead concentrations above the BTV of 200 mg/kg; this soil will be dispositioned in the OSDF. As described in the design documents, the Trap Range Stabilization Contractor will use the data summarized in this report and the results of a Treatability Study to finalize a stabilization mixture and approach.

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2.0 OU5 RI/FS INVESTIGATION

As part of the OU5 RI (DOE 1995), a 1993 soil study of the Trap Range characterized the general distribution of the lead shot. In the OU5 Record of Decision (ROD), the A1PII Trap Range was one of seven potential RCRA areas designated at the FEMP. The RI/FS data indicated additional study was needed to delineate the extent of contamination in the Trap Range and to determine the characteristics of the material. However, the OU5 RI/FS, the OU5 ROD, and subsequent regulatory documents established the following criteria that directly affect A1PII Trap Range remediation:

- Excavation/Cleanup Level. The FRL for lead in soil was originally set at 400 mg/kg; however, a more conservative BTV level of 200 mg/kg was established as the cleanup standard for the A1PII Trap Range.
- Material Disposition. The On-Site Disposal Facility (OSDF) established Waste Acceptance Criteria (WAC) which prohibited the placement of RCRA characteristic waste. Therefore, RCRA-characteristic soil from the Trap Range must be treated before it can be placed in the OSDF.

The locations and results associated with RI/FS sampling and analysis are presented in Appendix 1, and the location of the samples are shown on Figure 1, with the results shown on Figure 2. A further discussion of these results is in Section 5.0. These results confirmed lead contamination in near-surface soils but failed to define the horizontal and vertical extent, and did not determine if the material was RCRA characteristic. The data did, however, provide the basis for the pre-design investigation.

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3.0 PRE-DESIGN INVESTIGATION

The pre-design investigation had two primary goals:

- To delineate the horizontal and vertical extent of soil with lead concentrations above the BTV level of 200 mg/kg. This analysis would also confirm the RI assumption that subsurface lead contamination is not extensive because lead is relatively immobile in the environment
- To determine if the lead contaminated soil is RCRA characteristic. This would be done by Toxicity Characteristic Leaching Procedure (TCLP) analyses.

Prior to pre-design sampling, the approximate spatial distribution of the lead shot in the Trap Range was established using a scoop and a sieve. Beginning in areas of high lead shot concentration, soil scoops were collected to several inches below the surface, and sieved for lead shot. After moving approximately 30 to 50 feet toward the periphery, this process was repeated. When a scoop revealed little or no lead shot and a second nearby scoop verified this finding, the location was marked with a flag. The flagged locations were surveyed to determine the approximate periphery of the shot distribution. This information was then used to select the sampling locations, which are shown in Figure 3. The basis for the locations were as follows:

- A greater sampling density was selected at the periphery of the contamination to delineate lead concentrations at the 200 mg/kg BTV.
- Several sample locations were selected approximately 100 feet beyond the assumed periphery of the lead shot to ensure that the extent of contamination is bounded for modeling purposes.
- Several sample locations were also selected in the middle of the shot distribution pattern where high lead concentrations were detected during the RI/FS investigation. The purposes of these samples were: 1) investigate the vertical extent of contamination, 2) evaluate the soil anticipated for excavation by TCLP analysis, and 3) to add data for modeling purposes.

Sampling and analysis proceeded in two phases. Phase I consisted of collecting samples at all locations from the 0 - 0.5 foot and 0.5 - 1 foot intervals. The 0 - 0.5 foot sample was analyzed for total lead, and the 0.5 - 1.0 foot sample was archived, except for the locations designated as 2, 3, 20, 21, 27, and



28 on Figure 3. At these locations, the samples from the 0 – 0.5 foot and 0.5 – 1.0 foot intervals were analyzed for total lead and TCLP lead.

Phase II consisted of analyzing Phase I samples where the total lead concentrations exceeded 400 mg/kg for TCLP Lead. Also, at locations where the 0 - 6 inch samples analyzed in Phase I revealed a lead concentration greater than 400 mg/kg, the 6 - 12 inch samples were analyzed for total lead and for TCLP lead.

In March 1998, additional pre-design sampling and analysis was performed in accordance with a variance (Pre-design V). Under this variance, additional samples from 30 locations in the Trap Range were collected to further refine the kriging model which was based on the RI/FS and previous pre-design data. Appendix 1 presents the analytical data for all the RI/FS and Pre-design Investigations, Figure 1 illustrates the sample locations, and Figure 2 presents the analytical results. Section 5.0 provides a summary of the significant findings from this investigation.

4.0 CERTIFICATION SAMPLING

The primary objective of certification sampling is to demonstrate that the area requires no remedial action and that the FRLs for the Area Specific Contaminants of Concern (ASCOCs) have been met. A certification effort was completed in July 1998 for several A1PII areas, as described in the Certification Report for Area 1, Phase II - Sector 1, 2a, and the Conveyance Ditch (DOE 1998). This certification activity included five Certification Units (CUs) adjacent to the Trap Range. These CUs (A1PII-S1-02, A1PII-S1-04, A1PII-S1-06, A1PII-S1-07, A1PII-S1-18, and A1PII-S1-19) are shown in Figure 4. A1PII-S1-19 is the location of run-on and runoff control ditches protecting the Trap Range area. Certification of this area consisted of collecting and analyzing 16 samples (see Figure 4) from each CU for the ASCOCs, which included lead. These CUs all passed certification on the first round of certification; however, review of the data showed elevated lead results for one sample (A1PII-S1-19-10). The corrective action, as agreed upon with the regulatory agencies, is to excavate soil from an area 32 feet in diameter centered on the sampling location to a depth of 6 inches (approximately 15 yd³) and spread the excavated material (to a maximum depth of 2 inches) in the area of the Trap Range that will be stabilized Figure 5 shows the location of this sampling location. The spreading area will be shown on the construction drawings.

5.0 SUMMARY OF RESULTS

5.1 DATA SUMMARY

As a result of the extensive sampling from the above programs, the Trap Range area is well characterized and the contamination limits are defined. Appendix 1 presents all the total lead and TCLP lead data within the Trap Range from the various programs previously discussed including the RI/FS, Pre-design (and Pre-design Variance or Pre-design V), and Certification. Figure 1 shows all the location of the samples as listed in Appendix 1. Figure 2 shows the sample locations, the total lead results (mg/kg), and the starting depth of the sample interval.

The samples with total lead concentrations greater than the BTV limit of 200 mg/kg are listed in Table 1. As shown in Table 1, except for one sample location (28), all samples with lead contamination greater than 200 mg/kg were located in the top 6 inches of soil.

TABLE 1
SAMPLES WITH TOTAL LEAD CONCENTRATIONS GREATER THAN 200 MG/KG

PROGRAM	SAMPLE ID	DEPTH	RESULT
Pre-design	A1P2TRAP-28-2-M-D	0.5 - 1.0	239
Pre-design	A1P2TRAP-28-2-M	0.5 - 1.0	281
Pre-design V.	A1P2TRAP-10S-1-M	0 - 0.5	362
RI/FS	126519	0 - 0.33	693
Pre-design	A1P2TRAP-33-1-M	0 - 0.5	784.9
Pre-design	A1P2TRAP-21-1-M	0 - 0.5	895
Pre-design V.	A1P2TRAP-5S-1-M	0 - 0.5	985
Pre-design	A1P2TRAP-20-1-M	0 - 0.5	1079
RI/FS	30917UTR11J-14	0 - 0.33	1150
Pre-design	A1P2TRAP-21-1-M-D	0 - 0.5	1150
Certification	A1PII-S1-19-10M	0 - 0.5	1152
RI/FS	30917UTR9M-08	0 - 0.33	2020
RI/FS	30917UTR12M-12	0 - 0.33	2160
RI/FS	30917UTR12N-13	0 - 0.33	2180
Pre-design	A1P2TRAP-28-1-M-D	0 - 0.5	2960
Pre-design	A1P2TRAP-28-1-M	0 - 0.5	3730

Twenty seven samples were analyzed for total lead and TCLP lead, as presented in Table 2.

TABLE 2
TOTAL LEAD AND TCLP LEAD PAIRS

Project	Sample Identification	Interval (ft)	Total Lead (mg/kg)	TCLP Lead (mg/L)
Pre-design	A1P2TRAP-28-1-M	0 - 0.5	3730	46.6
Pre-design	A1P2TRAP-28-1-M-D	0 - 0.5	2960	61.5
Pre-design	A1P2TRAP-21-1-M-D	0 - 0.5	1150	5.28
Pre-design	A1P2TRAP-20-1-M	0 - 0.5	1079	26.7
Pre-design	A1P2TRAP-5S-1-M	0 - 0.5	985	20.86
Pre-design	A1P2TRAP-21-1-M	0 - 0.5	895	15.6
Pre-design	A1P2TRAP-33-1-M	0 - 0.5	784.9	6
Pre-design	A1P2TRAP-28-2-M	0.5 - 1.0	281	7.22
Pre-design	A1P2TRAP-28-2-M-D	0.5 - 1.0	237	1.63
Pre-design	A1P2TRAP-21-2-M	0.5 - 1.0	151	0.0312
Pre-design	A1P2TRAP-27-1-M-D	0 - 0.5	112	0.0806
Pre-design	A1P2TRAP-27-1-M	0 - 0.5	96.2	0.107
Pre-design	A1P2TRAP-21-2-M-D	0.5 - 1.0	77.3	0.0312
Pre-design	A1P2TRAP-20-2-M	0.5 - 1.0	53.5	0.0312
Pre-design	A1P2TRAP-33-2-M	0.5 - 1.0	52.8	0.13
Pre-design	A1P2TRAP-3-1-M-D	0 - 0.5	28.1	0.0025
Pre-design	A1P2TRAP-3-1-M	0 - 0.5	27.4	0.0021
Pre-design	A1P2TRAP-2-1-M	0 - 0.5	26.4	0.0022
Pre-design	A1P2TRAP-27-2-M	0.5 - 1.0	25.4	0.0254
Pre-design	A1P2TRAP-27-2-M-D	0.5 - 1.0	22.7	0.0975
Pre-design	A1P2TRAP-3-2-M-D	0.5 - 1.0	22.6	0.0066
Pre-design	A1P2TRAP-2-2-M	0.5 - 1.0	19.8	0.0018
RI/FS	200113	0 - 0.17	19.7	0.0072
RI/FS	200099	0 - 0.17	19.2	0.008
Pre-design	A1P2TRAP-3-2-M	0.5 - 1.0	17.7	0.006
RI/FS	200114	2.0 - 2.5	16.3	0.0046
RI/FS	200100	2.0 - 2.5	16.2	0.7

The sample locations are shown in Figure 6.

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5.2 DATA EVALUATION

Using all the data as presented in Appendix 1, the contamination limits were modeled and are presented in Figure 6, which shows the 200 mg/kg, and 1500 mg/kg contours. In accordance with a regulatory agreement, all soil within the 200 mg/kg contour will be stabilized to a depth of 6 inches. In addition, the areas identified with surface soil contamination above 1500 mg/kg will be stabilized to a depth of 12 inches, and the area on which lead contaminated soil (from certification sample A1PII-S1-19-10) will be stabilized to a depth of 8 inches.

Evaluation of the data set and kriged limits of contamination related to the pre-design investigation goals as stated in Section 3.0 can be summarized as follows:

- *To delineate the horizontal and vertical extent of soil with lead concentrations above the BTV level of 200 mg/kg. This analysis would also confirm the RI assumption that subsurface lead contamination is unlikely because lead is relatively immobile in the environment.*

All samples with lead concentrations above the 200 mg/kg BTV are within the area to be stabilized and excavated as shown in Figure 6. This includes the sampling location (A1PII-S1-19-10) identified during adjacent certification sampling. Also, as presented in Appendix 1, 14 samples were taken at depth (below 6 inches); however, only one location (Location 28) had a lead concentration greater than 200 mg/kg. Duplicate samples, A1P2TRAP-28-2-M and A1P2TRAP-28-2-M-D, were taken from this location, and the total lead results were 281 mg/kg and 239 mg/kg, respectively. The corresponding TCLP lead results were 7.22 mg/l and 1.63 mg/l. Review of the data does not indicate which TCLP result is more accurate. Since these samples lie within the stabilization area, this area will be stabilized to a depth of 1 foot. The one-foot stabilization area is defined by the 1500 mg/kg contour as shown in Figure 6.

- *To determine if the lead contaminated soil is RCRA characteristic. This would be done by TCLP analyses.*

As shown on Table 2, some lead contaminated soil samples from the A1PII Trap Range exceed the RCRA characteristic level for lead based on TCLP analysis (5.0 mg/L). These samples have total lead levels above 281 mg/kg, and as shown on Figure 6, are located within the area to be stabilized and excavated.

REFERENCES

U.S. Department of Energy, 1995, "Remedial Investigation/Feasibility Study for Operable Unit 5;"
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U.S. Department of Energy, 1997, "Pre-Design Investigation for Lead Delineation in the A1PII trap
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5

U.S. Department of Energy, 1998, "Certification Report for Area 1, Phase II - Sector 1, 2a and the
Conveyance Ditch," DOE, Fernald Area Office, Cincinnati, OH. 6
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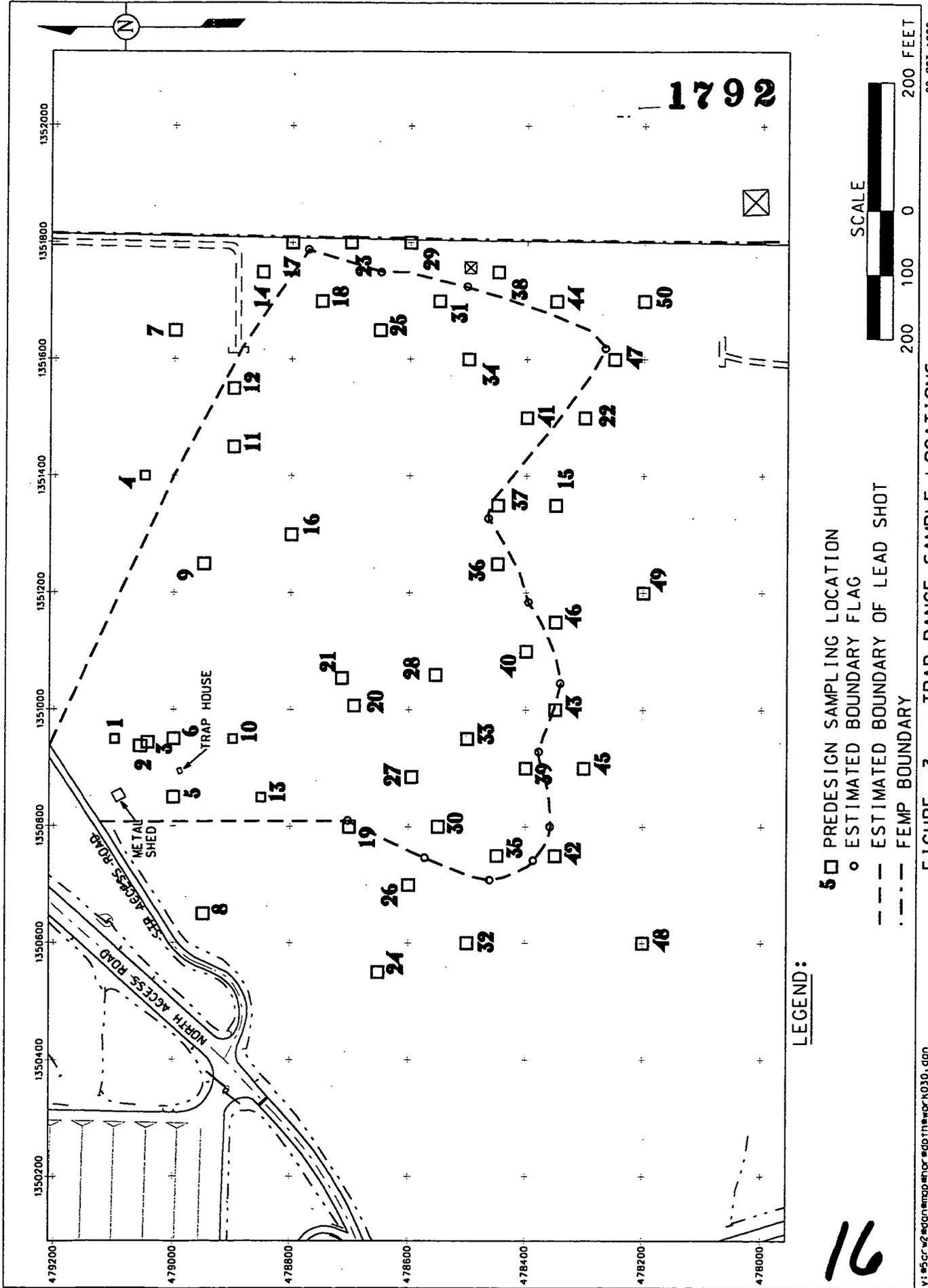


FIGURE 3. TRAP RANGE SAMPLE LOCATIONS

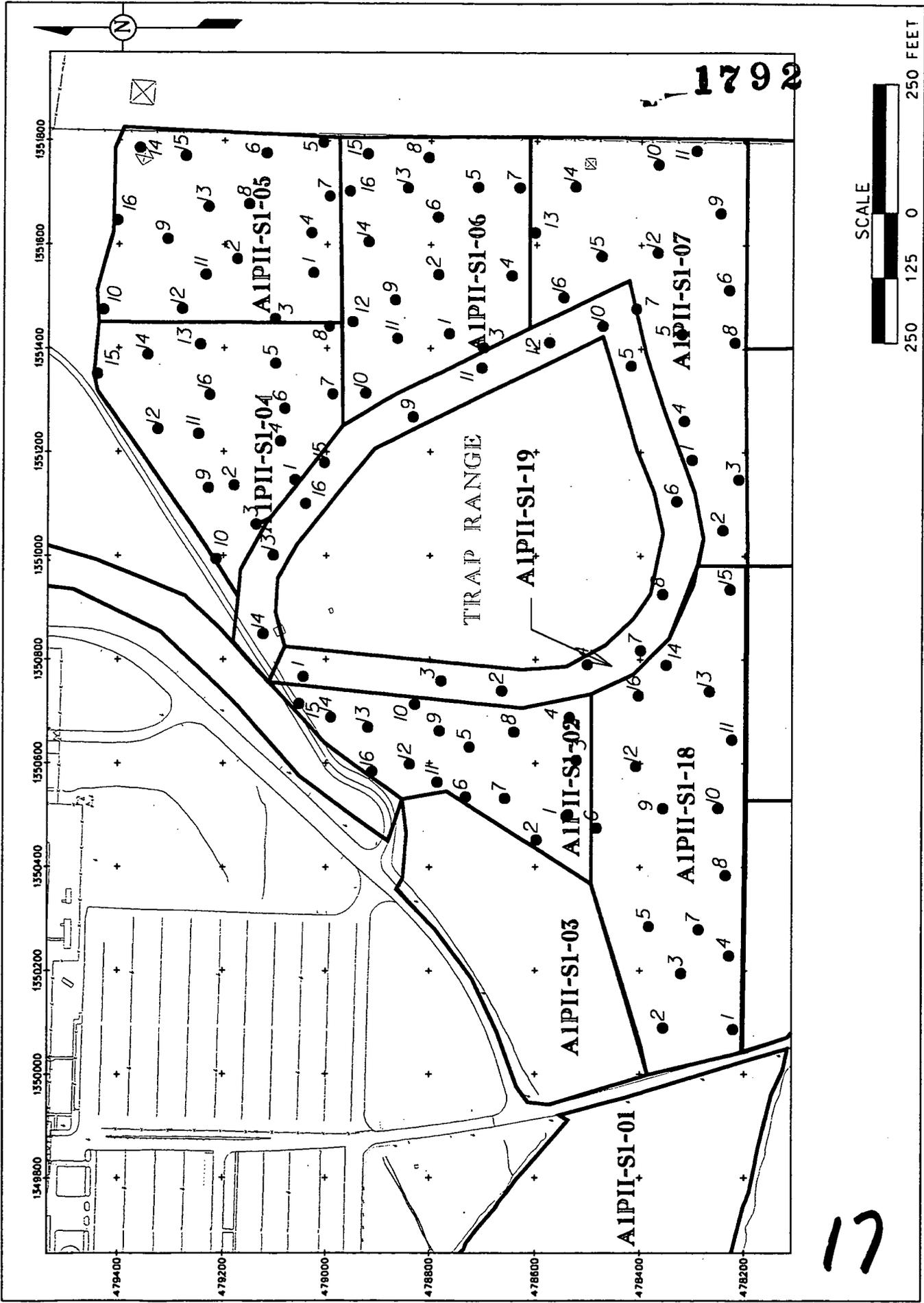
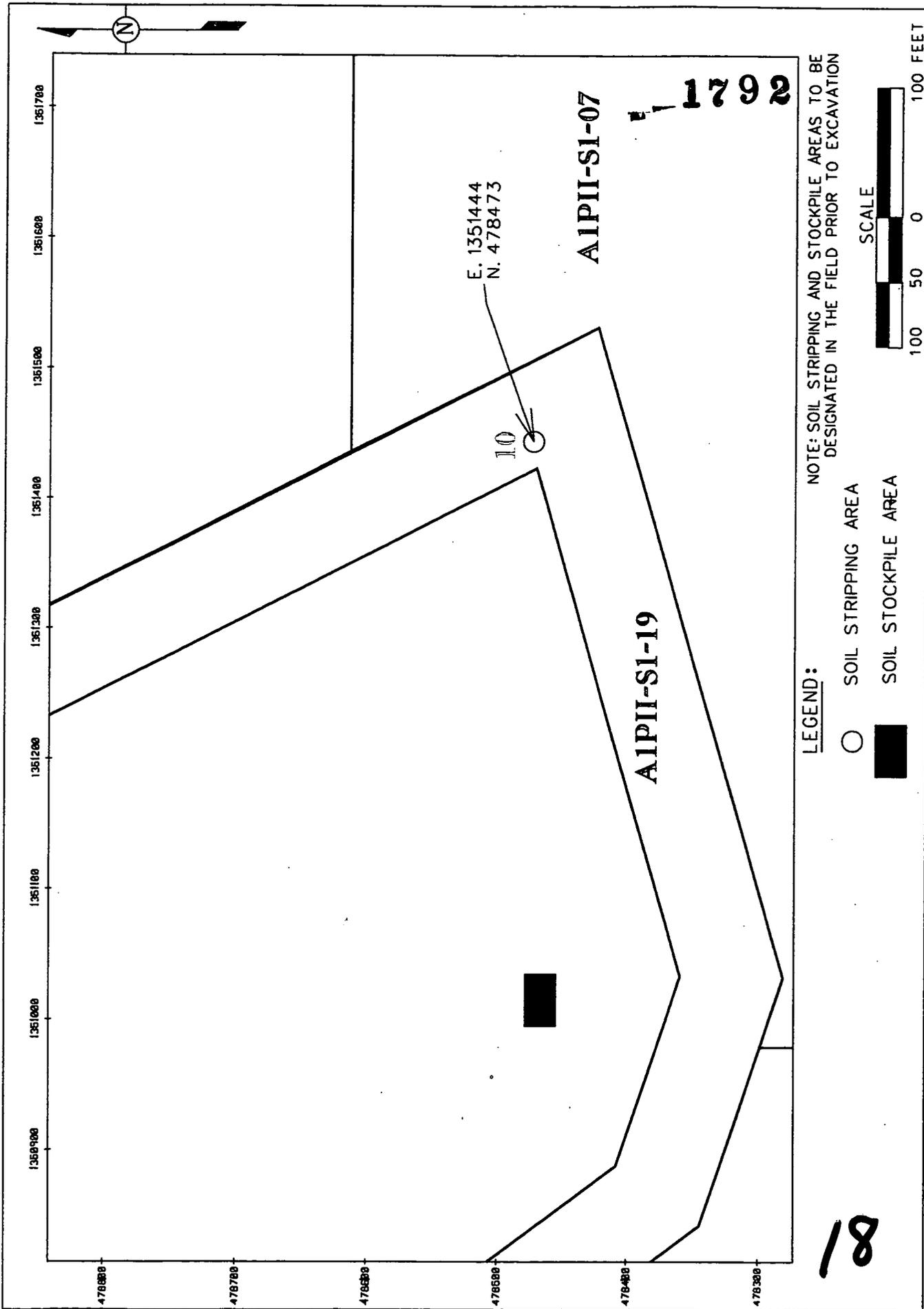


FIGURE 4. CU SAMPLE LOCATIONS ON TRAP RANGE AREA



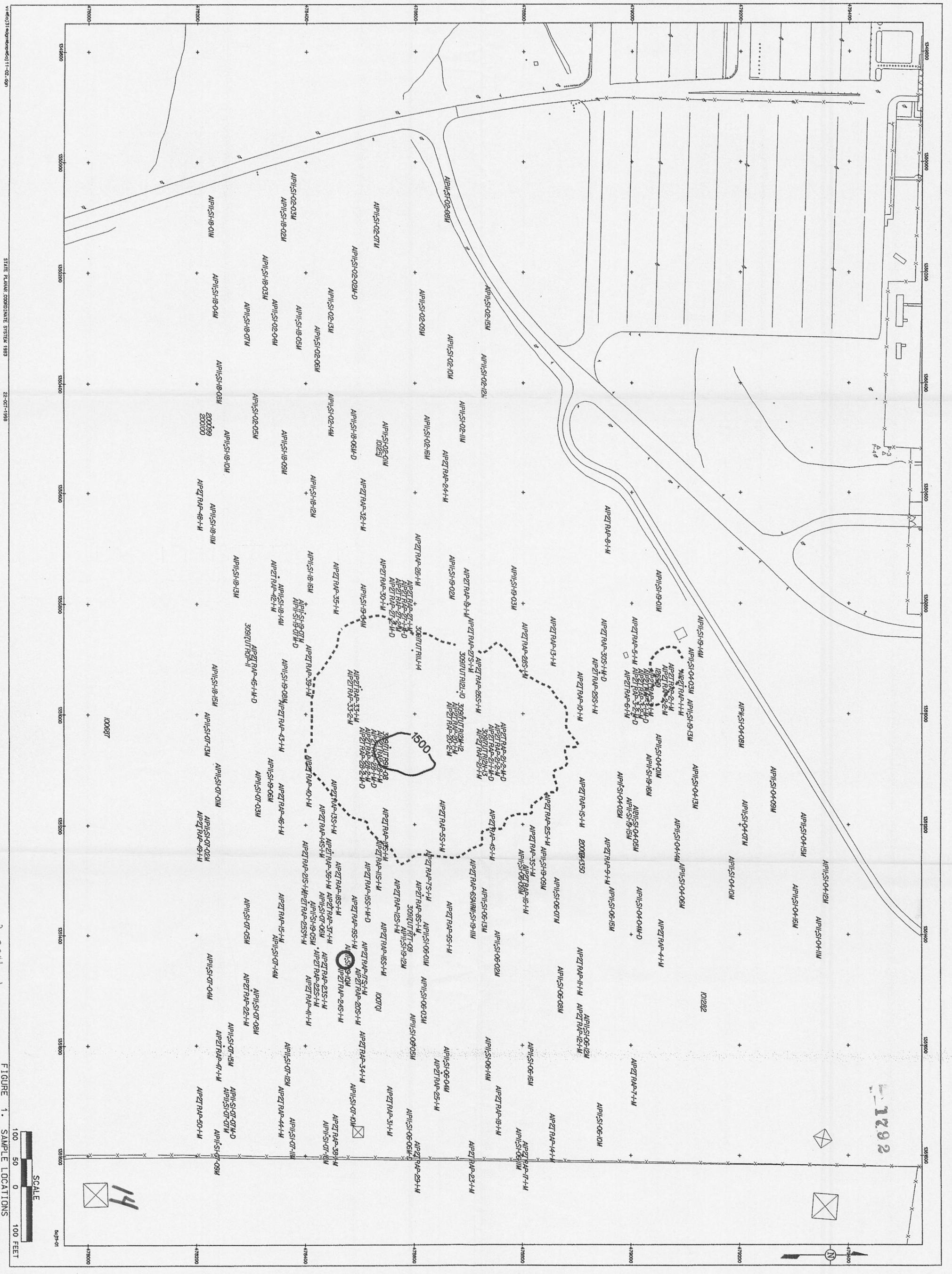
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FIGURE 5. PLANNED EXCAVATION AROUND SAMPLE A1P11-S1-19-10

STATE PLANAR COORDINATE SYSTEM 1983

v:\510703\edg\comp\tr\apdb3.dgn

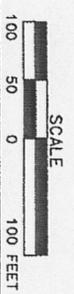
22-OCT-1998

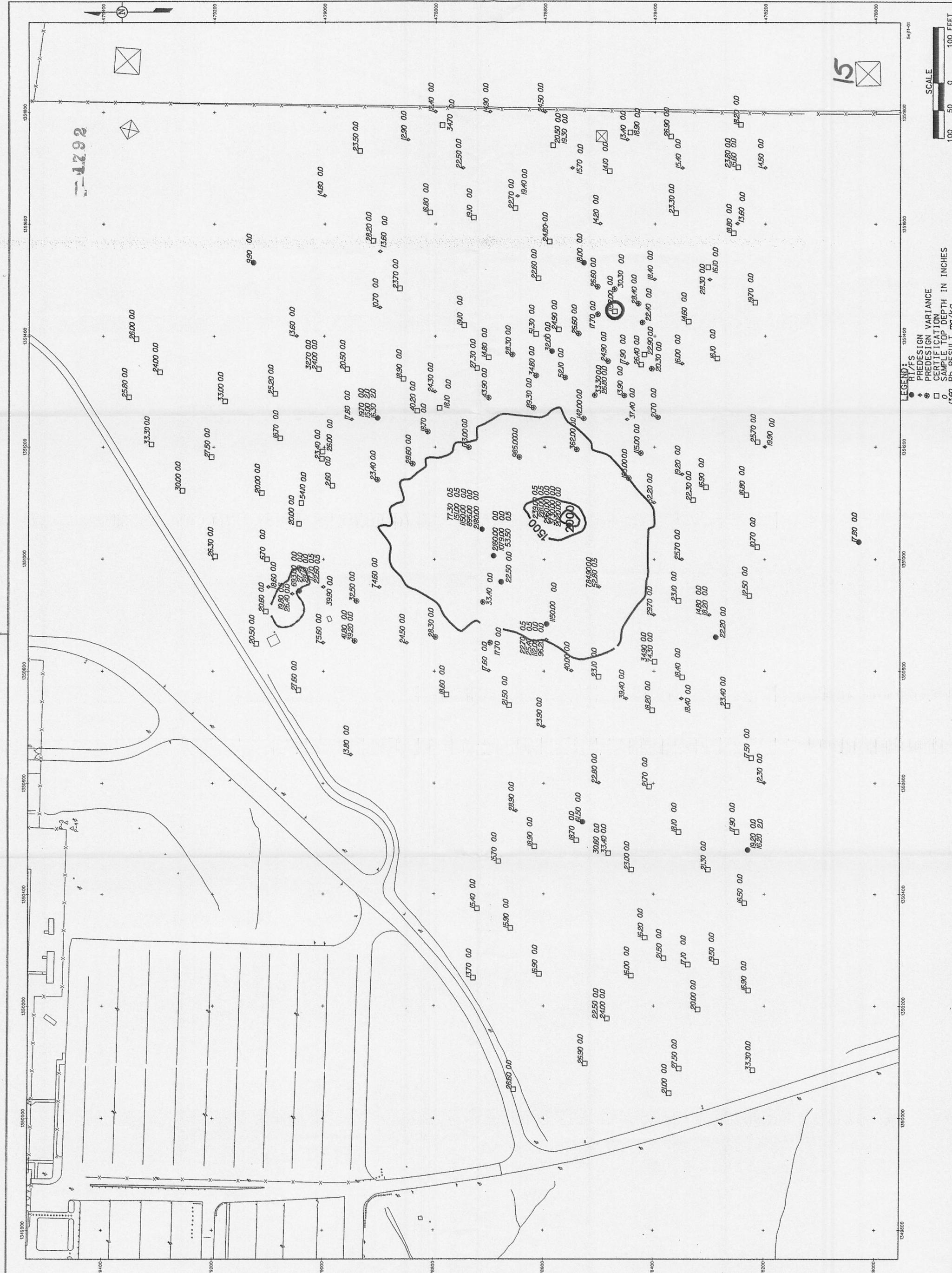


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FIGURE 1. SAMPLE LOCATIONS



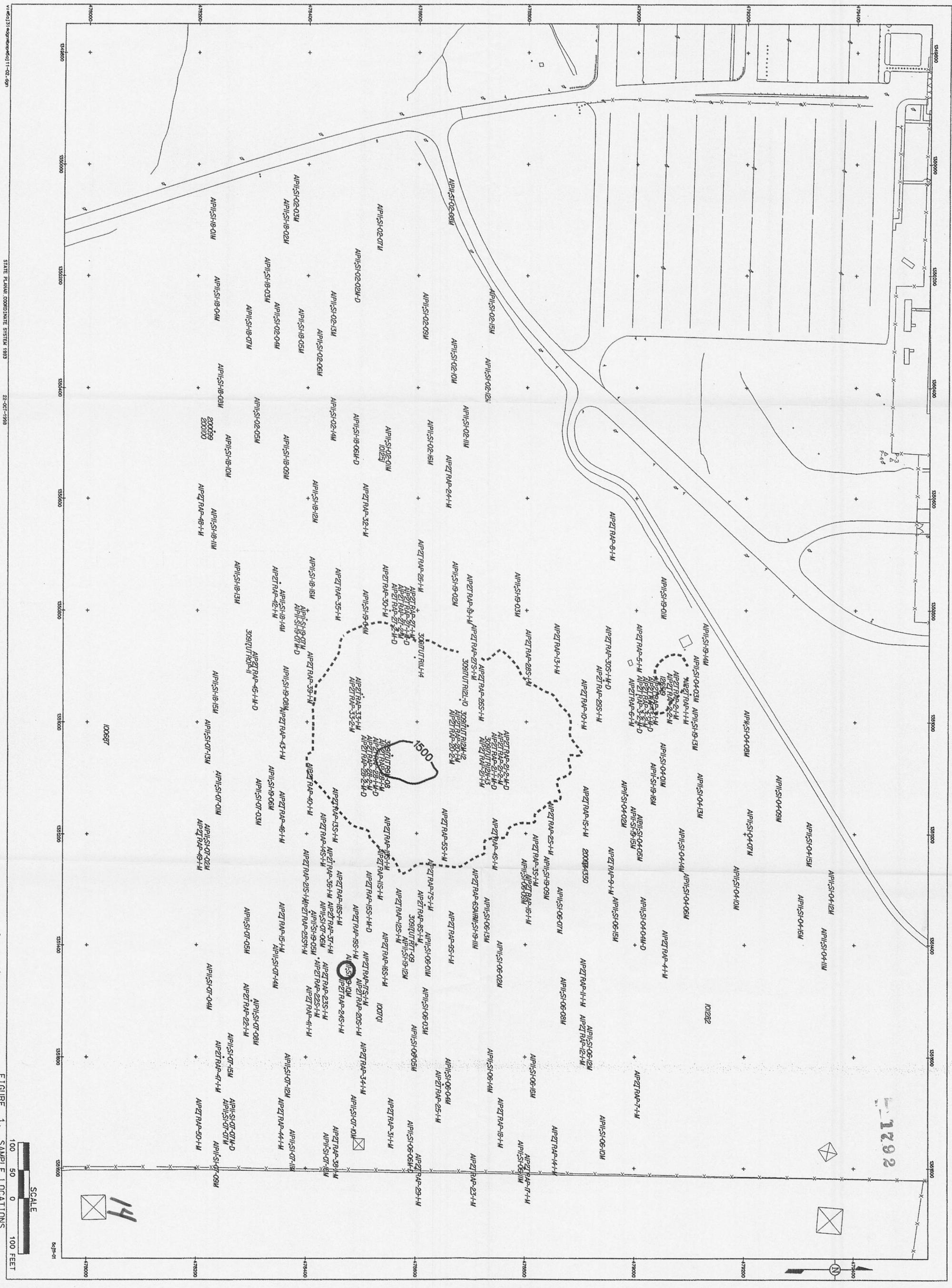


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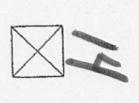
LEGEND:
 ● RT/FS
 ◆ PREDESIGN VARIANCE
 ○ CERTIFICATION
 □ SAMPLE TOP DEPTH IN INCHES
 13.60 Pb RESULT mg/kg

SCALE
 100 50 0 100 FEET



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FIGURE 1. SAMPLE LOCATIONS



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100887

20008350

101282

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