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SUBMITTAL OF THE REVISED REMEDIAL ACTION WORK PLAN FOR AREA 1, PHASE SOIL REMEDIATION (THIS DOCUMENT CONTAINS THE REVISED WORK PLAN, COMMENT RESPONSES AND TRANSMITTAL LETTE ARE LOCATED IN 5-309.3)

12/09/96

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DOE-FEMP EPAS
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WORK PLAN

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

REMEDIAL ACTION WORK PLAN FOR THE SOIL REMEDIATION PROJECT AREA 1, PHASE I

NOVEMBER 1996

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

2502-WP-0020
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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

REMEDIAL ACTION WORK PLAN FOR THE SOIL REMEDIATION PROJECT AREA 1, PHASE I

NOVEMBER 1996

U.S. DEPARTMENT OF ENERGY
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2502-WP-0020
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LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ACOE	Army Corps of Engineers
ARAR	applicable or relevant and appropriate requirement
ALARA	as low as reasonably achievable
ASCOC	area-specific constituent of concern
ASL	analytical support level
ASTM	American Society of Testing and Materials
BLRA	Baseline Risk Assessment
BTVs	benchmark toxicity values
CAMU	Corrective Action Management Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	certified for construction
CFR	Code of Federal Regulation
COC	constituent of concern
CU	certification unit
CU-1	class I certification unit
CU-II	class II certification unit
CI-H	homogeneous certification unit
dBa	decibels
DOE	U.S. Department of Energy
DOE-FN	U.S.Department of Energy, Fernald Office
DQO	data quality objective
EMP	Environmental Monitoring Program
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	Ecological Risk Assessment
FACTS	Fernald Analytical Computerized Tracking System
FDF	Fluor Daniel Fernald
FEMP	Fernald Environmental Management Project
FPA	former production area
FPXRF	field portable x-ray fluorescence
FRL	final remediation level
FTF	Fire Training Facility

List of Acronyms
(Cont'd)

FTP	file transfer protocol
GIS	Geographic Information System
HPGe	high-purity germanium (detector)
IRDP	Interim Remedial Design Package
IEMP	Integrated Environmental Monitoring Plan
IRDP	Integrated Remedial Design Package
LARD	long-range alpha detector
MDL	method detection limit
NaI	sodium iodide
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollution Discharge Elimination System
OAC	Ohio Administrative Code
ODOT	Ohio Department of Transportation
OEPA	Ohio Environmental Protection Agency
OSDF	On-Site Disposal Facility
OSHA	Occupational Safety and Health Act
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
pCi/g	picoCuries per gram
ppm	parts per million
PS	pump station (for OSDF)
PSP	Project-Specific Plan
QA/QC	quality assurance/quality control
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RDRA	Remedial Design Remedial Action
RD	remedial design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RTRAK	mobile enhanced NaI detector
SARA	Superfund Amendments and Reauthorization Act

List of Acronyms
(Cont'd)

SB	sediment basin (for OSDF)
SCQ	Sitewide CERCLA Quality Assurance Project Plan
SED	Sitewide Environmental Database
SEP	Sitewide Excavation Plan
SRDIG	Soil Remediation Data Integrated GIS
STP	sewage treatment plant
SWIFTS	Sitewide Waste Information Forecasting and Tracking System
SWPPP	Stormwater Pollution Prevention Plan
SWRB	Stormwater Retention Basin
TAT	turnaround time
VOC	volatile organic compound
USC	United States Code
USID	Uranium Soils Identification Program
WAC	waste acceptance criteria

FOREWORD

As part of the Remedial Investigation/Feasibility Study (RI/FS) at the Fernald Environmental Management Project (FEMP), an operable unit management approach was adopted to focus the characterization and remedy decision processes to expedite initiation of final remedial actions. Now, based on the FEMP Operable Units (OUs) Records of Decision (ROD), the focus of the facility is shifting toward the efficient completion of the remedial design/remedial action processes. The selected remedy described in the Operable Unit 5 ROD provides the basis for this remedial action work plan in support of the disposal facility construction identified in the Operable Unit 2 ROD and the rail yard identified in the Operable Unit 1 ROD.

The FEMP has been divided into seven areas for soil remediation, the first of which will be Area 1. A description of the remediation areas and their associated work plans are presented in the draft Remedial Design Work Plan for Remedial Actions at Operable Unit 5, Section 4.0. Actual boundaries for these remediation areas are contingent on construction and remediation design requirements.

Several of these areas will be remediated in phases. It is estimated that Area 1 will be remediated in three phases; however, the sequence of phases will not necessarily be consecutive (i.e., remediation of Area 1, Phase II will not immediately follow remediation of Area 1, Phase I). This Remedial Action Work Plan (RAWP) establishes the methods and specifications for remediation of certain portions of Area 1 during the first phase (Phase I).

The shaded areas in the text represent DOE-FN responses to US EPA and OEPA comments dated November 1, 1996.

1.0 INTRODUCTION

The Remedial Action Work Plan (RAWP) for Area 1, Phase I is the first in a series of work plans for soil remediation at the Fernald Environmental Management Project (FEMP). Area 1, shown in Figure 1-1, is one of seven functional remediation areas at the FEMP, referred to in the text as Remediation Areas. Phase I comprises the northeastern portion of Area 1 plus the borrow area for the On-Site Disposal Facility (OSDF). This RAWP is based on the selected remedy in the Operable Unit 5 Record of Decision [U.S. Department of Energy (DOE) 1996a]. The scope of this RAWP is determined by the Operable Unit 5 ROD and by the applicable or relevant and appropriate requirements (ARARs) that govern this remedy.

During 1996 and 1997, construction will be initiated within portions of Area 1 and for two OSDF support facilities, all of which support the further remediation of the FEMP:

- Relocated North Access Road (subarea A)
- Northern portion of the OSDF (subarea B)
- OSDF borrow area (subarea C)
- OSDF support areas (subareas SB and PS).

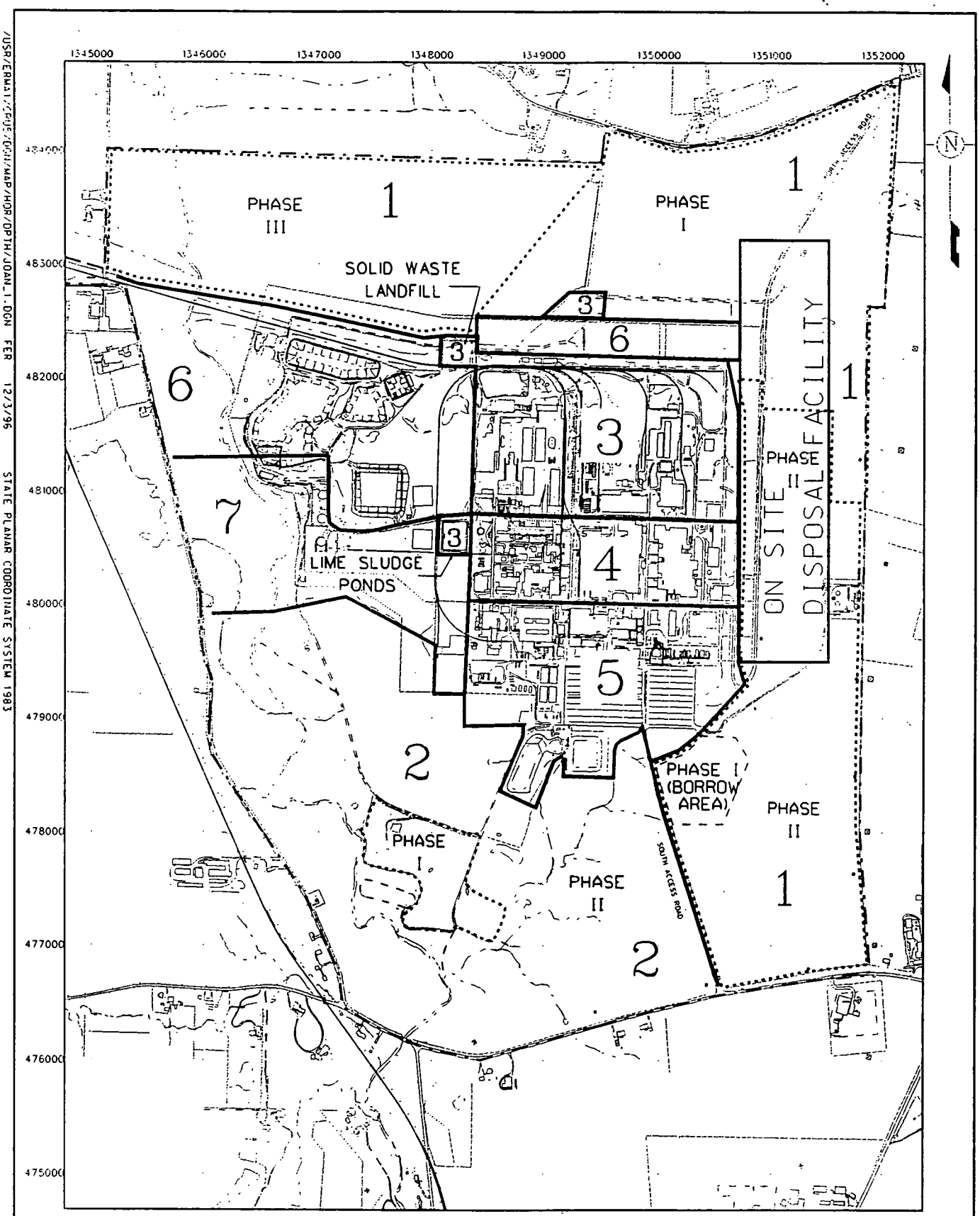
The purpose of the activities in this RAWP is to prepare for the subsequent construction of the above areas, as shown in Figure 1-2. The first remediation work, to be performed in Area 1, is termed Phase I activities. This RAWP presents the approach and methods to be used in remediating and certifying that remedial goals have been met in Area 1, Phase I. A detailed discussion of the activities to be performed under the scope of this RAWP, adjacent to the scope of this RAWP, and in support of OSDF construction, is provided in Section 2.0.

The remediation and excavation approach and methods described in this RAWP are based on construction needs, the nature of the contaminants present in Area 1, Phase I and the mode of contaminant distribution. Future RAWPs may differ in approach and methods and, in particular, the techniques used when planning and conducting deeper excavations, but the fundamental approach for the attainment of final remediation levels (FRLs) for site soil should remain consistent. Figure 1-3 identifies the FEMP areas planned for remedial action. The figure superimposes the selected remedy footprint over the site

and clearly identifies Remediation Area 1. The organization and description of the future RAWPs pertaining to Remediation Areas 2-7 of Operable Unit 5 are presented in the Operable Unit 5 Remedial Design Work Plan (DOE 1996b).

This RAWP is presented in seven sections and also contains supporting documentation and data included as Appendices A through G. These sections and brief descriptions of their individual contents are as follows:

Section 1.0:	Introduction
Section 2.0:	Project Description - summarizes the Operable Unit 5 selected remedy, defines Area 1, Phase I scope, identifies activities in adjacent and support subareas, identifies contamination in various subareas, and outlines the project organization
Section 3.0:	Components of the Work Plan - general discussions of Area 1, Phase I activities, ARARs, data quality objectives (DQOs), quality assurance/quality control (QA/QC) requirements, and implementation of selected remedy commitments
Section 4.0:	Excavation - discusses the work description, engineering, environmental and health and safety controls, construction methods and the proposed schedule
Section 5.0:	Identification of Constituents of Concern (COCs) - discusses compilation of existing data, sitewide COCs, area-specific COC (ASCOCs) selection process, list of ASCOCs, and determination of additional characterization needs
Section 6.0:	Analytical Methods and Protocols - summarizes sampling and analytical support for Phase I, analytical methods, gamma spectrometry, nonradiological analytical methods, QA/QC sampling, and data acquisition/storage/reporting
Section 7.0	Precertification and Certification Plans - discusses the approach and strategy for sampling and analysis for waste acceptance criteria, precertification and certification, defines the certification units, and the contents of certification reports



LEGEND:

PHASE BOUNDARIES

FEMP BOUNDARY

1 REMEDIATION AREA

SCALE

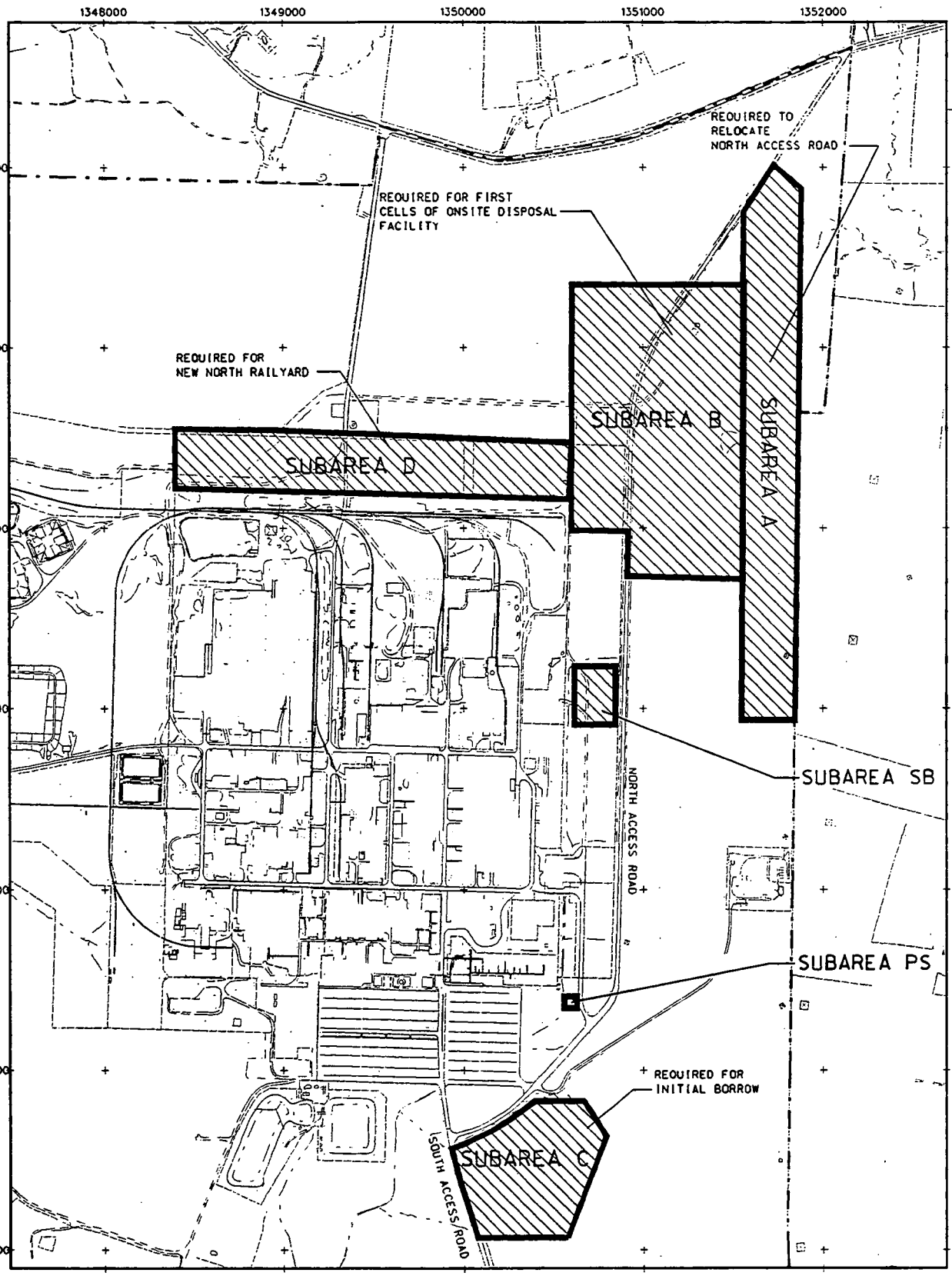
1200 600 0 1200 FEET

DRAFT

FIGURE 1-1. GENERAL REMEDIATION AREAS 1 THROUGH 7

/USR/ERM31/CFUE/DGN/MAP/HDR/DPTH/JOAN_1.DGN FER 12/3/96 STATE PLANAR COORDINATE SYSTEM 1983

/USR/FRMA/CRU5/DGN/MAP/HOR/OPTH/JOAN_2.DGN FER 12/2/96 STATE PLANAR COORDINATE SYSTEM 1983



LEGEND:

—·—·— FEMP BOUNDARY

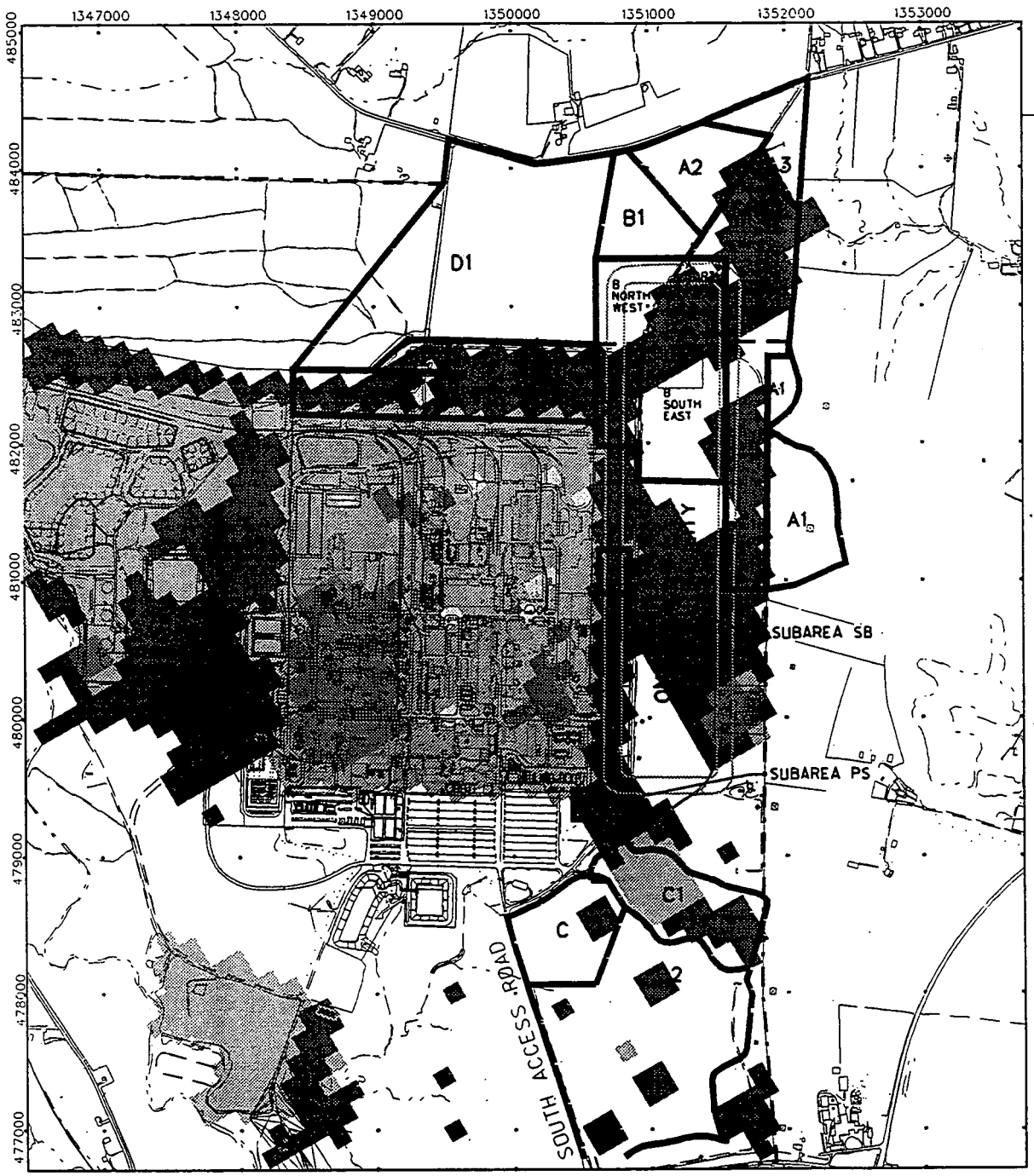
NOTE: SUBAREA D HAS BEEN REMOVED FROM THE AREA 1, PHASE I SCOPE. IT WILL BE REMEDIATED AS PART OF REMEDIATION AREA 6.

SCALE

820 410 0 820 FEET

FIGURE 1-2. BOUNDARIES OF AREA 1, PHASE I SUBAREAS AND OSDF SUPPORT AREAS IMPACTED BY CONSTRUCTION

/USR/ERMA5/2CCS1/DGN/MAP/HOR/OPTH/JOAN_3.DGN FER 11/12/96 STATE PLANAR COORDINATE SYSTEM 1983



LEGEND:

FEMP BOUNDARY

AREA BOUNDARIES

0 to 6" | 6" to 2.5' | 2.5 - 5' | 5 - 10' | 10 - 15' | > 15' | OTHER OU's

NOTE: OUTLINE BASED ON RI/FS URANIUM DATA. ACTUAL EXCAVATION BOUNDARIES HAVE BEEN REFINED.

SCALE

1200 600 0 1200 FEET

DRAFT

FIGURE 1-3. DEFINED AREAS FOR REMEDIAL ACTION WITH SELECTED REMEDY FOOTPRINT AND AREA 1 OVERLAY

2.0 PROJECT DESCRIPTION

Area 1, Phase I remediation activities will be performed in accordance with the remedy documented in the Operable Unit 5 ROD (DOE 1996a) which encompasses the excavation and disposal of contaminated soil at the FEMP. This section provides discussions of the selected remedy as it applies to Area 1, Phase I soil characterization information, a detailed Area 1, Phase I definition, and project organization.

2.1 APPLICABILITY OF THE SELECTED REMEDY TO AREA 1, PHASE I

2.1.1 Components of the Remedy

The remedy for Operable Unit 5 was selected to provide acceptable protection of human health and the environment. The selected remedy involves the excavation and placement of contaminated soil into the OSDF and the restoration of the Great Miami Aquifer to full use. The selected remedy as presented in the Operable Unit 5 ROD and as applicable to Area 1 during Phase I includes the following major components:

- Excavation (using conventional construction equipment) of contaminated soil and sediment to the extent necessary to establish with reasonable certainty that the average concentrations of contaminants are below the FRLs established in the Operable Unit 5 RI/FS and ROD
- Placement of contaminated soil and sediment which conform to concentration-based WAC into the OSDF; potential treatment of soil exhibiting contaminant concentrations exceeding the WAC and subsequent placement in the OSDF or shipment off-site for disposal at an appropriate commercial or federal disposal facility. No waste generated outside the FEMP will be placed in the OSDF
- Application of institutional controls, such as access controls, deed restrictions, and alternate water supplies, during and after remedial activities to minimize the potential for human exposure to site-introduced contaminants and ensure the continued protection of human health
- Implementation of a long-term environmental monitoring program and a maintenance program to ensure the continued protectiveness of the remedy, including the integrity of the OSDF

2.1.2 Commitments

Each of the above components requires certain actions to ensure the intent of the selected remedy is met. The following commitments will be addressed and incorporated in this RAWP:

- Application of as low as reasonably achievable (ALARA) principles through the use of hand-held instruments to support verification sampling and excavation processes

- Continuation of efforts to examine and apply (where practical), throughout the duration of remedial activities, new methods or technologies to mitigate environmental releases occurring as a result of the implementation of remedial actions

- Excavation of site soil and sediment to the extent necessary to attain the FRLs

- Identification and segregation (and treatment as necessary) of soil containing concentrations of organic compounds at levels that could potentially compromise the integrity of the OSDF's earthen liner

- Interim storage of soil and sediment

- Implementation of a certification sampling program following excavation activities to demonstrate that FRLs have been attained

- Restoration of affected areas following excavation and certification sampling

The implementation of selected remedy commitments is discussed in Section 3.5.

2.1.3 Good Management Practices

In order for planned remediation efforts at the FEMP to be completed, new construction must take place (as discussed in Section 1). As a prelude to that new construction, the FEMP is instituting the following good management practices to reduce the likelihood of initiating new construction on contaminated soil:

- For permanent facilities (i.e., areas which will not be accessible after remediation is completed), soil will be excavated and the area analyzed for compliance with FRLs before construction (i.e., OSDF, and the relocated North Access Road)

- For areas where scheduling constraints preclude complete certification of the area before construction involving cut and fill operations commences, contaminated material (as identified by the Operable Unit 5 RI/FS) will be excavated, certified and then placed in a controlled interim stockpile awaiting ultimate disposal in the OSDF, or stockpiled/containerized and moved to a staging area to await off-site shipment if the material exceeds the WAC. The OSDF segregated soils from Area 1, Phase I will be stored in one of two stockpiles discussed in Section 4, and as presented in Appendix A of this RAWP. The soils will be stockpiled until the OSDF is accepting waste, which is currently planned for Spring 1998. The soils segregated for off-site disposal will be stored in an OU1 stockpile dispositioned according to the OU1 schedule. (OEPA Comment #6 & 10)

- Upgradient areas from which stormwater drains onto remediated soil will be evaluated for compliance with the primary FRLs and, depending on the results, either excavated to remove impacted soil or subjected to engineering controls to isolate runoff to remediated downgradient areas, until these upgradient areas can be addressed in a future RAWP.

Upgradient areas which drain onto subareas A north and A south are either being certified as part of the current work or are being isolated by engineering controls. The one exception is the northern portion of subarea A1. This area is off-site. Isolating it with engineering controls would require extensive ditch construction. Since the known level of contamination in that area is low, the proposed plan is to avoid ditch construction by doing the following:

- monitor the regions immediately adjacent to the northern portion of subarea A using real-time equipment;

- excavate subarea A as currently proposed;

- in the unlikely event that real-time monitoring reveals the soil immediately adjacent to parts of A1 are impacted in excess of FRLs, a silt fence would be installed along the edges of those adjacent parts. The purpose of this fence would be to allow the passage of water, but not of solids, since the solids could potentially recontaminate portions of subarea A;

- proceed with certification of subarea A. (OEPA comment #6)

2.2 CONTAMINATION IN AREA 1

Extensive soil sampling was performed over the years; data compiled in the RDRA database clearly indicate that uranium contamination is widespread on the FEMP property. Thorium and radium also have extensive aerial distributions. Uranium is not demonstrated to be >50 parts per million (ppm) in the areas northeast and east of the FEMP boundary line (located adjacent to subarea A). The source of this uranium contamination was dust emissions from plant stacks during operations, influenced by predominantly southwesterly winds.

With the exception of subarea D2 the former Fire Training Facility (FTF) (identified in Figure 2-1 as being in the vicinity of Area 1, Phase I activities but not within the scope), the soil in the areas shown in Figure 1-2 was similarly contaminated by airborne deposition of uranium and other constituents originating from the former production facilities. This mode of contaminant distribution, confirmed by data collected during the Operable Unit 5 RI/FS, indicates that all of the contaminated soil in Area 1, Phase 1 is expected to be removed by shallow excavations (6 inches) (see Figure 1-3).

The inorganic contaminants detected above the FRL in surface soil in Area 1, Phase 1 are arsenic and beryllium. Although volatile organic compounds (VOCs), semivolatile organic compounds, and polychlorinated biphenyls (PCBs) were detected in samples collected from subarea D2, the former FTF, the Operable Unit 5 RI data indicate there are no significant concentrations of these compounds

in Area 1, Phase I. Subarea D2, the FTF, is near Area 1, Phase I subareas, but is not part of the Area 1, Phase I scope. It will be remediated as part of Remediation Area 3 in a later RAWP.

As previously noted, the contamination in Area 1, Phase I is expected to be surface contamination. Therefore, where needed, excavation of Area 1, Phase I to a depth of 6 inches is expected to meet the FRLs established in the Operable Unit 5 ROD. Figure 1-3 shows the extent of the planned 6-inch excavations that will address the contamination identified in the Operable Unit 5 FS Report (DOE 1995a).

2.3 AREA 1, PHASE I

2.3.1 Definition

The intent of this RAWP is to describe Area 1, Phase I efforts, the completion of which will allow planned construction of remediation support facilities to begin at the FEMP. The steps encompassed by this RAWP can be divided into two major efforts. The first is excavation; the second is certification. The remaining sections of the document discuss various issues and steps in the certification process. The goal of the Area 1, Phase I effort is to excavate and certify (as meeting FRLs) certain specific portions of the FEMP site.

Area 1, Phase I has been divided into subareas A, B, C, and D (subarea D has been removed from the scope of Area 1, Phase I).

- Subarea A - Subarea A is east and north of the former production area and east of the existing North Access Road.
- Subarea B - Subarea B is west of subarea A and includes land on both sides of the existing North Access Road. This subarea is needed for construction of the northern portion of the OSDF.
- Subarea C - Subarea C is south of the eastern parking lot and is identified for potential use as a soil borrow area in the construction of the OSDF.
- Subarea D - Subarea D is adjacent to the full length of the northern boundary of the former production area and is needed to construct the north rail yard in support of Operable Unit 1 for off-site shipment of the site's waste pit contents. Subarea D also contains the former FTF. Although these subareas are located physically in Area 1, both of these areas have special considerations (discussed in Section 2.3.2). They will be remediated under Remediation Area 6, which will be discussed in a future RAWP.

Subareas A, B C, and D have been further subdivided with alpha-numeric codes (for example, A1) and alpha-coordinate codes (for example, B north east) as shown on Figure 2-1. Figure 2-1 represents all the subareas discussed within this RAWP; however, it is important to note that not all the subareas discussed in this RAWP will undergo field activities under the Area 1, Phase 1 scope. Some of the subareas identified on Figure 2-1 are adjacent to, and could possibly impact, planned Area 1, Phase I field activities. Other subareas are discussed because they support Area 1, Phase 1 OSDF construction activities. They are, therefore, considered for their potential impact and discussed in this RAWP.

Areas discussed in this RAWP fall into four categories:

- Construction subareas - planned for Area 1, Phase I initial construction activities
- Certification units - planned for Area 1, Phase I certification activities
- Adjacent subareas - upgradient of Area 1, Phase I scope, but considered for their potential impact on construction and certification areas
- Support subareas - beyond the scope of Area 1, Phase I but requiring certification for construction activities in OSDF support areas

A description of the construction subareas, certification units, adjacent subareas, and support areas is provided in Sections 2.3.3 through 2.3.6.

2.3.2 Scope

Dividing contiguous FEMP soils into discrete remediation units has been an iterative process throughout the development of this RAWP. Early attempts to define discrete remediation units served well for initial planning purposes; however, field conditions, such as surface drainage patterns and other Operable Unit commitments and construction activities, have led to a rethinking and further refinement of these earlier defined units. The result is a patchwork of interconnected units in Area 1, Phase 1. An attempt to "freeze" this iterative remediation process, based on the current understanding of the subareas in Area 1, Phase I, is presented in the following series of Figures and Tables:

- Figure 1-1 FEMP Site Remediation Areas 1-7

- Figure 2-1 All Subareas Discussed In The Area 1, Phase I Work Plan
- Figure 2-2 All Subareas Discussed In The Area 1, Phase I Work Plan Undergoing Certification
- Figure 2-3 Area 1, Phase I Scope
- Figure 2-4 Area 1, Phase I Scope Initial Construction
- Figure 2-5 Area 1, Phase I Scope Certification
- Figure 2-6 Adjacent Subareas With Potential Impact To Area 1, Phase I Scope
- Figure 2-7 Support Subareas Being Certified Concurrent With Area 1, Phase I Scope
- Table 2-1 Activities Under The Area 1, Phase I Scope (List)
- Table 2-2 Adjacent Areas With Activities With Potential Impact To Area 1, Phase I Scope (List)

The figures provided begin as global descriptions and become sequentially more specific in areal extent and descriptions of activities. Figure 2-1 is the most global figure. It is a rollup of Figures 2-2 through 2-7 and is provided to orient the reader to the subareas under discussion in this RAWP.

Figures 2-3, 2-4 and 2-5 identify work to be performed under the Area 1, Phase I scope only. Figure 2-3 is a rollup of Figures 2-4 and 2-5. It identifies all subareas under the Area 1 Phase I scope to receive either construction or certification activities. Figure 2-4 identifies those subareas that are initially planned for construction excavation within the Area 1, Phase I scope. (The term "initially planned" is used here because the certification process may drive the need for additional shallow excavation not currently envisioned.) Figure 2-5 identifies the areas planned for certification activities under the Area 1, Phase I scope.

Figure 2-2 is a global certification figure. It is a rollup of Figures 2-5 and 2-7 and identifies all the subareas discussed in the RAWP that are to be certified as meeting FRLs. Figure 2-5, again, identifies only those subareas in the Area 1, Phase I scope that are to be certified as meeting the FRLs. Figure 2-6 identifies subareas adjacent to Area 1, Phase I scope with the potential to impact them. Figure 2-7 identifies the support subareas to be certified concurrent with the Area 1, Phase 1 scope.

It is important to understand the differences between Figures 2-4 and Figure 2-5 since those differences highlight the construction and certification activities within the Area 1, Phase 1 scope.

Tables 2-1 and 2-2 provide subarea descriptions, map/text designations, the activities to be performed and any special circumstances pertaining to the Area 1, Phase I scope, adjacent and support areas.

Three subareas discussed in the Draft Area 1, Phase I Work Plan have been removed from the scope of this RAWP. They will be addressed in forthcoming RAWPs. They are subareas D north and D south, as well as subarea D2.

- Subareas D north and D south- Subarea D south is adjacent to the full length of the northern boundary of the former production area. This subarea will be excavated to construct the rail yard in support of Operable Unit 1 off-site shipment of the site's waste pit contents. D north is immediately north and upgradient from D south, and is potentially a source for recontamination to subarea D south. D north will be excavated to remove impacted soil that might provide a source of recontamination to subarea D south (OEPA Comment #11). Limited pre-certification testing will be performed prior to construction of the rail yard to ensure best management practices are employed in these subareas. D north and D south will be certified under Remediation Area 6, a later RAWP, when remediation of the waste pits is concluded.

- Subarea D2 - the former FTF is located within subarea D2. The FTF was contaminated primarily by localized releases. Contamination associated with FTF extends deeper than that present in subareas A, B, and C. This subarea will require deeper and more complex remediation efforts than those planned in this RAWP. Due to the various contamination within D2 and the ability to isolate the surface drainage from the other areas by constructing a ditch along its southern downgradient boundary, remediation and certification of D2 are excluded from this RAWP. It will be excavated and certified as part of Remediation Area 3 in a later RAWP.

2.3.3 Construction Subareas

Construction subareas identified in the Area 1, Phase I Work Plan are subareas where construction and/or certification activities are planned. Due to the shallow contamination, excavation in these areas is limited to removal of the top 6" of soil. Area 1, Phase 1 general construction subareas are identified in Figure 2-4 as the following:

- Subareas A north and A south - needed for construction of the proposed relocated North Access Road

- Subareas B northeast, B southeast, and B southwest - required for construction of the northernmost portion of the OSDF

A detailed description of each Area 1, Phase I construction subarea follows.

Subareas A North and A South

The division between A north and A south delineate topographical drainage pattern differences. A north drains to the northeast and A south drains to the southwest. Excavating the top 6" of contaminated soil from this subarea will facilitate construction of the relocated North Access Road. The new road is being built to replace the existing North Access Road, which is being removed to allow for construction of the OSDF. A north and A south are planned for construction and certification activities.

At the southeast corner of subarea A south is an electrical tower. The region around this tower will be isolated from subarea A south by a diversion ditch. This region was designated in design drawings to be excavated, however, this region will not be excavated at this time. It will be addressed by the Area 1, Phase II Integrated Remedial Design Package (IRDP) (due to regulatory agencies on November 21, 1997).

The relocated North Access Road construction schedule results in the need to initiate construction before the certification report is completed and approved. Road construction will begin after certification samples are collected, but prior to completion of certification analyses and submission of a written certification report. Efforts will be made to minimize the risk associated with construction in this area by performing real-time analyses (precertification) and obtaining and analyzing certification samples as rapidly as possible.

Subareas B Northeast, B Southeast, and B Southwest

Subarea B is needed for construction of the northern portion of the OSDF. Subarea B has been further divided into B northeast, B northwest, B southeast, and B southwest. Subarea B northeast defines the northeastern corner of the OSDF construction. However, because this area drains northeast, its remediation will be accomplished in conjunction with A north. B southeast and B southwest delineate areas east and west, respectively, of the existing North Access Road. B northeast, B southeast, and B southwest are planned for construction and certification activities. B northwest on Figure 2-5 is currently wooded and is not expected to exhibit concentrations of ASCOCs above FRLs and is therefore planned to undergo certification only.

2.3.4 Certification Subareas

Certification subareas identified in the Area 1, Phase I Work Plan are subareas planned to undergo certification only or certification and construction activities. All areas to be certified will undergo precertification testing with the goal of achieving the target of 75% of the FRL for ASCOCs. This precertification step will instill confidence that certification testing to follow will be successful.

All subareas undergoing excavation for purposes of remediation or construction preparation will be certified directly following excavation. No grading or filling will occur prior to completion of certification sampling; no excavation for FRL will be initiated in areas not receiving immediate certification following excavation.

Additional information on certification activities can be found in Sections 3.1 and 7.0 as well as Appendix C. Area 1, Phase I certification subareas are identified in Figure 2-5 as the following:

- Subarea A north and south - discussed in Section 2.3.3
- Subarea A2 - upgradient of Area A north
- Subarea A3 - downgradient of Area A north
- Subarea B northeast, southeast, and southwest - discussed in Section 2.3.3
- Subarea B northwest - covered by a pine woodlot
- Subarea B1 - upgradient from subareas B northwest and B northeast
- Subarea C - proposed borrow source for clay material to construct the OSDF
- Subarea D1 - upgradient from subarea D north

A detailed description of each Area 1, Phase I certification subarea follows:

Subarea A2

Subarea A2 is upgradient of Area A north. It currently drains into a culvert which passes under the existing North Access Road at a location north of the proposed construction, thereby circumventing and avoiding recontamination of subarea A north. Subarea A2 is planned for certification activity only. (OEPA Comment #7)

Subarea A3

Subarea A3 is located northeast of subarea A north. Based on Operable Unit 5 FS data, it is not expected to be contaminated above FRLs; also, because Area A3 is downgradient and stormwater runoff is naturally routed off site to the east, contaminated runoff is not a concern to the proposed remediation area. Subarea A3 is planned for certification activity only. (OEPA Comment #7)

Subarea B northwest

Subarea B northwest is the area covered by a pine woodlot west of the FEMP site existing North Access Road. B northwest has not demonstrated contamination of ASCOCs above the FRLs and is therefore planned to undergo certification only.

Subarea B1

Subarea B1 is north and upgradient from subarea B northwest. B1 will be tested and excavated or isolated, if necessary, to ensure that no contaminated runoff enters B northwest. Subarea B1 is currently expected to require certification only.

Subarea C

Subarea C, south of the east parking lot, is identified for potential use as a soil borrow area in the construction of the OSDF. Ensuring that this subarea is in compliance with FRLs will free it for general use as an unrestricted borrow source. Subarea C is planned for certification activities before the final decision is made to use the soil for construction activities. (OEPA Comment #7)

Subarea D1

Subarea D1 is upgradient from subarea D north and is therefore a potential concern for remediation efforts. An existing ditch at the southern boundary of subarea D1 currently captures D1 runoff and diverts it westerly along the northern boundary of subarea D, thereby ensuring there will be no recontamination of subarea D from subarea D1 runoff. Therefore, subarea D1 is not a direct concern for this RAWP. Subarea D1 is planned for certification activity only. (OEPA Comment #7)

2.3.5 Adjacent Subareas

Adjacent subareas are upgradient or adjacent to Area 1, Phase I construction or certification subareas. They are considered in this RAWP because of their proximity to construction activities in Area 1, Phase I subareas A south, and C (see Figure 2-6). They have the potential to recontaminate a remediated or certified area by surface runoff after cleanup is completed.

Data from the Operable Unit 5 FS indicate there should be minimal, if any, COC contamination above the FRLs in the soil of these adjacent subareas. No soil excavation is planned or expected at this time for adjacent subareas discussed below.

The off-site area north of State Route 126 is upgradient of subareas D1, B1, A2, and A3. Runoff from this off-site area is collected in a ditch on the north side of State Route 126 which flows east around the on-site construction areas. Therefore, this area is not considered further in this RAWP.

These adjacent subareas are identified on Figure 2-6 as the following:

- Subarea A1 - potential runon to subarea A south
- Subarea C1, and C2 - runoff routing around subarea C

A detailed description of each adjacent subarea follows:

Subarea A1

Subarea A1 is located upgradient of subarea A south, and east of the proposed relocated North Access Road. Although A1 is not expected to be contaminated, it must be established to be below the primary FRLs and, if necessary, excavated or isolated to ensure no runoff recontaminates subarea A south.

Existing characterization data indicate that subarea A1 is not expected to recontaminate subarea A south once it is remediated; therefore, isolating A1 with engineering controls requiring extensive ditch construction is not warranted. Since the known level of contamination in that area is low, the proposed plan is to avoid ditch construction by doing the following:

- Monitor the regions immediately adjacent to the northern portion of subarea A1 using real-time equipment

- Excavate subarea A south

- In the unlikely event that real-time monitoring reveals that immediately adjacent parts of subarea A1 are impacted in excess of the FRLs, a silt fence will be installed along the edge of the affected parts. The purpose of this fence will be to allow the passage of water, but not solids, since the solids could potentially recontaminate portions of subarea A.

- Proceed with the certification of subarea A south

Subareas C1 and C2

Subareas C1 and C2 are upgradient and adjacent to the eastern and southern boundary of subarea C. Drainage from C1 follows natural topography and is currently routed into a ditch bordering the northern portion of C; runoff from C1, therefore, circumvents subarea C. Although C2 is also upgradient of subarea C, drainage is naturally routed to the west away from subarea C. No recontamination from C2 is expected and it is not addressed further in this RAWP.

Subareas C1 and C2 will be addressed more fully in the Area 1, Phase II RAWP.

2.3.6 Support Subareas

Support subareas are isolated locations beyond the Area 1, Phase I scope requiring imminent certification to support construction. Support subareas are identified on Figure 2-7 as the following:

- Subarea PS - certification of the OSDF main leachate pump station will allow its construction as a permanent OSDF feature. The PS will be certified using the same certification protocols employed for Area 1, Phase I scope subareas.

- Subarea SB - certification of the OSDF sediment basin will allow material excavated from it to be used in OSDF construction. The SB will be certified using the same certification protocols employed for Area 1, Phase I scope subareas.

A detailed description of each of the support subareas follows.

Subarea PS

Subarea PS is located north of subarea C at the southwestern edge of the proposed OSDF. The soil within a specified radius of the proposed pump station needs to be certified to support the construction of the pump station as a permanent facility supporting the OSDF. Certification units for subarea PS are shown in Figures 7-1 and 7-3. Detailed design drawings are not provided in this RAWP since

that is beyond the scope of the document; they will be provided as part of the OSDF design (OEPA Comment #3).

Subarea SB

Subarea SB is located west of the proposed OSDF. Certification of the soils in this sediment basin will allow material excavated from it to be used in OSDF construction. Subarea SB is being excavated as part of the OSDF project. Certification units for subarea SB are shown in Figures 7-1 and 7-3. Detailed design drawings are provided in Appendix A, drawings 75X-5900-G-00455 and 75X-5500-G-00441 (OEPA Comment #3).

2.4 PROJECT ORGANIZATION

The DOE is the lead federal agency at the FEMP. The DOE-Fernald Field Office (DOE-FN) has overall responsibility for coordination and execution of this remedial action.

Fluor Daniel Fernald (FDF) is the managing contractor. FDF is responsible for implementation of the remedial action in a manner consistent with DOE Orders and regulatory guidance. FDF will be responsible for the following items:

- Development and implementation of ARARs
- Preparation of a project specific health and safety plan
- Preparation of a construction cost estimate
- Selection of a construction subcontractor
- Requisition of selected materials
- Construction management
- Operation and maintenance
- Resolution of National Environmental Policy Act (NEPA)/cultural requirements
- Communication and coordination with regulatory agencies
- Assurance that cost, schedule, and scope requirements are met
- Assurance of continuity in performance and information exchange among project participants

- Collection of samples and data
- Analysis of samples
- Interpretation of sampling results and certification report development.

Construction activities will be performed by subcontractors working to FDF specifications. For areas covered in this RAWP, the construction subcontractors will be responsible for excavation and removal of contaminated surface soil in preparation for construction of the proposed relocated North Access Road, site preparation for the northernmost portions of the OSDF (excluding the existing North Access Road), site preparation for the north rail yard, transporting excavated soil to the proper soil stockpiles, and temporarily seeding or otherwise stabilizing disturbed areas. The existing North Access Road and its associated drainage ditches will be removed at the time the Relocated North Access Road is in service, which will be at the time of OSDF construction, as discussed in Section 4.0.

TABLE 2-1
ACTIVITIES UNDER AREA 1, PHASE I SCOPE

17AREA DESCRIPTION	MAP/TEXT DESIGNATION	ACTIVITIES UNDER AREA 1, PHASE I RAWP	SPECIAL CIRCUMSTANCES
The footprint for the relocation of the North Entrance Road	A (North & South)	Excavate and Certify	The road construction schedule results in the need to initiate construction after the certification samples are collected, but prior to completion of certification analyses and reporting. Efforts will be made to minimize the risk associated with construction in this area by performing real-time analyses (precertification) and obtaining certification samples as rapidly as possible. At the southeast corner of subarea A is an electrical tower. The region around this tower will be isolated from subarea A by a diversion ditch. This region was designated in design drawings as being excavated. However, this region will not be excavated at this time, but will be addressed by the Area 1, Phase II RAWP. Eastern portion of subarea A receives runon from subarea A1. Please see the subarea A1 discussion in the next table. Any tiles impacting the OSDF (i.e. either entering or exiting the OSDF footprint) will be removed. However, the drain tile system associated with the swale at the northeastern corner of the site does not impact the OSDF. DOE does not currently plan to excavate that drain tile system because of the combination of (1) the desire of the neighboring property owner to not change the overall drainage patterns adjacent to his property and (2) low level of contamination in that area, DOE considers it inadvisable to excavate that drain tile system.
Northeast corner of FEMP	A2	No excavation expected; Certify	None.

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TABLE 2-1
ACTIVITIES UNDER AREA 1, PHASE I SCOPE

17AREA DESCRIPTION	MAP/TEXT DESIGNATION	ACTIVITIES UNDER AREA 1, PHASE I RAWP	SPECIAL CIRCUMSTANCES
North-Northeast corner of FEMP	A3	No excavation expected; Certify	None.
Northern end of the OSDF footprint	B (NE,NW, SE, SW)	Excavate 6 inches from all but northwestern portion and the roadway; Certify all	The northwestern portion of this area is not expected to require excavation prior to certification. The existing North Entrance Road goes through subarea B and it's removal is required for Phase I of the OSDF construction. It is proposed that the certification for this feature be based on the following: (i) Core samples through the pavement into the soil beneath it, and core samples of the adjoining ditched areas. (ii) From the core samples, analyze the native material (below the pavement and roadway aggregate) in 6 inch increments to determine to what depth the road area and the ditched area exceed FRLs. (iii) After the OSDF project excavates the roadway and adjoining ditched areas to the depth determined in step (ii), confirm the completeness of the removal with real-time monitoring equipment. This alternative certification strategy for the roadway will be detailed in a separate Project Specific Plan to be submitted for certification.

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TABLE 2-1 (continued)
ACTIVITIES UNDER AREA 1, PHASE I SCOPE

17AREA DESCRIPTION	MAP/TEXT DESIGNATION	ACTIVITIES UNDER AREA 1, PHASE I RAWP	SPECIAL CIRCUMSTANCES
Runon area for OSDF footprint	B1	No excavation expected; Certify	None.
Initial portion of Borrow Area	C	No excavation expected; Certify	None.
North central portion of FEMP site	D1	No excavation expected; Certify	None.

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TABLE 2-2
ADJACENT SUBAREAS ACTIVITIES WITH POTENTIAL IMPACT ON AREA 1, PHASE I SCOPE

17AREA DESCRIPTION	MAP/TEXT DESIGNATION	ACTIVITIES UNDER AREA 1, PHASE I RAWP	SPECIAL CIRCUMSTANCES
Off-property area with potential runon to subarea A	A1	Surface water from the southern portion of A1 (flowing south-west) will be isolated from subarea A with a diversion ditch. Surface water from the northern portion of A1 (flowing north-west) will be managed using best management practices.	The eastern portion of subarea A south receives run-on from the northern portion of subarea A1 and the southern portion of A1. The southern portion of A1 has been isolated by a diversion ditch. The northern portion of A1 cannot be isolated without extensive ditch construction. Since the known level of contamination in all of subarea A1 is low, the proposed plan to manage the flow from the northern portion of A1 onto A south is as follows: (i) Monitor the border between A south and the northern portion of A1 using real-time equipment (ii) Excavate subarea A south as currently proposed. (iii) If real-time monitoring reveals that the FEMP property line between the northern portion of subarea A1 and subarea A south is impacted in excess of FRLs, a silt fence will be installed along the boundary. The purpose of this fence will be to allow the passage of water, but not solids, since the solids could potentially recontaminate portions of subarea A south. (iv) Proceed with the certification of subarea A south.
East and north of subarea C	C1	None. Due to topography, this area does not impact subarea C.	None.
East and south of subarea C	C2	None. Due to topography, this area does not impact subarea C.	None.

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TABLE 2-2 (continued)
ACTIVITIES UNDER AREA 1, PHASE I SCOPE

17AREA DESCRIPTION	MAP/TEXT DESIGNATION	ACTIVITIES UNDER AREA 1, PHASE I RAWP	SPECIAL CIRCUMSTANCES
North rail yard and area immediately to the north	D (N&S)	OU1 is doing surface excavation per good management practices; Real-time scanning, but no certification is scheduled at this time	Will be certified under Remediation Area 6.
Fire Training Facility (FTF)	D2	Not part of Area 1, Phase I; Isolated from a surface water stand point;	Will require deep excavation to remove organics and radiological ASCOCs. Will be certified under Remediation Area 3.
Main leachate pump station for the OSDF	PS	No excavation expected; Certify	The area in the immediate vicinity of this pump station will be certified to allow its construction as a permanent feature.
OSDF Sediment basin	SB	Excavation under the OSDF project; Certify	Certification of this area will allow material excavated from it to be used in OSDF construction. Currently, this area is covered by a gravel pad and used for storage. Certification cannot take place until this material is removed and overexcavated and precertification has taken place.

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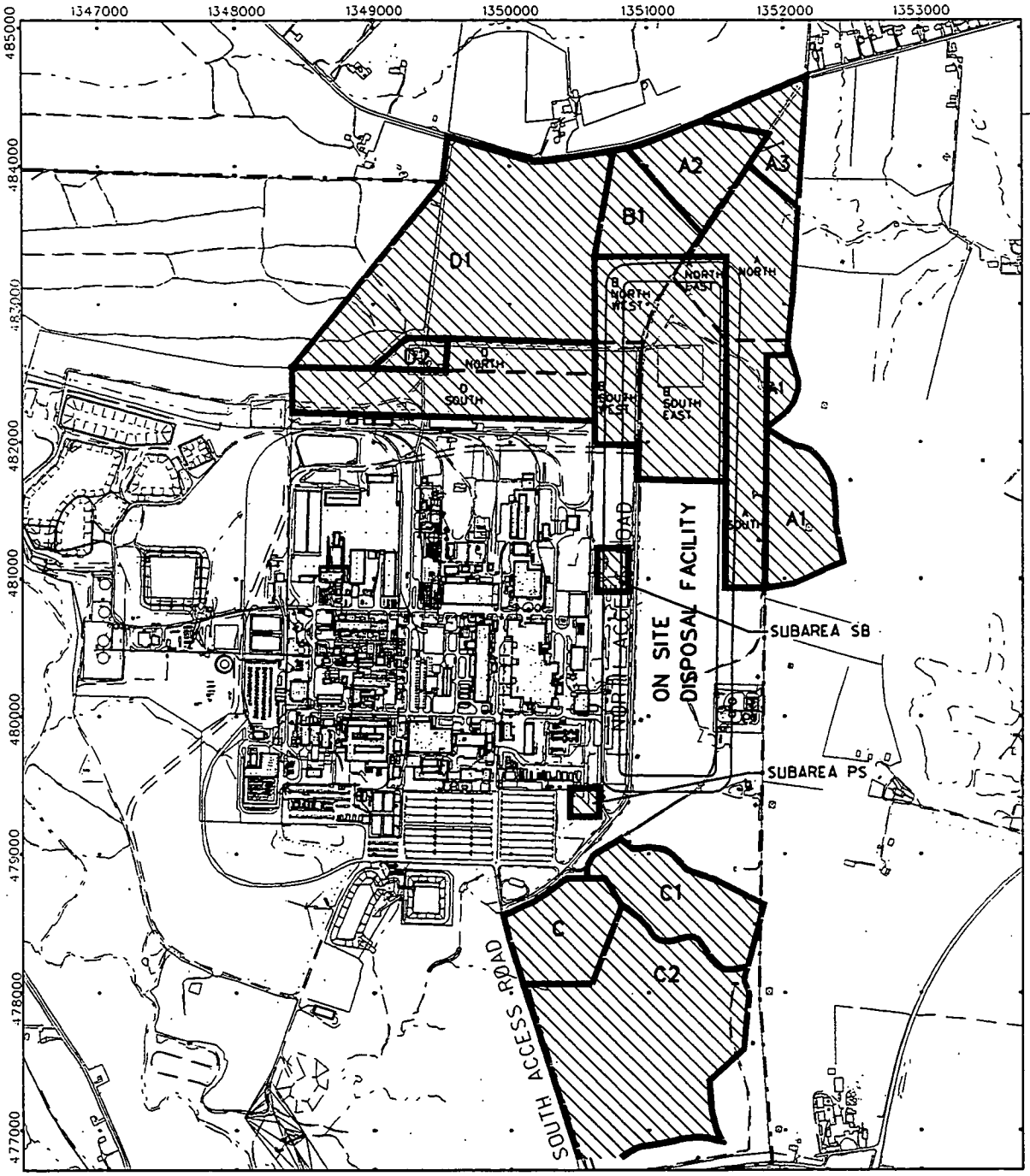
/USR/ERMAS/2CCS1/DGN/MAP/HOR/DPTH/JOAN_4.DGN FER 11/13/96 STATE PLANAR COORDINATE SYSTEM 1983



LEGEND:

FEMP BOUNDARY

AREA BOUNDARIES

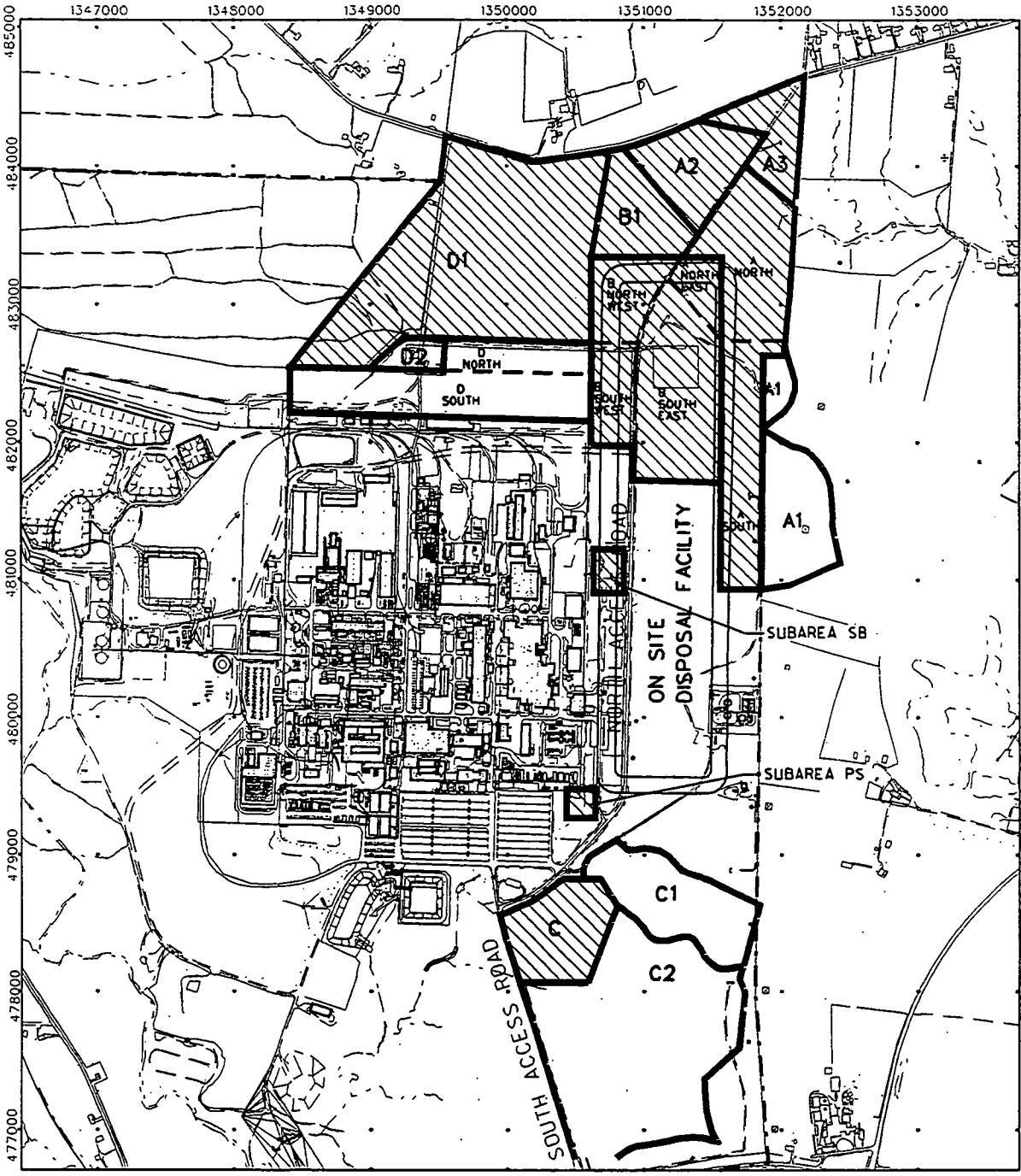
SCALE

1200 600 0 1200 FEET

DRAFT

FIGURE 2-1. ALL SUBAREAS DISCUSSED IN THE AREA 1, PHASE I WORK PLAN

/USR/ERMAS/2CCS1/DGN/MAP/HOR/DPTH/JOAN_5.DGN FER 11/13/96 STATE PLANAR COORDINATE SYSTEM 1983



LEGEND:

FEMP BOUNDARY

AREA BOUNDARIES

SCALE

1200 600 0 1200 FEET

DRAFT

FIGURE 2-2. ALL SUBAREAS DISCUSSED IN THE AREA 1, PHASE I WORK PLAN UNDERGOING CERTIFICATION

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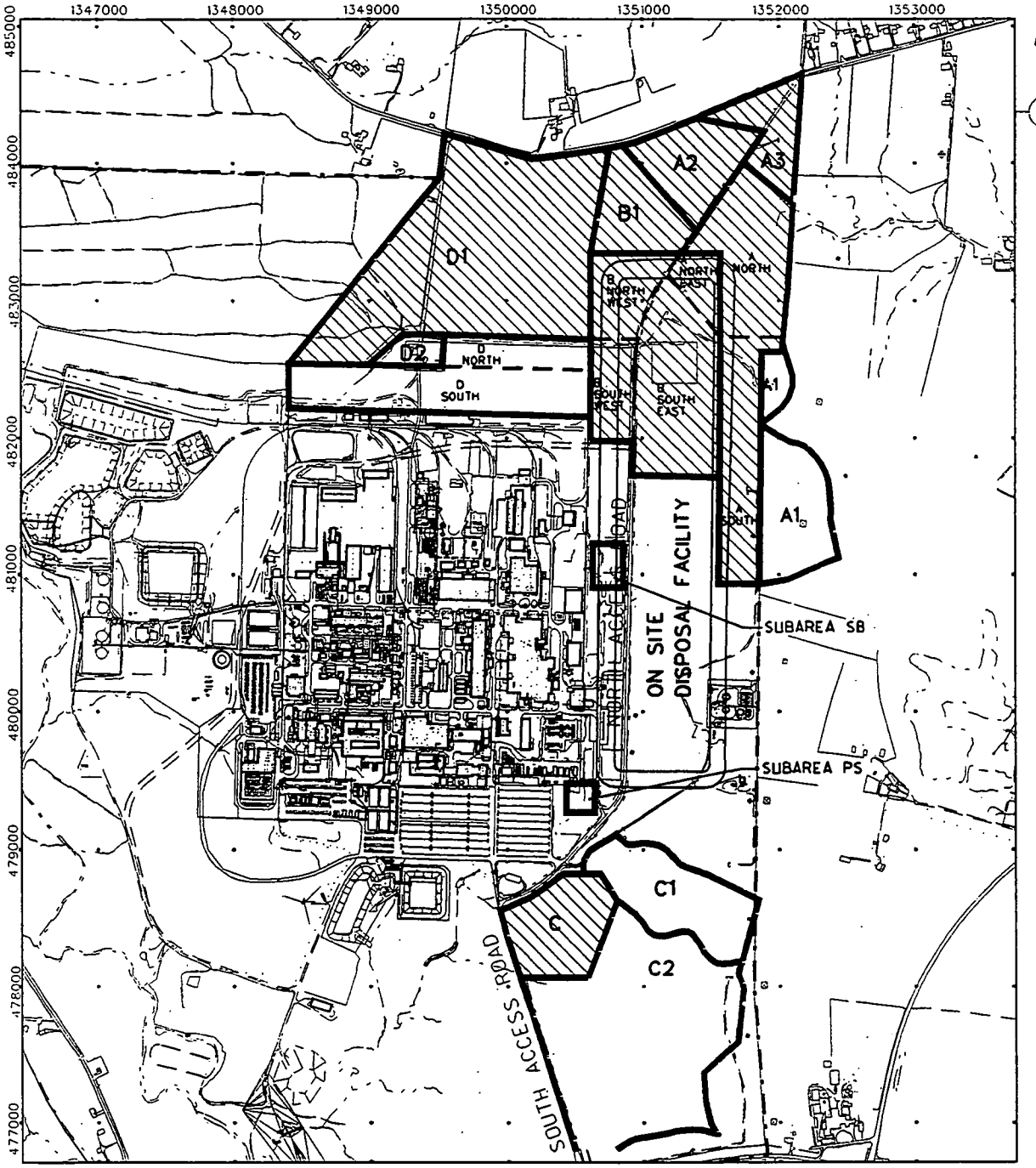


LEGEND:

FEMP BOUNDARY

AREA BOUNDARIES

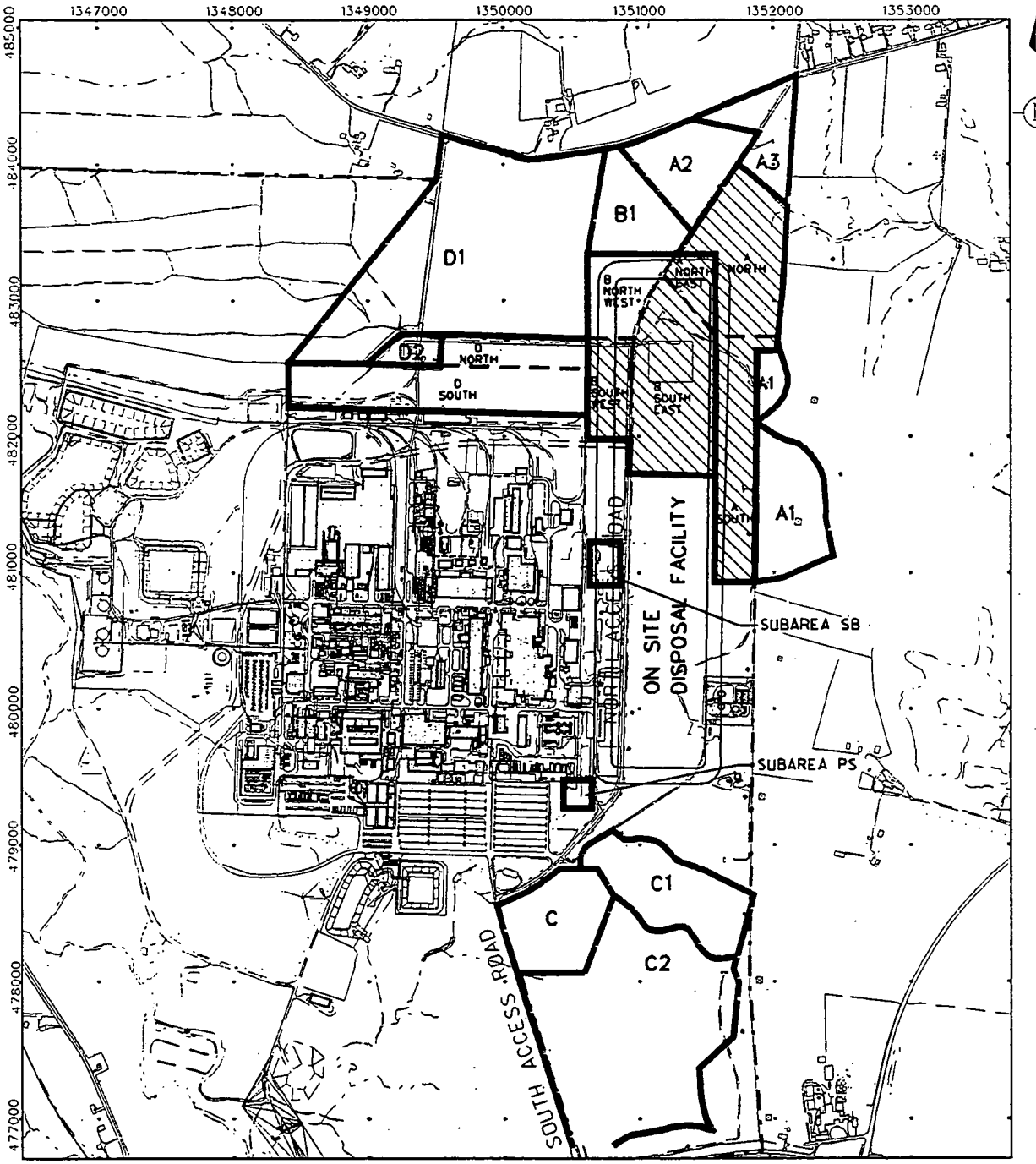
SCALE

1200 600 0 1200 FEET

DRAFT

FIGURE 2-3. AREA 1, PHASE I SCOPE

/USR/ERMA5/2CCS1/DGN/MAP/HOR/DFTR/JOAN_T.DGN FER 11/13/96 STATE PLANAR COORDINATE SYSTEM 1983



LEGEND:

FEMP BOUNDARY

AREA BOUNDARIES

NOTE: SHADING REPRESENTS 6" EXCAVATION

SCALE

1200 600 0 1200 FEET

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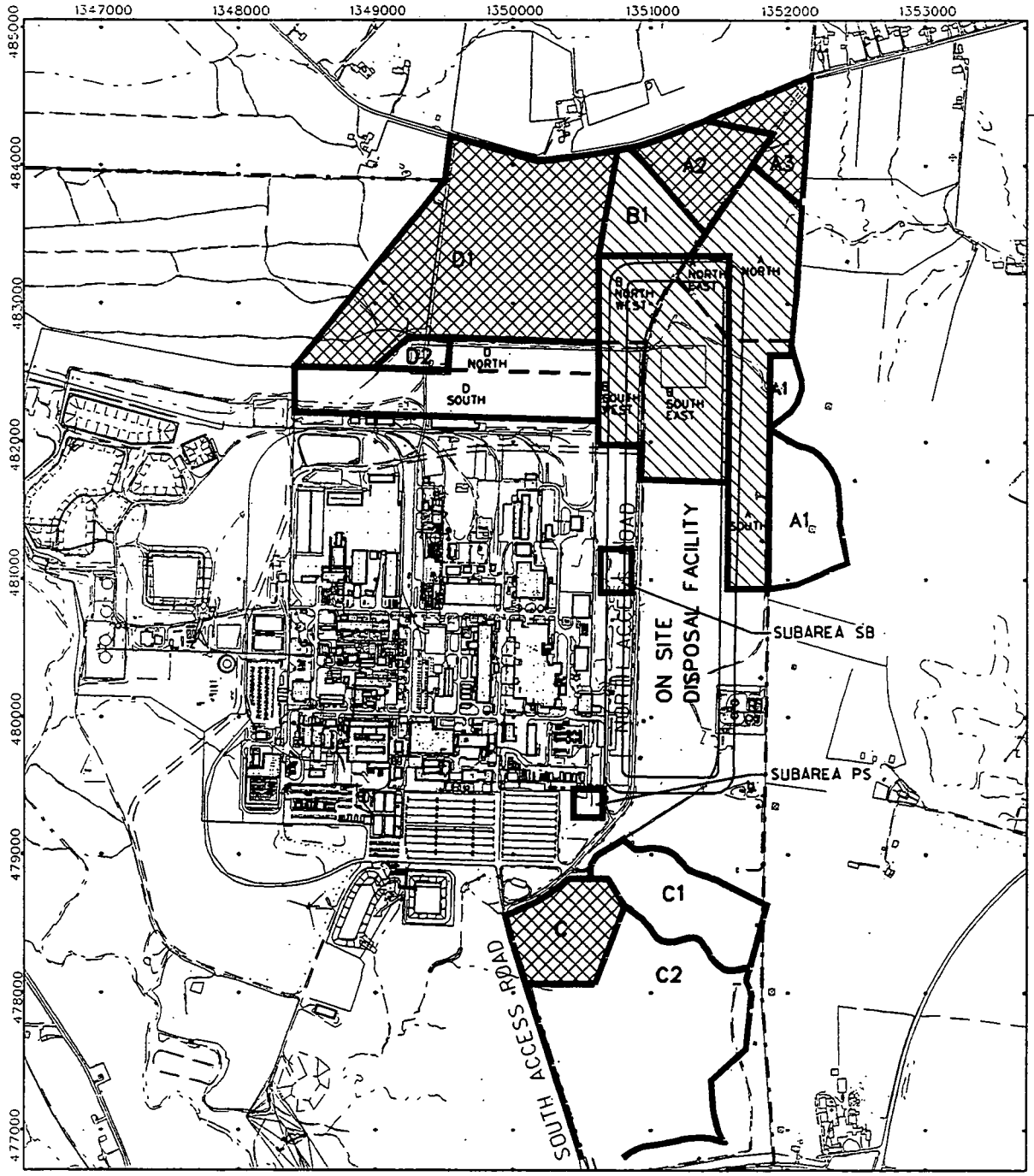
FIGURE 2-4. AREA 1, PHASE I SCOPE INITIAL CONSTRUCTION



LEGEND:

- - · — · — · - FEMP BOUNDARY

CERTIFICATION REPORTS DUE MARCH 1, 1997

CERTIFICATION REPORTS DUE JANUARY 30, 1998

NOTE: SUPPORT SUBAREAS SB & PS CERTIFICATION REPORTS ALSO DUE MARCH 1, 1997

SCALE

1200 600 0 1200 FEET

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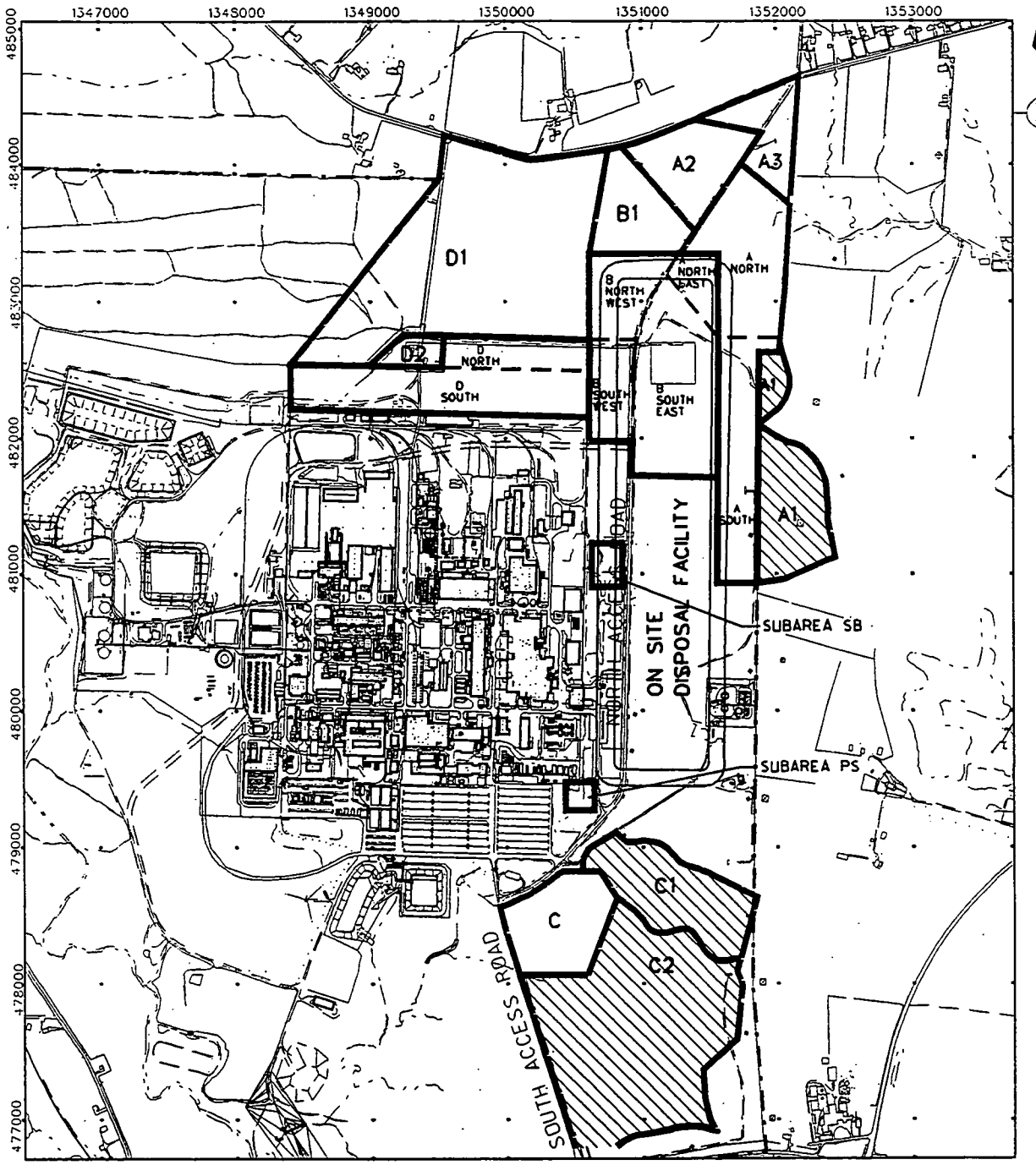
FIGURE 2-5. AREA 1, PHASE I SCOPE CERTIFICATION

/USR/ERMA5/2CCS1/DGN/MAP/HOR/DPTH/JDAN_B.DGN FER 11/13/96 STATE PLANAR COORDINATE SYSTEM 1983

/USR/ERMA5/2CCS1/DGN/MAP/HOR/OPTH/JOAN_9.DGN FER 11/13/96 STATE PLANAR COORDINATE SYSTEM 1983



LEGEND:

FEMP BOUNDARY

AREA BOUNDARIES

SCALE

1200 600 0 1200 FEET

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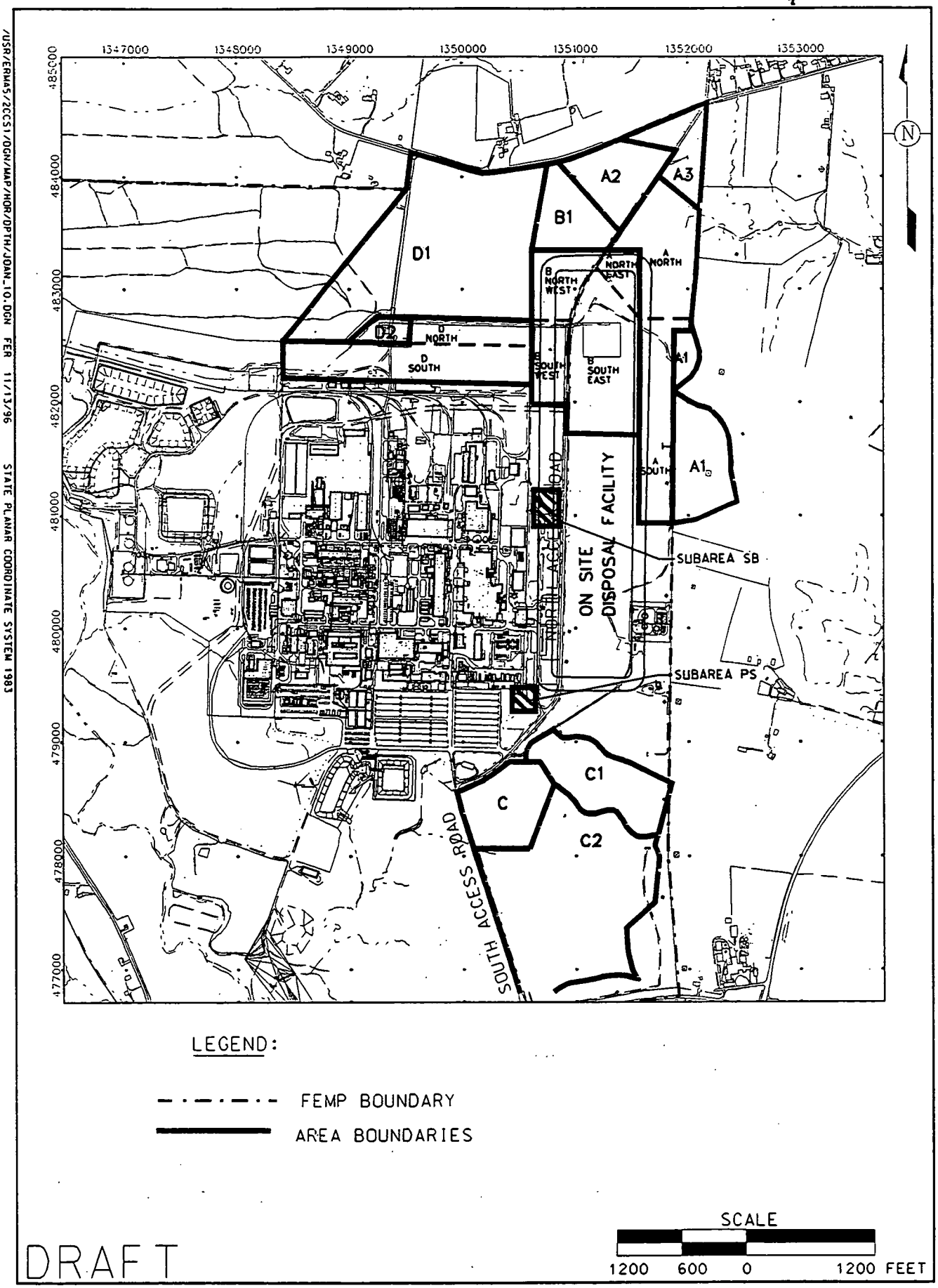
FIGURE 2-6. ADJACENT SUBAREAS WITH POTENTIAL TO IMPACT AREA 1, PHASE I SCOPE



/USR/ERM45/2CCS1/DGN/MAP/HOR/DPTH/JOAN_10.DGN FER 11/13/96 STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 2-7. SUPPORT SUBAREAS BEING CERTIFIED CONCURRENT WITH AREA 1, PHASE I SCOPE

3.0 COMPONENTS OF AREA 1, PHASE I REMEDIAL ACTIONS

As discussed in Section 1.0, the purpose of this RAWP is to define the approach and methods to remediate Area 1, Phase I in preparation for future construction. The principal activities necessary to prepare for construction are discussed in this section. The actual methods to be used for soil excavation, analytical testing, and certification to the FRLs are discussed in Sections 4.0, 6.0, and 7.0, respectively.

3.1 AREA 1, PHASE I ACTIVITIES

The activities necessary to prepare for future construction and to implement the good management practices discussed in Section 2.1 can be categorized as follows:

- Identification of soil levels in excess of WAC
- Precertification testing for verification of excavation design
- Implementation of runoff controls
- Excavation of impacted material
- Precertification testing for achievement of target levels (sufficiency of excavation)
- Certification testing
- Schedule

Each of these activities are discussed below. Refer to Figure 2.3 for the subareas under the scope of Area 1, Phase I activities.

3.1.1 Identification of Soil Levels in Excess of Waste Acceptance Criteria

Precertification testing will be performed in specified areas identified as having soil levels in excess of the WAC for total uranium. Soil identified in excess of the WAC will be segregated for offsite disposition.

3.1.2 Precertification Testing for Verification of Excavation Design

The intent of construction precertification is to verify excavation design before remediation. Verification of excavation design may be needed to determine whether or not sufficient soil is being excavated to meet the target levels.

3.1.3 Implementation of Runoff Controls

In general, runoff from upgradient areas will be controlled and rerouted to prevent potential recontamination of remediated areas meeting FRLs, unless it is demonstrated that contamination is not present in an upgradient area.

In subareas A1 and B1, precertification is needed to establish whether or not soil carried from those areas could recontaminate adjacent downgradient areas where excavation to meet FRLs is already planned. If precertification testing of subareas A1 and B1 indicates that the soil will exceed these values, drainage ditches will be installed or extended to prevent stormwater run-on contamination of subareas A and B.

Although subareas C1 and C2 are upgradient and adjacent to the eastern and southern boundary of subarea C, they do not pose a threat of recontaminating subarea C. Drainage from C1 follows natural topography and is currently routed into a ditch bordering the northern portion of C, circumventing subarea C. Drainage from C2 is naturally routed to the west, away from subarea C.

3.1.4 Excavation of Impacted Material

Excavation of impacted material refers to the removal of soil and associated debris with the goal of reducing the average COC levels to below the target levels. Based on existing knowledge of subareas A north and south, B northeast, B southeast and B southwest, contamination is expected to exist in the top 6" of soil. For this reason, excavated areas will be excavated to a depth of 6" over their entirety.

3.1.5 Precertification Testing for Achievement of Target Levels (sufficiency of excavation)

Precertification testing for excavation control will be performed after excavation of the initial 6" is completed. Additional excavation will follow in any subarea where the average test results are above the target levels or the hot spot criteria for the primary ASCOCs is exceeded. The purpose of this testing is to provide confidence that the excavation has been successful and to reduce project costs and adverse

schedule impacts by ensuring that certification testing is not performed until it will be successful. All areas to be certified will undergo precertification testing with the goal of achieving the target of 75% of the FRL for ASCOCs. This precertification step will instill confidence that certification testing to follow will be successful. Additionally, the BTVs will not drive soil remediation or excavation at the FEMP. The BTVs will be reviewed during remediation in order to assess potential impacts to future ecological habitat(s).

3.1.6 Certification Testing

Certification testing is the final confirmation of remediation adequacy. The results must demonstrate that an area meets FRLs and will receive regulatory agency approval of completion of certification. If the average of the certification results are not less than the FRLs within the specified limits of confidence, re-evaluation of the data and an alternate course of action will be required.

FDF intends to begin construction of the planned relocated North Access Road (subareas A north and A south), prior to completion of certification. Efforts will be made to minimize the risk associated with construction of this road by performing real-time analyses (precertification) and getting certification samples collected and analyzed as rapidly as possible. This approach has been taken to avoid schedule impacts on the North Access Road relocation and, in turn, on excavation of the OSDF liner.

3.1.7 Schedule

A summary of the Area 1, Phase I scope of activities is described in Table 3-1. The table identifies the construction preparation, precertification, excavation and certification activities planned for these subareas. Table 3-2 identifies the same activities for the Area 1, Phase I adjacent and OSDF support sub areas.

Field activities within the Area 1, Phase I scope and OSDF support subareas will be accomplished according to the schedule on Table 3-3. In preparation for these field activities, a number of supporting documents are being developed. These support documents are described in Sections 6.0 and 7.0. The schedule for their completion is presented in Table 3-4. Certification and comparability reports for work under the Area 1, Phase I RAWP will be submitted to the United States Environmental Protection Agency (EPA) and Ohio EPA (OEPA) on the schedule identified in Table 3-5.

The Area 1, Phase I report schedule is coordinated with the schedule for construction of the relocated North Access Road and for OSDF excavation and certification. Under the Area 1, Phase I schedule, the certification report covering the OSDF footprint will be submitted to the regulatory agencies by March 1, 1997. Site preparation work for the OSDF may begin in early 1997, but liner excavation is not planned before early May 1997.

Note that the existing North Access Road within subarea B is an exception because it is planned to be left in place until the relocated North Access Road is completed. The certification report for Subarea B cannot be completed, and Area 1, Phase I construction of the OSDF cannot begin until the North Access Road is completed and the existing North Access Road is removed.

Construction for relocation of the existing North Access Road in subareas A north and A south will begin after certification samples are collected, but prior to completion of the final certification report. Efforts will be made to minimize the risk associated with construction in this area by performing real-time analysis (precertification) and accelerated certification sampling and analysis of the soils for the road base.

It is anticipated that the Operable Unit (OU) 1 North Rail Yard grading activities in subareas D north and D south will be completed by November 30, 1996. While this area is not being certified as part of Area 1, Phase 1, the area to be graded will be monitored and precertification samples obtained prior to grading with real-time equipment as a good management practice as discussed in Section 2.1.3. Subareas D north and D south will be certified as part of Remediation Area 6 under a future RAWP.

3.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Remedial action decisions must include consideration of ARARs. Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and Section 300.68(i)(1) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) require response actions to attain, at a minimum, environmental and public health ARARs. The full listing of ARARs for the selected remedy is presented in Appendix B of the Operable Unit 5 ROD (DOE 1996a). As certain ARARs pertain to specific activities described in this RAWP, they are identified as part of this scope of work. The chemical-, location-, and action-specific ARARs pertinent to this RAWP are provided in

Appendix B of this document. Pertinent ARARs for on-site disposal are addressed through the Permitting Plan and Substantive Requirements for the OSDF (DOE 1996c).

3.3 DATA QUALITY OBJECTIVES

The DOE Orders, environmental regulations, the FEMP Federal Facilities Compliance Agreement, OEPA Director's Findings and Orders, and the EPA/DOE Amended Consent Agreement require sampling and analysis by specific methods and procedures for analytes of FEMP environmental media. This is accomplished at the FEMP through the DQO process in the development of a project-specific work plan, as required by the Sitewide CERCLA Quality Assurance Project Plan (SCQ). The DQOs pertinent to the Area 1 soil precertification sampling and soil certification are contained in Appendix C.

3.4 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

Precertification and certification sampling events using field instruments for Area 1, Phase I will follow QA/QC protocol established in the SCQ as well as applicable American Society for Testing and Materials (ASTM) methods. These sampling requirements are summarized in the SCQ and include the calibration, blanks, and standards performance for instruments and test methods. The collection and laboratory analysis of samples for precertification and certification testing follow QA/QC protocols established in the SCQ (see Section 4 and Appendix K of the SCQ) and applicable FEMP sampling procedures.

3.5 IMPLEMENTATION OF SELECTED REMEDY COMMITMENTS

The commitments made to support the selected remedy in the Operable Unit 5 ROD are presented in Section 2.1. Achieving these commitments during remedial activities relies on an accurate assessment of the nature and extent of contamination, type of contaminants potentially present, and/or process knowledge of the contaminants' origins.

The commitment to provide a verification sampling program is addressed in Section 7.0 of this RAWP. As discussed in Section 3.1, this sampling program is identified as precertification for the purposes of this document.

The final extent of excavation in Area 1, Phase I will be driven by the ALARA level of 50 mg/kg of soil for uranium and the target levels for the remaining constituents. The current excavation design is considered adequate to meet the ALARA and target levels.

The ALARA goal of 50 ppm for uranium as a target level in precertification will be achieved during the Area 1, Phase I remedial action using sodium iodide (NaI) detector(s) and high-purity germanium (HPGe) gamma spectroscopy. Use of this equipment fulfills the intent of "hand-held equipment" (DOE 1996a) by providing direct, real-time readings in the field (OEPA Comment #4).

Certification testing of soil will statistically demonstrate that the average levels are less than the target levels for Area 1 ASCOCs.

Environmental releases will be minimized during excavation of Area 1, Phase I soil through several mechanisms (e.g., confinement of sediment movement, control of erosion, and suppression of fugitive dust emissions). A detailed description of these control mechanisms is provided in Section 4.0. However, the commitment remains to continually examine and apply, where practical, new methods or technologies to mitigate environmental releases as remedial action progresses.

The commitment to restore affected areas after completion of remedial actions will be addressed in the FEMP's Site Restoration Plan, as discussed in the Operable Unit 5 Remedial Design Work Plan (DOE 1996b).

The ASCOC list for Area 1, Phase I does not include VOCs. Therefore, the commitment to segregate or treat VOCs is not pertinent to the scope of work in this RAWP.

TABLE 3-1
SUMMARY OF AREA 1, PHASE I SCOPE AND ADJACENT AREAS ACTIVITIES

Activity	Area A North	Area A South	Area B NW	Area B NE	Area B SW	Area B SE	Area C	Adjacent Areas A2,A3,D1
Construction Preparation	Traps 1 & 2	NA	NA	NA	Sediment basin 2 and west stock pile	Sediment basin 1, traps 2 and 3, east stock pile	NA	NA
<u>Precertification</u>								
Identification of WAC	NaI/HPGe/ physical samples	NaI/HPGe/ physical samples	NaI/HPGe/ physical samples	NaI/HPGe/ physical samples	NaI/HPGe/ physical samples	RTRAK/ HPGe/ physical samples	Unplanned*	Unplanned*
Verify Excavation Footprint	NA	NA	Primary COCs and metals	NA	NA	NA	Primary COCs and metals	NA
Excavation Control (Achievement of Target Levels)	Yes	Yes	Dependent on excavation verification results	Yes	Yes	Yes	Dependent on excavation verification results	NA
Excavation	6 inches	6 inches	Unplanned*	6 inches	6 inches	6 inches	Dependent on excavation verification results	Unplanned*
Certification	Report due March 1, 1997	Report due March 1, 1997	Report due March 1, 1997	Report due March 1, 1997	Report due March 1, 1997	Report due March 1, 1997	Report due Jan. 30, 1998	Report due Jan. 30, 1998

NA - Not applicable
IRDP - Integrated Remedial Design package (per Operable Unit 5 RDWP)
* Based on interpretation of existing data

TABLE 3-2
SUMMARY OF AREA 1, PHASE I & OSDF SUPPORT ACTIVITES AREAS

Activity	SB	PS
Construction Preparation	Gravel pad & material to be removed, area over excavated	NA
<u>Precertification</u>		
Identification of WAC	RTRAK/HPGe/physical samples	RTRAK/HPGe/physical samples
Excavation Verification	Primary COC metals & PCBs	No excavation planned
Excavation Control	Dependent on excavation verification results	NA
Excavation	Dependent on excavation verification results	NA
Certification	Prior to or during OSDF construction	Prior to or during OSDF construction

NA - Not applicable
IRDP - Integrated Remedial Design package (per Operable Unit 5 RDWP)

TABLE 3-3
Area 1, Phase 1 Scope And Support Subareas SB & PS, Schedule of Activities

SUBAREA	Field Activity	Anticipated Completion Date
A(N&S) B(NW,NE SW,SE), B1, PS, SB	Begin Mobilization for Excavation	4 September 1996
	Installation of runoff controls along A1	6 December 1996
	Excavation, subarea A	8 November 1996
	Excavation, subarea B	15 December 1996
	Certification Sampling	31 January 1997
A2, A3, C, D1	Certification Sampling	01 December 1997
Existing North Access Road (in Subarea B)	Certification Sampling	31 January 1997
	Roadway Removal	25 May 1997 (with OSDF construction)
	Final Check with Real-time Equipment	31 May 1997

TABLE 3-4
Area 1, Phase I Scope, Supporting Documents Schedule

Document	Dates Submitted
Project Specific Plan for Certification	October 31, 1996
Project Specific Plan for WAC Attainment	October 31, 1996
Procedure for R-TRAK Operation	October 31, 1996
Procedure for HPGe Detector Operation	October 31, 1996
October 31, 1996 Project Specific Plan for Comparability Study	October 31, 1996
Letter addenda (as described in Section 4) for unexpected excavations within the areas to be certified for Area 1, Phase I	As Needed

TABLE 3-5
Area 1, Phase I Scope And Support Subareas SB & PS, Reports Schedule

Description	Proposed Date, Submittal of Report
Certification Report for: Subarea A - Footprint for relocation of North Access Road Subarea B - North end of OSDF Subarea B1 - OSDF runon area Subarea PS - Main Leachate Pump Station for the OSDF Subarea SB - Initial Sediment Basin for the OSDF	01 March 1997
Comparability Study Report	14 March 1997
Certification Report for: Subarea A2 - North-Northeast corner of site Subarea A3 - Northeast corner of site Subarea C - Initial portion of Borrow Area Subarea D1 - North central portion of site	30 January 1998

Note: shaded area refers to OEPA Comment #7

4.0 EXCAVATION

This section defines the scope of excavation activities to be performed under Area 1, Phase I East Soil Remediation Project contract and the means by which FDF will manage the excavation process. Details regarding excavation limits, engineering and environmental controls, excavation sequence and technique, disposition of soil, and health and safety requirements are provided. Excavation drawings and specifications, for areas east and west of the North Access Road, are provided in Appendix A.

4.1 WORK DESCRIPTION

4.1.1 Excavation Limits, Depths, and Quantity

Excavation work on the Area 1, Phase East Remediation Project contract is planned in subareas A north and A south and subarea B (except B northwest) as shown in Figure 2-4. The planned excavation limits, depths, and quantities of soil identified in the design package for Phase I were derived from existing RI analytical data to establish limits of soil contamination (see Figure 1-3), construction milestone requirements, and other factors. The boundaries presented in this RAWP are the planned boundaries for the excavations. Actual boundaries will be contingent on circumstances that will be encountered during remediation including, the final extent of soil contamination identified before or after excavation.

Precertification sampling will be performed before excavation to confirm the adequacy of the excavation footprint, to determine the need for surface water controls, and to detect areas exceeding the uranium WAC. If precertification sampling indicates significant additional remedial excavation needs, a letter addendum to this RAWP will be issued.

4.1.2 Site Preparation

Site preparation tasks include moving equipment and personnel onto the site; setting up an office area, a laydown/staging area, sanitary facilities, and a decontamination unit; and installing construction fences/barricades in the appropriate locations, as shown in the drawings in Appendix A. These activities will be performed before any excavation efforts begin.

4.1.3 Existing Structures, Utilities, and Wells

The existing above- and below-ground utilities, structures, and monitoring wells in the construction areas have been located (see Appendix A drawings) and identified so those items necessary for ongoing remediation operations (e.g., monitoring wells) could be preserved and unnecessary facilities removed.

Field drainage structures impacted by the Area 1, Phase I scope are located in subareas A north, A south, A3 and all of subarea B. Drain tiles within the footprint of the OSDF will not be removed during Area 1 Phase I east soil remediation, but will be addressed during the construction of the OSDF. Drain tiles outside the OSDF footprint will be removed as detailed in Appendix G.

The existing North Access Road, its associated drainage ditches and adjacent fiber optic lines will be removed after the relocated North Access Road is in service.

Two existing air monitoring stations (8A and 9B) that are integral to the Integrated Environmental Monitoring Plan (IEMP) are located within the area of excavation for this RAWP. Stations 8A and 9B are located along the east FEMP property line, north of the former production facilities, and south of the OEPA monitoring station. Access to the air monitoring stations will be maintained and existing power to the monitors will not be impacted by field activities. The applicable health and safety matrix has been revised to allow Ohio EPA access to its monitoring station along the east fence line.

4.1.4 Coordination with Other Operable Units

Area 1, Phase I activities have been coordinated with other operable units' design and construction activities with the goal of minimizing potential impacts to activities being planned and performed under the site's overall remediation effort. The following activities have been addressed:

- Equipment and material laydown and staging area
- Transportation and stockpiling of contaminated soil
- Installation of sedimentation control facilities
- Use of FEMP facilities and utilities, traffic, and pedestrian controls
- Discharge of potentially contaminated runoff from the impacted soil stockpile into the adjacent on-site stormwater collection system
- Relocation of existing air monitoring stations.

4.1.5 Engineering and Environmental Controls

4.1.5.1 Stormwater Management Controls

Erosion and sedimentation controls will be in place before the start of excavation activities. The erosion and sedimentation devices indicated on the excavation drawings in Appendix A have been designed in accordance with standard State of Ohio construction methods.

Subareas A and B are located outside the site's former production area. Runoff from these areas is not a major concern during excavation activities, since excavation will occur from upgradient to downgradient with the top 6 inches of soil being excavated. The runoff will be collected in the sedimentation ponds/traps to mitigate sediment transport prior to discharge into the same waterways it currently travels. This runoff will be monitored as noted in Section 4.1.5.10. Sediment collected in the sedimentation ponds/traps will be periodically removed, and placed in the appropriate soil stockpile after testing for OSDF WAC. Figure 4-1 indicates the drainage area for each of the sedimentation ponds/traps. The controls will remain in place to support the follow-on construction activities, such as relocation of the North Access Road.

This project will adhere to the sitewide Stormwater Pollution Prevention Plan, which has been developed to prevent the potential contamination or recontamination of soil, stormwater, and groundwater as a result of excavation and construction activities. The plan includes checking heavy equipment for fluid leaks and a requirement for fuel storage units to have secondary containment features.

4.1.5.2 Noise Monitoring and Abatement

Federal law mandates that all federal government agencies comply with federal, state, interstate, and local requirements for the control and abatement of environmental noise. The two primary federal laws are the Noise Control Act, 42 United States Code (USC) 4901, et seq., and Noise Pollution and Abatement Act 42 USC 7641. Executive Order 12088, Federal Compliance With Pollution Control Standards, requires federal agencies to comply with the Noise Control Act. The Operable Unit 5 ROD identifies these laws as applicable [see Appendix B and Table B-3 of the Operable Unit 5 ROD (DOE 1996a)]. An updated version is provided in Appendix B of this document.

There are several federal regulations implementing various parts of the Noise Control Act. Construction equipment noise standards are set forth in 40 Code of Federal Regulations (CFR) 204.1, et seq. Transportation equipment noise standards are set forth at 40 CFR 205.1, et seq.

Environmental noise monitoring will be performed during remediation in conjunction with implementation of the on-site health and safety program, in lieu of having a regulatory environmental standard available. Health and safety protocol will be used in the field to ensure that workers' occupational and environmental exposures to noise do not exceed Occupational Safety and Health Act (OSHA) and American Conference of Governmental Industrial Hygienists (ACGIH) limits. Therefore, an administrative action level of 85 decibels (dBA) in the vicinity of field personnel will also be established as an environmental action level. Measurements will be made by health and safety field personnel using instruments accepted for use in health and safety occupational noise monitoring, and as specified in the health and safety project-specific requirements matrix.

Components of noise monitoring will include establishing background levels in Area 1 before remediation activities and occasional monitoring during implementation of activities. If the administrative environmental action level falls within 5 dBA of the action level (i.e., 80 dBA), field health and safety personnel will contact the project field manager to begin noise abatement efforts. Noise abatement will include proper maintenance of all vehicles or machinery to be used in Area 1, Phase I, and may include rescheduling the times that loud machinery is used during the day. No Phase I remediation activities are expected to be performed after sunset.

4.1.5.3 Fugitive Dust Emissions Abatement

Short-term fugitive dust emissions are expected during some remediation activities. These include excavation, transportation, soil spreading, soil compaction, and soil staging.

The following controls will be utilized, when necessary, to minimize the potential for fugitive dust emissions:

- Covers and physical barriers - Covers will be deployed when appropriate. Efforts will be employed in soil staging areas to prevent windblown emissions as well as protection from precipitation, and may include such controls as dust suppressants, plastic sheeting, wind barrier fences, etc.
- Moisture adjustment - The use of water to adjust the moisture of material being placed on haul vehicles.
- Water spray - Water will be sprayed, as necessary, to control dust in all areas of an exposed excavation, and excavation area roadways.
- Vehicle speed restrictions - A speed limit of 15 mph will be established for construction vehicles in areas within the project limits which contain exposed soils. This includes excavation areas and

stockpiles. FDF field managers ensure any excavation equipment, such as an excavator, capable of speeds greater than 15 mph are kept below that speed. They are equipped with speedometers for operators to monitor. Most excavation equipment, such as end loaders or dozers, are operated below 15 mph. An additional reduction in vehicle speed is enforced by FDF field management when dry soil conditions prevail (OEPA Comment #15).

- Crusting agents - The use of crusting agents (e.g., surfactant) will be considered when water proves ineffective or when a particular area will not be disturbed for a long period of time.

- Operational controls - Operational controls are measures which reduce potential emissions by limiting activities that may contribute to the generation of emissions, or procedural measures taken to limit emissions.

- Wind screens - Wind screens may be used on occasions when wind velocities necessitate additional protection.

- Temporary shut down - The job may be temporarily shut down during high wind events.

- Seeding - After certification samples have been taken for an area, all exposed soil surfaces will be treated with a hydro mulch during seeding operations to stabilize the surface of the soil and prevent seed from being blown away. After seeding operations, vehicle access will be restricted until ground cover is firmly established. Vehicle access will also be restricted to prevent cross contamination during other site remediation activities.

- Dust alert - The subcontractor shall have someone on-call 24 hours/day seven days/week to respond to a dust alert. Dust suppression to begin within two (2) hours after notification during non-work periods.

A copy of the subcontractor dust suppression plan, and the portion of the Area 1, Phase I Health and Safety Plan, defining the scope of the dust suppression plan, have been submitted to the Ohio EPA as an attachment to the Comment Resolution Package, which responded to comments on the Draft version of this Area 1, Phase I Work Plan (OEPA Comment #12, US EPA Comment #4).

4.1.5.4 Fugitive Dust Emissions Monitoring

Several Federal regulatory standards on the release of radionuclides to the air are summarized in Table B.1 under the header "Air." These releases will be monitored through the continuous sitewide air monitoring program discussed in Section 4.1.5.5. Occupational exposure monitoring will be performed in accordance with the health and safety matrix.

Fugitive dust emissions produced from soil remediation activities will be attenuated through standard abatement practices. The abatement practices will, at a minimum, comply with the ARARs defined under the heading "Air" in Tables B.1 and B.3 in Appendix B. These ARARs are expected to be met through

the use of visual monitoring. Regulatory limits {Ohio Administrative Code [OAC] 3745-17-07(B)(4),(5), and (6)} for these activities include the following:

- No visible emissions from any unpaved roadway or parking area except for a period of time not to exceed 13 minutes during any 60-minute observation period
- No visible particulate emissions from any material storage piles except for a period of time not to exceed 13 minutes during any 60-minute period.

An FDF administrative level of 6 minutes will be established to achieve compliance with this regulation.

For purposes of this project, visible particulate emissions will be defined as visible particulate generated during construction/remediation activities which rises above the apex of the equipment wheels or tracks, and/or drifts more than 10 feet. Visible particulate is also those generated by wind movement with the potential to migrate from the work area (OEPA Comment #12, US EPA Comment #4).

4.1.5.5 Continuous Sitewide Air Monitoring

The sitewide Environmental Monitoring Program (EMP) will be used to measure the efficiency of dust suppression controls.

Radiological environmental monitoring will continue under the sitewide EMP for the frequency specified in the IEMP. Data will be collected during the implementation of the remedial action from air monitoring stations located on site, near the fence line, and at several locations in nearby communities. The monitoring program has been developed in response to DOE Orders 5400.1 and 5400.5, and is presented in the IEMP. Some air monitoring locations will require relocation to accommodate these remediation activities. These location-based modifications will be addressed in the IEMP.

4.1.5.6 Floodplains and Wetlands

Executive Orders 11988 (Protection of Floodplains), 11990 (Protection of Wetlands), and DOE Regulation "Compliance with Floodplain/Wetlands Environmental Review Requirements" (10 CFR 1022) specify the requirements for a floodplain/wetland assessment where DOE is responsible for providing federally undertaken, financed, or assisted construction and improvements. Accordingly, a Floodplain/Wetland Notice of Involvement is also required to be published in the Federal Register to satisfy public notice requirements of 10 CFR 1022.14. None of the Phase I work lies within either the

floodplain of Paddys Run or the Great Miami River (see Figure 4-2); therefore, no floodplain assessment is required.

Figure 4-2 identifies the total site wetlands delineated in 1993 (Ebasco 1993). Direct impacts to jurisdictional wetlands in Phase I are limited to an east-west drainage ditch identified as wetland WG - WH - WJ - WT - WGG. Impacts to these wetland areas were addressed in the Operable Unit 5 FS to satisfy requirements of 10 CFR 1022; therefore, a wetland assessment will not be performed for this area. However, dredge and fill activities associated with these impacts (approximately 0.3 acre) are subject to compliance with applicable substantive permitting requirements of the Army Corps of Engineers (ACOE) and OEPA wetland permit programs established under Sections 401 and 404 of the Clean Water Act. Because these impacts will occur within wetland areas located above the headwater region of Paddys Run, upcoming remediation activities in Area 1, Phase I are authorized under Nationwide Permit No. 26 - Headwaters and Isolated Waters, as promulgated in Appendix A to 33 CFR 330. OEPA issued its corresponding Section 401 State Water Quality Certification for Nationwide Permit 26 on January 17, 1992.

Applicable substantive wetland permitting requirements include the use of appropriate erosion control devices to minimize sediment loading during construction activities, as well as compensatory mitigation efforts to off-set the acreage of disturbed wetlands. Two small wetland areas (WM and WN) located in the northeast corner of the site will not be directly impacted by Area 1, Phase I activities, but will be protected from receiving excessive sediment from stormwater runoff through stormwater and erosion controls being installed for the Area 1, Phase I work. In addition, excavation proposed for relocation of the east-west drainage ditch near the northern forested wetland has been evaluated to ensure that it will not impact this wetland.

Wetland impacts, including the 0.3 acre impact associated with this project, are being mitigated on a sitewide basis. Documentation addressing the implementation of specific mitigatory requirements will be submitted in accordance with the schedule established under the Operable Unit 5 Remedial Design Work Plan.

4.1.5.7 Threatened and Endangered Species

The FEMP has previously conducted sitewide surveys for threatened and endangered species; the Phase I remediation could potentially impact a population of state-threatened Sloan's crayfish

(Orconectes sloanii) in Paddys Run just downstream from where the north drainage ditch empties into the creek. Sloan's crayfish is vulnerable to environmental stress, particularly siltation. Area 1, Phase I drainage flows for the most part into drainage areas 1 & 2 (Figure 4-1). Only subarea B southwest drainage flows into drainage area 3 (subareas D north and D south, not part of Area 1, Phase I scope, also drain into drainage area 3).

To protect the Sloan's crayfish from possible periodic heavy siltation, the FEMP will use best management practices to control erosion in Area D (not part of the Area 1, Phase I RAWP) which could potentially impact the north drainage ditch. A sedimentation pond will be built near the west end of Area D to capture the sediment in the stormwater runoff (Figure 4-1). The runoff will flow through the sedimentation pond before entering the north drainage ditch. Excessive silt loads may require eventual relocation of Sloan's crayfish either upstream of the north drainage ditch or at a suitable off-property location. However, it is important to note that the success of this relocation is unknown. A management plan for Sloan's crayfish is included as Appendix D.

The survey for the state-listed endangered cave salamander (*Eurycea lucifuga*) identified marginal habitat in the ravine in the northern sections of the site. Excavation activities should not impact this area.

4.1.5.8 Pine Woodlot

The northwest portion of Subarea B contains 7.13 acres of White and Austrian pines; this part of the area is referred to as the north pine woodlot. The average contaminant concentrations in this area are not expected to be above their respective FRLs. Planned precertification/certification of the area may prove otherwise. There are approximately 4300 pine trees on the 7.13 acres; all the trees will eventually be removed along with their root systems as part of the follow-on OSDF construction.

The disposition of trees and stumps will be managed according to the Sitewide Excavation Plan (SEP) which is due to the regulatory agencies on March 14, 1997. An analysis of COC uptake in trees will be included in the SEP. These materials within Area 1, Phase I are currently being rad screened and are being place in the OSDF debris stockpile (separate from the soil pile) if they are below the OSDF WAC, or placed in the off-site debris pile for later disposition if they exceed the OSDF WAC.

4.1.5.9 Personnel Monitoring

Personnel monitoring during construction activities will be in compliance with OSHA, 29 CFR 1926, and the project-specific health and safety requirements matrix for this work.

4.1.5.10 Water/Runoff Monitoring

Sediment monitoring will be limited to total suspended solids for the purpose of checking the efficiency of sediment and erosion control measures. Project-specific monitoring will be limited to total suspended solids for the purpose of checking he efficiency of sediment and erosion control measures. Chemical-specific monitoring will be left to the IEMP and will not be performed on a project-specific basis. Total suspended solids monitoring will be performed on the influent and effluent at Sediment Trap #2 and the East Sediment Basin. The sampling will be performed for major storm events (greater than 0.5 inches of rainfall), but no more frequently that once per month.

4.1.5.11 Historic and Cultural Resource Protection

Section 110 of the National Historic Preservation Act (NHPA) requires that historic data be recorded before the destruction of any archaeological site is eligible for listing on the National Register of Historic Places. Section 106 of the NHPA requires DOE to consider and consult with the Advisory Council on Historic Preservation and the Ohio Historic Preservation Office regarding the effects of remedial activities on archaeological sites eligible for listing on the National Register of Historic Places. Section 3 of the Native American Graves Protection and Repatriation Act requires the repatriation of certain Native American cultural items excavated or discovered at the FEMP to the appropriate federally recognized Native American tribes. The following paragraphs describe the archaeological activities being conducted for this RAWP.

The entire on-site area east of the existing North Access Road has been surveyed for the presence of cultural resources. Data recovery will be completed for historic properties in this area before field activities begin. A Phase I archaeological survey has been completed for the north pine woodlot (inclusive of subarea B1) and subareas D1 and A1.

When a Phase I archaeological survey reveals the potential for historic properties, a Phase II investigation may be necessary. If historic properties are delineated during the Phase II investigation which will be affected by excavation, those sites will undergo data recovery (Phase III investigation) before any remedial excavation activities occur. Unexpected discovery of cultural resources (human remains or

associated funerary objects, unassociated funerary objects, sacred objects, or objects of cultural patrimony) may occur during any excavation or construction activities, and may result in work stoppages.

4.1.5.12 Security/Traffic Control

Currently there is little activity in the planned excavation areas, with the exception of the existing North Access Road. Routine traffic on the existing North Access Road consists of DOE, public safety, commercial and privately owned vehicles. In order to not interfere with this traffic flow, excavation activities will be kept clear of the roadway. All equipment will be limited to a clearance of approximately 25 feet from the edge of the existing roadway (see drawings in Appendix A).

4.1.6 Construction Drawings and Specifications

The excavation design packages for Phase I consists of drawings/specifications for various elements of the project scope. The drawing packages for these elements include the following:

- Location plans and index to drawings
- Sedimentation ponds/traps and details
- Excavation plans and details
- Impacted soil stockpile plans and details
- Site preparation plans and details.

The drawings/specifications included in Appendix A of this RAWP represent the package for subarea A and subareas B northeast and B southeast. Drawings and specifications for subarea B southwest are being developed by Operable Unit 1 and are also included in Appendix A.

The basis of the specifications is the latest edition of the State of Ohio Department of Transportation (ODOT) Construction and Material Specifications. These will serve as baseline specifications and have been modified to address specific technical requirements for each phase of the project. These ODOT standards address construction and materials for any earthwork project within the state. These baseline specifications provide standards that will be familiar to any contractor who has performed similar work within the state.

4.2 CONSTRUCTION METHODS

4.2.1 Mobilization

The contractor will mobilize by moving construction trailers and equipment to the site. The contractor will provide appropriate training levels to all contractor personnel before beginning work.

A preconstruction meeting will be held between FDF Construction Management and Engineering and the remediation subcontractor to coordinate construction activities, promote efficient planning/performance of the work, and define requirements for mobilization. Participants will review the project scope of work, permitting requirements, material and equipment status, safety requirements, inspection testing, certification, and project schedule.

4.2.2 Excavation Sequence

Soil remediation excavation will be completed in two areas: A and B (excluding B northwest). Stormwater runoff quality will be controlled throughout the excavation work phases by excavating from upgradient to downgradient.

The following is a summary of the excavation sequence. Subareas may be worked concurrently to expedite the schedule.

- Subarea A - To control stormwater runoff and cross contamination, the area will be excavated in two parts based on existing natural drainage patterns. The northern portion, which naturally drains northeast, will be excavated from south to north and from west to east. The southern portion, which drains southwest, will be excavated from north to south and from east to west.

- Subarea B - To control stormwater runoff and contamination, the area (exclusive of the northwest portion) will be excavated from north to south. This excavation will minimize the change in current (i.e., upgradient to downgradient) drainage patterns in this area.

After mobilization, each of the following activities will be components of the work:

- Install air monitoring devices
- Install erosion and sedimentation controls
- Prepare staging area and decontamination area
- Layout of field limits of excavation

- Relocate, remove, or modify existing utilities (as required)
- Construct impacted soil stockpiles and associated controls
- Begin excavation activities
- Haul and deposit soil at the impacted soil stockpile
- Perform precertification
- Re-evaluate any area soil excavation indicated by precertification testing to be above FRLs
- Perform certification according to design
- Install temporary vegetation as required.

Subareas B northwest and/or C, although not currently planned for excavation, may require excavation depending on the outcome of precertification. If excavation is required, a letter addendum to this RAWP will be issued to indicate the extent of excavation. All other guidelines presented in this RAWP will apply to subareas B northwest and C, if excavated.

4.2.3 Excavation Technique

All excavations currently identified will be shallow (6 inches). Standard construction equipment will be used (such as bulldozers, front-end loaders, scrapers, or similar equipment). The pattern of excavation will be generally uniform across each area. The soil will be excavated and deposited in the appropriate impacted material stockpile area. To the extent possible, vehicles will be operated on downgradient unexcavated areas to minimize impacts to remediated areas and to avoid potential recontamination.

Any soil exhibiting concentrations above the OSDF WAC will be identified and selectively excavated. The excavated soil will be transported to the Operable Unit 1 staging area for eventual off-site disposal. If further characterization of the area is warranted, it will be conducted in accordance with the guidelines set forth in Sections 6.0 and 7.0 of this RAWP.

To ensure remediated areas are not recontaminated, equipment used in remediation activities will not be allowed to traverse areas following certification sampling. Access to the remediated areas will be restricted to those with prior approval from FDF management.

4.2.4 Sampling and Analytical Testing

As discussed in Section 5.0, the sitewide COCs were identified based on a matrix of parameters. Based on the spatial distribution of these sitewide COCs, the ASCOCs for Area 1, Phase I were determined. The ASCOCs are then retained for further consideration as soil contaminants in Area 1, Phase I and are carried into the certification process. Sampling and analytical testing for the ASCOCs will be performed to satisfy the following needs.

4.2.4.1 Precertification Sampling and Analysis

Precertification sampling and analysis is defined, for the purposes of this RAWP, as any sampling and analysis performed under its auspices that occurs before formal certification sampling and analysis. Precertification sampling and analysis will occur prior to excavation to assure that WAC materials are identified, confirm the adequacy of the excavation footprint and determine the need for surface water runoff control. Precertification sampling and analysis during and after excavation will be performed to provide assurance that the residual soil will meet certification for FRLs or applicable BTVs. Certification sampling and analysis will demonstrate compliance with FRLs by methods described in Section 7. Information provided in the Operable Unit 5 FS Report and soil data in the remedial design (RD) database indicate that the contamination in these work areas is confined to a depth of less than 6 inches and is deposited by airborne dispersion from the former production facilities. Based on a review of the existing data, removal of this 6-inch layer of surface soil and vegetative matter in the work areas will result in the remaining ASCOC concentrations being below the FRLs.

Once a designated work area has been excavated to the 6-inch depth and excavation control sampling indicates there is either vertical (depth component) or horizontal (areal component) residual contamination, then the identified soil will be excavated and resampled. When excavation control sampling has been concluded (ASCOCs have achieved their target levels), certification sampling can be initiated in those areas. Certification sampling will demonstrate that average concentrations of the ASCOCs are below their respective FRLs. Analytical methods to support the precertification and certification activities are identified in Section 6.0 and Appendix F.

4.2.5 Disposition and Staging of Excavated Material

Material types that may be excavated during Phase I remediation include soil, vitrified clay drainage tiles and tree roots. Much of this material will be dispositioned for consolidation in the OSDF and will require staging until the OSDF is available to accept waste. Some material will require staging for

management, reuse, or possible shipment for off-site disposal. This section describes the staging locations, management requirements, and expected volumes of excavated material that will remain on site.

4.2.5.1 Impacted Soil Stockpile Locations

Two impacted soil stockpile areas will be prepared, one on either side of the existing North Access Road. This will allow free passage of vehicles on the existing North Access Road without interference from remediation activities. Therefore material excavated from subarea A, subareas B northeast and B southeast which meet the OSDF WAC will be staged on the east side of the existing North Access Road (Stockpile 1).

Material excavated from subarea B southwest (and potentially subarea B northwest) which meets the OSDF WAC will be staged on the west side of the existing North Access Road (Stockpile 2). Soil from subarea D excavations meeting the OSDF WAC (not in the scope of this RAWP) will also be staged on the west side of the existing North Access Road (Stockpile #2).

Soil exhibiting concentrations above the WAC will be transported in the appropriate container/vehicle to the Operable Unit 1 staging area for eventual off-site disposal.

4.2.5.2 Material Disposition and Volume

Disposition of the initial 6-inch excavation material from Area 1, Phase I will be based on Operable Unit 5 RI data, results from precertification, and in accordance with the WAC for the OSDF. It is estimated that the volume of impacted soil east of the existing North Access Road will be approximately 37,000 cubic yards; the volume of impacted soil west of the existing North Access Road is estimated at approximately 4,300 cubic yards. Soil excavated from the sedimentation ponds/traps below the initial 6-inch excavation east of the existing North Access Road will be used for construction of the sedimentation ponds/traps (e.g., berms).

Excess material below the initial 6-inch excavation generated from the construction west of the existing North Access Road, will be used as fill for the Operable Unit 1 process area site improvement construction. Use of this excess material will significantly reduce the need for Operable Unit 1 to obtain fill from a borrow area located north of Waste Pit 5. In addition, approximately 17,600 cubic yards of excess soils from the construction of the Operable Unit 1 rail yard and the supporting drainage ditches in subarea D (not in the scope of this RAWP) will also be used for fill.

4.2.5.3 Impacted Soil Stockpile Management Requirements

Preparation of the stockpile areas includes installation of a runoff detention basin, silt fence, straw bales, and any ditches or dikes deemed necessary to control erosion and runoff from the stockpile. Access control is also a management requirement.

The west sedimentation basin will collect runoff from both impacted soil stockpiles and from the debris stockpiles; as a result, the basin shall be designed with a holding capacity of not less than the volume for a 10-year, 24-hour storm. The discharge at the west sedimentation basin will be routed through the existing former production stormwater system via the Stormwater Retention Basin. Discharge will be minimized to allow time for the Stormwater Retention Basin to accommodate the added capacity.

The other major water control structures (including the east sedimentation basin and the three sedimentation traps) will not collect runoff from any stockpiled impacted material. Therefore, the Rainwater and Land Development: Ohio's Standard for Stormwater Management Land Development and Urban Stream Protection, 2nd Edition 1996 is to be taken into consideration when designing holding capacities, overflow features, and other surface water controls with the intent of trapping sediment.

The diversion ditches within the work area will be inspected by FEMP Environmental Compliance staff to ensure that erosion is not occurring. If significant ditch erosion is found, check dams will be installed at that time.

To assist in the maintenance of both sedimentation basins, level indicators for sediment clean-out will be installed in both the east and west sedimentation basins.

Several maintenance activities will be performed during Area 1, Phase I remediation. These activities include suppression of fugitive dust, periodic collection and stockpiling of sediment, and stabilizing the stockpiles with engineering controls.

During active use of the stockpiles, dust suppression will be performed in accordance with Section 4.1.5.3 of this RAWP. If necessary, temporary seeding of the stockpiles will be implemented to control erosion, sediment, and fugitive dust.

4.2.6 Underground Utility Removal

Identified underground utilities will be excavated to a depth of 2 feet beyond the trench bedding and backfill. Manmade material will be segregated and stored adjacent to the impacted soil stockpiles. All soil and gravel will be placed in the appropriate impacted soil stockpile. Manmade materials include, but are not limited to, pipe, fencing, foundations, and conduits.

4.2.7 Decontamination and Demobilization

The vehicles and equipment used during the excavation operations will be decontaminated by vehicle washes before exiting the site. Decontamination wash water will flow to the impacted soil stockpile runoff detention basin. Earth moving equipment will be monitored for contamination and/or decontaminated, if necessary.

4.2.8 Disposition of Dredged Sediment

Dredged sediment from sedimentation ponds/traps will be managed as remediation waste under the Corrective Action Management Unit (CAMU). Sediment from each of the ponds/traps will be temporarily stored on the appropriate impacted soil stockpile.

Sediment will be removed when the storage capacity of the pond/trap has been reduced to 60 percent. The sediment cleanout elevations are noted in the drawings (Appendix A).

4.3 HEALTH AND SAFETY

The health and safety of the project workforce will be administered through the use of a project-specific health and safety requirements matrix and contract language. The matrix has been written following the guidelines of FEMP site procedure SH-0001, "Developing Project-Specific Health and Safety Plans." The primary focus of the matrix is to ensure worker safety. In addition to the matrix, several programmatic documents are in place to support safety during this construction effort. Some of these programs include the following:

- FEMP site permits
- FEMP site access training
- Hazardous worker training (as required)
- FDF Contractor/Subcontractor Safety Handbook.

Language has been included in the contracts that defines the fundamental and specific programs required to safely complete the projects. Part 8 of the construction contract identifies safety programs, training, and safety/hazard assessments as they relate to the scope of work within the contract.

All field activities supporting this project have completed project-specific health and safety plans or project-specific health and safety requirements matrices, unless a site procedure addressing safety hazards is in place.

All personnel involved in the construction effort are required to be briefed on the safety requirements and hazards involved in the task being executed.

4.4 PROPOSED SCHEDULE

The Certified For Construction (CFC) excavation design drawings and specifications in Appendix A were completed in June 1996 and issued for bid. Contract award and mobilization is expected in July, 1996 with actual excavation work expected to begin in August 1996.

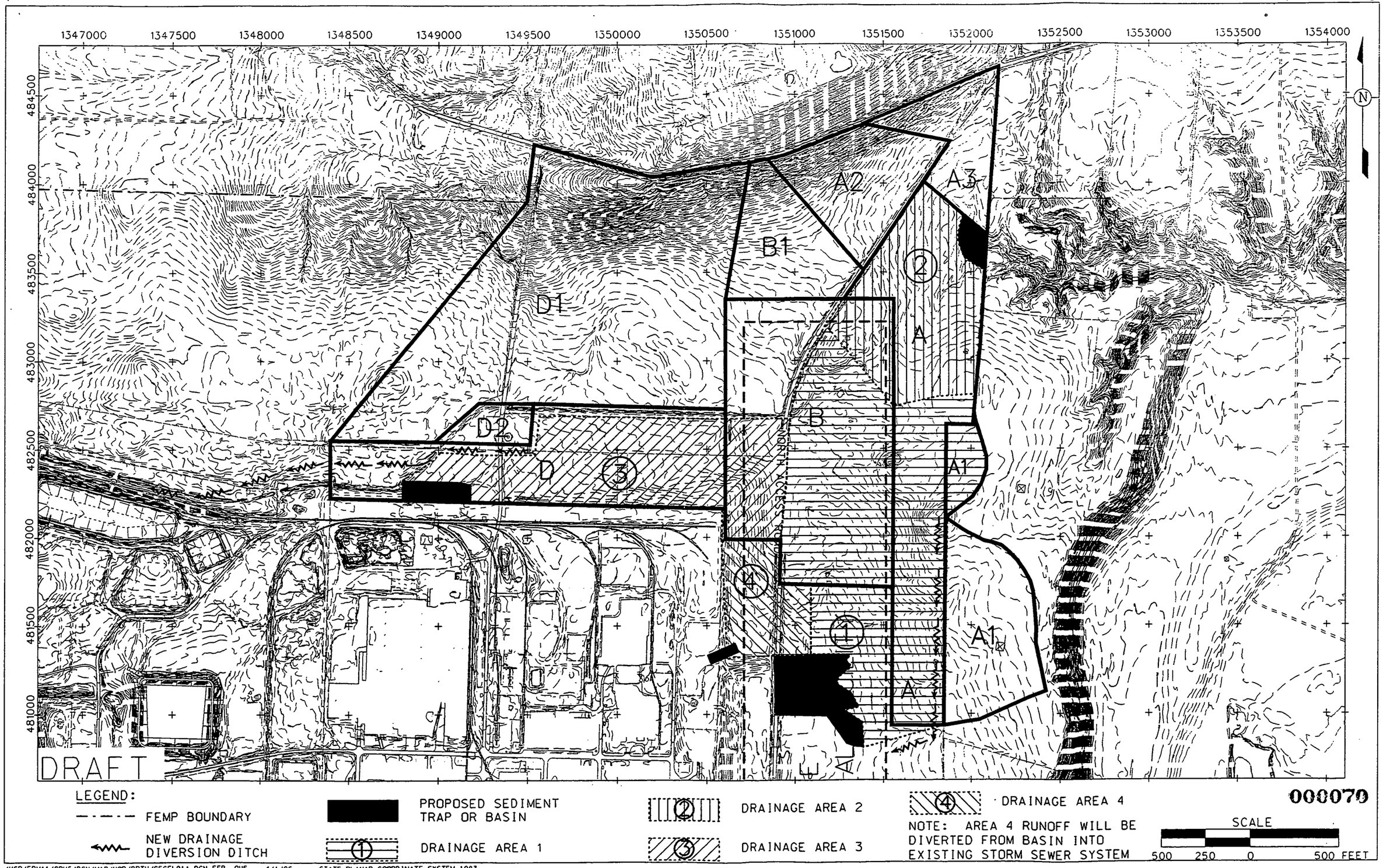


FIGURE 4-1. EXCAVATION AND DRAINAGE AREA LOCATION PLAN

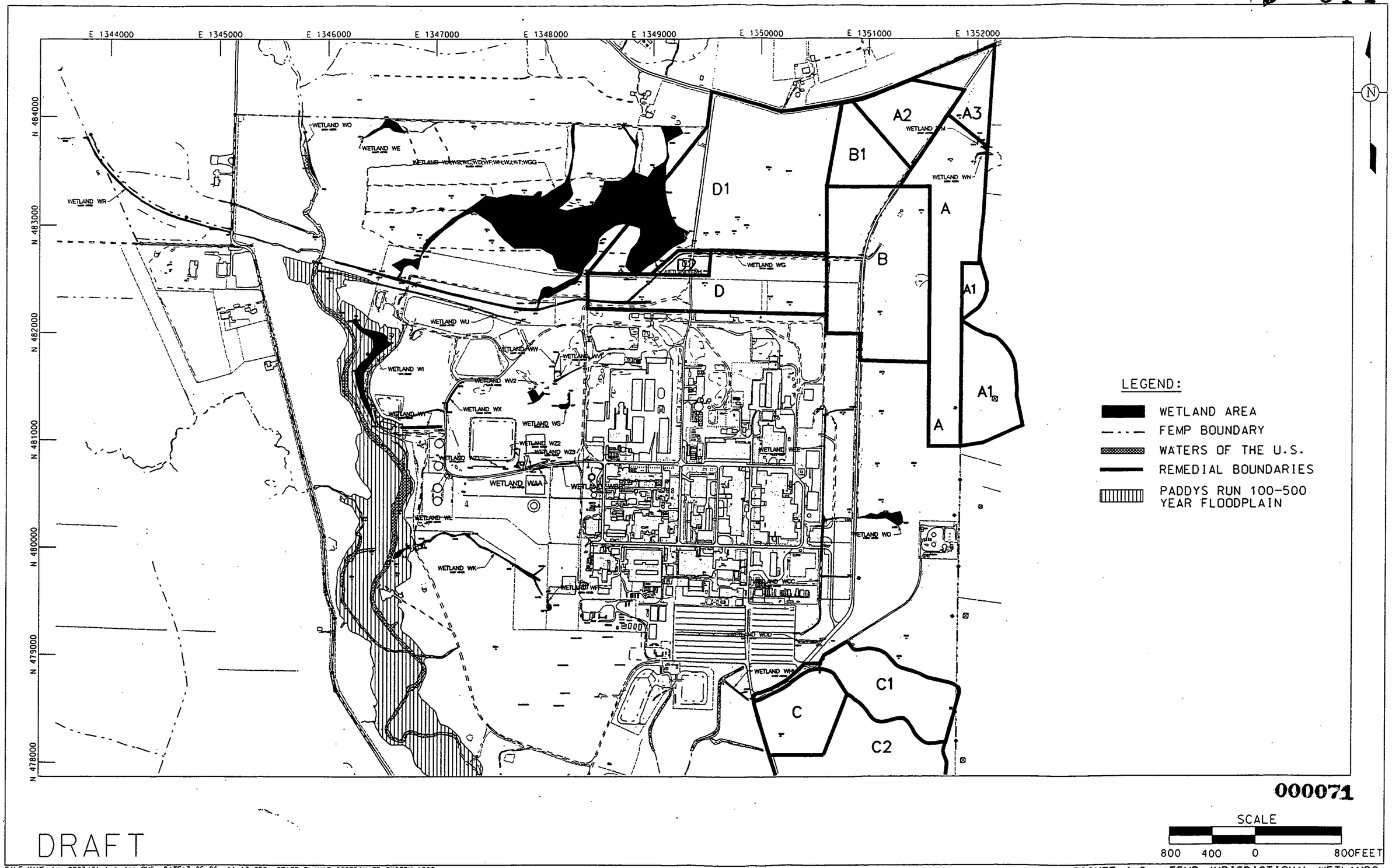


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FIGURE 4-2. FEMP JURISDICTIONAL WETLANDS, WATERS OF THE U.S., AND PADDYS RUN FLOODPLAIN

5.0 CONSTITUENTS OF CONCERN EVALUATION AND IDENTIFICATION

Successful remediation through excavation and certification testing relies on the identification and delineation of soils contaminated with COCs at levels exceeding the OSDF WAC concentrations published FRLs, and applicable ecological BTVs.

The first step performed in identifying and assessing soil COCs was the compilation of a Remedial Design (RD) soil database from available soil characterization data. This soil data, combined with information regarding the nature and extent of contamination, and human and ecological risk, from the Operable Unit 5 RI/FS documents, was used to evaluate the COCs (COC Evaluation Matrix Table 5-1 and Figure 5-1). The evaluation matrix was used to identify those COCs present at levels above their respective FRLs on FEMP soils. These sitewide COCs were then spatially examined. The evaluation matrix and spatial distribution of the data were then used to classify the sitewide COCs as either primary or secondary COCs and then to identify an individual list of ASCOCs for Area 1, Phase I. Primary COCs are considered to be the widespread contaminants which represent approximately 90 percent of the human health risk from soil. Secondary constituents are those COCs which have localized contamination above the FRL or BTV but the extent of contamination is limited to smaller areas, or has intermittent hits marginally above the FRL over large areas (metals) which may or may not reside entirely within the footprint of the primary constituents. ASCOCs represent the COCs that have been demonstrated to impact a specific work area and will be certified for in that specific work area.

Although this COC evaluation process is primarily a sitewide issue which will be addressed in the FEMP Sitewide Excavation Plan (SEP), details are provided in this RAWP as a result of the Area 1, Phase I submittal preceding the SEP.

5.1 COMPILATION OF REMEDIAL DESIGN DATABASE

To identify COCs which impact one or more of the seven construction areas, a sitewide RD database for existing soil data was compiled from three categories of data stored in the FEMP Sitewide Environmental Database (SED). The primary source of data was the extensive analytical data collected from numerous sitewide sampling efforts conducted during the RI/FS over a period of approximately 10 years. The second source consisted of data collected through sampling and analytical testing performed in conjunction with geotechnical studies for the site selection and

engineering design of the OSDF (DOE 1995b). The final source of data was the conversion of isotopic values in soil into total uranium concentrations. Because of the importance of total uranium data in the development and modeling of soil contamination in the FS, it was critical that total uranium at each sample location be determined whenever possible. In cases where isotopic uranium results were available, the total uranium concentrations were derived from isotopic equilibrium ratios of natural uranium paralleling site isotopic ratios. This conversion process was utilized previously in the Operable Unit 5 FS.

A review of the compiled RD soil database, resulted in several data points being reevaluated. Predominantly these data points were found to have transposed sample coordinates. However, a series of thorium-228 results were found to be marginally above the FRLs in the northern wetlands (Figure E-2). These results were first considered suspect due to the similarity between thorium-228 concentrations in surface soil and thorium hits at depths greater than 20 feet below the surface. These thorium-228 concentrations were discontinuous with other demonstrated contamination in the area and were inconsistent with site history and production knowledge. Review of the complete data packages indicated that the suspect samples originated from one sampling effort and were analyzed using both alpha and gamma spectroscopy methods per standard laboratory protocol. The alpha results yielded high values and these values were retained in the SED. A data validation review by FDF, determined that the alpha results were unreliable. The gamma results for these samples indicate that the thorium-228 levels were below the FRL and within the normal range of background. However, since the alpha data remained in the SED, these values were plotted on Figure E-2. Thorium-228 still remains a primary ASCOC but it is not considered a contaminant driving remedial design in the northern wetland area. During the certification process, sampling for thorium-228 will be performed with the density specified in the certification plan (Sec. 7.0). Details regarding pertinent samples and the validation process for these analytical results have been already submitted to the regulatory agencies.

5.2 EVALUATION OF SOIL CONSTITUENTS OF CONCERN

The COC evaluation matrix (Table 5-1) makes use of multiple qualitative and quantitative parameters to evaluate all soil COCs. The evaluation process includes consideration of the 80 COCs published in the Operable Unit 5 ROD with FRLs that were developed and approved for soil. Uranium is listed separately, as uranium-238 and total uranium, to show both the carcinogenic (uranium-238) and noncarcinogenic (total uranium) impacts on human health. Chromium is treated as all chromium VI

which is highly conservative under site conditions. The total uranium FRL of 82 mg/kg is based on preliminary remediation goal of uranium-238 (26 picoCuries per gram (pCi/g) plus background).

The parameters presented in Table-5-1 are considered as factors in the COC evaluation process and are discussed below.

5.2.1 Benchmark Toxicity Values

The Operable Unit 5 Ecological Risk Assessment (ERA), identified COCs and their soil BTVs which are considered to be protective of ecological receptors. Based on these values, the ERA identified 17 constituents as constituents of ecological concern. The 17 constituents that failed the ecological risk screening conducted during the ERA (identified as BTV drivers on Table 5-2) were demonstrated to have a sufficient source term to possibly present a current and future risk to ecological risk receptors in the FEMP and surrounding areas. Two of the 17 constituents do not have published FRLs: aluminum and benzo(g,h,i)perylene. With the exception of total uranium, all constituents identified as ecological concerns in the ERA have BTVs less than the FRLs.

Certification samples will be collected for these constituents and analyzed to the FRL levels. If the BTV level is more stringent than the corresponding FRL, the samples will be analyzed to the BTV level. The analytical results will be used to assess potential post-remedial ecological risk impacts to ecological habitats considered in the final land use plan. The BTVs will not drive soil remediation or excavation in Area 1, Phase I. FRLs provide remediation levels for soils and BTVs are levels that will be reviewed during certification in order to assess potential future ecological impacts.

5.2.2 Total Number of Site Wide Soil Samples Greater than the FRL

The number and percent of sitewide soil samples with positive detections above the FRL for each COC were determined. Based on the total number of unique samples analyzed for each COC in the RD database, thirty of the 80 COCs had one or more positive detections (hits) above their respective FRLs.

5.2.3 Percent Contribution to Human Health Risk

The contribution made to human health risk on a sitewide basis from each of the 80 COCs can be used to identify those COCs contributing the majority of the health risk to the modeled undeveloped park user receptor. The percent contribution to human health risk was based on the Operable Unit 5

Baseline Risk Assessment (BLRA), and the 10 exposure areas evaluated in that study. Both the maximum and average COC concentrations from all 10 areas were considered to quantify carcinogenic and noncarcinogenic health risks and determine the percent contribution made by each COC. This method indicates three COCs (uranium, thorium, and radium) account for approximately 90 percent of the human health risk in site soil.

5.2.4 Ratio of Exposure Point Concentration and Final Remediation Level

Human health risk was not the only factor considered in the determination of the FRLs, although it was important to the FRL development process. The ratio of the maximum exposure point concentration (EPC) from the 10 areas modeled in the Operable Unit 5 BLRA to the published FRL is an inclusive strategy that incorporates all the factors used to develop the FRLs. A soil EPC represents the conservative soil concentration of a contaminant in an exposure area that a receptor may contact.

5.2.5 Representative Background Level in Surface Soil

To develop the FRLs, surface soil constituent concentrations in the 95th percentile from the background study were used (DOE 1995a). Those constituents which have FRLs or BTVs close to the upper range of natural background may require special consideration during certification.

In addition, the ratio of the FRL or BTV to the analytical detection limit was evaluated. If the FRL or BTV is close to the analytical detection limit, special consideration may be necessary when evaluating results at or slightly above the detection limits.

5.2.6 Production Knowledge

This parameter makes use of site production knowledge to categorize COCs as originating from natural background levels (b), product of weapons fallout (f), product (p), present in recycled uranium (r), a process or industrial use item (I) or a radiological daughter product (d). Inclusion of the parameter allows a qualitative consideration of a COC's presence on this site from the perspective of production knowledge and site history (Table 5-1).

5.3 SITEWIDE CONSTITUENTS OF CONCERN

The matrix of COC evaluation parameters (Table 5-1) was used to rank individual constituents for their calculated contributions to adverse impacts on human health and the environment. As a result of this review, it was noted that, of the 80 constituents with site-specific soil FRLs published in the OU5 ROD, there were 30 that had one or more detections in the sitewide soil remediation database above their respective FRLs. This reduction is possible due to the conservative manner with which COCs were developed in the RI/FS process. A gross count of constituents on Table 5-1 will indicate 31 COCs. This discrepancy is due to the inclusion of uranium in the evaluation for its dual roles as a carcinogen and as a toxicant. A preliminary review of the matrix will reveal the following:

- Thirty COCs have at least one detection in site soil above the published FRL
- Of the 17 constituents noted as failing the Ecological Risk Assessment:
  - Eight have corresponding FRLs that are included in the above 30 COCs
  - Seven have corresponding FRLs that are not included in the above 30 COCs; two have no corresponding FRLs (aluminum and benzo(g,h,i)perylene).

Of the 15 BTV constituents that failed the Ecological Risk Screening and have corresponding FRL values, total uranium is the only COC that has a BTV level higher than the FRL. (OEPA Comment #2)

The conservatism of these drivers can be confirmed by comparison to other parameters. For example, these 30 COCs account for over 99 percent of risk to the undeveloped park receptor from exposure to soil. Also, these 30 COCs include all COCs with an EPC to FRL ratio greater than 0.5.

These 30 sitewide COCs were further evaluated by examining their spatial distribution based on their sample results. Combined with the COC evaluation matrix, these results categorized them as primary or secondary COCs. The spatial distribution is also used to identify those COCs which have demonstrated significant impact on one or more of the seven sitewide remediation areas to determine if any secondary COCs are located or enveloped within the extent of another COC. If the spatial distribution of a primary COC, both in area and depth, so completely envelops the distribution of another COC, excavation of the enveloping COC (surrogate) may provide sufficient evidence that the secondary COC was excavated. This surrogate evaluation will be performed before assignment of certification units for ASCOCs in each RAWP.

5.4 SPATIAL DISTRIBUTION OF DATA

To evaluate the spatial extent of the constituents sitewide, their relationship to FRL, BTV and OSDF WAC, a series of maps were assembled identified as E-1 through E-48 (Appendix E). These maps display the actual distribution of contamination sitewide and identify the extent of contamination relative to the seven Remediation Areas. These maps can also indicate if a COC distribution is confined to a limited area or if it impacts larger areas. These distributions presented by these COCs can then be augmented with production knowledge.

Specifically, Figures E-1 through E-30 show the location of data points for given constituents and their relationship to their FRLs (some show FRL and BTV). Figures E-31 through E-39 identify location of data points for given constituents in excess of the OSDF WAC. Figures E-40a through E-48 identify the location of data points for given constituents in excess of BTVs. These constituents were identified by the Operable Unit 5 ERA as posing potential ecological risk.

The maps in Appendix E identify, by the use of a solid circle, the locations of all sitewide data points having concentrations detected above the respective FRL or BTV. Other sample locations resulting in either a nondetect above the FRL or a result below the FRL were marked by a nonfilled circle or small triangle respectively. For COCs which have a BTV that is lower than the respective FRL, the number and locations of detects and nondetect above the both the BTV and the FRL are represented on one figure. For these two-dimensional maps, all positively detected results exceeding the FRLs or BTVs were marked with solid circles irrespective of depth. For example, if three samples were taken from different depths at one location, and any one of the three samples was above the FRL or BTV, then that location was marked with a solid circle.

The ASCOCs for each of the seven remediation areas were identified based on the sample results represented by these maps (see Table E-1). The maps and interpretations of spatial distributions of COCs will be discussed in more detail in the SEP.

5.5 PRIMARY AND SECONDARY CONSTITUENTS OF CONCERN

The sitewide COCs were categorized as primary or secondary COCs based on the COC Evaluation Matrix (Table 5-1) and the spatial distribution of the results. Five sitewide primary COCs were identified as total uranium, radium-226, radium-228, thorium-228, and thorium-232. Primary COCs are considered to be the widespread contaminants which represent approximately 90 percent of the

risk to human health from soil. The distribution of these primary constituents represent the majority of the soil excavation footprint of the FEMP. The remediation of the primary COCs is driven by their respective FRLs.

The remaining 26 COCs were identified as sitewide secondary COCs (Table 5-2). Secondary constituents are those COCs which have localized contamination above the FRLs or potential BTVs, but the extent of contamination is limited to smaller areas, or has intermittent hits marginally above the FRL over large areas (metals) which may or may not reside within the footprint of the primary constituents. In addition, there are two constituents, aluminum and benzo(g,h,i)perylene, which have BTVs only and do not have FRLs.

5.6 AREA 1, PHASE I AREA SPECIFIC CONSTITUENTS OF CONCERN

The 5 primary ASCOCs and the 6 secondary Area 1, Phase I ASCOCs were identified as being present, or having a high likelihood of being present, at or above the FRLs or BTVs. Two constituents, aluminum and molybdenum, were present only above the BTV (Aluminum is not considered a COC since it does not have a corresponding FRL) (Table 5-3). Within Area 1, Phase I, the remediation drivers are the FRLs. BTVs are not a concern in Area 1, Phase I due to the determined land use. BTVs will not drive the remediation; however, data for area-specific BTVs will be collected during certification sampling to assess post-remedial concentrations of the constituents. Based on spatial evaluation of the data (Figures E-31 through E-39), only total uranium (Figure E-31) a primary ASCOC, is considered to be at levels potentially exceeding the OSDF WAC in the vicinity of Area 1, Phase I scope. This potential excess was in Area D, which will not be certified under the scope of this work plan (see Section 2).

The 12 ASCOCs listed as primary and secondary (Table 5-3) are considered to represent the demonstrated or likely contaminants in Area 1, Phase I. The spatial distribution of these COCs in Area 1, Phase I does not indicate that any one contaminant completely envelops other COCs in both horizontal and vertical extent. Thus, sampling will take place for all 12 ASCOCs (plus aluminum) during certification to demonstrate that the residual soil levels comply with the applicable standards (see Section 7.0). However, in other area-specific certification plans it may be demonstrated that the area contaminated by a primary ASCOC, both in area and depth, so completely envelops another COC that certification of the enveloping ASCOC (surrogate) will provide sufficient evidence that both constituents were removed. The certification sampling strategy for the Area 1, Phase I COCs (see

Section 7.0) was based on the location of existing samples above the FRLs. Manganese (Figure E-16), molybdenum (Figure E-46) and aluminum (Figure E-40a) are BTV concerns only in Area 1, Phase I; data will be obtained during certification but these constituents will not impact the extent of excavation or cause failure of certification.

TA[illegible]5.1 MATRIX OF COC EVALUATION PARAMETERS

COC	Final Remediation Level	Benchmark Toxicity Value	Failed Ecological Risk Screening[1]	Total Number of Site Wide Soil Samples	Number of Detects Greater than the FRL (% of Total)	Number of Detects Greater than the BTV (% of Total)[6]	Percent Contribution to Human Health Risk (Maximum Area)[3]	95th Percentile Background Level in Surface Soil	Ratio of FRL/BTV to Analytical Detection Limit[4]	Production Knowledge
aroclor-1254	0.13 mg/kg	1	-	833	71 (8.5%)	-	4.6%	-	3.3	
radium-228	1.8 pCi/g	340000	-	1741	366 (21.0%)	-	14.9%	1.25	3.6	b, d
thorium-232	1.5 pCi/g	240000	-	3290	652 (19.8%)	-	30.8%	1.26	15	b, p
aroclor-1260	0.13 mg/kg	1	-	834	24 (2.9%)	-	3.2%	-	3.3	
uranium, total (carcinogen)	82 mg/kg	230	yes	5963	1401 (23.5%)*	480 (8.0%)	1.0%	3.73	820	b, p
uranium-238 (carcinogen)	26[2] pCi/g	12000	-	3493	851 (24.4%)	-	4.3%	1.24	na	b, p
radium-226	1.7 pCi/g	670	-	3062	1328 (43.4%)	-	21.1%	1.42	6.8	b, i, d
thorium-228	1.7 pCi/g	1400000	-	2003	407 (20.3%)	-	17.6%	1.43	17	b, p
technetium-99	30 pCi/g	93000	-	1540	38 (2.5%)	-	0.0%	-	30	f, r
benzo(a)pyrene	2 mg/kg	1	yes	944	20 (2.1%)	27 (2.9%)	0.8%	-	11	
lead	400 mg/kg	200	yes	1158	12 (1.0%)	18 (1.6%)	na	26.4	400	i
arsenic	12 mg/kg	30	-	1101	111 (10.1%)	-	0.3%	8.2	9.2	b
dibenzo(a,h)anthracene	2 mg/kg	0.088	yes	945	7 (0.7%)	14 (1.5%)	0.3%	-	176	
beryllium	1.5 mg/kg	56	-	1113	140 (12.6%)	-	0.2%	0.6	30	b
cesium-137	1.4 pCi/g	12000	-	2614	78 (3.0%)	-	0.1%	c 0.71	7	f, r
lead-210	38 pCi/g	-	-	103	4 (3.9%)	-	0.1%	1.3	76	d
dieldrin	0.015 mg/kg	0.04	-	826	6 (0.7%)	-	0.1%	-	3.75	
thorium-230	280 pCi/g	210000	-	2047	12 (0.6%)	-	0.0%	1.97	2800	d
plutonium-238	78 pCi/g	3800000	-	1509	8 (0.5%)	-	0.0%	-	390	f, r
tetrachloroethene	3.6 mg/kg	25	-	1084	7 (0.6%)	-	0.0%	-	3600	i
benzo(b)fluoranthene	20 mg/kg	1	yes	946	4 (0.4%)	31 (3.3%)	0.1%	-	11	
trichloroethene	25 mg/kg	-	-	1093	4 (0.4%)	-	0.0%	-	25000	i
neptunium-237	3.2 pCi/g	-	-	1335	4 (0.3%)	-	0.1%	-	16	f, r
benzo(a)anthracene	20 mg/kg	1	yes	947	2 (0.2%)	29 (3.1%)	0.1%	-	11	
indeno(1,2,3-cd)pyrene	20 mg/kg	1	yes	946	2 (0.2%)	22 (2.3%)	0.1%	-	250	
manganese	4600 mg/kg	1500	yes	1106	2 (0.2%)	31 (2.8%)	0.1%	1350	1500	b, i
strontium-90	14 pCi/g	2800	-	1497	2 (0.1%)	-	0.0%	0.42	28	f, r
heptachlorodibenzo-p-dioxins	0.00088 mg/kg	-	-	70	1 (1.4%)	-	0.0%	-	18	
octachlorodibenzo-p-dioxin	0.0088 mg/kg	-	-	70	1 (1.4%)	-	0.0%	-	880	
carbazole	12 mg/kg	-	-	484	1 (0.2%)	-	0.0%	-	300	
1,1-dichloroethene	0.41 mg/kg	-	-	1088	1 (0.1%)	-	0.0%	-	410	i
antimony	96 mg/kg	10	yes	643	0 (0.0%)	92 (14.3%)	0.1%	-	20	b
benzo(k)fluoranthene	200 mg/kg	1	yes	946	0 (0.0%)	22 (2.3%)	0.0%	-	11	
aluminum[5]	-	10103	yes	1121	-	444 (39.6%)	0.0%	16300	506	b,i

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TA[illegible]5.1 MATRIX OF COC EVALUATION PARAMETERS

COC	Final Remediation Level	Benchmark Toxicity Value	Failed Ecological Risk Screening[1]	Total Number of Site Wide Soil Samples	Number of Detects Greater than the FRL (% of Total)	Number of Detects Greater than the BTV (% of Total)[6]	Percent Contribution to Human Health Risk (Maximum Area)[3]	95th Percentile Background Level in Surface Soil	Ratio of FRL/BTV to Analytical Detection Limit[4]	Production Knowledge
benzo(g,h,i)perylene[5]	-	1	yes	946	-	23 (2.4%)	0.0%	-	11	i
cadmium	82 mg/kg	5	yes	1147	0 (0.0%)	96 (8.4%)	0.0%	0.87	50	b, i
chrysene	2000 mg/kg	1	yes	947	0 (0.0%)	30 (3.2%)	0.0%	-	500	
molybdenum	2900 mg/kg	10	yes	1081	0 (0.0%)	52 (4.8%)	0.0%	-	1	b, i
silver	29000 mg/kg	10	yes	1129	0 (0.0%)	46 (4.1%)	0.0%	-	10	b
zinc	120000 mg/kg	500	yes	1109	0 (0.0%)	6 (0.5%)	0.0%	59.6	500	b, i
1,1,2-trichloroethane	4.3 mg/kg	-	-	1093	0 (0.0%)	-	0.0%	-	4300	i
1,2-dichloroethane	0.16 mg/kg	-	-	1085	0 (0.0%)	-	0.0%	-	160	i
3,3'-dichlorobenzidine	0.55 mg/kg	-	-	936	0 (0.0%)	-	0.0%	-	2.8	
4-methyl-2-pentanone	2500 mg/kg	-	-	915	0 (0.0%)	-	0.0%	-	416667	
4-methylphenol	250 mg/kg	-	-	945	0 (0.0%)	-	0.0%	-	1250	
4-nitroaniline	150 mg/kg	-	-	868	0 (0.0%)	-	0.0%	-	188	
acetone	43000 mg/kg	-	-	1089	0 (0.0%)	-	0.0%	-	6142857	i
barium	68000 mg/kg	500	-	1180	0 (0.0%)	-	0.0%	94.1	385	i
benzene	850 mg/kg	-	-	1123	0 (0.0%)	-	0.0%	-	850000	i
bis(2-chloroisopropyl)ether	420 mg/kg	-	-	886	0 (0.0%)	-	0.0%	-	2100	
bis(2-ethylhexyl)phthalate	820 mg/kg	70	-	938	0 (0.0%)	-	0.0%	-	350	
boron	7400 mg/kg	-	-	20	0 (0.0%)	-	0.0%	-	1850	i
bromodichloromethane	4 mg/kg	-	-	1047	0 (0.0%)	-	0.0%	-	4000	
bromoform	31 mg/kg	-	-	1046	0 (0.0%)	-	0.0%	-	31000	
bromomethane	8200 mg/kg	-	-	1068	0 (0.0%)	-	0.0%	-	8200000	
carbon disulfide	5000 mg/kg	7800	-	1098	0 (0.0%)	-	0.0%	-	5000000	
carbon tetrachloride	2.1 mg/kg	-	-	1093	0 (0.0%)	-	0.0%	-	2100	i
chlordane (alpha / gamma)	0.19 mg/kg	-	-	826 / 845	0 (0.0%)	-	0.0%	-	95	
chlorobenzene	340 mg/kg	-	-	1088	0 (0.0%)	-	0.0%	-	340000	
chloroform	45 mg/kg	-	-	1067	0 (0.0%)	-	0.0%	-	45000	i
chromium (chromium vi)	300 mg/kg	250 (0.05)	-	1163	0 (0.0%)	-	0.0%	15.5	115	i
cobalt	740 mg/kg	-	-	1121	0 (0.0%)	-	0.0%	14.2	2467	b, i
copper	220000 mg/kg	100	-	1119	0 (0.0%)	-	0.0%	14.1	200	i
cyanide	120000 mg/kg	-	-	997	0 (0.0%)	-	0.0%	0.27	150000	
di-n-octyl phthalate	1100 mg/kg	-	-	936	0 (0.0%)	-	0.0%	-	5500	
ethylbenzene	5100 mg/kg	-	-	1117	0 (0.0%)	-	0.0%	-	5100000	
fluoride	78000 mg/kg	-	-	3	0 (0.0%)	-	0.0%	-	111429	i
heptachlorodibenzofurans	0.00088 mg/kg	-	-	70	0 (0.0%)	-	0.1%	-	18	

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TA[illegible]5.1 MATRIX OF COC EVALUATION PARAMETERS

COC	Final Remediation Level	Benchmark Toxicity Value	Failed Ecological Risk Screening[1]	Total Number of Site Wide Soil Samples	Number of Detects Greater than the FRL (% of Total)	Number of Detects Greater than the BTV (% of Total)[6]	Percent Contribution to Human Health Risk (Maximum Area)[3]	95th Percentile Background Level in Surface Soil	Ratio of FRL/BTV to Analytical Detection Limit[4]	Production Knowledge
mercury	7.5 mg/kg	5	-	1171	0 (0.0%)	-	0.0%	0.3	50	b, i
methylene chloride	37 mg/kg	85	-	1117	0 (0.0%)	-	0.0%	-	18500	i
n-nitrosodiphenylamine	51 mg/kg	-	-	937	0 (0.0%)	-	0.0%	-	255	
n-nitrosodipropylamine	0.2 mg/kg	-	-	925	0 (0.0%)	-	0.0%	-	1	
nickel	15000 mg/kg	100	-	1102	0 (0.0%)	-	0.0%	20.9	25	i
octachlorodibenzofuran	0.0088 mg/kg	-	-	72	0 (0.0%)	-	0.0%	-	880	
pentachlorophenol	2.3 mg/kg	-	-	959	0 (0.0%)	-	0.0%	-	2.6	
plutonium-239/240	77 pCi/g	4100000	-	1494	0 (0.0%)	-	0.0%	-	385	f, r
selenium	5400 mg/kg	3	-	1019	0 (0.0%)	-	0.0%	0.72	3	b
thallium	91 mg/kg	6.3	-	1119	0 (0.0%)	-	0.0%	0.58	6.3	b
toluene	100000 mg/kg	-	-	1138	0 (0.0%)	-	0.0%	-	100000000	i
tributyl phosphate	250 mg/kg	-	-	113	0 (0.0%)	-	0.0%	-	6250	i
vanadium	5100 mg/kg	150	-	1121	0 (0.0%)	-	0.0%	30.4	150	b, i
vinyl chloride	0.13 mg/kg	-	-	1088	0 (0.0%)	-	0.0%	-	130	
xylenes, total	920000 mg/kg	-	-	1095	0 (0.0%)	-	0.0%	-	920000000	i

Notes and Abbreviations:

[1] COCs which may exhibit or present a current of future risk to ecological receptors in the FEMP and surrounding areas.

[2] Based on PRG of 26 which is basis of total uranium FRL (PRG plus background).

[3] Bold Values in Percent Constribution to Human Health identifies the top 99% contributers.

[4] Analytical detection limits based on values used in development of FRLs. The lower the value, the closer the FRL is to the detection limit.

[5] Aluminum and benzo(g,h,i)perlyene do not have published FRLs.

[6] Percentages of detects above BTVs have been provide for thos COCs which may exhibit or present a current of future risk to ecological receptors in the FEMP and surrounding areas.

Legend to Production Knowledge Symbols

b: Background
f: Weapons fall-out
p: Product
r: Recycle enriched uranium
i: Industrial process
d: Radiological daughters

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TABLE 5-2
SUMMARY OF SITEWIDE CONSTITUENTS OF CONCERN

Constituent of Concern	Driver	Constituent of Concern	Driver
Primary COCs			
Uranium, total	FRL, BTV[a]	Thorium-228	FRL
Radium-226	FRL	Thorium-232	FRL
Radium-228	FRL		
Secondary COCs			
Aroclor-1254	FRL	Heptachlorodibenzo-p-dioxin	FRL
Aroclor-1260	FRL	Indeno(1,2,3-cd)pyrene	FRL, BTV
Arsenic	FRL	Lead	FRL, BTV
Benzo(a)anthracene	FRL, BTV	Lead-210	FRL
Benzo(a)pyrene	FRL, BTV	Manganese	FRL, BTV
Benzo(b)fluoranthene	FRL, BTV	Neptunium-237	FRL
Benzo(k)fluoranthene	FRL, BTV	Octachlorodibenzo-p-dioxin	FRL
Beryllium	FRL	Plutonium-238	FRL
Carbazole	FRL	Strontium-90	FRL
Cesium-137	FRL	Technetium-99	FRL
Dibenzo(a,h)anthracene	FRL, BTV	Tetrachloroethene	FRL
1,1-dichloroethene	FRL	Thorium-230	FRL
Dieldrin	FRL	Trichloroethene	FRL
BTV			
Aluminum	BTV[b]	Chrysene	BTV
Antimony	BTV	Molybdenum	BTV
Benzo(g,h,i)perylene	BTV	Silver	BTV
Cadmium	BTV	Zinc	BTV

[a] FRLs will drive remediation, but BTVs will be evaluated in the certification process in Area 1, Phase I.
[b] Aluminum and Benzo(g,h,i)perylene do not have published FRLs.

TABLE 5-3
SUMMARY OF AREA 1, PHASE I AREA SPECIFIC CONSTITUENTS OF CONCERN

Constituent of Concern	Figure Reference	Driver
Primary ASCOCs		
Uranium, total	E-1	FRL, BTV[a]
Radium-226	E-2	FRL
Radium-228	E-3	FRL
Thorium-228	E-4	FRL
Thorium-232	E-5	FRL
Secondary ASCOCs		
Arsenic	E-13	FRL
Thorium-230	E-12	FRL
Aroclor-1260	E-17	FRL
Beryllium	E-14	FRL
Cesium-137	E-6	FRL
Manganese	E-52	FRL,BTV[a]
BTV		
Aluminum	E-41	BTV[b]
Molybdenum	E-53	BTV

[a]FRLs will drive remediation, but BTVs will be evaluated in the certification process.
[b]Aluminum and Benzo(g,h,i)perylene do not have published FRLs.

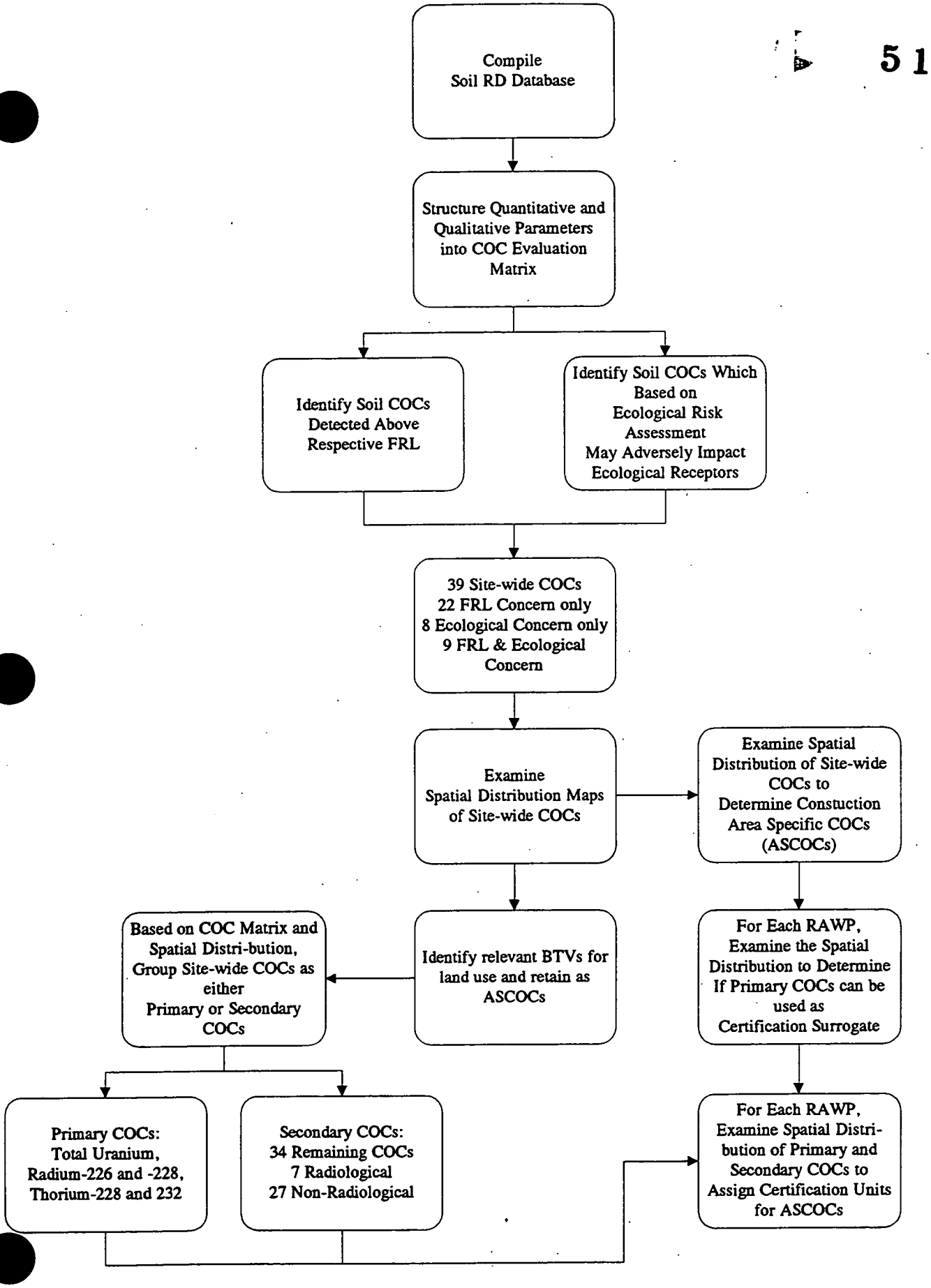

Figure 5-1. Summary of COC Evaluation Process

6.0 ANALYTICAL METHODS AND PROTOCOLS

6.1 SAMPLING AND ANALYTICAL SUPPORT FOR AREA 1, PHASE I

Sampling and analytical support play major roles in the successful implementation of Remedial Design (RD) and certification of remediation at CERCLA sites. To effectively plan, perform, and certify completion of remediation, accurate sampling and analysis for ASCOCs is crucial. For the remedial and construction activities planned for Area 1 during Phase I, the sampling and analysis can be subdivided into two functional components: precertification and certification.

In Area 1, Phase I, certification sampling and analytical testing will rely exclusively on standard laboratory methods listed in the SCQ and/or methods referenced in EPA SW-846. The analytical suites that will be utilized to analyze soil samples in the Area 1, Phase I certification process (e.g., radiological, inorganics, semivolatiles, PCB/pesticides) will incorporate all of the ASCOCs that have been identified and assigned to Area 1, Phase I by the COC evaluation matrix (Table 5-1).

Precertification sampling will be accomplished using the NaI and HPGe detector systems, physical samples, and where applicable, FPXRF and field test kits. The quick turnaround field methods and laboratory methods approved in the SCQ will be employed along with some methods not currently in the SCQ. The NaI detector (mounted on the R-TRAK) and the HPGe detector have not yet been included in the SCQ. Selected quick turnaround field methods and laboratory methods will be supported by quality control measures during sample collection and preparation, instrument operation, performing analytical procedures, and through the use of periodic laboratory confirmation samples. Standard laboratory methods and procedures will be used for quality control of both the field and quick-turnaround analyses chosen to support the excavation decisions. These analytical methods are described in the SCQ.

Section 7.0 provides detailed maps of the proposed certification units (CUs) for the analytical suites to be used for certification sampling. Analysis of the certification samples will be conducted at analytical support level (ASL) B with a minimum of 10 percent of the samples being run at ASL C/D or equivalent, plus required site QA/QC as described in the SCQ. Separate sampling and analytical approaches are necessary for precertification and certification sampling that will be conducted during remediation of Area 1, Phase I. Management of data generated as a result of this effort is discussed in Section 6.5.

6.1.1 Precertification

Precertification includes all sampling and testing performed before certification sampling and analysis. Four decision processes will be addressed by precertification sampling and analytical testing during this RAWP. Those decisions are as follows:

1. Identification of soils meeting the OSDF WAC, and those for off-site disposition, before remediation.

2. Verification of areal extent of excavation prior to remediation by development of isoconcentration gradient maps of the primary constituents using NaI output, combined with strategic HPGe readings.

3. Identification of levels exceeding FRLs in adjacent, hydraulically upgradient areas to assess the need for run-on controls such as diversion ditching.

4. Provide assurance that postremedial and unexcavated areas are prepared for certification by:

   - Targeting 75 percent of the FRLs in areas to be certified

   - Detecting, defining, and explaining irregularities or anomalies in the surface soil contamination pattern

   - "Hot spot" identification at three times the FRLs of the primary COCs, which is a not-to-exceed level for the NaI and HPGe 12 m^2 read areas.

The NaI and HPGe detectors are currently being used to support WAC attainment in areas that are undergoing excavation for purposes of remediation and construction preparation. DOE plans to use these instruments for precertification in excavated and unexcavated areas prior to certification testing. The first two documents have been prepared. The third document, once prepared will support and demonstrate the effectiveness of these instruments on site, including the control of field variables:

- HPGe operating procedure

- RTRAK instrumentation procedures and software

- Comparability Studies between HPGe and NaI output (see Section 6.3)

In Area 1, Phase I, designated work areas will be initially excavated to a depth of 6". Radiological readings for primary COCs, and sampling and analysis for nonradiological COCs, will be conducted to determine the concentration of ASCOCs compared to the target levels before certification is

approved (Table 6-1). Data quality for precertification will be at ASL A/B with emphasis on field methods and rapid turnaround, reflecting schedule dependency on the acquired data.

6.1.2 Certification

When remediation has been deemed complete based on precertification testing, a management decision will be made to collect and analyze certification samples in the designated CUs. Certification will be performed according to the certification plan for Area 1, Phase I, as described in Section 7.4. Certification sampling for non-gamma-discernible ASCOCs will rely only on conventional methods in Area 1, Phase I. Samples collected during certification sampling will include a minimum of 10 percent of ASL C/D analyses to ensure overall data quality and provide valid risk assessment data for later use. Complete sampling protocol and area-specific information will be documented in the certification Project-Specific Plan (PSP).

6.2 ANALYTICAL METHODS FOR EVALUATING CONSTITUENTS OF CONCERN

All sample analyses will be coordinated by the FEMP laboratory and will be performed using SCQ-approved methods. Methods for organic and inorganic analytes will be adopted from SW-846. Radiological analytes may vary, but all methods must meet the performance requirements in Appendix G of the SCQ (DOE 1993). A summary of these methods and performance requirements is listed in Table 6-2.

6.2.1 Analytical Methods Used in Precertification

In addition to laboratory sample analyses, other methods are available to obtain precertification data. The methods available to analyze samples from this project vary based on the end uses of the data. Most of the analytical data generated from this project for precertification require a quick turnaround. Many COCs can be analyzed by field instruments or field test kits, which have the ability to give acceptable analytical data in a timely manner. In cases where quick turnaround is required, analytical methods are employed which give acceptable results while reducing the time necessary to generate data. In many cases, these methods can generate analytical results in reduced time but have higher detection levels than other laboratory methods. In addition, the data generated are usually less precise. The accuracy and detection levels associated with quick turnaround methods for precertification can be acceptable and the cost savings of using these methods could be substantial. When quick turnaround methods are either not available or not acceptable, more traditional analytical methods will be used.

6.2.1.1 Radiological Area-Specific Constituents of Concern

Increased efficiency and lower cost than conventional methods make the NaI and the HPGe detectors appealing to use in precertification and certification activities. In Area 1, Phase I both detection systems will be employed for precertification. Comparability studies for both systems are being performed concurrent with the remediation and certification of Area 1, Phase I. Upon successful conclusion of these comparability studies and acceptance of their use within defined operational parameters by the regulatory agencies, the systems will be made integral with precertification and/or certification efforts in subsequent soil RAWPs.

6.2.1.2 Nonradiological Area-Specific Constituents of Concern

Methods which quickly determine the concentration of nonradiological contaminants will be used to support precertification testing. Methods to be implemented for field use will be chosen based on their ability to support the excavation schedule. For the purpose of excavation control, quick-turnaround methods for organic COCs will include methods specific to the compound class which includes PCBs. Immunoassay test kits will be employed as ASL A analytical tests. If a positive detection is found above the action levels, additional tests at ASL B or higher will be performed to specifically identify the COCs responsible and eliminate false positives. If further testing reveals COCs above the action levels, the soil will be removed until the contaminant is no longer seen with the quick-turnaround analyses.

Table 6-3 details the chemical COC constituent, their FRL action levels, method detection limits (MDLs), and the potential methods of detection where a quick turnaround is available. The MDL is based on standard laboratory reference tests. The table also includes vendor information (not a recommendation or specification), along with the expected detection level at the given method turnaround time.

6.2.2 Analytical Methods Used in Certification

Twelve COCs are retained as ASCOCs for Area 1, Phase I as a result of the selection process described in Section 5.0. They are listed in Table 5-3 and again in Table 7-15 with their certification levels. These 12 ASCOCs are reduced functionally to four analytical suites: primary radiologicals, secondary radiologicals, metals, and PCBs. After the planned excavation and precertification sampling have been performed, Area 1, Phase I will be sampled according to the certification plan presented in Section 7.0. Analytical testing on the physical samples will be conducted as follows.

6.2.2.1 Radiological Constituents of Concern

The SCQ contains the methods used by the FEMP laboratory and its subcontractors for analyzing discrete radiological soil samples. The QC requirements for all analytes are included in the analytical methods. The FEMP laboratory and subcontracted laboratories are required to meet the QC requirements of the SCQ. The sitewide radiological COCs are listed in Table 6-2.

6.2.2.2 Chemical (Nonradiological) Constituents of Concern

As previously discussed in Section 5.0, chemical or nonradiological COCs exist in some areas of Area 1, Phase I. The SCQ contains the methods used by the FEMP laboratory and its subcontractors for analyzing discrete non-radiological soil samples. The QC requirements for all analytes are included in the analytical methods. Due to the disparity in existing data available for some areas and differences in constituent-specific production knowledge and other evaluation criteria, COCs demonstrated to be present (ASCOCs) are unique in their distributions. The sitewide chemical COCs are listed in Table 6-2.

6.3 DEMONSTRATING COMPARABILITY BETWEEN REAL-TIME AND LABORATORY METHODS

A study evaluating several different types of soil radiation detector systems was conducted at the FEMP in 1994 as part of the Uranium Soils Identification (USID) program sponsored by Sandia Laboratories and FDF Technology Programs (Miller et al. 1994). The detector systems evaluated in this study included beta detectors, long range alpha detectors (LRAD), NaI detectors (including the Fidler), and HPGe detectors. The area investigated in this study was limited to a zone just north of the incinerator, which demonstrated low to moderate levels of uranium contamination in the soil.

Results of this study indicated that the HPGe and NaI detector systems, which both recorded gamma ray emissions, were the best performers under the given conditions. Due to the broad scope of the USID study some inadequacies were also noted, including the narrow range of uranium soil contamination subjected to in-situ analysis and the limited number of comparisons done for any one detector system. In order to ascertain whether the HPGe detector system could be employed to meet the remediation support requirements of the Soils Project, further site specific testing was conducted.

In August 1995, the HPGe detector system was tested on site soils to make a preliminary evaluation of its usefulness for detecting total uranium. Nine test areas were identified, ranging from near

background for uranium to areas exhibiting significant contamination. All testing was done with the detector at a standard height of one meter above ground level and multiple (six) readings from the same position. The nominal read area with the detector at this height is a circle approximately 33 feet in diameter (or 100 square meters in surface area). The read areas for all tests were partitioned into 20 grid squares. A physical soil sample was obtained from each grid square and submitted to the FEMP laboratory to be analyzed for total uranium. In several instances there was substantial variability between individual uranium values in soil samples obtained from the read areas, but when numerically averaged, the results were very close to the HPGe values for total uranium. These results were as anticipated. Details of these tests are found in Appendix F.

The site-specific comparability studies will be performed during Area 1, Phase I for the HPGe and NaI instrumentation. Goals of these studies are as follows:

- Acquire quantity and quality data under controlled conditions as a final validation of these systems for their intended applications.
- Determine accuracy and repeatability of systems in actual field conditions across the range of contaminant levels present in soil at the FEMP including hot spots and OSDF WAC levels.
- To the extent possible, assess impacts to the systems from environmental variables such as moisture levels of soil and atmosphere, soil density, vegetation, and sources of emissions in proximity of detection systems (see Section C of the Comparability Study DQO, Section 3.0) (OEPA Comment #17).
- Calibrate recording adjustments such as counting time, detector height, speed of platform, alarm thresholds, potential operator bias, and other parameters.
- Optimize initial type and frequency of QA/QC protocol for operation of the systems.
- Determine if certification decisions at the CU level are comparable when basing decisions on either real-time results or laboratory sampling.

With these project goals in mind, the field study conducted during Area 1, Phase I work will evaluate the comparability of discrete laboratory analytical tests with the in-situ nonintrusive NaI and HPGe systems. The DQO for the proposed comparability study of these two instruments are contained in Appendix C of this RAWP.

Before the real-time radiological detection instrumentation can be integrated with the remedial action, its performance and capabilities must be thoroughly evaluated. Certain limitations and boundaries of

the instruments must be acknowledged. Laboratory analytical results for discrete sampling points and real-time field spectroscopy cannot be equated on a point-by-point basis; however, this is not the intent of the study.

Laboratory results from a discrete soil sample represent only the collected sample and the results must be considered as part of some underlying distribution to provide information of value in media characterization. In order to represent this underlying distribution using statistics, reliance is placed on both variance between data points and the overall number of data points in the media of concern. Based on the demonstration of variability and the number of samples, an estimate of the contaminant concentration is made.

Real-time NaI and HPGe spectroscopes are, by nature, averaging instruments that record ambient gamma ray emissions in a weighted or biased manner from the read area beneath the detector. The bias of the detector reading with either system is based on the geometric configuration of the target area, which is center weighted by the detector with progressive diminution of influence as radius from the center increases. Detection of buried or covered gamma-emitting material is dependent on, and proportional to, shielding resulting from soil or other obstruction(s) to the direct line of sight of the receiving crystal.

A portion of the comparability study focuses on the manner in which the HPGe output compares to physical samples obtained beneath the read area in a manner that parallels this concentric geometric pattern. Due to significant point-to-point variability, which is characteristic of most environmental data, it is not expected that an NaI or HPGE reading will mimic a single discrete point taken from the center of the reading area. However, there should be fairly close agreement between an in-situ reading and an average number of samples obtained from the surface and just below the surface within the boundaries of the read area.

The primary question to ask for FEMP applications of this instrumentation in certification is: "Will the same remedial decision be made whether the information is obtained from discrete sampling and laboratory analysis or real-time data collections?" This is a fundamentally different question than: "Is there point-to-point comparability between in situ techniques and discrete samples?" For the purposes of utility and application in certification, the focus must remain on the decision point and not the fact

that in situ techniques and discrete sampling and laboratory analysis make measurements of the same source in different manners.

It is vital that any study on comparability between in situ techniques and laboratory analysis of discrete samples explore not only the point-to-point comparability of one method versus the other, but also, given an adequate number of samples (N), correlate what decision point is reached based on differently acquired sets of information. Limitations and sensitivity of the in situ methods must also be understood and include environmental variables, operator interpretative skill and bias, calibration of equipment, and physical parameters, such as counting time and detector height and speed of mobile platforms. Comparability trials of in situ instruments should be designed to quantify these uncertainties with as much rigor as necessary to gain confidence with system performance under the site-specific conditions. Operating limitations of the instrumentation will be recognized and uncertainties quantified and considered in the decision-making process.

It must also be understood that there are distinct advantages to in situ methods, including the following:

- Ability to completely cover, or cover in a large proportion, the area under investigation. This capability is at variance with discrete sampling and laboratory analytical testing which covers only a minute fraction of the actual area and relies on assumptions about statistically derived underlying distribution to fill in the gaps between samples.

- Depending on detector height, in situ instruments average the read area (which is a method consistent with the way exposure is calculated for risk impacts to modeled hypothetical receptors). Area and concentration-based not-to-exceed criteria for gamma discernable radionuclides can be addressed by setting the count time and speed of the mobile NaI detector platform to redefine the read area, and adjusting the detector sensitivity so it will alarm when a threshold, such as three times the FRL (3XFRL), is achieved for any read area.

- Real-time data acquisition provides data users with the ability to see immediately, or within a short TAT, values for a given read area. This allows FDF management to make rapid decisions in the field and deal with changes as they occur. Efficient data reduction and electronic downloading capabilities also allow spatial and geostatistical mapping to be rapidly performed and maps can be continuously updated with generated data.

- Output from real-time instrumentation adds another dimension to characterization information when used in conjunction with existing and newly acquired laboratory data. The concept of layered information from different sources regarding potentially contaminated media is becoming more recognized and accepted as more definitive than information from a single source or sampling event.

As described in the DQO contained in Appendix C, the intent of the comparability study involving the RTRAK and the HPGe systems is to demonstrate and quantify the performance of these systems. An HPGe reading will be obtained from each of the designated sampling blocks within the CU. The location of the HPGe and the physical sample will be independently and randomly selected within the block, so there will be no attempt to match exact locations in this portion of the test for the reasons discussed previously. In a second set of measurements, the HPGe reading will be placed over the point from which the physical sample was obtained and these results will be compared to the first set.

The objective for this proposed comparability testing is to determine, using discrete samples analyzed by conventional laboratory methods and data collected from the HPGe detector system, whether certification decisions made for the primary COCs at the CU level would be the same. An adequate number of sample comparisons between the HPGe system output and physical samples must be collected to accomplish this goal.

If samples and in situ readings are collected only in remediated areas where the target cleanup level is 75 percent or less of the FRLs, the demonstrated comparability will be limited to low (sub-FRL) levels of radiological contamination. For purposes of the study, comparability over a wider range of site contamination than is present in postremedial conditions in Area 1, Phase I will be necessary to illustrate linearity of response. Several unremediated areas on site with sufficient characterization to establish average contaminant levels will be selected and subjected to sampling and laboratory analysis and in situ measurements for this purpose. The lower and upper bounds of soil contamination for this study will be background levels and uranium levels approaching or exceeding the WAC respectively.

When data have been collected from the proposed comparability study, as described in Appendix C, it will be assimilated and submitted to the regulatory agencies for review. The statistics used in assessing comparability of data and the presentation format will be agreed upon at a later date.

6.4 QUALITY ASSURANCE AND QUALITY CONTROL SAMPLING

The QA/QC sampling will be performed during certification sampling to ensure that SCQ requirements are met. For every 20 samples collected, one will be submitted as a blind duplicate. For ASLs B and C/D, a field blank will also be submitted with every 20 samples during certification sampling. QA/QC is discussed in more detail in the PSP for each of the 7 remediation areas.

6.5 DATA MANAGEMENT

The SED contains the analytical and characterization data for the FEMP. Management of the existing and newly acquired data is vital to the successful and cost-effective remediation of the FEMP. The SED will be the central depository for all newly acquired analytical data collected during the precertification and certification programs. In addition, any new data acquired from field instruments, global positioning systems, manual field data, in situ radiological measurements, and geographic information systems (GISs) will be incorporated into the SED.

Two secondary databases will be linked to the SED. The Sitewide Waste Information Forecasting and Tracking System (SWIFTS) will contain data tracking the volume of soil excavated during remediation and associated characterization data from the SED. This system will track the soil as it is placed in stockpiles and disposed of either in the OSDF or at an off-site facility. The second database system, the Soil Remediation Data Integrated GIS (SRDIG), will provide analytical data in the form of tables to be used to identify areas or potential contamination requiring further investigation.

When the data are in final (post-processed) form, the electronic and physical sample data obtained in the precertification and certification efforts will be made available to the OEPA through electronic transfer via Internet from the FEMP to the OEPA maintained file transfer protocol (FTP) server. Information will be in the form of ORACLE export files.

6.5.1 DATA GENERATION AND REDUCTION

Data will be acquired from field instruments, global positioning systems, manual field data, laboratory analysis, GIS, and in situ radiological measurements. All analytical data will be electronically transferred or manually entered into the SED for retrieval by approved parties.

6.5.1.1 Analytical Data

Analytical data will be generated by both the on-site laboratory and off-site contract laboratories. Information generated at the time of field sample collection will be stored in the Fernald Analytical Computerized Tracking System (FACTS) database until it is later linked to the on-site or off-site analytical results. Once the sample has been analyzed, the data will be linked to the field collection information by the sample identification number, and stored in the FACTS until the data are validated by FDF data validation personnel. Once the data are validated, they will be transferred into the SED.

6.5.1.2 Field Data

Field data will include information on sample collection and survey locations. These data may be provided in electronic or manual field form. The appropriate information is directly transferred to the SED. Additional field data will include field analysis of soil during excavation control to determine if an area is ready for certification or additional excavation is required. This information may be used by the SWIFTS system in characterizing excavated soil.

6.5.1.3 In Situ Measurements (RTRAK and High Purity Germanium Detector)

The potential use of in situ radiological methods generates new information parameters for the SED. The RTRAK is designed to continuously read the average activity of uranium, thorium, and radium as the instrument is driven over a measurement area. The RTRAK will provide the starting and ending coordinates of each measurement area from the Trimble global positioning system (GPS) coupled with the detected activities. Coordinates for each reading are collected with Trimble GPS during collection, coordinates are resolved to an accuracy of 1-2 feet. This information will be transferred into the SED by the FEMP (GIS) personnel. The very large amount of data points surveyed by the RTRAK (approximately 1500/hour), allows for dense mapping of the average radiological activity.

The HPGe also provides average activity over a given area, however it works by stationary measurement and activity, detector height, and location and depth of the surface where the reading is collected. The HPGe will be used during precertification and may be used during certification if approved for this use. Precertification data will be stored in the SED and will be submitted with certification data for final reporting and sitewide closeout. The HPGe detectors will be used to read the RTRAK high biased points to establish an upper limit of radiological contamination at those points. These high biased locations will be located using the Trimble GPS or traditional surveying methods.

6.5.2 Soil Remediation Data Integrated Geographic Information System

The SRDIG is the GIS operator's link to the SED and will be used to provide accurate, timely data in table format to guide in remediation excavation. Precertification and certification data in the SRDIG will be used to identify the areas of highest potential contamination requiring further investigation. Excavation data collected from the field and plotted by a GIS operator will be retrievable from the SRDIG through the Intergraph RIS Net Server software.

6.5.3 Sitewide Waste Information Forecasting and Tracking System

The SWIFTS contains the volumes of soil generated from excavation and remediation, and the SED contains soil analytical results. An electronic link between the two databases is crucial in characterizing and tracking the soil as it is excavated. This electronic link will utilize the location and depth of the soil excavation to extract applicable data from the SED tables. Linking the two databases will allow the volume of soil listed in the SWIFTS to be linked to the analytical results for the volume of soil. In addition to linking to the SED, SWIFTS will receive important information from the field on the extent of excavation.

6.5.4 Data Access

The data manager will designate users allowed direct access to the database. Access to the SED tables and SRDIG database will be available on the network through PC-based reporting. The database will be managed by FDF.

As a group or an individual identifies the data requirements of a project, the required data will be copied to an accessible database in the form of tables for use by that group or individual. The information copied will contain only the data which is useful for that particular group or individual. The tables will be further customized to link the analytical data to the SWIFTS database or other projects as necessary.

TABLE 6-1
SUMMARY OF SAMPLING AND ANALYTICAL SUPPORT FOR AREA 1, PHASE I

	Functional Components		
Project Parameter	Precertification (before excavation)	Precertification (during excavation)	Certification
Function	Address data gaps and uncertainties[a]	Confidence of having attained FRLs in field[b]	Demonstrate attainment of soil FRLs to regulatory agencies
Timing	Before start of excavation	During excavation process	After completion of excavation
Sampling locations	Predetermined based on existing data	On-site call by field manager at floor and boundary of excavation	Based on preapproved certification plan
Analytical methods	NaI and HPGe radiological field screening and quick turnaround laboratory analysis	NaI and HPGe radiological field screening and quick-turn laboratory methods	HPGe radiological; standard sampling and laboratory analysis[c]
Analytical support level[a]	ASL A/B	ASL A/B	ASL B with 10 percent C/D
QA/QC samples	Daily gamma performance checks; SCQ; QA/QC	Daily gamma performance checks; SCQ; QA/QC	To meet SCQ
TAT	Real-time quick-turn or standard turnaround	Real-time, field screen, quick-turn (less than 24-48 hours)	Standard

[a]Detect exceedances of total uranium WAC. Assess upgradient areas.
[b]Detect hot spots for primary COCs at 3 times FRL.
[c]In parallel with physical sampling for comparability study.

TABLE 6-2
ANALYTICAL METHODS USED FOR VARIOUS ANALYTE GROUPS FOR CERTIFICATION AND QA/QC

Analyte Group	Analytes	ASL[a]	Method or Performance Criteria[b]
Radionuclides	Cesium-137 Radium-226 Radium-228 Thorium-228 Thorium-230 Thorium-232 Uranium, total	B	SCQ - Appendix G (performance criteria)
Metals	Aluminum Arsenic Beryllium Manganese Molybdenum	B CD	SW-846 7000A series (furnace) or 6010 A Contract Laboratory program (CLP)
Pesticides/PCBs	Arocolor-1260	B	SW-846 8080

[a]Analytical support levels are defined in the SCQ, Appendix G.
[b]Methods are all approved EPA methods; performance criteria are from the SCQ (DOE 1993)

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TABLE 6-3
QUICK TURNAROUND DETECTION METHODS
FOR PRECERTIFICATION SAMPLING

Constituent	FRL[a]	MDL[b]	Instrument/Vendor[c]	Detection Level/TAT[d]
Arsenic	12	4	FPXRF/Metorex	33 ppm/5 minutes
Beryllium	1.5	0.4	ICP-AES	0.01 ppm/360 minutes
Aroclor-1260	0.13	1	ELISA/Betech	0.5 ppm/25 minutes

[a]FRL - final remediation level (ppm) from operable Unit 5 ROD
[b]MDL - method detection limit (ppb) for reference test done in FEMP laboratory
[c]FPXRF - field portable x-ray fluorescence; ELISA - enzyme-linked immunosorbent assay
[d]TAT - turnaround time

7.0 SAMPLING AND ANALYSIS

For purposes of this RAWP, precertification sampling and analysis is defined as any sampling and analysis performed before formal certification sampling and analysis. Certification sampling and analysis is the structured process to be employed after contaminated soil has been excavated to demonstrate attainment of FRLs for soil COCs in areas of demonstrated contamination or in areas which meet the FRL without excavation.

The sampling and analysis program will utilize in situ instrumentation, field-portable x-ray fluorescence (FPXRF), field test kits, and physical samples analyzed at both on-site and off-site laboratories. In situ instrumentation will include the use of a mobile NaI detector system mounted on the RTRAK and a HPGe detector system. The NaI and HPGe detector systems will be used to measure gamma discernable radiological COCs.

When certification sampling and analysis in Area 1, Phase I is completed, the data will be reviewed and evaluated to determine if the remediation has been successfully completed. Attainment of the FRLs for ASCOCs (Section 5.6) will be statistically evaluated based on the analysis of certification sampling results. BTVs will not drive the remediation of soils within Area 1, Phase I. These data, and calculations used in data interpretation, will be incorporated into a certification report compiled for this phase of certification sampling. After concurrence with the certification report's conclusion is obtained from the regulatory agencies, those areas passing final certification can be released for construction and/or regrading in preparation for interim or final land use.

7.1 WASTE ACCEPTANCE CRITERIA (WAC) SAMPLING AND ANALYSIS

The purpose of WAC attainment sampling is to identify soil which may be above the uranium OSDF WAC prior to soil excavation. Initially, the NaI will collect data to identify the hot spots. The HPGe detectors will then be used to collect additional data on the highest NaI detector reading locations. A predetermined number of soil samples per CU, 2" in diameter and 6" deep (reflecting the 6" excavation zone), will then be collected based on the highest NaI and HPGe detector readings. The physical samples will be analyzed for total uranium at the on-site laboratory with quick TAT. The analytical results will ensure that the soils excavated and destined for the OSDF do not exceed the WAC for total uranium (1030 ppm).

Soils identified through sampling as exceeding the OSDF WAC will be excavated and segregated for eventual off-site disposal. Reduction in the volumes of soil exceeding the OSDF WAC in Area 1, Phase I will not be made based only on real-time analysis; confirmation of the real-time results will be obtained through on-site laboratory analysis of physical samples for total uranium. (OEPA Comment #8)

7.2 PRECERTIFICATION SAMPLING AND ANALYSIS

The purpose of precertification conducted during or after excavation is to provide assurance that certification sampling and analysis will successfully meet the FRLs. Precertification sampling will be accomplished using the NaI and HPGe detector systems, physical samples, and, where applicable, FPXRF and field test kits. Physical samples collected will be submitted to the on-site laboratory for quick TAT. These methods are discussed in the Area 1, Phase I Procedures and PSPs for Precertification and Certification for Operable Unit 5 Soils (Document 20701-PL-0001 Rev. B Draft, November 1996). In Area 1, Phase I a reduction in the excavation extent proposed in this RAWP will not be made with real-time results without confirmation of this information through on-site laboratory analysis of physical samples.

Currently, the NaI and HPGe detectors can provide adequate precertification information to identify and confirm primary COC contamination. Both these methods are discussed fully in Appendix C. These methods are currently being studied during the Area 1, Phase I effort for comparability to conventional sampling and laboratory analysis for ultimate use in certification. Preliminary results indicate that both systems can currently provide adequate information for use in precertification for confirmation and identification of primary COC contamination.

The NaI detector will be utilized to provide 100 percent coverage of accessible areas. The HPGe detector will be used to measure areas of high primary COC contamination from both historical data and NaI detector system measurements. The HPGe detector will also be used in areas that are not accessible by the NaI detector system, such as ditches, wooded areas, etc. In addition, the FPXRF, field test kits, and quick TAT laboratory analysis will be utilized for precertification, where applicable.

The number of physical soil samples taken for purposes of precertification, the sample locations and the analytes selected will be based on existing RI/FS and WAC characterization data, including the results of measurements collected by the NaI and HPGe detectors. The samples are planned to be 2" in diameter

and 4" deep (different from the 6" deep OSDF WAC attainment samples). The physical sample shall be analyzed for the total uranium at the on-site laboratory for quick TAT.

Precertification sampling conducted during excavation will compare the residual soil levels to the target levels of 75 percent of the FRLs. This target level is used in Area 1, Phase I to estimate the number of samples required for successful certification (see Appendix C, Precertification Sampling and Analysis DQO). Attainment of these ASCOC target levels will minimize the chance of certification failures. Certification failures could result in construction delays and increased costs due to the need to remobilize and resample for certification in those areas. Upon receipt of favorable precertification sampling results, FDF will proceed with certification sampling.

7.2.1 Precertification of the North Pine Woods (Subarea B North West)

In the north pine wooded area, the HPGe and quick turn laboratory analysis will be used to check the southernmost boundaries to evaluate whether levels of primary rads and other potential contaminants are above the appropriate FRLs. If the boundary areas are found to be above FRLs, then additional field and quick turn laboratory analyses will be systematically performed on samples collected from accessible plantation rows northward until there is confidence that these areas do not exceed the target levels for the ASCOCs. If pre-certification indicates excavation of a portion of the wooded area is necessary, their scope will be added to the Area 1, Phase I RAWP prior to certification in a manner consistent with the rest of Area 1, Phase I. The assumption is that prevailing winds from the site were to the north and that water flow and/or erosion is to the south; therefore, contamination in the soil diminishes from south to north. (OEPA Comment #13)

7.3 CERTIFICATION SAMPLING AND ANALYSIS

The purpose of certification sampling is to demonstrate attainment of FRLs for soil COCs and to allow the successfully certified areas to be released for construction and/or regrading in preparation for interim or final land use. The following plan for certification is designed to demonstrate Area 1, Phase I compliance with the soil FRLs published in the Operable Unit 5 ROD in a manner acceptable to the regulatory agencies. The soil FRLs were developed by determining the average level of a contaminant to which an undeveloped park user could be safely exposed. The certification process demonstrates compliance with the FRLs by using averaging areas which are smaller than the reasonable exposure areas considered under the projected land use as an undeveloped park. The goal of the certification approach for this RAWP is to statistically demonstrate that compliance with the FRLs has been achieved or

exceeded in each certified area to standards and confidence levels agreed to by the regulatory agencies and presented in this RAWP (Table 7-1). Subsequent RAWPs covering the remaining 6 remediation areas will, as applicable, statistically demonstrate that compliance with the FRLs or relevant BTVs has been achieved or exceeded in each certified area to the standards and confidence levels agreed to by the regulatory agencies and presented in this RAWP.

The methods and implementation of the certification process are based on a number of considerations including the following:

- ASCOC being assessed. These contaminants are identified based on output from the Matrix of COC Evaluation Parameters (Table 5-1) and COC distribution from existing analytical data spatial maps
- Certification unit (CU) types
- Spatial assignment of CUs
- Statistical confidence, certification sampling density and analytical support level
- Statistical testing of certification data
- Incorporation of certification analytical results into certification reports.

7.4 CERTIFICATION SAMPLING FOR AREA SPECIFIC AREA 1, PHASE I CONSTITUENTS OF CONCERN

To design the certification program for Area 1, Phase I, the 12 ASCOCs (and 1 BTV for Aluminum) that demonstrated a presence in the proximity of the Area 1, Phase I boundary, were placed into 4 analytical groups: primary radionuclides, secondary radionuclides, metals, and PCBs (see Table 7-1). This is consistent with the "analytical suites" that will be requested from the laboratory for the certification samples. As discussed in Section 5.0, BTVs will not drive soil remediation within Area 1, Phase I.

Based on existing characterization data, a series of maps were generated showing the locations of samples with specific constituents in excess of or below the FRL, BTV or background levels. These maps are identified as Figures E-1 through E-48. (Not all these maps are applicable to the Area 1, Phase I effort; they are provided only to give a site-wide perspective of these constitutents). In Area 1, Phase I, the primary uranium radionuclide contamination has been found near the former production area and in a plume extending north and east, as shown on Figures E-1 through E-5. In addition, radium and thorium

contamination is found in the zones of primary contamination adjacent to the incinerator and the STP. As discussed in Section 5.1, several thorium-228 results exceeding the FRL found in the northern forested wetlands were determined to be inaccurate. However, due to the significant nature of the three primary COCs (uranium, radium, and thorium), these constituents will be certified throughout Area 1, Phase I according to the schedule of activities as presented in Section 3.0.

A limited number of samples collected near the former production area and Fire Training Facility (FTF) (Figures E-6 and E-12, respectively) exceed the FRLs for the secondary radiological COCs, cesium-137, and thorium-230 (the FTF, subarea D2, will not be remediated or certified under this RAWP. See Section 2.3.2 for further discussion). These areas are already known to be contaminated with the primary COCs and these two additional radiological contaminants will be certified to their FRLs. In addition, a single cesium-137 detection above the FRL was found along the northern boundary of the FEMP (Figure E-6). This area will be certified for cesium-137.

Several locations within the former production area appear to have metal contamination. In Area 1, Phase I, the metals (arsenic, aluminum, beryllium, manganese, and molybdenum) have scattered patterns of distribution which do not follow patterns of contamination expected from airborne or direct dispersion (Figures E-13, E-14, E-16, E-40a through E-40c, and E-46). The spatial distribution of metals suggests the values may be due to natural background levels. This becomes apparent in a comparison of the maps of sample results greater than the BTV, surface background levels, and subsurface background levels (Figures E-40a through E40c). The limited number of samples above the 95th percentile of subsurface background levels are inconsistent with a particular pattern of contamination. However, these metals will be examined in Area 1, Phase I at the sampling densities indicated on the certification maps in order to gather sufficient data to test this hypothesis.

The PCBs (aroclor-1260) are considered to be a concern only along the perimeter of the former production area (FPA) (Figure E-17). Many of the aroclor-1260 samples near the FTF were nondetects with reported detection limits higher than the FRLs. However, there is sufficient process knowledge and data to suggest that PCBs are present at the northern former production area perimeter and within the boundaries of the FTF. The FTF (subarea D2) will not be remediated or certified under this RAWP (see Section 2.3.2 for further discussion).

Lead (metal) and PAHs are not of a concern in Area 1, Phase I. Therefore, no PAH and lead certification sampling will be conducted under this RAWP. Lead analytical data is generated as part of the metals analysis and will therefore be available for review.

BTVs for molybdenum and manganese will not drive remediation, the respective FRLs for these COCs will be remedial drivers. Additionally, the BTV for aluminum will not drive the remediation. Analytical data for these ASCOCs will be collected at a resolution adequate to compare with the BTV.

7.5 CERTIFICATION UNITS

A CU is the predefined area which will be sampled in a specified manner to demonstrate that the average COC level meets the FRLs or other applicable remedial goal within a specified confidence level. The actual physical dimension and location of a CU is largely based the following:

- Exposure patterns for the type of receptor evaluated for occupation of the site after remediation. For the FEMP, the undeveloped park user is the primary receptor. Under the definition of the undeveloped park final land use scenario, there is the possibility of walking trails, bike paths, wildlife viewing areas, grassy fields, and picnic areas, but there would be no rest room facilities or other developed recreational amenities. The CU dimensions should be conservative when compared to the exposure pattern typical of the undeveloped park user.
- ASCOC data distribution based on existing data and process knowledge
- Irregularities in the Area 1, Phase I boundary as well as the property boundaries (fence lines).

The certification unit system contains three CU categories identified as:

- Class I Unit = 0.92 acre
- Class II Unit = 3.68 acres
- Homogeneous Unit < 15 acres

Typical sampling densities and planned analysis for each CU are shown on Table 7-2.

A sitewide CU assignment system has been developed to effectively administer the tracking of certification units in Area 1, Phase I, and in later remediation areas. All CUs will fit into this system, which will enable certification results to be reviewed and documented in a consistent and repeatable manner. The certification process will be complete for any unit when all certification test results designated for a CU have been returned and the confidence limits with respect to the FRLs have been demonstrated to, and approved by, the regulators.

7.5.1 Class I

Based on existing characterization data and process knowledge, areas demonstrating contiguous contamination, or a high probability of contamination due to the proximity to demonstrated contamination, will be certified by overlying the area with Class I (CU-I) CUs. A CU-I is typically a square area of 200 by 200 feet (0.92 acres). The size of a CU-I may be larger or smaller than 0.92 acres when it is necessary to fit the CU into an irregular size property boundary. A CU-I is a considerably smaller area than an undeveloped park receptor would encounter during repetitive visits to the park.

7.5.2 Class II

In areas demonstrating marginal or scattered detections above the FRLs, yet still showing relative homogeneity and discontinuity from contiguous contaminated areas, a larger CU will be utilized. A Class II CU (CU-II) is typically a square area of 400 x 400 ft. (3.68 acres). The size of a CU-II may be smaller or larger than 3.68 acres when it is necessary to fit the CU to an irregular size property boundary. The CU-IIs are still considered to represent a considerably smaller area than an undeveloped park receptor will encounter during park use. The CU-IIs are used only in certifying for radiological COCs in areas exhibiting only marginal indications of contamination.

7.5.3 Homogenous Units

For primary COCs and metals, there are large units within the Area 1, Phase I boundary that have demonstrated no appreciable contamination and can be considered relatively unimpacted. Because of the sitewide importance of primary COCs and the scattered metal results (potentially attributed to elevated background levels), these larger areas will be divided into units of "homogenous strata" which will be treated as independent CUs. These homogenous units (CU-H) are of no fixed dimension or size but will not exceed 15 acres. The use of these homogenous CUs will provide additional confidence that areas considered unimpacted are in compliance with the FRLs or BTVs for the primary COCs and metals.

7.6 ASSIGNMENT OF CERTIFICATION UNITS IN AREA 1, PHASE I

Selecting the location and type of CU to be used in Area 1, Phase I was based largely on spatial analysis of the existing characterization data of all ASCOCs with detections above their FRL, and on process knowledge. BTV constituents were identified in the ecological risk assessment (Section 5.0 and Appendix E). Maps showing the locations of CUs were generated for the 12 ASCOCs representing the 4 analytical suites for Area 1, Phase I: primary COCs (Figure 7-1, secondary radiological COCs (Figure 7-2), metals (Figure 7-3), and PCBs (Figure 7-4). The CUs are identified using the site-specific alpha-numeric grid system for reference; this system is being used sitewide to track and report final results.

Separate CUs have been developed for each analytical group of ASCOCs, as appropriate. Although airborne dispersion is thought to be the dominant mechanism of contaminant dispersion in the FEMP soil, it is not the only one. Evaluation of the existing soils data against the FRLs, combined with process knowledge, demonstrates that the primary contaminants are present in more extensive distribution patterns than the other ASCOCs. CU design is based on the demonstrated presence of ASCOCs in site soil, not their original mode of deposition. The differences in extent of ASCOC distributions are a function not only of the quantity of contaminant deposited over during the production period, but also of the contaminant mobility (solubility), degradation rates, affinity for the soil substrate, and relative toxicity of the contaminant which impacts the stringency of the FRL. The certification process is intended to document the removal of this demonstrated soil contamination. In order to do this efficiently and cost effectively, certification sampling for ASCOCs, by agreement with the regulators, will be limited to areas where the presence of the contaminant is demonstrated or suspected.

Due to the relatively high number of COC detections above the FRLs in the FPA and the proximity to the incinerator, these areas have been designated as CU-Is. Therefore, the CUs will be conservatively biased surrounding the boundary of the FPA and the zone upwind of the Sewage Treatment Plant (STP) incinerator. This approach is designed to demonstrate that contamination from sitewide COCs present in the former production area and the area affected by the incinerator do not extend into of Area 1, Phase I. (OEPA Comment #18)

The eastern boundary of the site in Area 1, Phase I has been identified as a Class II CU area for primary COCs (see Figure 7-1) due to the relatively high number of above-FRL detections along the boundary (see Figures E-1 through E-5). In addition, one cesium-137 sample along the northern boundary of the site was identified as having results above the FRL (see Figure E-6). Since this area does not appear to

be part of the contiguous pattern of contamination, it was identified as a Class II CU for secondary radiological constituents.

Because of concerns with the primary COCs and uncertainties in the background conditions of metals, the remaining areas not designated as a CU-I or CU-II will be sampled for primary COCs and metals in homogenous units (CU-H) not to exceed 15 acres. The proposed certification units for Area 1, Phase I are summarized in Figures 7-1 through 7-4.

7.6.1 Certification of OSDF Support Subareas

Three areas have been identified as requiring certification in support of the OSDF. The existing North Access Road is part of the Area 1, Phase I scope, whereas the PS and SB are beyond the scope of this RAWP. PS and SB are being certified as OSDF support subareas.

- Existing North Access Road (subarea B) - location not currently accessible due to the existing road surface cover over soils to be certified; irregular CU shape
- OSDF pump station (subarea PS) - isolated CU
- OSDF sediment basin (subarea SB) - isolated CU, location not currently accessible for certification due to 18" of gravel cover.

Due to special circumstances, these areas must be certified using a modified approach. The soil within Area 1, Phase I that encompasses the existing North Access Road and associated ditches will be certified by separate protocol. A separate PSP will be submitted to address this certification effort.

7.6.1.1 Certification of the Existing North Access Road

Due to the current OSDF schedule, there is a certification scheduling conflict between the construction of the relocated North Access Road and the currently existing North Access Road. Continuity of service must be maintained for access to State Route 126 allowing passage of site traffic and emergency vehicles. Due to weather impingements on completion of the relocated North Access Road, its completion and opening date is not expected until late March to April 1997. Until this occurs, the current road must remain in service.

Excavation, construction, and liner installation for the first cell of the OSDF is scheduled to begin in May to June 1997. The existing North Access Road will need to be removed at or before this time in order to prepare the area. There is insufficient time between the removal of the existing road and initiation of

OSDF construction to conduct certification testing, await laboratory analytical results and submit a certification report.

DOE proposes the following strategy to address this situation:

- The existing North Access Road will be considered and tested as two separate certification units. This decision is based on the spatial distribution of ASCOCs along the length of the road. The roadway will include not only the width of the road surface but also extend to the external limits of the ditches on either side of the road.

- A limited series of test borings will be performed to characterize the strata beneath the road surface. The initial testing performed will be limited to approximately 6 geoprobe borings that will determine characteristics of the roadway including the thickness of the cover material, thickness and material type of the subgrade fill, and depth and type of the underlying soil base. Soil cores of the underlying base material recovered from the test borings will be submitted to the laboratory for quick turnaround testing for total uranium.

- Based on the physical and analytical information obtained from the test borings, an addendum to the Area 1 Phase I Project Specific Plan (PSP) will be written detailing the certification approach. This will be submitted to the regulators when completed. Certification sampling will then commence.

- Certification samples will be obtained in the quantity and locations contained in the PSP addendum. The goal is to obtain physical samples of the base soil material underlying the roadway and submit the samples for certification. Depending on the strata encountered and results from the analytical tests performed on the initial soil samples, either single discrete samples will be obtained from the first 6 inches of soil base material, or a series of cores will be obtained to allow soil analysis to be performed at depth differentials. Provided the FRLs prove to be in statistical compliance, the analytical tests obtained from a discrete depth profile will constitute the certification testing for the roadway.

- Based on sample analytical results, a proposal will be made to excavate the roadway to a specified depth and the material generated will be dispositioned to the appropriate OSDF disposal soil pile. The excavated road base will then be checked with real-time instruments and quick turn around laboratory tests to verify all contaminated material has been removed. The roadway excavation will then be considered "certified" and will be available for OSDF construction.

- The proposed schedule for the existing North Access Road certification activities is as follows:

Test borings	-	Dec 14, 1996
PSP Addendum	-	Jan 4, 1997
Certification Sampling	-	Jan 10, 1997
Certification Report	-	March 1997 (OEPA Comment #1, US EPA Comment #2)

7.6.1.2 Certification of the OSDF Pump Station and Sedimentation

For the OSDF pump station and sediment basin, certification units will be positioned to contain limits of the construction activities to be conducted at each location. Any area outside the limits of the excavation and/or outside the limits of the construction area for either facility, will be certified when that outside area is being excavated or scheduled for remediation and certification. For example, any areas adjacent to the pump station construction activities will be certified with Remediation Area 5. These OSDF support areas, though not part of Area 1 Phase I by location, are integral to the OSDF and will be certified during the time frame of Area 1, Phase I.

7.7 CERTIFICATION SAMPLING PLAN

Certification sampling consists of systematically sampling each CU for the known or suspected contaminants at a predetermined density. The release and closure of a CU requires that the average soil level within the CU in Area 1, Phase I be demonstrated below the FRLs with a minimum statistical confidence of 95 percent for the primary contaminants and at least 90 percent for secondary contaminants.

In addition to the certification sampling described below, a comparability study for the NaI and the HPGe systems is being conducted (see the Site Soils In-Situ Comparability Study DQO in Appendix C). Results of this comparability study will be used to assess the viability of employing these real-time technologies for precertification and certification in subsequent soil excavation RAWPs.

One certification PSP has been written for Area 1, Phase I, and is being used for certification sampling of each CU (reference Area 1, Phase I, Procedures and Project Specific Plans for Precertification and Certification for Operable Unit 5 Soils, Rev. B Draft). Certification Reports will be submitted according to the schedule on Table 3-5.

7.7.1 Class I Certification Units

Based on current data and the expected ASCOC levels after cleanup, 12 samples for primary ASCOCs and 9 samples for secondary ASCOCs will be collected to attain the required statistical confidence that the average soil ASCOC levels in a given CU are less than the FRLs (see Certification Sampling and Analysis in Area 1, Phase I DQO in Appendix C). Table 7-4 shows the number of samples needed in each CU in Area 1, Phase I to achieve acceptable confidence limits.

The number of samples required to achieve statistical confidence was determined from the following equation:

$$n = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{\left(\frac{FRL - \bar{x}_{target}}{S_{CA}}\right)^2}$$

where

α = probability of a Type I Error (.05)

β = probability of a Type II Error (.20)

FRL = the FRL for the given analyte

$\bar{x}_{target}$ = target clean-up level mean (equals 75% of the FRL)

S_{ca} = standard deviation estimated Clean Areas

The target clean-up level during precertification is 75 percent of the FRL. At this target clean-up level, the maximum expected value (average level) would be no greater than 75% of the FRL. As a conservative estimate, the 75% level of the FRL has been selected as the mean target clean-up level. The target levels are not committed levels that are goals to be sought in order to demonstrate preparation for certification sampling.

An estimate of the variability for post-remedial conditions was based on estimates calculated from existing data in "clean areas." The concept was that the variability demonstrated in unimpacted areas would be similar to post-remedial conditions in impacted areas. The procedure used to estimate the clear area variability is as follows:

- The site was divided into 100 ft. by 100 ft. blocks. This was accomplished by dividing the northing and easting coordinate by 100 since these coordinates are presented in feet.
- Block averages were calculated for each 100 ft. x 100 ft. block.
- Blocks were then categorized as either impacted (average greater than or equal to the FRL) or unimpacted (average less than the FRL).
- All sample locations located in impacted blocks were then eliminated from consideration.

- The final screening removed any sample that was in excess of three times the FRL (3XFRL) since these sample values would immediately trigger a localized remedial effort.

- From the data remaining (unimpacted areas), the variability used in the calculations was calculated. Using this methodology, an estimate of post-remedial variability was developed. Under these assumptions and methods, the estimated sample sizes are 12 for primary ASCOCs and 9 for secondary ASCOCs. The drivers for these sample sizes were thorium-232 (primary) and arsenic and beryllium (secondary) (see Table 7-4).

Samples will be collected from randomly selected locations within each CU. Each CU will be divided, through geometric means, into 16 subunits of approximately equal surface area. Using a random number generator, 9 or 12 subunits (based upon the ASCOC) will be selected along with northing and easting coordinates within each subunit for sample collection locations. If re-sampling is required for a CU, new randomly selected subunits and location coordinates will be generated.

Certification sampling for primary ASCOCs will consist of the collection of physical samples from 12 randomly selected subunits. All samples will be submitted to an off-site laboratory for analysis. One randomly located physical sample shall also be collected from each of the 4 subunits not selected for analytical sample collection and archived.

Certification sampling for secondary ASCOCs (radiological, metals, and PCBs) will consist of the collection of physical samples from 9 randomly selected subunits. All samples will be submitted to an off-site laboratory for analysis. One randomly located physical sample shall also be collected and archived from 3 randomly selected subunits that are not selected for certification analytical sample collection.

The samples collected for analysis will be submitted to an approved off-site laboratory and analyzed by analytical suite for the indicated contaminants at ASL B, with 10 percent analyzed at ASL D. In accordance with the certification DQO requirements (see the Certification Sampling and Analysis in Area 1, Phase I DQO in Appendix C), the appropriate number and type of QA/QC samples will be collected for the analytical methods and submitted to an approved laboratory. The number of planned QA/QC samples will be reviewed by the on-site laboratory for accuracy. The samples collected for archiving shall be maintained by the approved laboratory until the determination has been made that they are no longer needed to support certification sampling or the sample holding time has expired.

7.7.2 Class II and Homogenous Certification Units

The same sampling protocol used for Class I CUs will be used for the Class II and Homogenous CUs. Samples will be collected from randomly selected locations within each CU. Each CU will be divided, through geometric means, into 16 subunits of approximately equal surface area. Using a random number generator, 9 or 12 subunits (based upon the ASCOC) will be selected along with the northerning and easting coordinates within each subunits for sample collection locations. A total of 12 samples will be collected for primary COCs analysis, and 9 will be randomly selected for appropriate secondary COCs analysis. In addition, 4 primary and 3 secondary archive samples will be collected from subunits not randomly selected for certification analytical sample collection. If re-sampling is required for a CU, a new random selection of subunits and location coordinates will be generated.

The samples collected for analysis will be submitted to an approved off-site laboratory and analyzed for the indicated contaminants at ASL B, with 10 percent validated at ASL D. In accordance with the requirements of the SCQ, the FEMP laboratory will ensure that, based on the analytical methods and number of samples, the appropriate number and type of QA/QC samples are collected by the field crew and submitted to the approved laboratories. As with CU-I samples, in accordance with the requirements of the Certification Sampling DQO (see Appendix C), the appropriate number and type of QA/QC samples will be collected for the analytical methods and samples collected and submitted to an approved laboratory. The number of planned QA/QC samples will be reviewed by the on-site laboratory for accuracy. The samples collected for archiving will be maintained by the approved laboratory until they are no longer needed to support certification sampling or the sample holding time has expired.

The results from the discrete samples will be compared to the FRLs. If the average level is statistically below the FRL, the CU will be considered remediated. If the average level is not statistically below the FRL, actions will be taken as detailed in the flow chart/decision matrix (Figure 7-5). The matrix identifies the decision points in the process and where regulatory approval will be required prior to initiating further action.

7.8 STATISTICAL TESTING

In order to statistically determine if a CU can receive final certification and be designated as "certified," the average soil sample value will be compared to the remedial goal (FRL). Since the burden is on the FEMP to prove that the remedial goals have been achieved, the hypothesis is formulated as:

H_0 = the i_{th} CU is assumed to be out of compliance (i.e. the average concentration for a given analyte is equal to or greater than the remedial goal).

H_A = there is significant evidence to indicate that the average concentration of the given analyte in the i_{th} CU is less than the remedial goal and therefore we reject the null hypothesis and deem the CU as remediated.

The following statistical test will be used to determine if the average concentration in the i_{th} CU is less than the remedial goal:

$$t = \frac{RG - \bar{x}_i}{\sqrt{S_i^2/(n_i - 1)}}$$

Where:

t = computed value

RG = remedial goal (FRL)

x_i = mean of the samples from the ith CU

S^2 = sample variance

n_i = number of samples from the ith CU.

If the computed value (t) exceeds the critical value of a t-distribution with $\sigma = 0.05$ at n-1 degrees of freedom then the null hypothesis is rejected in favor of the alternative. Thus, if the average concentration of the given analyte is significantly less than the remedial goal the test statistic (t) becomes large. If the test statistic exceeds the critical value then there is significant evidence that the average concentration for the given analyte is less than the remedial goal and, therefore, the hypothesis that the CU is out of compliance can be rejected and the CU can be deemed remediated. If the average is not statistically less than an FRL at a minimum confidence level of 95 percent certification fails.

7.9 CERTIFICATION FAILURE

There are four different conditions that could cause a CU to fail certification and each has a different action:

1. The CUs average is below the FRL but the CU fails due to high variability. In this case the archived samples will be analyzed, added to the certification data set, and the certification analysis will be performed. If the CU still fails the certification analysis then proceed to 2, 3 or 4, as appropriate.

2. The CU fails because of widespread contamination. In this case the entire CU is excavated and recertified as CU-Is. If the original CU is a CU-I, then it would be re-certified as such. If the CU was a CU-II then it would be subdivided int CU-Is, excavated, and re-certified.

3. The CU fails due to a small localized contamination area. In this case real-time quickturn methods will be used to isolate the contaminated area. This are would be excavated and resampled to assure that the excavation was successful. If successful, the CU would achieve certification. If unsuccessful, the process would be repeated until certification is successful.

4. The CU fails due to improper CU delineation. In other words, the designated CU is not homogeneous, it should be re-designated as two or more separate CUs for either re-certification, or remediation and re-certification if found to be above the FRL.

In all cases when a CU is redesignated as smaller CUs, each of these new CUs will follow the standard sampling requirements of the smaller CU. (OEPA Comment #19)

7.10 CERTIFICATION REPORTS

If the reviewed certification sampling and analysis data meets the criteria stated in Section 7.6 and in the DQOs in Appendix C, certification reports for the subareas that have undergone certification will be prepared and submitted to the regulatory agencies. A listing of the certification reports and their scheduled submittal dates is presented in Table 3-5. In parallel, real-time isoconcentration maps and germanium results from the analysis will be provided. These additional data, obtained during the comparability study, will provide information to support or augment decision making.

The contents of the certification report will include the following:

- A detailed map of the area or areas that were subjected to certification sampling and analytical testing
- Maps containing isoconcentration lines generated by the NaI, HPGe, and analytical results
- Locations, dates, and times of all samples collected and any variances from the certification sampling plan submitted with the RAWP
- The extent of final remediation relative to the original estimated extent of excavation

- A copy of the Area 1, Phase I Project-Specific Plan including procedures for analytical methods and operation of equipment not in the SCQ or EPA SW 846
- Data summary of all returned certification analytical results, with full data packages available for review if requested
- Calculations of average soil concentrations of ASCOCs relative to the FRLs
- QA/QC results including results of required blanks and duplicates and copies of the signed chain-of-custody forms
- Relevant field and laboratory notes and comments regarding the samples
- Conclusions based on the review of assembled information.

Upon receipt of regulatory agency concurrence with the conclusions in the certification report, those areas passing final certification can be released for construction and/or regrading in preparation for interim or final land use.

TABLE 7-1
SUMMARY OF AREA 1, PHASE I AREA SPECIFIC CONSTITUENTS OF CONCERN CERTIFICATION LEVELS

Analytical Suites	Area 1, Phase I Constituents of Concern	Driver
Primary ASCOCs		
Gamma discernable radiological	Total uranium	82 mg/kg FRL
	Radium-226	1.7 pCi/g FRL
	Radium-228	1.8 pCi/g FRL
	Thorium-228	1.7 pCi/g FRL
	Thorium-232	1.5 pCi/g FRL
Secondary ASCOCs		
Radiological COCs	Cesium-137	1.4 pCi/g FRL
	Thorium-230	280 pCi/g FRL
Metals	Arsenic	12 mg/kg FRL
	Beryllium	1.5 mg/kg FRL
	Manganese	4600 mg/kg FRL 1500 mg/kgBTV[a]
	Molybdenum	2900 mg/kg FRL 10 mg/kg BTV[a]
Polychlorinated biphenyl	Aroclor-1260	0.13 mg/kg FRL
BTV	Aluminum[b]	16,100 mg/kg BG

[a] Data for this COC will be collected at a resolution adequate to compare to the BTV. However, the BTV will not drive remediation.

[b] As used in the development of the FRLs, aluminum defaults to the 95th percentile of background. The 95th percentile of subsurface background is used to more closely reflect residual soil. Although aluminum IS NOT CONSIDERED AN ASCOC it will be included in the analytical suite for data aquisition. Its BTV level will not drive remediation.

TABLE 7-2
SUMMARY OF CERTIFICATION CLASS PROTOCOLS
FOR AREA 1, PHASE I CONTAMINANTS

Protocol	Class I	Class II	Homogenous Units
Certification unit size	200 x 200 ft, 0.92 acres	400 x 400 ft. or 3.68 acres	Not to exceed 15 acres
Sampling density	9 or 12 discrete samples plus 3 or 4 archive samples using 2-inch Shelby tubes to a depth of 6 inches.	Same as Class I	Same as Class I
Analysis	9 samples analyzed for secondary COCs with 3 samples archived. 12 samples analyzed for primary COCs with 4 samples archived. Analysis at ASL B with 10 percent at ASL D	Same as Class I	Same as Class I

TABLE 7-3
SUMMARY OF CERTIFICATION UNITS, ANALYTICAL SUITES, AND FACTORS FOR DESIGNATION

CERTIFICATION UNIT NUMBER	CLASS	ANALYTICAL SUITE	MAJOR FACTORS
N18	H	Metals	Scattered Results Above FRL plus Uncertainty in Contamination Pattern
N20-20	II	Secondary Radionuclides	Scattered Inconsistent Contamination
P17-31, P17-33, P18-11	I	Primary COC Metals PCBs	Proximity to FPA plus Uncertain Contamination Boundary Proximity to FPA plus Uncertainty in Contamination Pattern Proximity to FPA plus Uncertain Contamination Boundary
P18, P19, P20	H	Primary COC	No Indication of Contamination
O14-42, P14-31	I	Primary COC Metals	Proximity to FPA plus Uncertain Contamination Boundary Proximity to FPA plus Uncertain Contamination Boundary
O18	H	Primary COC Metals	No Indication of Contamination Scattered Results above FRL plus Uncertainty in Contamination Pattern
O15-44, O16-22, O16-24, O16-42, P15-33, P16-11, P16-13, P16-31, P15-34, P16-12, P16-14, P16-32	I	Primary COC Metals	Proximity to FPA plus Uncertain Contamination Boundary Proximity to FPA plus Uncertain Contamination Boundary
Q16-31, Q16-32, Q16-33, Q16-34	I	Primary COC	Proximity to STP plus Demonstrated Contamination
M18, N19, O19, O20	H	Primary COC Metals	No Indication of Contamination Scattered Results above FRL plus Uncertainty in Contamination Pattern
P17-14, P17-32	I	Primary COC	Proximity to FPA plus Uncertain Contamination Boundary
P17-34, P18-42	I	Primary COC Metals	Proximity to FPA plus Uncertain Contamination Boundary
P17, P18, P19, P20, Q16, Q17, Q18, Q19, Q20	H	Metals	Scattered Results above FRL plus Uncertainty in Contamination Pattern

TABLE 7-3
(Cont'd)

CERTIFICATION UNIT NUMBER	CLASS	ANALYTICAL SUITE	MAJOR FACTORS
P17, P17-40, P18-20, P18-40, P19-20, P19-40, P20-20, Q18-10, Q18-30, Q19-10, Q19-30, Q20-10, Q20-30, Q18-40, Q19-20, Q19-40, Q20-20, Q20-40	II	Primary COC	Scattered Inconsistent Contamination, Assumed Airborne Deposition
Q17-10, Q17-30	II	Primary COC Secondary Radionuclides	Scattered Inconsistent Contamination, Assumed Airborne Deposition Scattered Inconsistent Contamination
Undesignated Areas Not to be Certified			No Indication of Contamination

I- Class I Certification Unit
II - Class II Certification Unit
H - Homogenous Zones
BTV - Benchmark Toxicity Value
FPA - Former Production Area
FRL - Final Remediation Level
FTF - Fire Training Facility

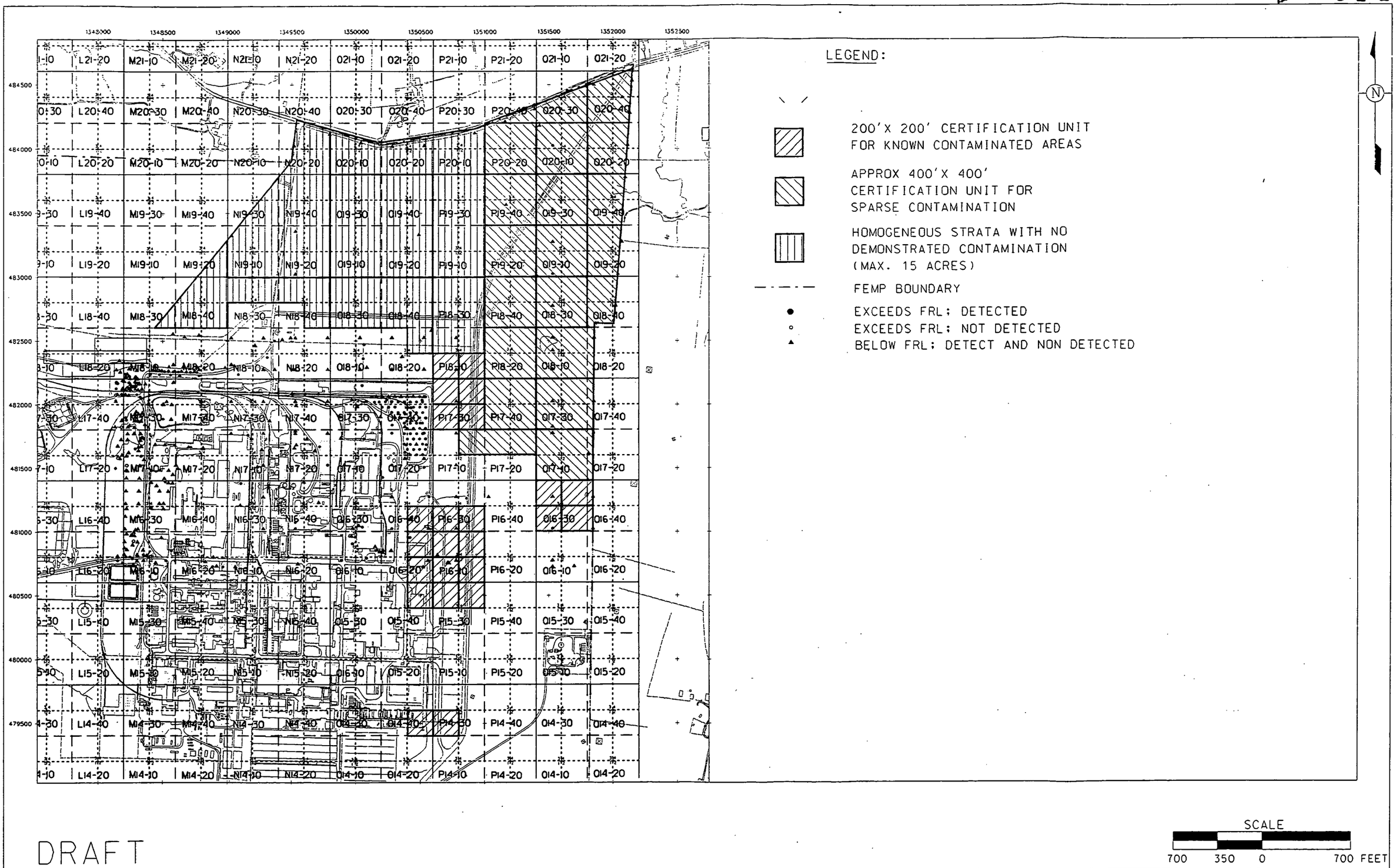
TABLE 7-4
CALCULATING THE NUMBER OF SAMPLES PER CERTIFICATION UNIT IN AREA 1, PHASE I TO ACHIEVE ACCEPTABLE CONFIDENCE LEVELS

ASCOC	FRL	Number of Samples Used in Model	Standard Deviation	Maximum Expected Average Soil Concentration after Excavation [2]	Number of Samples Required
Aroclor-1260	0.13 mg/Kg	641	0.035	0.098	8
Arsenic	12 mg/Kg	983	3.475	9.00	9
Beryllium	1.5mg/Kg	999	0.397	1.12	7
Cesium-137	1.4 mg/Kg	2595	0.381	1.05	8
Radium-226	1.7 pCi/g	2224	0.574	1.28	12
Radium-228	1.8 pCi/g	1508	0.441	1.35	6
Technetium-99	30 pCi/g	1511	3.153	22.5	2
Thorium-228	1.7 pCi/g	1514	0.471	1.28	8
Thorium-230	280 pCi/g	2034	29.472	210	2
Thorium-232	1.5 pCi/g	2258	0.503	1.12	12
Uranium, Total	82 mg/Kg	4211	23.166	50.0 [1]	9

[1] Uranium level is based on As Low As Reasonably Achievable (ALARA) goals. 75% of the FRL for uranium is 61.5mg/Kg U_{total}

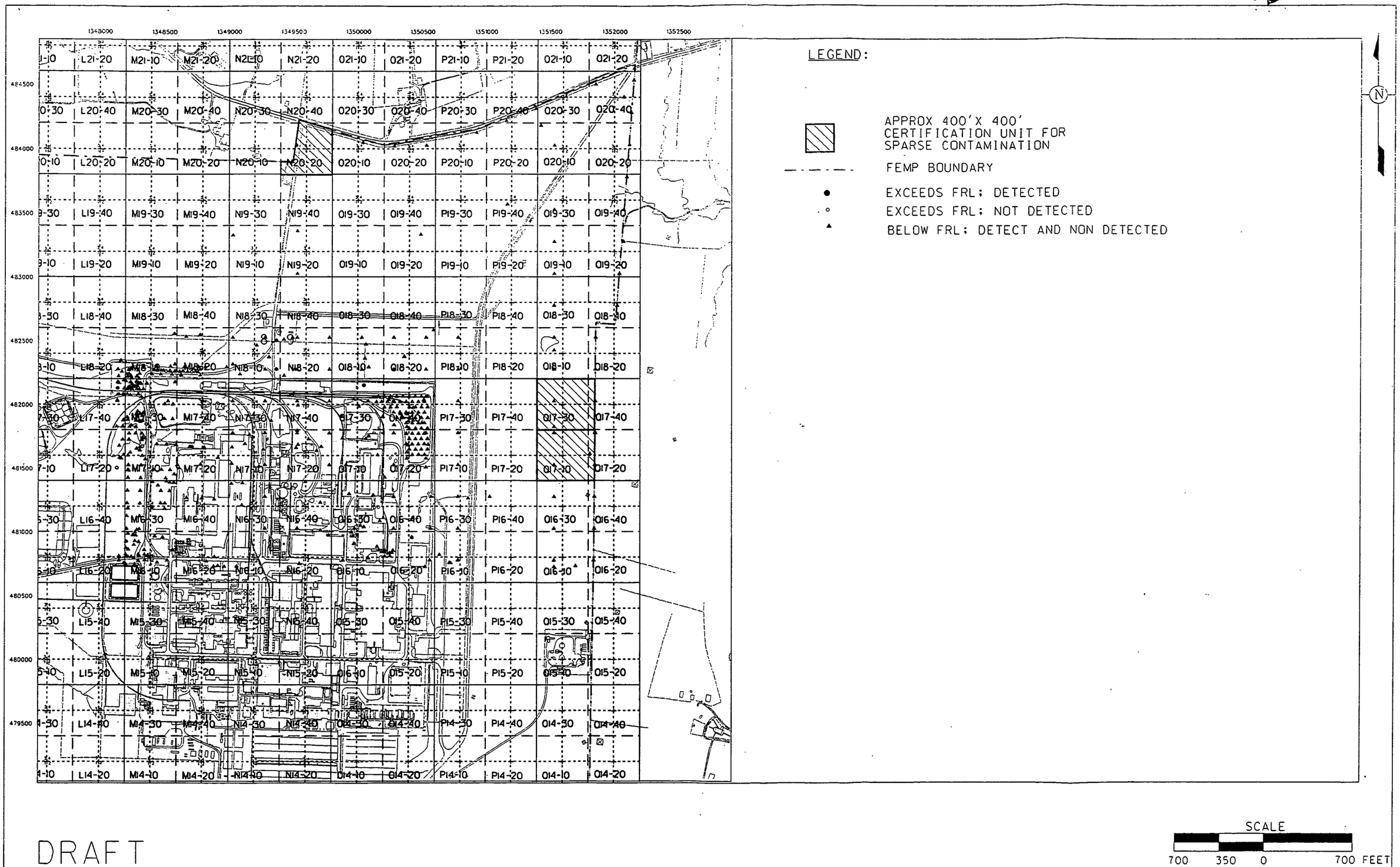
[2] Assumptions:
- Estimated average soil concentration after excavation is 75 percent of the FRL.
- Alpha = 0.05, beta = 0.2

Note: The metals aluminum and manganese are omitted from this list. The BTV levels are believed to be naturally occurring and not derived from past site processes. These metals will be sampled for but the analytical results will be collected for source term estimates only, and not used as clean up target levels.



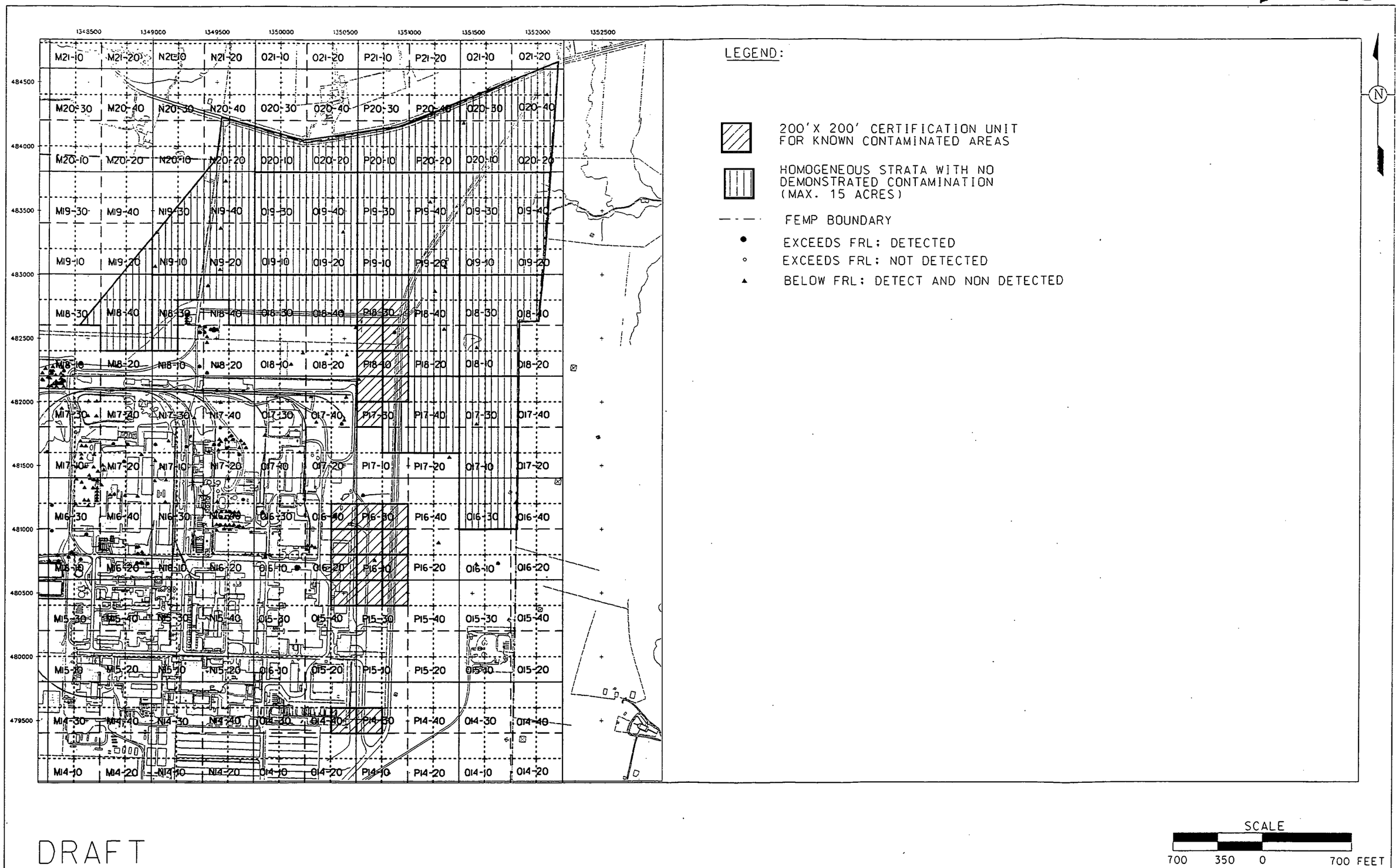
/mge/srdig/dgn/map/hor/dpth/s183_059.dgn FER 12/2/96 STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 7-1. AREA 1 PHASE I CERTIFICATION SAMPLING PLAN PRIMARY CONSTITUENTS OF CONCERN



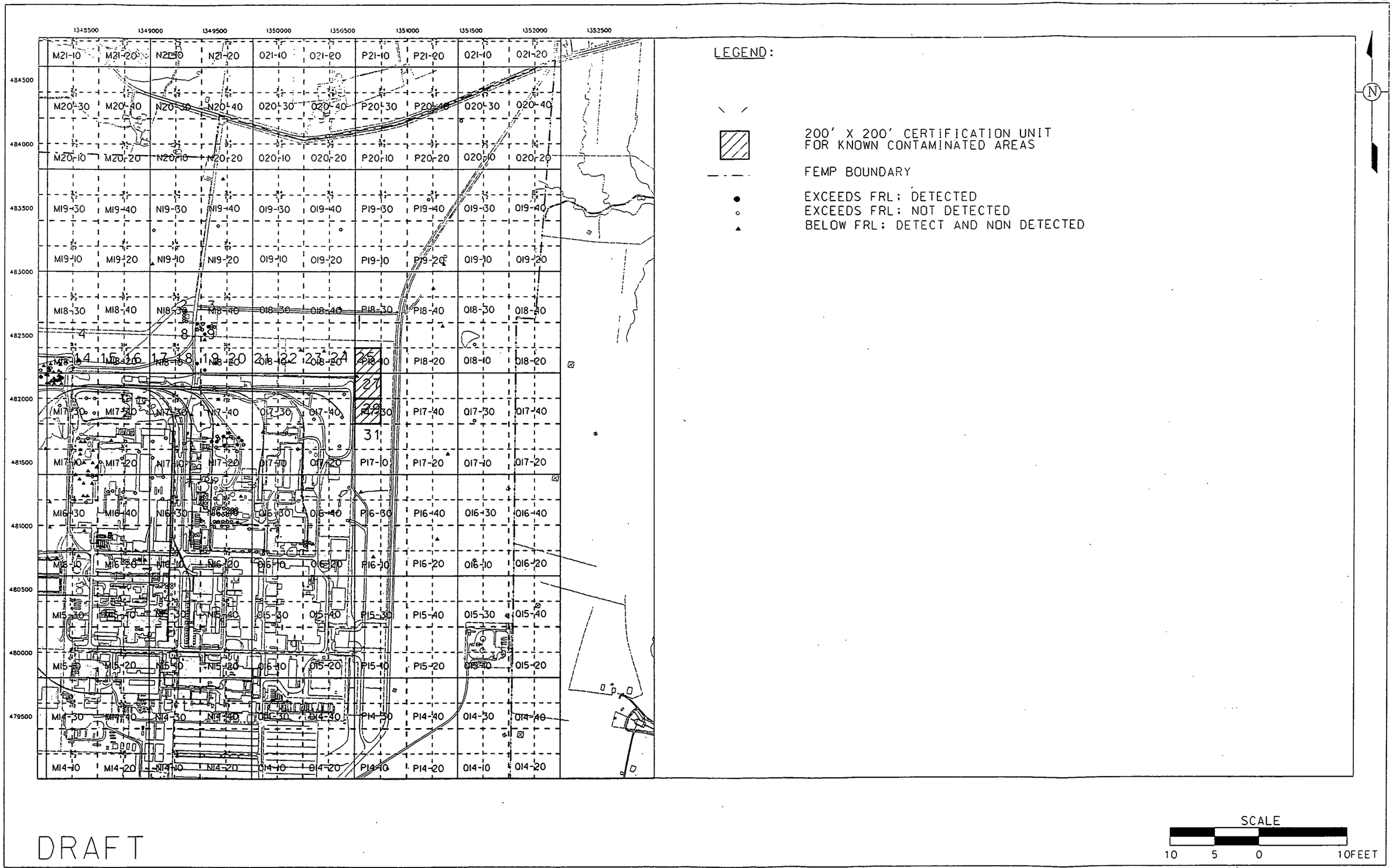
/usr/mge/srdig/dgn/map/hor/dpth/s183_060.dgn FER 12/2/96 STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 7-2. AREA 1 PHASE I CERTIFICATION SAMPLING PLAN SECONDARY CONSTITUENTS OF CONCERN; RADS



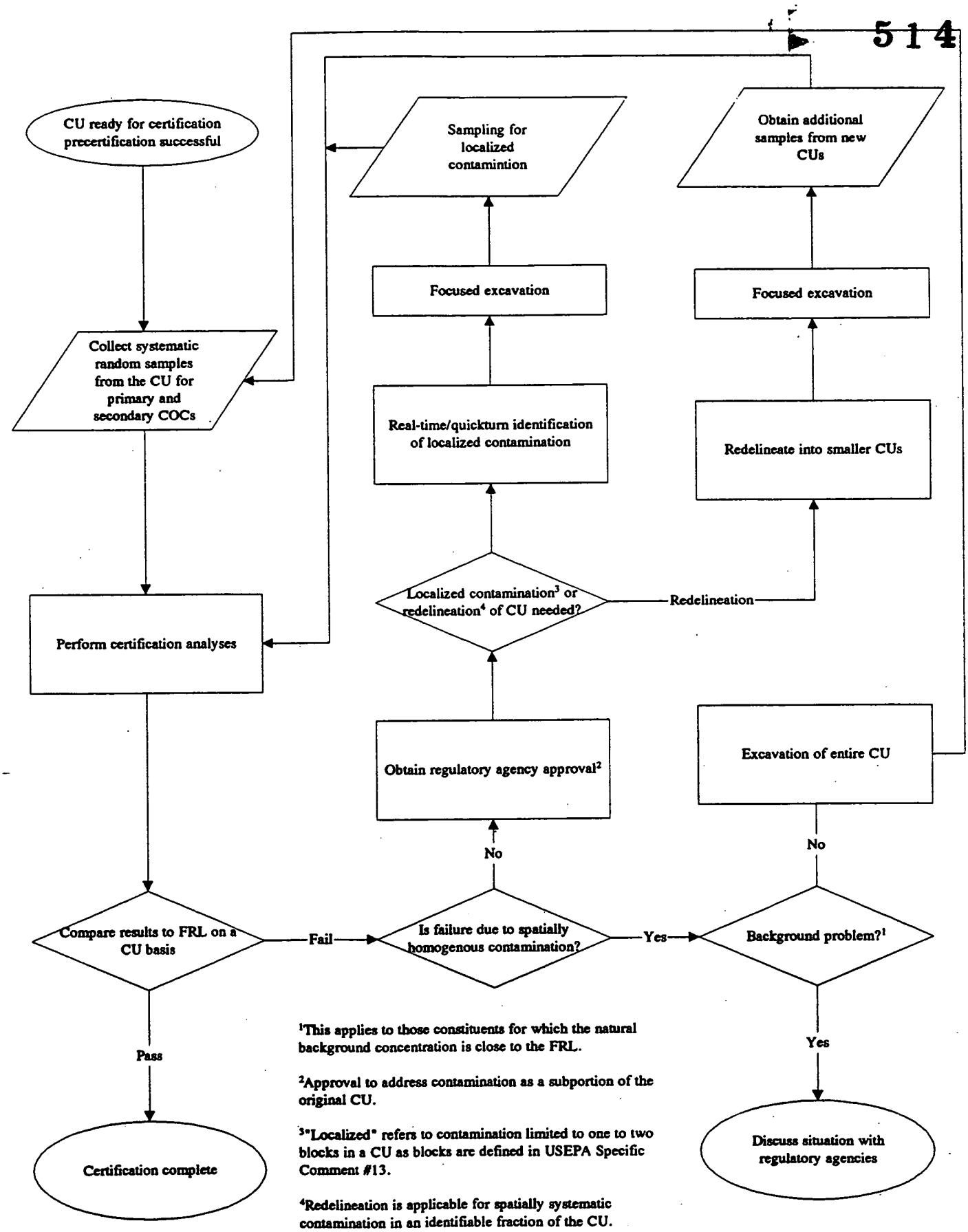
/usr/mge/srdig/dgn/map/hor/dpth/s183_061.dgn FER 12/2/96 STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 7-3. AREA 1 PHASE I CERTIFICATION SAMPLING PLAN SECONDARY CONSTITUENTS OF CONCERN: METALS



/usr/mge/srdig/dgn/map/hor/dpth/s183_062.dgn FER 12/2/96 STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 7-4. AREA 1 PHASE I CERTIFICATION SAMPLING PLAN SECONDARY CONSTITUENTS OF CONCERN: PCBs



[1]This applies to those constituents for which the natural background concentration is close to the FRL.

[2]Approval to address contamination as a subportion of the original CU.

[3]"Localized" refers to contamination limited to one to two blocks in a CU as blocks are defined in USEPA Specific Comment #13.

[4]Redelineation is applicable for spatially systematic contamination in an identifiable fraction of the CU.

Figure 7-5. Certification Decision Process

REFERENCES

REFERENCES

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APPENDIX A
CONSTRUCTION DRAWINGS AND SPECIFICATIONS

APPENDIX A
CONSTRUCTION DRAWINGS AND SPECIFICATIONS

Appendix A contains technical documentation related primarily to soil remediation within Area 1, Phase I (East) and the associated areas for construction support facilities (see Figure A-1). This includes both the north and south portions of Area A, both the northeast and southeast portions of Area B (see Figure 2-1), and areas outside Area 1, Phase I required for the construction of related support facilities. Support facilities include the east impacted stockpile, debris stockpile, sedimentation basin #1 and related surface water controls, and a subcontractor laydown area.

Appendix A also contains technical documentation related to the construction of the west impacted stockpile and associated sedimentation basin (sedimentation basin #2).

Technical drawings for the Site Rail System Improvement Project (Grading and Drainage Package) have also been included in Appendix A for reference. Excavated soils from this project will be stored at the west impacted stockpile. Since this RAWP does not govern the construction of the Operable Unit 1 railyard, the technical specification for the Site Rail System Improvements Project have not been included in Appendix A.

Finally, one Design Change Notice (DCN) and two Request for Clarification of Information (RCI) documents have been included in Appendix A that relate to specific DOE responses for the Ohio EPA Technical Review on the "Draft Operable Unit 5, Area 1, Phase I Remedial Action Work Plan," as follows:

<u>DCN No.:1697-004 [Drainage Modification (Area 1/Phase I (East))]:</u>

This DCN documents the following subcontractor notifications:

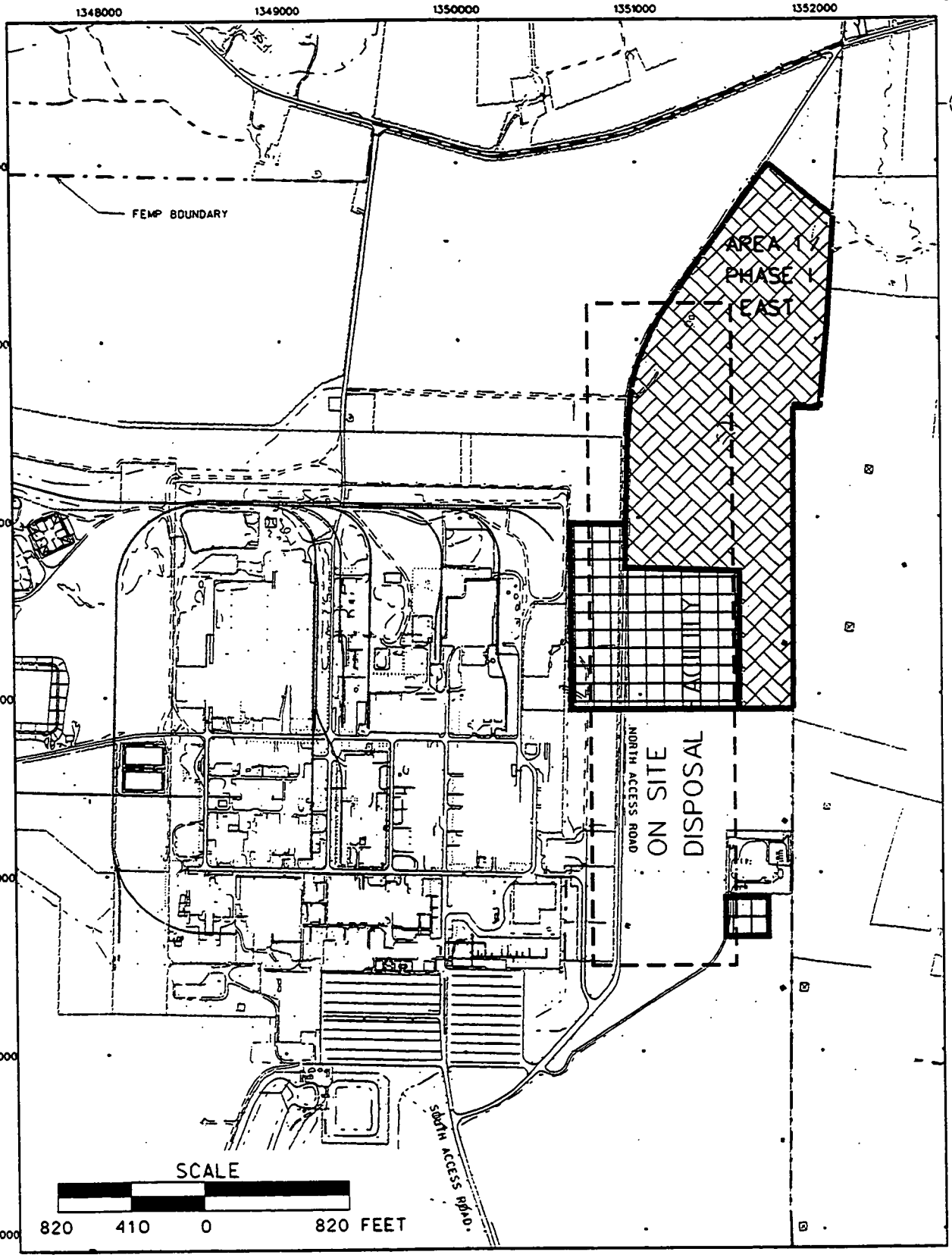
- Geotextile wrap around east sedimentation basin riser pipe (see response to comment #59).
- Sediment level cleanout indicator for the east sedimentation basin (see response to comment #64).
- Replacement of straw bales with silt fence (see response to comment #66).

RCI No.:1697-003R [Stockpile Seeding Timeframe]:

This RCI documents clarification to the subcontractor on the timing requirements for seeding the east impacted soil stockpile after soil placement is completed (see response to comment #61).

RCI No.:1697-005R [Debris Pile Details]:

This RCI documents clarification to the subcontractor on detail requirements for the debris stockpile (see response to comment #55).



LEGEND:

EXCAVATION EAST OF EXISTING NORTH ACCESS ROAD

AREA FOR CONSTRUCTION SUPPORT FACILITIES

FIGURE A-1 REMEDIATION AREAS GOVERNED BY THIS RAWP

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ORIGINAL

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
AREA 1, PHASE I (EAST)
REMEDIAL ACTION PROJECT
HAMILTON COUNTY AND BUTLER COUNTY, OHIO
REV. 0

FOR INFORMATION ONLY

TECHNICAL SPECIFICATION
2502-TS-001

Technical Approvals

Prepared By _____ Date 12 JUNE 96

Project Engineer _____ Date 12 JUNE 96

Engineering Manager _____ Date 12 JUNE 96

Project Director _____ Date 12 Jun 1996
for Nancy Weatherup

Rev. No.	By	Revisions	Date	Checked	Approved
A	CRN	Issued for Review	5/27/96		
0	CRN	Issued for Procurement	6/12/96	CRN	

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Area 1, Phase I (East)
Remedial Action Project
Hamilton County and Butler County, Ohio

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DIVISION 2 - SITEWORK

DIVISION 2-SITEWORK
SECTION 02100
SITE PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This work includes the selective removal of trees and shrubs.

B. Excavation and removal of underground utilities, concrete foundations, cattle fencing and above ground structures, as shown on the contract drawings.

C. Placement of debris in debris stockpile area.

D. Protection of existing monitoring wells, as indicated on the contract drawings.

1.02 RELATED SECTIONS

A. Section 02210 Grading
B. Section 02220 Excavation, Backfilling, and Compaction
C. Section 02300 Construction Entrance/Decontamination Pad

1.03 REFERENCES

A. OSHA 29 CFR Part 1926, Subpart O.
B. ODOT Construction and Material Specifications, Item 202
C. OSHA 29 CFR Part 1926, Subpart P, Excavations

1.04 DELIVERY STORAGE AND HANDLING

A. Trees and shrubs will be cut and transported to the debris stockpile area.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Dust control shall be maintained according to approved subcontractor dust suppression plan.

B. Top six inches of excavated material will be transported to the east impacted soil stockpile shown on the contract drawings.

C. Manmade material will be segregated from soils prior to transfer to the debris stockpile area.

D. Aggregate material and geotextile material will be segregated from soils and transported to the debris stockpile area shown on the contract drawings.

1.06 SUBMITTALS

A. General submittal requirements are specified in Attachment B.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 DESCRIPTION

This work shall consist of:

A. The cutting and removal of all trees and shrubs in the limits of work.

B. The excavation and removal of roots to a depth of six inches below existing grade.

C. The excavation and/or removal of structural features. These features include concrete foundations, footers, gravel roads, and single strand cattle fencing.

3.02 EXECUTION

A. The subcontractor shall fell and remove all trees, stumps, and shrubs within the designated limits of work not designated to remain as shown on the contract drawings. The cuttings are to be removed and cut into sections easily transportable. The maximum length for any material is 6 feet. Root material shall be excavated and removed to a depth of six inches below existing grade. Roots below six inches in depth may be cut and left in place. The roots shall be transported to the debris stockpile area and segregated from attached soil. The segregated soil shall be placed in the east impacted soil stockpile. The roots shall be generally free of clumps of soil larger than four inches.

B. Backfill of excavations will not be permitted until precertification surveys are completed by FERMCO. It is anticipated the contamination will be removed upon the general six inch excavation operation. See Section 02210, Grading.

C. The subcontractor shall excavate and remove all items within the designated limits of work not designated to remain as shown on the contract drawings. The manmade materials are to be excavated and broken or cut into sections easily transportable. The maximum size for concrete is 6 feet by 4 feet by 1.5 feet high.

D. Excavate areas when within three feet of active utilities with nonmechanical hand tools.

E. Trench cave-ins shall be excavated immediately and the soil transported to the soil stockpile area located within the six inch topsoil removal boundary as designated by the FERMCO Construction Contract Manager (CCM).

F. Underground utilities are solely owned by FERMCO. Buried telephone and fiber optic cable are present within the limit of work. FERMCO shall field locate and identify locations of the fiber optic cable. The location and depth of all buried utilities are approximate. The subcontractor shall be responsible to confirm the locations and protect all buried utilities designated to remain. If damage to existing

cable or any other utility is incurred, all repairs will be completed by FERMCO at the subcontractors expense.

G. The subcontractor shall install an approved protective barrier around existing monitoring wells as indicated on the contract drawings. The subcontractor shall hand-excavate the area within the protective barrier. If damage to existing monitoring wells is incurred, all repairs will be completed by FERMCO at the subcontractors expense.

H. The gravel roads indicated to be removed on the contract drawings are separated from the existing grade by a geotextile blanket. The gravel shall be removed from the geotextile blanket. The gravel, geotextile blanket, and culverts shall be stockpiled separately within the debris stockpile area.

I. Burning is not permitted.

End of Section 02100

DIVISION 2-SITEWORK
SECTION 02110
EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation and maintenance of all erosion and sedimentation control devices required for this project.

B. Erosion and sedimentation control devices include silt fence, straw bales, diversions, soil excavation, embankment, slope protection, corrugated metal pipe (CMP) riser structures, and necessary appurtenances for sediment basin and sediment trap construction.

1.02 RELATED SECTIONS

A. Section 02220 Excavation, Backfilling and Compaction
B. Section 02230 Embankment
C. Section 02720 Piping
D. Section 02730 Riser Structure
E. Section 02999 Miscellaneous and Specialty Items

1.03 REFERENCES

A. OSHA 29 CFR Part 1926, Subpart P, Excavations
B. ODOT Construction and Material Specifications, Items 207, 601, 700, and 712.
C. OSHA 29 CFR Part 1926.106
D. Hamilton County Earthwork Regulations

1.04 DELIVERY STORAGE AND HANDLING

A. Top six inches of excavated soil will be transported to the east impacted soil stockpile area shown on the contract drawings.

B. All pipe shall be handled in a manner to preserve quality and fitness. Damaged pipe will be rejected at the time of installation.

C. Maintain the filter fabric and silt fence material wrapped in heavy duty covering to shield from sunlight, ultraviolet rays, and temperatures greater than 140 degrees Fahrenheit. Fabric and liners will be rejected at the time of installation if any defects, deterioration, or damage was incurred during manufacture, handling, transportation, and storage.

D. Aggregates shall be transported in a manner to prevent loss and segregation. Aggregates shall be stored in areas to prevent mixing with soil or other objectionable material.

E. Storage and laydown areas are as designated on the contract drawings.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Dust control shall be maintained according to approved subcontractor dust suppression plan.

1.06 SUBMITTALS

A. General submittal requirements are specified in Attachment B.

B. Twenty days prior to the start of work, the subcontractor shall submit to FERMCO for review and approval, for the following:

1. Silt fence
2. Corrugated metal pipe
3. Concrete, mix design
4. Slope protection
5. Aggregate outlet rock

PART 2 PRODUCTS

2.01 PRODUCTS INCLUDED

A. Portland Cement Concrete , Section 03300.

B. Corrugated Metal Pipe (CMP), Section 02720.

C. Silt Fence, ODOT Construction and Material Specification, Item 712.09 Geotextile Fabrics, Type C: Sediment Fence.

D. Sediment Trap Geotextile, ODOT Construction and Material Specification, Item 712.09, Geotextile Fabrics, Type B: Blankets for Rock Channel Protection.

E. Slope Protection, ODOT Construction and Material Specification, Item 601.07, Dumped Rock Fill, Type C.

F. Aggregate Outlet rock, ODOT Construction and Material Specification, Item 601.07, Dumped Rock Fill, Type C.

PART 3 EXECUTION

3.01 DESCRIPTION

This work shall consist of:

A. The installation and maintenance of silt fence, straw bales, diversions, riser structures, soil excavations and all associated work to install sediment basin and sediment traps.

3.02 EXECUTION

A. The subcontractor shall install all silt fence and straw bales designated on the contract drawings prior to the start of excavation for the sediment basin and site-wide excavation. The subcontractor shall maintain the silt fence and straw bales in good condition. The devices shall be inspected at a minimum of once per week and immediately after a rainfall event. Any breaks or damaged devices will be repaired by the subcontractor immediately.

B. The subcontractor shall excavate and install sediment basin and sediment traps to the lines and grades as shown on the contract drawings. The subcontractor shall remove the top six inches of soil in the immediate area of excavation and place this material in the east impacted soil stockpile area shown on the contract drawings. The remaining excavation shall be used in the construction of the embankments. The embankments shall be constructed in accordance with Section 02220, Embankment. The subcontractor shall minimize runon from entering active excavations for construction of the sediment basin and sediment traps and dewatering, as required, following storm events.

C. The emergency spillway for the sediment basin shall be protected with ODOT Type C rock. A geotextile blanket, Type B, shall be placed over the bottom and slope of the outlet spillway. The geotextile shall continue downstream of the embankment to form an apron on the surrounding grade. The geotextile shall be overlapped a minimum of two feet at all seams. The rock shall be installed to a thickness of eighteen inches. Accumulated sediment shall be excavated when the sediment reaches the elevation shown on the contract drawings. The sediment basin shall be restored to its original lines and grades. The riser structure shall be inspected for damage to the structure and

to the exterior filter fabric. Replace any visible damage. Clean the exterior filter fabric of any material that hinders its capabilities. The outfall of the sediment basin shall be protected with Type C rock, twelve inches thick installed over a Type B geotextile fabric as shown on the contract drawings.

D. The outlet spillway for the sediment traps shall be constructed of geotextile material and Type C rock. The Type B geotextile blanket shall be placed over the bottom and slope of the outlet spillway. The geotextile shall continue downstream of the embankment to form an apron on the surrounding grade. The geotextile shall be overlapped a minimum of two feet at all seams. The rock shall be installed to a thickness of twelve inches. Accumulated sediment shall be excavated when the sediment reaches the elevation shown on the contract drawings. The trap shall be restored to its original lines and grades. The trap and outlet spillway shall be inspected for damage after each storm event. Correct any visible erosion or damage.

E. The subcontractor shall install diversions as shown on the contract drawings. The subcontractor shall remove the top six inches of soil in the immediate area of excavation and place this material in the east impacted soil stockpile area shown on the contract drawings. The remaining excavation shall be used to construct diversion embankments.

F. Slope protection material may be placed by end dumping and may be spread by suitable equipment.

G. The sediment collected in the basin and traps, along the diversion ditches and upgradient silt fence and straw bales, shall be excavated and placed in the east impacted soil stockpile area shown on the contract drawings. Care will be taken by the subcontractor to transport the sediment to prevent loss or spillage during transport. A sediment clean out elevation for each sediment basin and trap is shown on the contract drawings.

H. The sediment basin and sediment traps will remain in operation for the contract period. The subcontractor is responsible to maintain each basin, trap, and other controls for the specified contract period.

3.03 TESTING AND INSPECTION

A. The subcontractor shall be responsible for furnishing all personnel and equipment required to perform all material and performance tests in accordance with ODOT Construction and Material Specification, Item 700, as a minimum.

End of Section 02110

DIVISION 2-SITEWORK
SECTION 02210
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grading operations during and following excavation activities.

1.02 RELATED SECTIONS

A. Section 02210 Site Preparation
B. Section 02220 Excavation, Backfilling, and Compaction

1.03 REFERENCES

Not Used

1.04 DELIVERY STORAGE AND HANDLING

Not Used

1.05 ENVIRONMENTAL REQUIREMENTS

A. Dust control shall be maintained according to approved subcontractor dust suppression plan.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 DESCRIPTION

This work shall consist of:

A. The finish grading of the area upon completion of the soil excavation.

3.02 EXECUTION

A. The subcontractor shall perform fine grading over the excavated areas to eliminate vehicle ruts, wind rows, stump/root removal depressions, and ponding areas. The fine grading operation will smooth the surface and not remove material. Minimal depth grading will be permitted to eliminate ponding areas. Grading depths greater than six inches will not be required except for the elimination of wheel ruts and over excavation.

B. The subcontractor will perform the grading operation upon completion of the precertification survey from an upgradient to downgradient direction. The subcontractor shall verify that equipment entering the precertified areas are not contaminated in order to prevent cross contamination.

End of Section 02210

DIVISION 2-SITEWORK
SECTION 02220
EXCAVATION, BACKFILLING, AND COMPACTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation, backfilling, and compaction of area wide soils.

1.02 RELATED SECTIONS

A. Section 02100 Site Preparation
B. Section 02110 Erosion and Sedimentation Controls
C. Section 02210 Grading
D. Section 02230 Embankment
E. Section 02720 Piping

1.03 REFERENCES

A. ODOT Construction and Material Specifications, Item 203, and 700
B. OSHA 29 CFR 1926 Subpart P Excavations

C. ASTM D698 Laboratory Compaction Characteristics of Soil using Standard Effort [12,000 ft - lbf/ft (600 kN - m/m)]

D. ASTM D2922 Density of Soil and Soil - Aggregate in place by Nuclear Methods (Shallow Depth)

1.04 DELIVERY STORAGE AND HANDLING

A. Excavated material will be transported to the east impacted soil stockpile area shown on the contract drawings.

B. Manmade material will be segregated from soils prior to transfer to the debris stockpile area shown on the contract drawings.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Dust control shall be maintained according to approved subcontractor dust suppression plan.

PART 2 PRODUCTS

2.01 PRODUCTS INCLUDED

A. Pipe bedding material, ODOT Construction and Material Specification, Item 703.01, AASHTO Number 57 Aggregate.

PART 3 EXECUTION

3.01 DESCRIPTION

This work shall consist of:

A. The excavation of existing soils to the limits of work as noted on the contract drawings. The depth of excavation for surface soils is six (6) inches (minimum 5 inches). The depth of excavation for diversion ditches, sediment traps, and sediment basin are noted on the contract drawings. The depth of excavation of subsurface areas are as noted on the contract drawings and in Section 02100, Site Preparation. Excavation and removal of above ground manmade features are included in Section 02100, Site Preparation. Excavation is defined as the excavation and removal of all materials of whatever character encountered in the work. It is anticipated rock will not be encountered in this work. Rock is defined as a solid mass requiring drilling or blasting to be removed. Blasting is not permitted on this project.

3.02 EXECUTION

A. EXCAVATION

1. Prior to the start of six inch topsoil removal excavation activities, all erosion and sedimentation devices shall be installed by the subcontractor in accordance with Section 02110, Erosion and Sedimentation Controls.

2. The subcontractor shall excavate and remove all soils and items within the designated limits of work not designated to remain as shown on the contract drawings.

3. The subcontractor shall excavate the area from an upgradient to a downgradient pattern to minimize and prevent recontamination of clean subsurface soils due to runoff and vehicular traffic. Additional excavation required due to recontamination of designated clean soil by the subcontractor will be the sole responsibility of the subcontractor and accomplished at no additional cost to FERMCO.

4. If the subcontractor encounters any manmade material unidentified on the contract drawings or any stained earth or unusual odor, he shall stop work in the area and contact the FERMCO CCM or their representative immediately.

5. The subcontractor is responsible for the depths and grades established on the contract drawings. The subcontractor is not authorized for over-excavation in any area unless specifically directed by the authorized FERMCO CCM or their representative.

6. The five-foot limit from the property line designated on the contract drawings is the limit of excavation. Additional excavation of this five-foot strip and beyond will be determined by FERMCO during the course of the project.

7. Excavations shall be performed in a manner and sequence that will provide drainage at all times. Water accumulated in the excavation area shall be removed by pumps or other approved means to a discharge point approved by the FERMCO CCM.

8. Stockpiles shall be built up and compacted in twelve-inch layers for the full width of the storage pile. Stockpile side slopes shall be as indicated on the contract drawings.

B. BACKFILLING

1. Backfill of excavations will not be permitted until notified by FERMCO, the subcontractor will backfill and compact the excavated trenches to the top of the trench (see Section 02210, Grading).

2. Backfill piping trenches with AASHTO number 57 aggregate in accordance with ODOT Construction and Material Specification, Item 703.01.

3. Borrow material area, if needed, will be located within the six inch topsoil removal boundary as designated by the FERMCO CCM.

C. COMPACTION

1. Soil backfill compaction efforts will be to the soil density of a minimum 95% of Standard Proctor, ASTM D698.

2. The compaction effort for piping is as follows: Tamp solidly the piping backfill material under and around the pipe to a height two-thirds of the diameter above the invert of the pipe. Backfill and tamp suitable soil to a height of 12 inches above the crown of the pipe in 4 inch lifts. Stone or other material larger than 4 inches in size in any dimension will be removed from the backfill prior to placement.

3. Embankment compaction for the sediment traps and basin will be a minimum of 95% of Standard Proctor, ASTM D698. Erosion or failure of any portion of the embankment will be corrected immediately by the subcontractor.

4. Compaction of the diversions will be by mechanical means to stabilize the embankment. Erosion or failure of the diversion embankments will be corrected immediately by the subcontractor.

5. Stockpile layers shall be compacted by a minimum of four passes with a roller compactor or other suitable equipment.

3.03 TESTING AND INSPECTION

A. The subcontractor shall be responsible for furnishing all personnel and equipment required to perform all material and performance tests in accordance with ODOT Construction and Material Specification, Item 700, as a minimum.

B. Compaction field tests shall be made according to ASTM D2922. Field density testing shall not be effected when vibratory equipment is operating. At least one field density test shall be performed by an independent testing and inspection agency per whichever of the following requires the greatest number of tests;

1. One test for each day of work filling and backfilling.
2. One test for each 1000 cubic yards of fill compacted by mechanical means.
3. One test for each 400 cubic yards compacted by nonmechanical means.

End of Section 02220

DIVISION 2-SITEWORK
SECTION 02230
EMBANKMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation and construction of an embankment for use as a diversion embankment, sediment basin embankment, or sediment trap embankment in conformity with the lines, grades, thickness, and cross section shown on the contract drawings.

1.02 RELATED SECTIONS

A. Section 02100 Site Preparation
B. Section 02110 Erosion and Sedimentation Controls
C. Section 02220 Excavation, Backfilling, and Compaction.

1.03 REFERENCES

A. ASTM D698 Laboratory Compaction Characteristics of Soil using Standard Effort [12,000 ft - lbf/ft (600 kN - m/m)]

B. ASTM D2922 Density of Soil and Soil - Aggregate in place by Nuclear Methods (Shallow Depth)

1.04 DELIVERY STORAGE AND HANDLING

A. Top six inches of excavated material will be transported to the east impacted soil stockpile area shown on the contract drawings.

B. Embankment material will be protected from cross contamination.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Dust control shall be maintained according to approved subcontractor dust suppression plan.

PART 2 PRODUCTS

2.01 PRODUCTS INCLUDED

Not Used.

PART 3 EXECUTION

3.01 DESCRIPTION

This work shall consist of:

A. The preparation of areas upon which embankments are to placed, and placing and compacting of suitable soil for the construction of embankments.

3.02 EXECUTION

A. PREPARATION

1. Prior to the start of six inch topsoil removal excavation activities, all erosion and sedimentation devices shall be installed by the subcontractor in accordance with Section 02110, Erosion and Sedimentation Control.

2. The subcontractor shall prepare the area for placement of the embankment by removing the top 6 inches of soil. The material will be transported and deposited in the east impacted soil stockpile area shown on the contract drawings.

B. MOISTURE CONTROL

1. Moisture control shall be in accordance with Item 203.11, Moisture Control of ODOT Construction and Material Specifications.

C. EMBANKMENT

1. Basin and trap embankments shall be constructed of suitable material excavated during construction of sediment basin and traps, below the initial six inch topsoil removal grade. Vegetative material, frozen material, topsoil and rock over 4 inches in any dimension is not permitted.

2. Diversion embankments will be constructed of soil excavated to construct diversion ditches. Vegetative material, frozen material, topsoil and rock over 4 inches in any dimension is not permitted.

D. COMPACTION

1. Embankment compaction requirements for sediment basins shall be a minimum of 95% of Standard Proctor, ASTM D698.

2. Embankment compaction requirements for sediment traps shall be a minimum of 95% of Standard Proctor, ASTM D698.

3. Embankment compaction requirements for diversion embankments shall be tamped in place by mechanical means.

E. EXECUTION

1. The subcontractor is responsible for the elevations, lines and grades established on the contract drawings.

2. Soil shall be spread in successive layers, not to exceed eight (8) inches in loose thickness. The layers shall be compacted in accordance with section 3.02(D), Compaction.

3. Erosion or failure of any embankment material shall be corrected by the subcontractor immediately.

3.03 TESTING AND INSPECTION

A. The subcontractor shall be responsible for furnishing all personnel and equipment required to perform all material and performance tests in accordance with ODOT Construction and Material Specification, Item 700, as a minimum.

B. Compaction field tests shall be made according to ASTM D2922. Field density testing shall not be effected when vibratory equipment is operating. At least one field density test shall be performed by an independent testing and inspection agency per whichever of the following requires the greatest number of tests;

1. One test for each day of work filling and backfilling.
2. One test for each 1000 cubic yards of fill compacted by mechanical means.
3. One test for each 400 cubic yards compacted by nonmechanical means.

End of Section 02230

DIVISION 2-SITEWORK
SECTION 02300
CONSTRUCTION ENTRANCE/DECONTAMINATION PAD

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction of a temporary construction entrance/decontamination pad

1.02 RELATED SECTIONS

A. Section 02100 Site Preparation
B. Section 02220 Excavation, Backfilling, and Compaction
C. Section 02720 Piping

1.03 REFERENCES

A. ODOT Construction and Material Specifications, Items 601, 700, and 707

B. OSHA 29 CFR 1926

C. ASTM D698 Laboratory Compaction Characteristics of Soil using Standard Effort [12,000 ft - lbf/ft (600 kN - m/m)]

D. ASTM D2922 Density of Soil and Soil - Aggregate in place by Nuclear Methods (Shallow Depth)

1.04 DELIVERY STORAGE AND HANDLING

Not Used

1.05 ENVIRONMENTAL REQUIREMENTS

A. Minimize overspray of water during cleaning operations.

B. Protect personnel and areas outside the decontamination pad during spraying operations.

PART 2 PRODUCTS

2.01 PRODUCTS INCLUDED

A. Aggregate, ODOT Construction and Material Specification, Item 601.07, Dumped Rock Fill, Type C

B. Corrugated Metal Pipe (CMP), ODOT Construction and Material Specifications Item 707, Steel, Aluminum, and Plastic Pipe, Subparagraph 707.02, Metallic Coated Corrugated Steel Conduits (1-inch Corrugations).

PART 3 EXECUTION

3.01 DESCRIPTION

This work shall consist of:

A. The installation of a temporary aggregate construction entrance/decontamination pad.

3.02 EXECUTION

A. The subcontractor shall excavate all vegetative materials, topsoil, and unsuitable materials and grade the area to the necessary elevation to install the aggregate construction entrance/decontamination pad. The subgrade shall be graded to drain and discharged as shown on the contract drawings. The subcontractor shall install a 12-inch CMP culvert to match grades of the existing roadside ditch to allow roadside runoff to bypass the construction entrance/decontamination facility.

B. The subgrade shall be compacted to a minimum of 85% of Standard Proctor. The aggregate shall be placed in lifts to the thickness and grades shown on the contract drawings. The aggregate shall be maintained in good working order by the subcontractor. Accumulations of soil on the aggregate shall be removed and placed in the east impacted soil stockpile shown on the contract drawings. The aggregate shall be turned and cleaned based upon visual inspections by the subcontractor. Wheel ruts shall be graded and eliminated by the subcontractor.

C. Construction of temporary aggregate construction entrance/decontamination pad encroaches upon existing fiber optics and telephone lines. FERMCO shall identify existing lines. Identifications are approximate. See Section 02100, Site Preparation.

3.03 TESTING AND INSPECTION

A. The subcontractor shall be responsible for furnishing all personnel and equipment required to perform all material and performance tests in accordance with ODOT Construction and Material Specification, Item 700, as a minimum.

B. Compaction field tests shall be made according to ASTM D2922. Field density testing shall not be effected when vibratory equipment is operating. At least one field density test shall be performed by an independent testing and inspection agency per whichever of the following requires the greatest number of tests;

1. One test for each day of work filling and backfilling.
2. One test for each 1000 cubic yards of fill compacted by mechanical means.
3. One test for each 400 cubic yards compacted by nonmechanical means.

End of Section 02300

DIVISION 2-SITEWORK
SECTION 02720
PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of corrugated metal pipe (CMP)
B. Installation of CMP riser structures
C. Installation of CMP anti-seep collars

1.02 RELATED SECTIONS

A. Section 02110 Erosion and Sedimentation Controls
B. Section 02220 Embankment
C. Section 02730 Riser Structure

1.03 REFERENCES

A. OSHA 29 CFR Part 1926
B. ODOT Construction and Material Specifications, Items 513, 603, 700, and 707

1.04 DELIVERY STORAGE AND HANDLING

A. Top six inches of excavated soil will be transported to the east impacted soil stockpile area.

B. All pipe shall be handled in a manner to preserve quality and fitness. Damaged pipe will be rejected at the time of installation.

C. Aggregates shall be transported in a manner to prevent loss and segregation. Aggregates shall be stored in areas to prevent mixing with soil or other objectionable material.

D. Storage and laydown areas will be designated by the FERMCO CCM or their representative, and as shown on the contract drawings.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Dust control shall be maintained according to approved subcontractor dust suppression plan.

1.06 SUBMITTALS

A. General submittal requirements are specified in Attachment B.

B. Twenty days prior to the start of work, the subcontractor shall submit to FERMCO, for review and approval, the following:

1. CMP pipe and supplier
2. Anti-seep collar and associated material
3. Aggregate

PART 2 PRODUCTS

2.01 PRODUCTS INCLUDED

A. Corrugated Metal Pipe (CMP), ODOT Construction and Material Specifications Item 707, Steel, Aluminum and Plastic Pipe, Subparagraph 707.02, Metallic Coated Corrugated Steel Conduits (1 inch Corrugations).

B. Aggregate Bedding and Backfill, ODOT Construction and Material Specification Item 603.04.

C. High strength steel bolts, nuts and washers, ODOT Construction and Material Specifications Item 513.15, one-half inch.

PART 3 EXECUTION

3.01 DESCRIPTION

This work shall consist of:

A. The installation and maintenance of pipe culverts and anti-seep collar in sedimentation basin.

3.02 EXECUTION

A. The subcontractor shall install all pipe culverts in reasonable conformity to the lines and grades designated on the contract drawings. The subcontractor shall excavate trenches and foundations for pipe culverts. The subcontractor shall maintain the culverts during construction activities including excavation of accumulated sediment and damage due to the construction activities. The devices shall be inspected at a minimum of once per week and immediately after a rainfall event. Any breaks or damaged devices will be repaired by the subcontractor, immediately.

B. The subcontractor shall remove the top six inches of soil in the immediate area of excavation and place this material in the east impacted soil stockpile area shown on the contract drawings. The remaining excavation shall be used in the construction of the embankments. The embankments shall be constructed in accordance with Section 02220, Embankment.

C. The subcontractor shall excavate trenches for the pipe culverts in accordance with Item 603.03, Excavation of the ODOT Construction and Material Specifications.

D. The culvert bedding shall be Class C in accordance with Item 603.04 Bedding of the ODOT Construction and Material Specifications.

E. The culvert shall be placed in accordance with Items 603.05, Laying Conduit, and 603.06, Joining Conduit of the ODOT Construction and Material Specifications.

F. The anti-seep collars shall be constructed of the same thickness steel as the CMP culverts. The connecting band shall be of the same thickness steel as the culvert and anti-seep collar. The anti-seep collar shall be fastened to the connecting band by a continuous weld. The connecting band shall match the corrugations of the culvert. The subcontractor shall apply a bituminous mastic to prepare a watertight seal and anchor the connecting band to the culvert. Connecting bolts, washers and nuts shall be one-half inch high strength steel.

3.03 TESTING AND INSPECTION

A. The subcontractor shall be responsible for furnishing all personnel and equipment required to perform all material and performance tests in accordance with ODOT Construction and Material Specification, Item 700, as a minimum.

End of Section 02720

DIVISION 2-SITEWORK
SECTION 02730
RISER STRUCTURE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of a CMP riser structure in a sedimentation basin including aggregate backfill and concrete base.

1.02 RELATED SECTIONS

A. Section 02110 Erosion and Sedimentation Controls
B. Section 03300 Concrete

1.03 REFERENCES

A. OSHA 29 CFR Part 1926
B. ODOT Construction and Material Specifications, Item 700, and 703

1.04 DELIVERY STORAGE AND HANDLING

A. Top six inches of excavated soil will be transported to the east impacted soil stockpile area.

B. All material shall be handled in a manner to preserve quality and fitness. Damaged riser structures will be rejected at the time of installation.

C. Storage and laydown areas are as designated by the FERMCO CCM or their representative, and as shown on the contract drawings.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Dust control shall be maintained according to approved subcontractor dust suppression plan.

1.06 SUBMITTALS

A. General submittal requirements are specified in Attachment B.

B. Twenty days prior to the start of work, the subcontractor shall submit to FERMCO, for review and approval, the following:

1. Corrugated Metal Pipe
2. Aggregate
3. Concrete
4. Geotextile

PART 2 PRODUCTS

2.01 PRODUCTS INCLUDED

A. Portland Cement Concrete, Section 03300.

B. Corrugated Metal Pipe, Section 02720.

C. Aggregate, ODOT Construction and Material Specification, Item 703.01, AASHTO No. 3 Aggregate.

PART 3 EXECUTION

3.01 DESCRIPTION

This work shall consist of:

A. The installation of a CMP riser structure in the sedimentation basin including aggregate backfill and concrete base.

3.02 EXECUTION

A. The subcontractor shall install the riser structure in accordance with the lines and grades designated on the contract drawings.

B. The riser structure will be set in a concrete base cast in place.

C. The riser structures will be shop fabricated with the barrel structure welded to the elevation shown on the contract drawings.

D. The riser structure will be perforated with one-inch diameter holes to the location and elevations shown on the contract drawings.

E. The riser structure shall be surrounded with ODOT Item 703.01, AASHTO No. 3 Aggregate, as shown on the contract drawings.

F. The riser structure shall be free from sharp edges and burrs.

3.03 TESTING AND INSPECTION

A. The subcontractor shall be responsible for furnishing all personnel and equipment required to perform all material and performance tests in accordance with ODOT Construction and Material Specification, Item 700, as a minimum.

End of Section 02730

DIVISION 2-SITEWORK
SECTION 02920
FERTILIZER, SEED, AND MULCH

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Application of fertilizer and seed to stockpile areas, sediment basin and sediment trap embankments, diversions and all disturbed areas.

1.02 RELATED SECTIONS

A. Section 02110 Erosion and Sedimentation Controls
B. Section 02210 Grading
C. Section 02230 Embankment

1.03 REFERENCES

A. ODOT Construction and Material Specifications, Items 659, and 700

1.04 DELIVERY STORAGE AND HANDLING

A. Store seed and fertilizer in areas kept dry and free from damage due to equipment operation.

B. Material damaged by water or mixed with soil will be rejected.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Dust control shall be maintained according to approved subcontractor dust suppression plan.

1.06 SUBMITTALS

A. General submittal requirements are specified in Section Attachment B.

B. Twenty days prior to the start of work the contractor shall submit to FERMCO, for review and approval, the following:

1. Fertilizer Mix
2. Seed Mix and supplier

PART 2 PRODUCTS

2.01 PRODUCTS INCLUDED

A. Commercial fertilizer 12-12-12, ODOT Construction and Material Specifications, Item 659.03

B. Seed, ODOT Item 659.04.

PART 3 EXECUTION

3.01 DESCRIPTION

This work shall consist of:

A. The application of fertilizer, seed, and mulch on stockpile areas, embankments and all disturbed areas.

3.02 EXECUTION

A. The east impacted soil stockpile surface does not require any raking or smoothing prior to the application of fertilizer and seed.

B. The subcontractor shall apply commercial fertilizer at the rate of 20 pounds per 1,000 square feet.

C. The subcontractor shall apply seed on the east impacted soil stockpile at the rate of one and one half pounds per 1,000 square feet of Crown Vetch consisting of; 33 percent Crown Vetch (*Coronilla varia*) and 67 percent Perennial Ryegrass (*Lolium perenne*).

D. The subcontractor shall apply seed on all disturbed areas, embankments, and diversions at the rate of 2 pounds per 1000 square feet of seed consisting of; 90 percent *Perennial Ryegrass (Lolium perenne)* and 10 percent Alsike Clover (*Trifolium hybridum*).

E. Seed shall be sown dry or hydraulically.

F. All disturbed areas shall be mulched during or immediately after seeding. If straw is used, it shall be unrotted small-grain straw applied at the rate of 2 tons/acre or 90 lb/1000 square feet (two to three bales). The mulch shall be spread uniformly by hand or mechanically so the soil surface is covered. For uniform distribution of hand-spread mulch, divide area into approximately 1000-square-foot sections and spread two 45-lb bales of straw in each section. If wood cellulose fiber is used with a hydroseeder, it shall be used at 2000 lb/acre or 46 lb/1000 square feet.

G. The outside slopes of the sediment basin will be fertilized and seeded in accordance with this section. The sediment basin slopes will be raked to remove large clumps of soil and stone prior to the application of fertilizer and seed.

H. The subcontractor shall be responsible for seeded areas 90 days after seed application. If satisfactory growth is not established by the end of this period, reseeding of the area will be accomplished by the subcontractor at no cost to FERMCO.

3.03 TESTING AND INSPECTION

A. The subcontractor shall be responsible for furnishing all personnel and equipment required to perform all material and performance tests in accordance with ODOT Construction and Material Specification, Item 700, as a minimum.

End of Section 02920

DIVISION 2-SITEWORK
SECTION 02999
MISCELLANEOUS AND SPECIALTY ITEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of construction fence.
B. Fabrication and installation of caution signs.
C. Ring buoys.

1.02 RELATED SECTIONS

Not Used

1.03 REFERENCES

A. ODOT Construction and Material Specifications, Item 603
B. OSHA 29 CFR Part 1926
C. OSHA 29 CFR Part 1926.106

1.04 DELIVERY STORAGE AND HANDLING

A. Construction fence, signs, and buoys shall be delivered to the site and protected from damage. Damaged items will be removed from the site.

1.05 ENVIRONMENTAL REQUIREMENTS

Not Used

1.06 Submittals

A. General submittal requirements are specified in Attachment B.

B. Twenty days prior to the start of work, the subcontractor shall submit to FERMCO, for review and approval, the following:

1. Construction fence
2. Caution signs, drawing to scale including color notations.
3. Buoys

PART 2 PRODUCTS

2.01 PRODUCTS INCLUDED

A. Caution signs, flat sheet aluminum, 0.063 inch thick, 12-inch minimum dimension in any one direction, yellow or orange reflective sheeting background, black lettering a minimum of one inch in height, all capital letters, standard block lettering. Signs shall read as follows:

CAUTION - DROWNING HAZARD, LIFE VEST REQUIRED WITHIN 5 FEET OF WATER

B. Construction fence shall be orange, high density polyethylene, four foot height, opening size approximately four inches by one half inch, minimum tensile strength of 2000 lbs/ft of width. Posts shall be metal, "t", or wood. Rebar shall not be permitted.

C. Buoys and line shall be U.S., Coast Guard approved, as required by OSHA in 1926.106.

PART 3 EXECUTION

3.01 DESCRIPTION

This work shall consist of:

A. The installation of construction fence, caution signs and buoys.

3.02 EXECUTION

A. Install construction fence at the locations designated on the contract drawings. The fence posts shall be driven. The subcontractor shall secure and stretch the fence fabric to the posts in order to eliminate any sags horizontally and vertically. The bottom of the fence fabric shall be installed to a maximum of 2 inches above the finished grade.

B. Install caution signs on metal posts at 20 foot intervals along the perimeter of the fence. Metal posts shall be driven and the signs securely bolted to the posts.

C. Provide ring buoys and 90 feet of line at maximum 200 foot intervals around the perimeter of each sediment trap and sediment basin. Buoys and line shall be hung on metal or wood posts. The buoys shall be installed at approximately four feet above grade. The subcontractor shall inspect each ring buoy for defects or damage. The subcontractor shall be responsible to repair or replace any damaged buoys.

D. All signs, construction fence, posts and buoys associated with the sediment basin and sediment traps shall remain the property of FERMCO and shall remain on site.

End of Section 02999

DIVISION 3 - CONCRETE

DIVISION 3-CONCRETE
SECTION 03300
CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of cast-in-place concrete for riser base foundations.

1.02 RELATED SECTIONS

A. Section 02110 Erosion and Sedimentation Control
B. Section 02720 Piping
C. Section 02730 Riser Structure

1.03 REFERENCES

A. ODOT Construction and Material Specifications, Item 511

1.04 DELIVERY STORAGE AND HANDLING

A. Deliver concrete in approved vehicles.

B. Concrete mixes stored on site shall be kept dry and free from exposure due to damage and intermingling with other materials during construction activities.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Dust control shall be maintained according to approved subcontractor dust suppression plan.

PART 2 PRODUCTS

2.01 PRODUCTS INCLUDED

A. Concrete, ODOT Construction and Material Specifications, Item 511, Concrete for Structures

PART 3 EXECUTION

3.01 DESCRIPTION

This work shall consist of:

A. The construction of a concrete base for the principal spillway riser pipe in sediment basins.

3.02 EXECUTION

A. An area conforming to the size and shape of the riser base shall be excavated by the subcontractor. The riser base shall be formed to the general shape and depth prior to the anchoring of the riser structure and application of the concrete.

B. Concrete shall have a minimum strength of 3000 psi and placement, mixing, proportioning, equipment and handling shall be in accordance with Item 511, Concrete for Structures of ODOT Construction and Material Specifications.

3.03 TESTING AND INSPECTION

A. The subcontractor shall be responsible for furnishing all personnel and equipment required to perform all material and performance tests in accordance with ODOT Construction and Material Specification, Item 700, as a minimum.

End of Section 03300

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE - 514

WP / WO NO.: 1697	S/C NO.: N/A	Pg 1 OF 1	DATE 9/26/96
TITLE: N/A		RCI NO.: N/A	
RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐	RCI/DCN TITLE: Drainage Modification (Area 1/Phase I (East))	DCN NO.: 1697-004	

DOCUMENTS AFFECTED	DOCUMENT NOS.	REV.	OTHER
Technical Specification for Area 1, Phase I (East) Remedial Action Project	2502-TS-001	0	Section 2730: Subsection 3.02
Drawing	75A-5500-G-00441	0	
Drawing	75X-5500-X-00450	0	Riser Pipe Detail
Drawing	75X-5500-X-00452	0	Straw Bale Erosion Control Detail

☐ RCI - INQUIRY ☐ PRE-SCREEN FOR USQD BY PROJECT ENGINEER X DCN-JUSTIFICATION,EXISTING CONDITION & REQUESTED/ PROPOSED CHANGE

On drawing 75A-5500-G-00441, replace "SEE DWG X00450 FOR STRAW BALE CULVERT PROTECTION DETAIL" with "PLACE SILT FENCE IN FRONT OF CULVERT ENTRANCE."

On drawing 75X-5500-X-00452, remove the Straw Bale Erosion Control Detail.

General: Replace all straw bales in channels/ditches with silt fences.

On drawing 75X-5500-X-00450 (Riser Pipe Detail), show placement of filter fabric around circumference of riser.

A sediment level indicator shall be placed in Sediment Basin #1. The sediment level indicator shall be 2" x 2" treated lumber posts driven into the bottom of the basin to a depth no less than 3 feet below the surface. Orange or red paint shall be marked on the post to indicate sediment cleaning level at elevation 589.00'.

Subsection 3.02 G to Section 2730, as follows:

ACS 9/26/96

G. Filter fabric shall be placed around the inlet orifices of the riser pipe in Sediment Basin #1, in accordance with the following criteria:
1. The filter fabric shall be a woven filtration geotextile.
2. The filter fabric water flow rate shall be no less than 140 gpm/ft² in accordance to ASTM D-4491.
3. The filter fabric shall be UV Resistant.
4. The filter fabric permeability shall be no less than 0.1 cm/sec, in accordance with ASTM D-4491.
5. The filter fabric puncture strength shall be no less than 100 lbs., in accordance with ASTM D-4833.
6. The Mess size of the filter fabric shall be no greater than U.S. Sieve Size number 30.
7. The filter fabric shall be wrapped around the riser pipe over the portion of the riser containing the approximately 1-inch orifices with at least a 1-foot overlap.
8. The filter fabric shall be attached to the riser using steel wires or bands, with at least 3-inches of fabric material extending past the wire or bands. Wires or bands should be tighten to the point where the fabric is difficult to remove.

INFORMATION ONLY

REQUESTOR: A.C. Snider 9/26/96 COMPANY: FERMCO	FCE / PE: Lee McDaniel 9-25-96

RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☒ YES FOR DCN: ☑ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

Modification are being made in responce to USEPA comments.

RCI - DCN ACCEPTANCE

DESIGN ORGANIZATION APPROVAL: 9/26/96	CHARGE NO. FOR CADD SERVICES TO INCORPORATE: 5CRA1
FERMCO PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) PERFORMANCE GRADE: 4 A.C. Snider 9/26/96	
CONSTRUCTION CONCURRENCE: Lee McDaniel 9-26-96 PURCHASE REQUISITION REQUIRED: ☐ YES ☒ NO	WORK COMPLETED: (SIGNOFF BY FCE OR PE) DATE:

Area1\DCN-004 (09/26/96)

ORIGINAL

SAR

000178

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

WP / WO NO.: 1697	S/C NO.: N/A	Pg 1 OF 1	DATE 10/03/96
C TITLE: N/A		RCI NO.: 1697-003R	
RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐	RCI/DCN TITLE: Stockpile Seeding Timeframe	DCN NO.: N/A	

DOCUMENTS AFFECTED	DOCUMENT NOS.	REV.	OTHER
Technical Specification for Area 1, Phase I (East) Remedial Action Project	2502-TS-001	0	Section 2920

X RCI - INQUIRY ☐ PRE-SCREEN FOR USQD BY PROJECT ENGINEER ☐ DCN-JUSTIFICATION,EXISTING CONDITION & REQUESTED/ PROPOSED CHANGE

The specification does not provide a timeframe by which the east impacted soil stockpile will be seeded.

This RCI is being initiated via Ohio EPA Technical Review Comments on the "Draft Operable Unit 5, Area 1, Phase I Remedial Action Work Plan (Comment # 61)."

REQUESTOR: A. C. Snider COMPANY: FERMCO 10/03/96	FCE / PE Lee E McDaniel 10-3-96

ESPONSE: FOR RCI, IS A DCN REQ'D? ☑ NO ☐ YES FOR DCN: ☐ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

The stockpile is intended to be seeded within 5 working days after impacted material placement is completed.

INFORMATION ONLY

RCI - DCN ACCEPTANCE

DESIGN ORGANIZATION APPROVAL: 10/3/96	CHARGE NO. FOR CADD SERVICES TO INCORPORATE: 5CRA1
FERMCO PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) A. C. Snider 10/03/96 PERFORMANCE GRADE: NA	
CONSTRUCTION CONCURRENCE: Lee E. McDaniel 10-3-96 PURCHASE REQUISITION REQUIRED: ☐ YES ☑ NO	WORK COMPLETED: (SIGNOFF BY FCE OR PE) DATE:

G:\area1\RCI-003R (10/03/96)

000179 ENTERED

ORIGINAL

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

/ WO NO.: 1697	S/C NO.: N/A	Pg 1 OF 1	DATE 11/14/96
S/C TITLE: N/A			RCI NO.: 1697-005R
RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐	RCI/DCN TITLE: Debris Pile Details		DCN NO.: N/A

DOCUMENTS AFFECTED	DOCUMENT NOS.	REV.	OTHER

X RCI - INQUIRY ☐ PRE-SCREEN FOR USQD BY PROJECT ENGINEER ☐ DCN-JUSTIFICATION,EXISTING CONDITION & REQUESTED/ PROPOSED CHANGE

Per Ohio EPA technical review comment #55, please clarify the lack of a detailed drawing related to the debris stockpile.

REQUESTOR: COMPANY: FERMCO 11/14/96	FCE / PE A. C. Snider 11/14/96

PONSE: FOR RCI, IS A DCN REQ'D? ☒ NO ☐ YES FOR DCN: ☐ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

Drawing 75A-5500-G-00441 shows the general location of the debris pile but does not give or reference details. Section 2100 of the technical specifications discusses how material will be separated and placed in the debris pile. Since the debris pile is located in the area draining to the west sedimentation basin, no surface water controls are required. The actual layout and arrangement of the debris pile (within the area shown on the referenced drawing) are left to the Subcontractor and to FERMCO's Field Construction Supervisor.

RCI - DCN ACCEPTANCE

DESIGN ORGANIZATION APPROVAL: 15 NOV 96	CHARGE NO. FOR CADD SERVICES TO INCORPORATE: 5CRA1

FERMCO PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY)

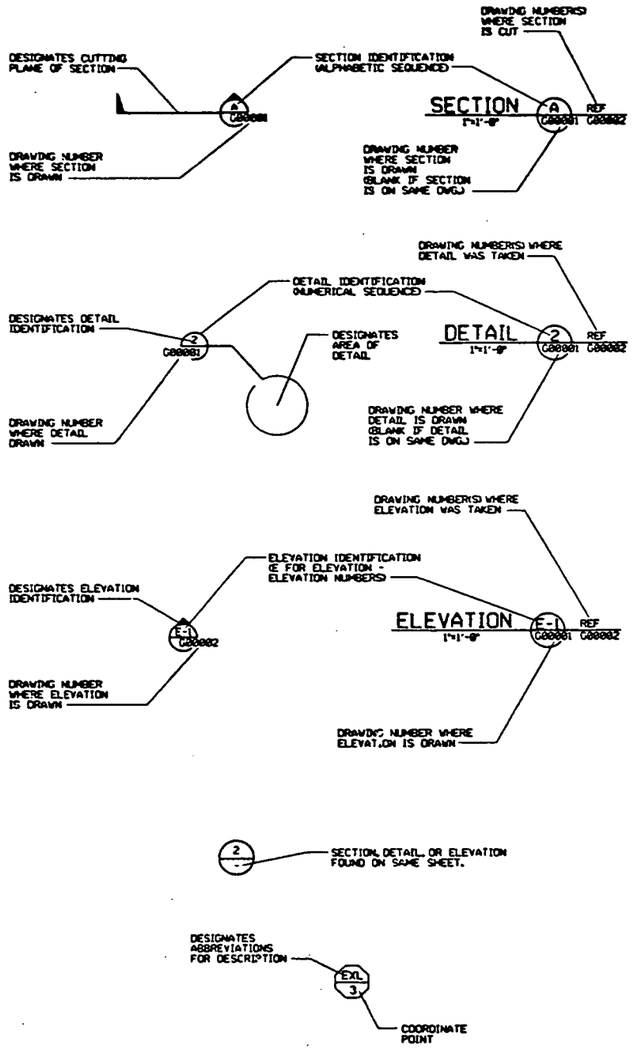
FORMANCE GRADE: ____

NSTRUCTION CONCURRENCE:	WORK COMPLETED: (SIGNOFF BY FCE OR PE)
PURCHASE REQUISITION REQUIRED: ☐ YES ☐ NO	DATE:

G:\area1\RCI-005R (11/14/96)

ORIGINAL

GENERAL LEGEND



NOTE:

ABBREVIATED DRAWING NUMBERS WILL BE USED FOR ALL SECTIONS, DETAILS, ELEVATIONS, AND WITHIN NOTES AND CALL OUTS IN THE BODY OF THE DRAWING.

FOR EXAMPLE: 95X-5900-G-00002 = DRAWING NUMBER
G00002 = ABBREVIATED DRAWING NUMBER

DIMENSIONING:

DIMENSIONS AND/OR ELEVATIONS MARKED THUS (+/-) SHALL BE VERIFIED IN THE FIELD BY CONTRACTOR.

USE DIMENSIONS AS SHOWN, DO NOT SCALE.

NTS (NOT TO SCALE) IS SHOWN ONLY WHERE DIMENSION IS OBVIOUSLY OUT OF SCALE.

UTILITY SYMBOLS

EXISTING		PROPOSED
ST	STORM SEWER	ST
SN	SANITARY SEWER	SN
FG	FUEL GAS	FG
DW	DRINKING WATER	DW
FQ1	FIRE PROTECTION	FQ
LS	LIVE STEAM	LS
WS	WATER SUPPLY	WS
WR	COOLING WATER RETURN	WR
TW	PROCESS WATER	TW
CE	CONTAMINATE WATER	CE
FT	FILTRATE OR EFFLUENT	FT
DF	DEIONIZED FEED	DF
PW	DEIONIZED WATER	PW
BR	BRINE	BR
RW	RAW WATER	RW
A	ALARM	A
CN	STEAM CONDENSATE	CN
VE	VENT LINES	VE
SD	SUB-SURFACE DRAINAGE	SD
SL	SUMP LIQUOR	SL
E	ELECTRICAL	E
OE	OVERHEAD ELECTRICAL	OE
T	TELEPHONE	T
G	ELECTRIC GROUND	G
PA	PLANT AIR	PA
SA	INSTRUMENT AIR SUPPLY	SA
	FORCE MAIN	FM

ABBREVIATIONS

AWWT FACILITY	ADVANCED WASTEWATER TREATMENT FACILITY
℄	BASELINE
℄	CENTERLINE
CMP	CORRUGATED METAL PIPE
EL	ELEVATION
E & S	EROSION AND SEDIMENTATION CONTROL
FEMP	FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FRL	FINAL REMEDIATION LIMIT
GW	GROUNDWATER
H:V	HORIZONTAL TO VERTICAL LENGTH RATIO FOR A SLOPE
ID	INSIDE DIAMETER
MAX	MAXIMUM
MIN	MINIMUM
NAD	NORTH AMERICAN DATUM
NGVD	NATIONAL GEODETIC VERTICAL DATUM
NO.	NUMBER
OD	OUTSIDE DIAMETER
℄	PROPERTY LINE
PC	POINT OF CURVATURE
PI	POINT OF INTERSECTION
PT	POINT OF TANGENT
RCP	REINFORCED CONCRETE PIPE
RP	RADIUS POINT
SWRB	STORMWATER RETENTION BASIN
(TYP)	TYPICAL

GRADING SYMBOLS

EXISTING		PROPOSED
584	CONTOUR - MINOR	583
585	CONTOUR - MAJOR	585
(TOE)	SLOPE INDICATOR	(TOP)

7/23/96

SYMBOLS LEGEND

EXISTING		PROPOSED
	POST INDICATOR VALVE (PIV)	
	FIRE HYDRANT (FH)	
	MANHOLE (MH)	S OR D
	CATCH BASIN (CB)	D
	POWER POLE/LIGHT POLE	
	PIPE SUPPORT	
	ELECTRICAL MANHOLE	E
	TELEPHONE MANHOLE	T
	STREET WASHERS	
	VALVE BOX	
	MONITORING WELL	
	POWER POLE	
	GRAVEL ROADWAY/DRIVEWAY	
	ASPHALT ROADWAY/DRIVEWAY	
	CONCRETE PAD/ ROADWAY/DRIVEWAY	
	WORK AREAS	
	CATTLE FENCE	
	CHAIN LINK FENCE	
	CONSTRUCTION FENCE	CF CF
	TREE LINE	
	DECIDUOUS TREE	
	CONIFEROUS TREE	
	CENTERLINE DRAINAGE DITCH	
	RIVER/CREEK	
	ELECTRICAL TRANSFORMER	T
	TRANSMISSION TOWER	
	HEADWALL	OR
BM	BENCH MARK	
	SURVEY CONTROL POINT	
	ROAD CENTERLINE OR BASELINE	
	FENCE GATE	
	IMPACTED MATERIAL DISPOSAL LIMIT	
	LIMIT OF 6" TOPSOIL EXCAVATION	
	EXISTING BUILDINGS/ TRAILERS	
	FEMP PROPERTY LINE	
	BUTLER COUNTY/HAMILTON COUNTY LINE	
	SILT FENCE	SF SF
	STRAW BALES	
	AIR MONITORING STATION	
	WORK BY OTHERS	
	MATCHLINE	
	CONSTRUCTION DECONTAMINATION PAD	
(WORK BY OTHERS)	TEMPORARY DIVERSION DITCH	

BENCHMARKS			
NUMBER	NORTHING	EASTING	ELEVATION
BM-1	N 482813.982	E 1345189.841	579.83
BM-9002	N 482566.178	E 1349891.116	593.811
BM-10	N 482637.962	E 1351857.178	615.875

NOTES:

1. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: SEA LEVEL DATUM REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM (NGVD)).
2. DIMENSIONS AS SHOWN SHALL BE USED FOR CONSTRUCTION. DRAWINGS SHALL NOT BE SCALED TO OBTAIN DIMENSIONS.

SEP 12 '96

FOR INFORMATION ONLY
000181

NO.	REVISIONS	DATE	DWN. BY	APPD.
1	REV. BENCHMARK VALUES PER RES 2868	7/18/96	GEP	JMG
0	ISSUED CERTIFIED FOR CONSTRUCTION	3/29/96	MET	CJB

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

PERFORMANCE GRADE 1 2 3 4 5

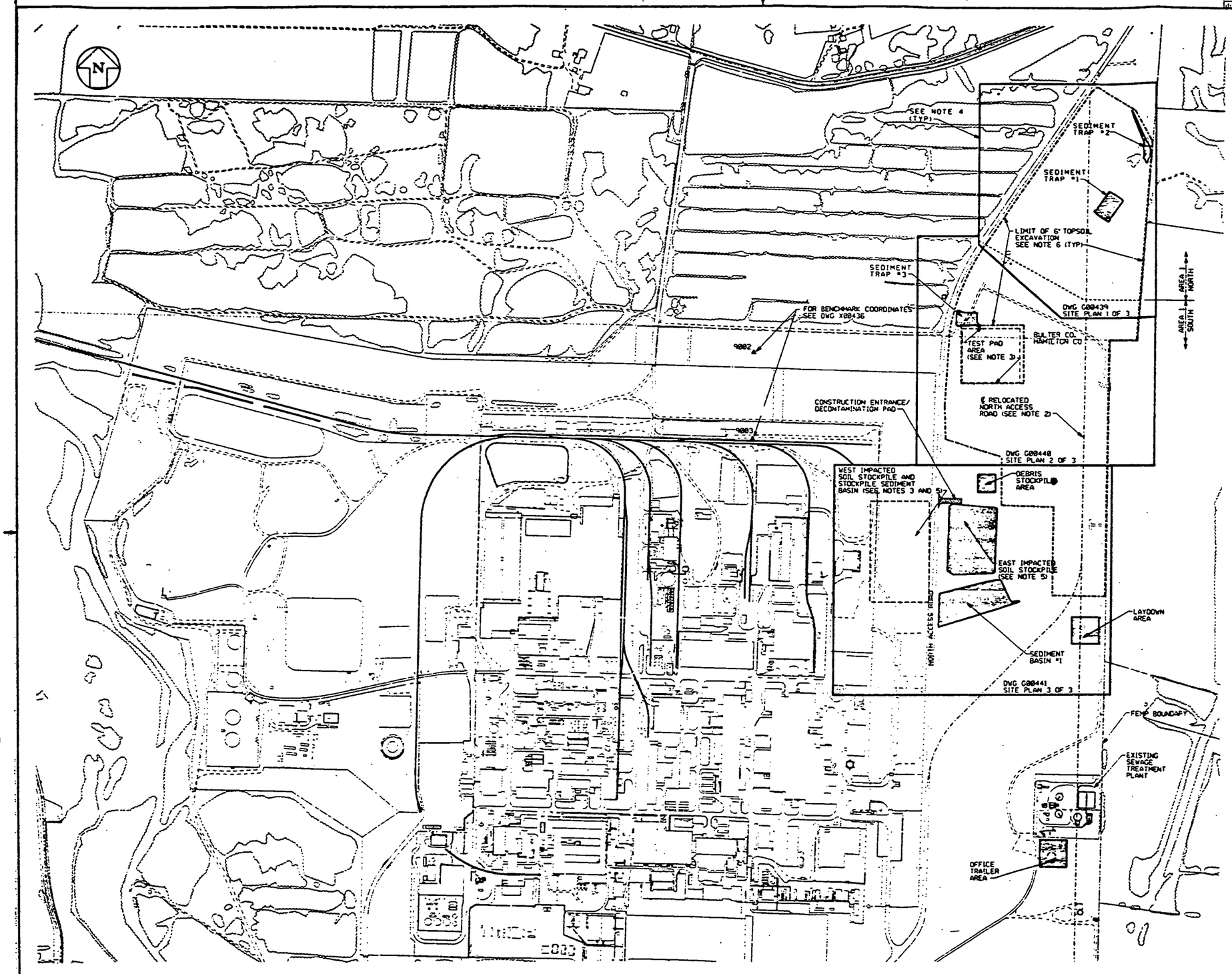
APPROVALS			
CIVIL & STR.	C.M. CLAWSON	7/23/96	SAFETY ENG.
ELECTRICAL			MAINTENANCE
ENGINEER			QA
INSTRUMENT			FIRE PROTECT.
MECHANICAL			WASTE MANAGE.
			SECURITY
			CRU
CHECKED	GEP		SOIL REM.
APPROVED	C.E. PAUL	7/23	

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

FEMP — SOIL REMEDIATION
AREA 1 PHASE 1 (EAST) REMEDIAL ACTION PROJECT
LEGEND AND SYMBOL
NOT TO SCALE

75X-5500-X-00436 | 1

FILE NAME: /RES2868/75x10436.dgn



GENERAL NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. THE RELOCATED NORTH ACCESS ROAD IS TO BE BUILT BY OTHERS. THE LOCATION SHOWN IS APPROXIMATE AND PROVIDED FOR CONTRACTOR INFORMATION ONLY.

3. WORK FOR THE TEST PAD AREA INCLUDING THE DRAINAGE DITCH AND THE WEST IMPACTED SOIL STOCKPILE AND STOCKPILE SEDIMENT BASIN WILL BE DONE BY OTHERS.

4. SHAPES INDICATE LIMITS OF DRAWINGS TO REFERENCE.

5. FOR THIS PROJECT THE TERM "IMPACTED MATERIAL" REFERS TO SOIL, DEBRIS, AND OTHER MATERIAL WHICH ARE WITHIN THE SCOPE OF THIS PROJECT.

6. THIS AREA IS THE LIMIT OF 6" TOPSOIL REMOVAL. SEE DWG 75X-5520-X-00452 FOR DETAIL OF EXCAVATION ALONG THE PROPERTY LINE. THE LIMIT OF 6" TOPSOIL REMOVAL ALONG THE NORTH ACCESS ROAD SHALL BE ESTABLISHED BY THE SUBCONTRACTOR ALONG THE RIDGE LINE. IF NO RIDGE LINE IS DEFINEABLE, THE DISTANCE SHALL BE NO LESS THAN 15' FROM EDGE OF PAVEMENT.

SEP 12 '96

FOR INFORMATION ONLY

000182

0 100 200 500 1000
SCALE IN FEET

NO.	REVISIONS	DATE	DWN	BY	APPD
0	ISSUED CERTIFIED FOR CONSTRUCTION	5/30	MET		DJB

NO.	REVISIONS	DATE	DWN.	BY	APPD

REF. DWG. NO.
75X-5500-X-00436
75A-5500-G-00434
75A-5500-G-00442
75A-5500-G-00441

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

PERFORMANCE GRADE 1 2 3 4 5
BY DJB DATE 5/30/96

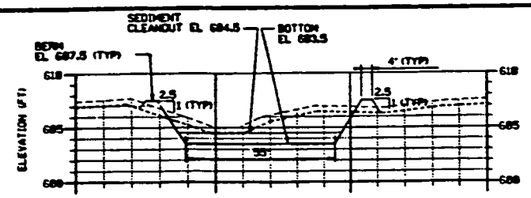
APPROVALS
SAFETY ENG.
CIVIL & STR.
MAINT. CHANGE
ELECTRICAL
Q.A.
ENGINEER
FIRE PROTECT
INSTRUMENT
WASTE MANAGE.
MECHANICAL
SECURITY
CHG.
CHECKED
APPROVED

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

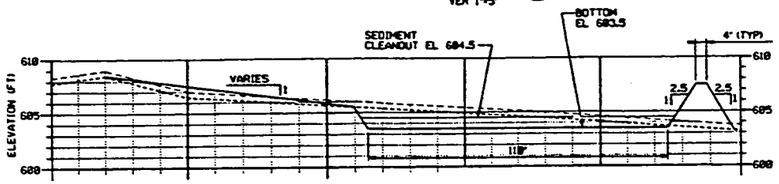
FEMP SOIL REMEDIATION
AREA 1 PHASE 1 (EAST)
REMEDIAL ACTION PROJECT
SITE LAYOUT PLAN
SCALE: 1" = 200'-0"

DES. EMB
DATE 5/30/96
DRAWN M.E. TILLMAN

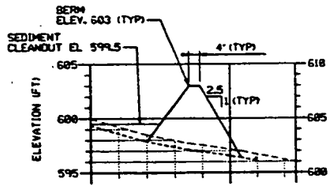
75X-5500-G-00438 | 0



SECTION A
SCALE: HOR 1"=20' VER 1"=5'



SECTION B
SCALE: HOR 1"=20' VER 1"=5'

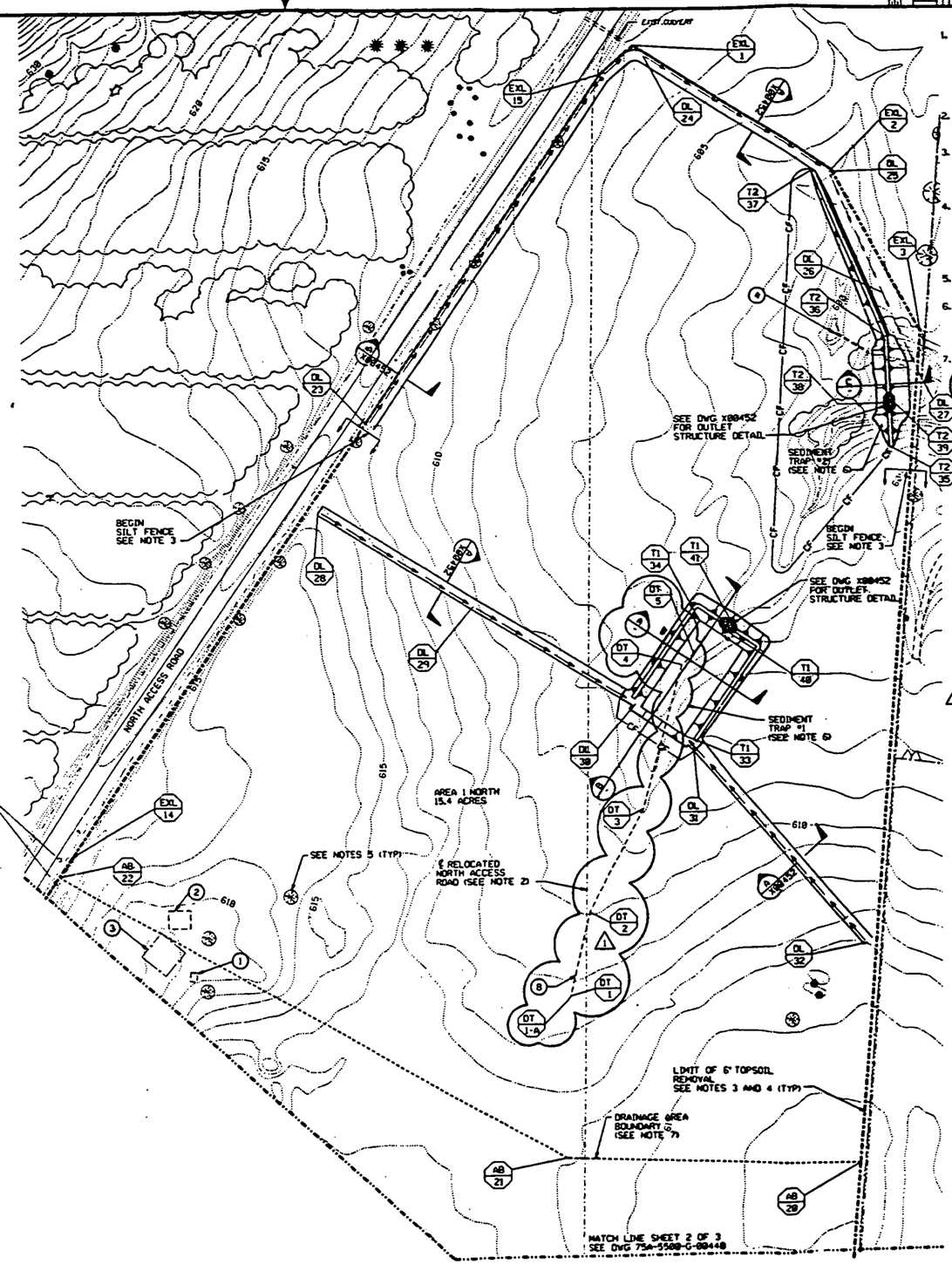


SECTION C
SCALE: HOR 1"=20' VER 1"=5'

LINE	GRADE
----	EXISTING
——	SEDIMENT
-----	DRAINAGE AREA

COORDINATES AND ELEVATIONS (NAD 83)					
POINT	ABBR	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	EXL	484042.11	1351782.57	N/A	LIMIT OF EXCAVATION
2	EXL	483988.78	1351991.27	N/A	LIMIT OF EXCAVATION
3	EXL	483737.34	1352884.36	N/A	LIMIT OF EXCAVATION
14	EXL	463189.95	1351187.66	N/A	LIMIT OF EXCAVATION
15	EXL	484811.75	1351747.30	N/A	LIMIT OF EXCAVATION
20	AB	482859.85	1352819.28	N/A	DRAINAGE AREA BOUNDARY
21	AB	482866.96	1351788.55	N/A	DRAINAGE AREA BOUNDARY
22	AB	483169.89	1351172.90	N/A	DRAINAGE AREA BOUNDARY
23	DL	483643.40	1351508.69	610.5**	DIVERSION DITCH CENTERLINE (BEGIN 0.8% SLOPE)
24	DL	484031.15	1351793.23	606.6	DIVERSION DITCH CENTERLINE (BEGIN 2.8% SLOPE)
25	DL	483986.41	1351988.47	N/A	DIVERSION DITCH CENTERLINE
26	DL	483778.38	1352845.10	599	DIVERSION DITCH CENTERLINE
27	DL	483696.47	1352881.33	**	DIVERSION DITCH CENTERLINE (END OF DITCH)
28	DL	483552.67	1351447.37	612.5**	DIVERSION DITCH CENTERLINE (BEGIN 2.3% SLOPE)
29	DL	483451.41	1351612.80	608	DIVERSION DITCH CENTERLINE (BEGIN 1.8% SLOPE)
30	DL	483346.32	1351782.92	606	DIVERSION DITCH CENTERLINE (END OF DITCH)
31	DL	483381.57	1351842.80	606	DIVERSION DITCH CENTERLINE (END OF DITCH)
32	DL	483091.69	1352826.31	612.5**	DIVERSION DITCH CENTERLINE (BEGIN 2.3% SLOPE)
33	T1	483312.88	1351833.70	SEE SECTION	SEDIMENT TRAP #1 (SE CORNER)
34	T1	483433.95	1351858.18	SEE SECTION	SEDIMENT TRAP #1 (NW CORNER)
35	T2	483615.17	1352853.86	SEE SECTION	SEDIMENT TRAP #2 (℄EMBANKMENT CENTERLINE)
36	T2	483731.96	1352848.38	SEE SECTION	SEDIMENT TRAP #2 (℄EMBANKMENT CENTERLINE)
37	T2	483988.59	1351971.10	SEE SECTION	SEDIMENT TRAP #2 (℄EMBANKMENT CENTERLINE)
38	T2	483661.85	1352845.92	601.5	SEDIMENT TRAP #2 (OUTLET STRUCTURE CENTERLINE)
39	T2	483662.38	1352857.40	601.4	EDIMENT TRAP #2 (OUTLET STRUCTURE CENTERLINE)
40	T1	483423.63	1351875.43	606	SEDIMENT TRAP #1 (OUTLET STRUCTURE CENTERLINE)
41	T1	483433.14	1351882.90	605.9	SEDIMENT TRAP #1 (OUTLET STRUCTURE CENTERLINE)
1-A	DT	483034.199	1351718.060	610.87	EXISTING DRAIN TILE COORDINATE (POB)
1	DT	483038.730	1351712.543	610.8	EXISTING DRAIN TILE COORDINATE
2	DT	483126.538	1351733.351	609.5	EXISTING DRAIN TILE COORDINATE
3	DT	483235.058	1351798.381	607.5	EXISTING DRAIN TILE COORDINATE
4	DT	483387.238	1351831.461	604.9	EXISTING DRAIN TILE COORDINATE
5	DT	483399.895	1351843.606	604.5	EXISTING DRAIN TILE COORDINATE (POE)

** MEET EXISTING GRADE



2- BURIED TELEPHONE CABLE RUNS, ONE 3'-5" FROM EAST EDGE OF ROAD, THE OTHER 7'-0" (REF DWG 00A-5500-G-01321)

GENERAL NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.
   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
2. THE RELOCATED NORTH ACCESS ROAD IS TO BE BUILT BY OTHERS. THE LOCATION SHOWN IS APPROXIMATE AND PROVIDED FOR CONTRACTOR INFORMATION ONLY.
3. THIS AREA IS THE LIMITS OF 6" TOPSOIL REMOVAL SEE TABLE ON THIS DRAWING FOR COORDINATES OF LIMITS. INSTALL SILT FENCE ALONG LIMITS OF EXCAVATION BETWEEN AREAS INDICATED. SEE DWG 75X-5500-X-00452 FOR SILT FENCE DETAIL.
4. THIS AREA IS THE LIMIT OF 6" TOPSOIL REMOVAL. SEE DWG 75X-5500-X-00452 FOR DETAIL OF EXCAVATION ALONG THE PROPERTY LINE. THE LIMIT OF 6" TOPSOIL REMOVAL ALONG THE NORTH ACCESS ROAD SHALL BE ESTABLISHED BY THE SUBCONTRACTOR ALONG THE RIDGE LINE. IF NO RIDGE LINE IS DEFINEABLE, THE DISTANCE SHALL BE NO LESS THAN 15' FROM EDGE OF PAVEMENT.
5. REMOVE ALL EXISTING TREES WITHIN EXCAVATION LIMITS AND STOCKPILE AREAS.
6. INSTALL CONSTRUCTION FENCE ALONG THE OUTSIDE TOE OF SLOPE OF SEDIMENT TRAPS #1 AND #2 EMBANKMENT. CONTINUE CONSTRUCTION FENCE AS INDICATED ON PLAN. SEE DWG 75X-5500-X-00452 FOR CONSTRUCTION FENCE DETAIL.
7. "DRAINAGE AREA BOUNDARY ILLUSTRATES LIMIT OF 6" TOPSOIL REMOVAL BETWEEN AREA 1 NORTH AND AREA 1 SOUTH. WHENEVER POSSIBLE, THE CONTRACTOR SHALL PERFORM EXCAVATION FROM AN UPGRADIENT TO A DOWNGRADIENT DIRECTION FROM THIS BOUNDARY; HOWEVER, EXCEPTIONS WILL BE ALLOWED TO FACILITATE EQUIPMENT ACCESS."

1. PROTECT EXISTING WELLS SEE DWG 75X-5500-X-00452 FOR MONITORING WELL DETAIL
2. EXISTING CONCRETE PAD AND FOUNDATION TO BE DEMOLISHED AND PLACED IN DEBRIS STOCKPILE AREA.
3. REMOVE EXISTING SINGLE STRAND CATTLE FENCE IN ITS ENTIRETY INCLUDING OUTSIDE OF 6" TOPSOIL REMOVAL AREA (APPROXIMATELY 5000 L.F.)
4. EXISTING CULVERTS TO BE REMOVED
5. PROTECT EXISTING BENCHMARKS
6. REMOVE EXISTING GRAVEL ROADS AND STOCKPILE SEE SPECIFICATION 02100 FOR DETAILS
7. PROTECT EXISTING OVERHEAD ELECTRIC TOWER SEE DWG 75X-X-5500-X-00452 FOR DETAIL
8. REMOVE EXISTING DRAIN TILES BETWEEN CONTROL POINTS (DT 1-A) AND (DT 5) SEE SPECIFICATION 2502-TS-001; AMEND SEC. 2220, 3.02, A.2 FOR DETAILS

NOV 7 '96

FOR INFORMATION ONLY

000183

0 25 50 125 250
SCALE IN FEET

NO.	REVISIONS	DATE	DWN. BY	APPD.
1	ADDED EXIST. DRAIN TILES TO BE REMOVED PER DCN #1697-007;	11-7-96	MET	MEF
	REVISED NOTE 7 PER DCN #1697-006			
0	ISSUED CERTIFIED FOR CONSTRUCTION	5/30	MET	DJB

REF. DWG. NO.
00A-5500-G-01321
75A-5500-G-00443
75A-5500-G-00448
75A-5500-G-00452

NOTE: FEMPCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

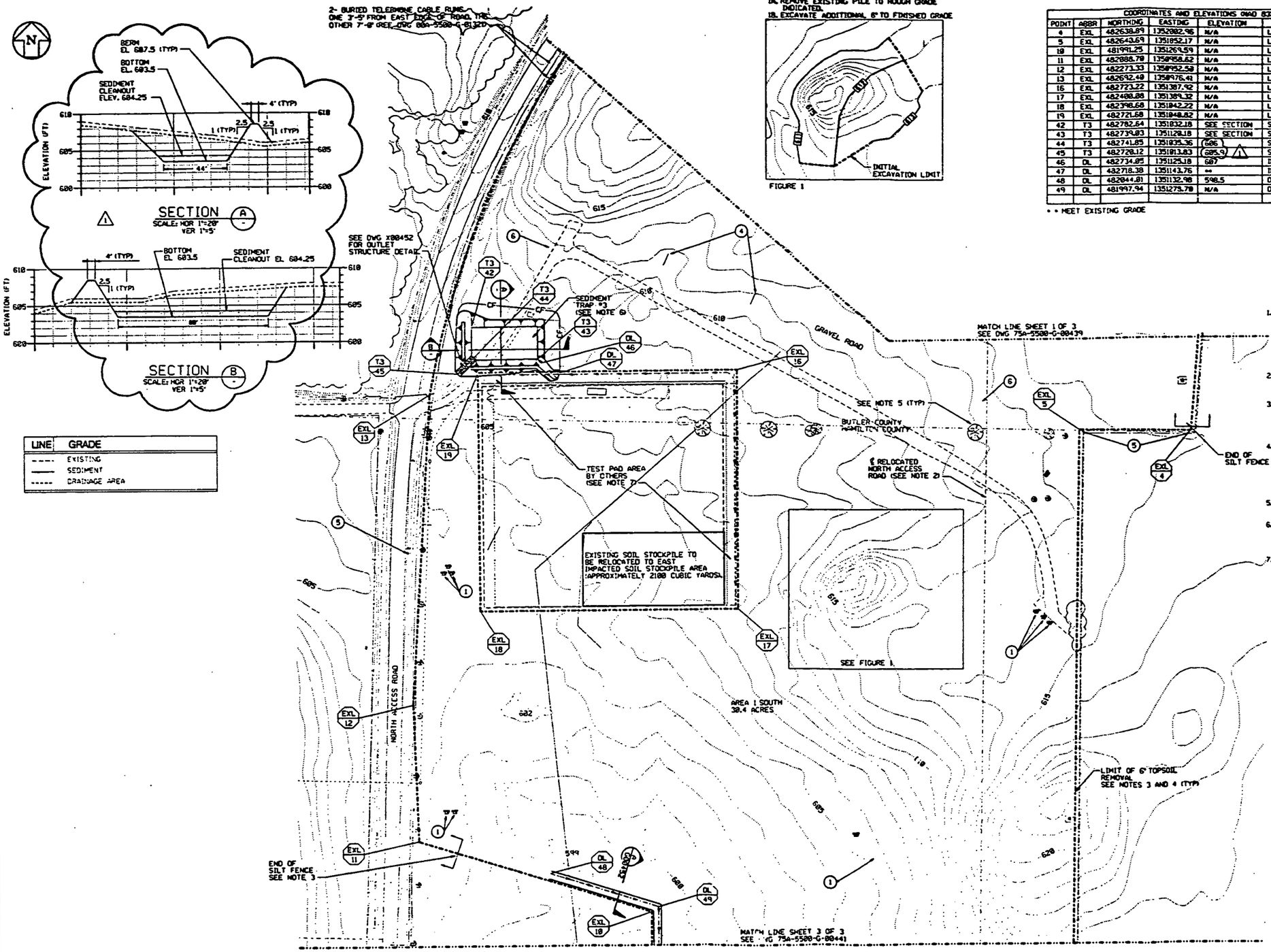
PERFORMANCE GRADE 1 2 3 4 5
DATE
APPROVALS
CIVIL & STR. C.NEUMANN
ELECTRICAL
ENGINEER
INSTRUMENT
MECHANICAL
CHECKED GEP
APPROVED C.E.PAUL
SAFETY ENG.
OPS. MAINTENANCE
QA
FIRE PROTECT.
WASTE MANAGE.
SECURITY
CRM
SOIL REM.
S.WITHERSPOON

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

FEMP — SOIL REMEDIATION
AREA 1 PHASE 1 (EAST) REMEDIAL ACTION PROJECT
SITE PLAN 1 OF 3
SCALE: 1" = 50'-0"

DES. 2220
DATE 9-30-96
DRAWN W.E. TILLMAN
75A-5500-G-00439 | 1

FILE NAME: DES2960/75ag0439.dgn



NOTES:
1A. REMOVE EXISTING PILE TO ROUGH GRADE INDICATED.
1B. EXCAVATE ADDITIONAL 6" TO FINISHED GRADE

FIGURE 1

COORDINATES AND ELEVATIONS GRID 83D					
POINT	ABBR	NORTHING	EASTING	ELEVATION	DESCRIPTION
4	EXL	482638.89	1352082.96	N/A	LIMIT OF EXCAVATION
5	EXL	482643.59	1351852.17	N/A	LIMIT OF EXCAVATION
10	EXL	481991.25	1351269.59	N/A	LIMIT OF EXCAVATION
11	EXL	482088.70	1350958.62	N/A	LIMIT OF EXCAVATION
12	EXL	482273.33	1350952.58	N/A	LIMIT OF EXCAVATION
13	EXL	482692.49	1350976.41	N/A	LIMIT OF EXCAVATION
16	EXL	482723.22	1351387.92	N/A	LIMIT OF EXCAVATION
17	EXL	482488.88	1351389.32	N/A	LIMIT OF EXCAVATION
18	EXL	482398.68	1351842.22	N/A	LIMIT OF EXCAVATION
19	EXL	482721.68	1351848.82	N/A	LIMIT OF EXCAVATION
42	T3	482782.64	1351832.18	SEE SECTION	SEDIMENT TRAP #3 (NW CORNER)
43	T3	482739.83	1351128.18	SEE SECTION	SEDIMENT TRAP #3 (SE CORNER)
44	T3	482741.85	1351835.36	(696)	SEDIMENT TRAP #3 (OUTLET STRUCTURE CENTERLINE)
45	T3	482728.12	1351813.83	(695.9) ⚠	SEDIMENT TRAP #3 (OUTLET STRUCTURE CENTERLINE)
46	DL	482734.85	1351125.18	687	INLET DITCH CENTERLINE
47	DL	482718.38	1351143.76	--	INLET DITCH CENTERLINE
48	DL	482044.81	1351132.98	598.5	DIVERSION DITCH CENTERLINE (BEGIN 8.8% SLOPE)
49	DL	481997.94	1351278.78	N/A	DIVERSION DITCH CENTERLINE

• • MEET EXISTING GRADE

GENERAL NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.
   EXISTING SITE DATA SOURCE (IN PLANT FILES)

   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
2. THE RELOCATED NORTH ACCESS ROAD IS TO BE BUILT BY OTHERS. THE LOCATION SHOWN IS APPROXIMATE AND PROVIDED FOR CONTRACTOR INFORMATION ONLY.
3. THIS AREA IS THE LIMITS OF 6" TOPSOIL REMOVAL SEE TABLE ON THIS DRAWING FOR COORDINATES OF LIMITS. INSTALL SILT FENCE ALONG LIMITS OF EXCAVATION BETWEEN AREAS INDICATED. SEE DWG 75X-5500-X-00452 FOR SILT FENCE DETAIL.
4. THIS AREA IS THE LIMIT OF 6" TOPSOIL REMOVAL. SEE DWG 75X-5500-X-00452 FOR DETAIL OF EXCAVATION ALONG THE PROPERTY LINE. THE LIMIT OF 6" TOPSOIL REMOVAL ALONG THE NORTH ACCESS ROAD SHALL BE ESTABLISHED BY THE SUBCONTRACTOR ALONG THE RIDGE LINE. IF NO RIDGE LINE IS DEFINEABLE, THE DISTANCE SHALL BE NO LESS THAN 15' FROM EDGE OF PAVEMENT.
5. REMOVE ALL EXISTING TREES WITHIN EXCAVATION LIMITS AND STOCKPILE AREAS.
6. INSTALL CONSTRUCTION FENCE ALONG THE OUTSIDE TOE OF SLOPE OF SEDIMENT TRAP #3 EMBANKMENT. CONTINUE CONSTRUCTION FENCE AS INDICATED ON PLAN. SEE DWG 75X-5500-X-00452 FOR CONSTRUCTION FENCE DETAIL.
7. WORK FOR THE TEST PAD AREA (INCLUDING THE DRAINAGE DITCH) WILL BE DONE BY OTHERS.

(1) PROTECT EXISTING WELLS SEE DWG 75X-5500-X-00452 FOR MONITORING WELL DETAIL
(2) EXISTING CONCRETE PAD AND FOUNDATION TO BE DEMOLISHED AND PLACED IN DEBRIS STOCKPILE AREA.
(3) REMOVE EXISTING SINGLE STRAND CATTLE FENCE IN ITS ENTIRETY INCLUDING OUTSIDE OF 6" TOPSOIL REMOVAL AREA (APPROXIMATELY 5200 L.F.)
(4) EXISTING CULVERTS TO BE REMOVED
(5) PROTECT EXISTING BENCHMARKS
(6) REMOVE EXISTING GRAVEL ROADS AND STOCKPILE SEE SPECIFICATION 02100 FOR DETAILS
(7) PROTECT EXISTING OVERHEAD ELECTRIC TOWER SEE DWG 75X-X-5500-X-00452 FOR DETAIL

FOR INFORMATION ONLY

000184

NO.	REVISIONS	DATE	DWN. BY	APPD.
1	SEDIMENTATION TRAP #3 ELEV. CHANGES PER DCN #647-008	3/31	MET	BKP
2	ISSUED CERTIFIED FOR CONSTRUCTION	5/30	MET	DJB

REF. DWG. NO.: 75A-5500-G-00439, 75A-5500-G-00441, 75X-5500-X-00452

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

PERFORMANCE SPACE 1 2 3 4 5

APPROVALS: SAFETY ENG., CIVIL & STR., ELECTRICAL, ENGINEER, INSTRUMENT, MECHANICAL, MAINTENANCE, QA, HAZ. MATERIAL, WASTE MANAGE., SECURITY, CAU, CHECKED, APPROVED

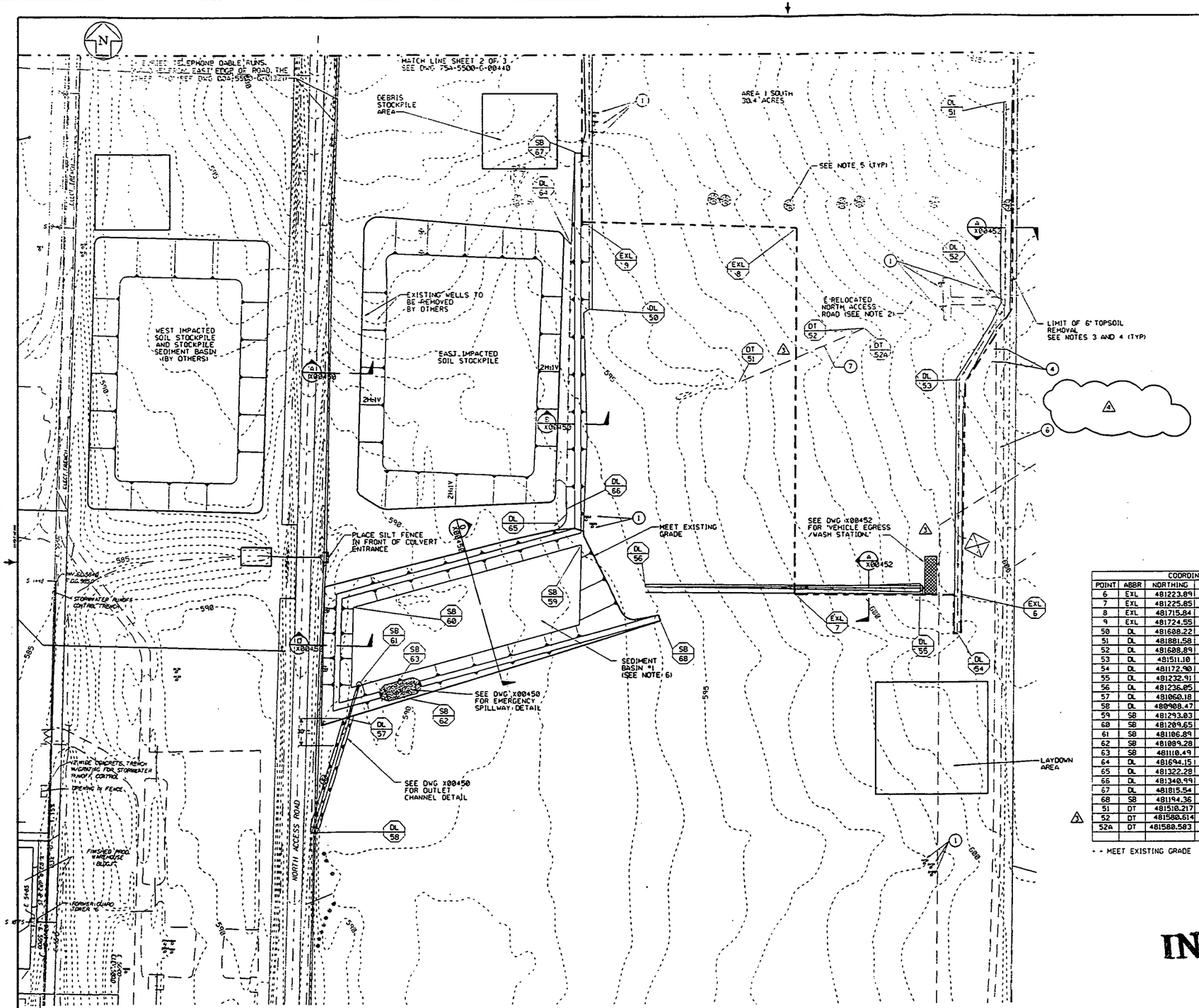
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

FEMP — SOIL REMEDIATION
AREA 1 PHASE 1 (EAST) REMEDIAL ACTION PROJECT
SITE PLAN 2 OF 3
SCALE: 1" = 80'-0"

DES. JBB
DATE 5/30/96
75A-5500-G-00440 | 1

DO NOT SCALE REDUCED DRAWING

FILE NAME



GENERAL NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM REMEDIAL SITE PROVIDED DATA FROM THE SOURCES LISTED BELOW.
   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   [illegible]
   [illegible]
   [illegible] PROJECT DESIGN DOCUMENTS
2. THE RE-GRAVEL NORTH ACCESS ROAD IS TO BE BUILT BY [illegible] THE LOCATION SHOWN IS APPROXIMATE AND [illegible] CONTRACTOR INFORMATION ONLY.
3. THIS AREA IS THE LIMITS OF 6" TOPSOIL REMOVAL. SEE TABLE ON THIS DRAWING FOR COORDINATES OF LIMITS. INSTALL SILT FENCE ALONG LIMITS OF EXCAVATION BETWEEN AREAS INDICATED. SEE DWG 75X-5500-X-00452 FOR SILT FENCE DETAIL.
4. THIS AREA IS THE LIMIT OF 6" TOPSOIL REMOVAL. SEE DWG 75X-5500-X-00452 FOR DETAIL OF EXCAVATION ALONG THE PROPERTY LINE. THE LIMIT OF 6" TOPSOIL REMOVAL ALONG THE NORTH ACCESS ROAD SHALL BE ESTABLISHED BY THE SUBCONTRACTOR ALONG THE RIDGE LINE. IF NO RIDGE LINE IS DEFINEABLE, THE DISTANCE SHALL BE NO LESS THAN 15' FROM EDGE OF PAVEMENT.
5. REMOVE ALL EXISTING TREES WITHIN EXCAVATION LIMITS AND STOCKPILE AREAS.
6. INSTALL CONSTRUCTION FENCE ALONG THE OUTSIDE TOE OF SLOPE OF SEDIMENT BASIN #1 EMBANKMENT. CONTINUE CONSTRUCTION FENCE AS INDICATED ON PLAN. SEE DWG 75X-5500-X-00452 FOR CONSTRUCTION FENCE DETAIL.

(1) PROTECT EXISTING WELLS SEE DWG 75X-5500-X-00452 FOR MONITORING WELL DETAIL
(2) EXISTING CONCRETE PAD AND FOUNDATION TO BE DEMOLISHED AND PLACED IN DEBRIS STOCKPILE AREA.
(3) REMOVE EXISTING SINGLE STRAND CATTLE FENCE IN ITS ENTIRETY INCLUDING OUTSIDE OF 6" TOPSOIL REMOVAL AREA (APPROXIMATELY 5000 L.F.)
(4) EXISTING CULVERTS TO BE REMOVED
(5) PROTECT EXISTING BENCHMARKS
(6) REMOVE EXISTING GRAVEL ROADS AND STOCKPILE SEE SPECIFICATION 02100 FOR DETAILS
(7) REMOVE EXISTING DRAIN TILES AND STOCKPILE SEE SPECIFICATION 2502-TS-001; AMEND SEC. 2220.3.02.A.2 FOR DETAILS
(3)

COORDINATES AND ELEVATIONS (NAD 83)

POINT	ABBR	NORTHING	EASTING	ELEVATION	DESCRIPTION
6	EXL	481223.89	1351775.02	N/A	LIMIT OF EXCAVATION
7	EXL	481225.85	1351551.48	N/A	LIMIT OF EXCAVATION
8	EXL	481715.84	1351555.25	N/A	LIMIT OF EXCAVATION
9	EXL	481724.55	1351269.59	N/A	LIMIT OF EXCAVATION
50	DL	481608.22	1351279.09	--	DIVERSION DITCH CENTERLINE (END)
51	DL	481881.58	1351835.58	612.0	DIVERSION DITCH CENTERLINE (BEGIN 2.7% SLOPE)
52	DL	481688.89	1351833.18	604.6	DIVERSION DITCH CENTERLINE (BEGIN 1.0% SLOPE)
53	DL	481511.10	1351772.30	N/A	DIVERSION DITCH CENTERLINE
54	DL	481172.90	1351769.28	--	DIVERSION DITCH CENTERLINE (END)
55	DL	481232.91	1351719.81	600.0	DIVERSION DITCH CENTERLINE (BEGIN 1.6% SLOPE)
56	DL	481236.05	1351353.83	--	DIVERSION DITCH CENTERLINE (END)
57	DL	481060.18	1350958.97	587.6	INVERT OF OUTLET PIPE
58	DL	480908.47	1350912.57	--	OUTLET CHANNEL (END)
59	SB	481293.03	1351268.81	SEE SECTION	SEDIMENT BASIN #1 INV CORNER)
60	SB	481289.65	1350966.38	SEE SECTION	SEDIMENT BASIN #1 INV CORNER)
61	SB	481186.84	1350973.25	SEE DETAIL	SEDIMENT BASIN #1 RISER
62	SB	481089.28	1351032.86	592.0	SEDIMENT BASIN #1(EMERGENCY SPILLWAY CENTERLINE)
63	SB	481110.49	1351026.22	592.0	SEDIMENT BASIN #1(EMERGENCY SPILLWAY CENTERLINE)
64	DL	481694.15	1351255.27	595.5	EAST STOCKPILE EAST DITCH (BEGIN 0.08% SLOPE)
65	DL	481322.28	1351234.44	--	EAST STOCKPILE EAST DITCH (END)
66	DL	481340.99	1351248.50	N/A	EAST STOCKPILE EAST DITCH CENTERLINE
67	DL	481815.54	1351263.84	--	EAST STOCKPILE (END OF BERM)
68	SB	481194.36	1351371.75	--	SEDIMENT BASIN #1(END OF BERM)
51	DT	481510.217	1351477.714	597.4	EXISTING DRAIN TILE LOCATION (POB)
52	DT	481580.614	1351644.741	601.6	EXISTING DRAIN TILE LOCATION
52A	DT	481580.583	13516646.056	601.7	EXISTING DRAIN TILE LOCATION (POE)

- - MEET EXISTING GRADE

FOR INFORMATION ONLY

INFORMATION ONLY
CADD SERVICES
000185

NO.	REVISIONS	DATE	DWN. BY	APPD.
4	DELETED CALLOUT BETWEEN BALLOON 1 & 4 AND 5 PER DCN 1697-005	11-8-96	GEP	GEP
3	RELOCATED CONSTRUCTION ENTRANCE 1/DESCN. PAD PER DCN 1697-003	10-8-96	MET	GEP
3	ADDED EXISTING DRAIN TILES TO PLAN AND TABLE PER DCN 1697-007	11-8-96	MET	GEP
2	REVISED EXCAVATION LIMIT #5 (EXL-5) WEST TO DIVERSION DITCH, DELETED SILT FENCE ON WEST SIDE DL-52, 53 & 54 DELETED NOTE (7) PER DCN 1697-005	10-24-96	MET	GEP
1	REVISED SILT FENCE ANNOTATION PER DCN 1697-004	10-2-96	MET	GEP
0	ISSUED CERTIFIED FOR CONSTRUCTION	5/30	MET	DJB

REF. DWG. NO.: 75A-5500-G-00441; 75X-5500-X-00450; 75X-5500-X-00452

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

PERFORMANCE GRADE: 1 2 3 4 5
BY: DJB DATE: 6/30/96

APPROVALS

CIVIL & STR.	IC. MEUMANN	SAFETY ENG.	
ELECTRICAL		QA	
ENGINEER		FIRE PROTECT.	
INSTRUMENTT		PROJECT MANAGR.	
MECHANICAL		SECURITY	
		CPM	
CHECKED	GEP	SOIL REM.	S. BETTOMENDEN/DOE
APPROVED	G.E. PAUL	DOE	

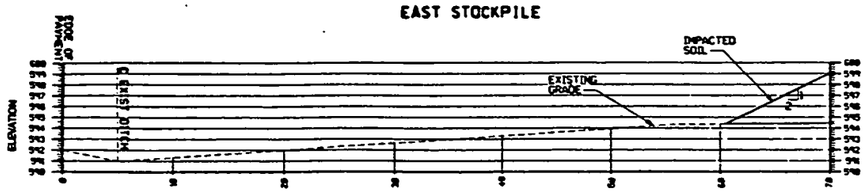
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

FEMP — SOIL REMEDIATION
AREA 1 PHASE 1 (EAST)
REMEDIAL ACTION PROJECT
SITE PLAN 3 OF 3
SCALE: 1" = 50'-0"
DES. [illegible]
DATE 6/30/96
DRAWN M. E. TILLMAN
75A-5500-G-00441 | 4

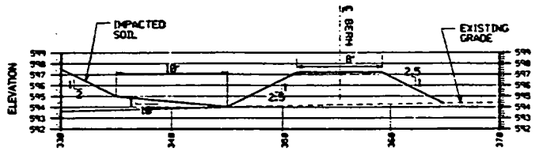
FILE NAME: RES2868/75gg0441.dgn

R75ag0441.m(2554.ws16) jerry@ws16. Tue Nov 19 08:19:19 EST 1996

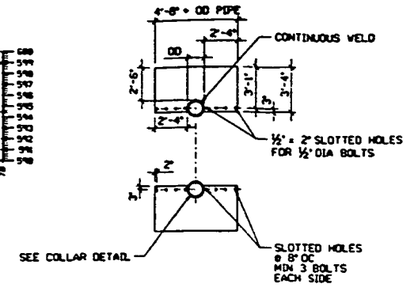
EAST STOCKPILE



SECTION (A) REF X00450 C00441
SCALE: HOR 1"=20' VER 1"=5'



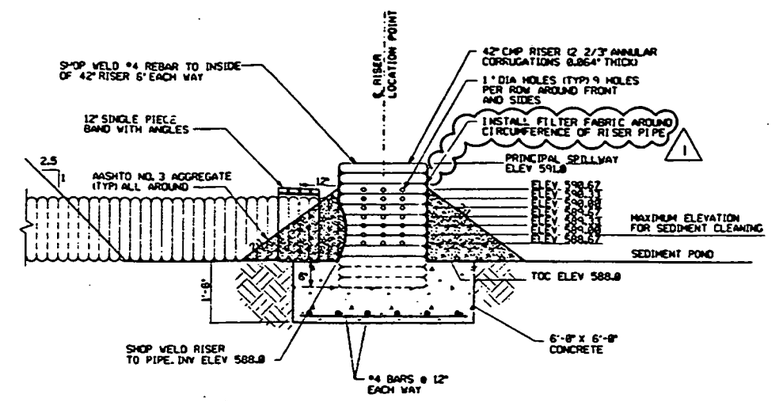
SECTION (B) REF X00450 C00441
SCALE: HOR 1"=20' VER 1"=5'



NOTE:

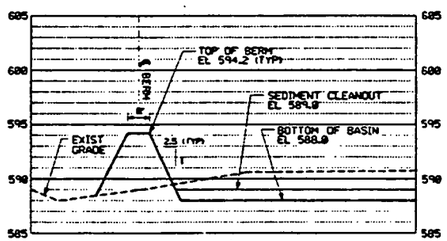
THE LAP BETWEEN THE PIPE AND COLLAR SHALL BE CAULKED WITH AN ASPHALTIC MASTIC AT TIME OF INSTALLATION.

ANTI SEEP COLLAR
NTS

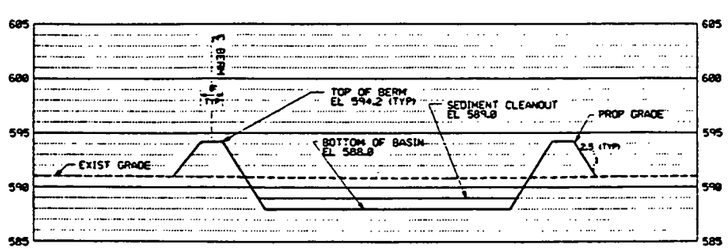


SIDE VIEW

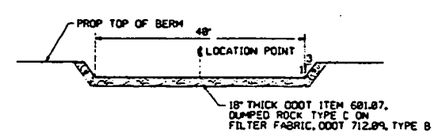
RISER PIPE DETAIL (4) REF X00450 C00441
NTS



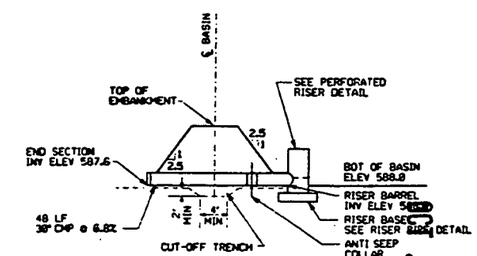
SECTION (C) REF X00450 C00441
SCALE: HOR 1"=20' VER 1"=5'



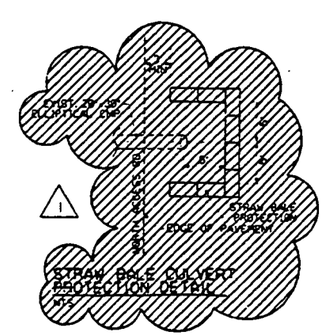
SECTION (D) REF X00450 C00441
SCALE: HOR 1"=20' VER 1"=5'



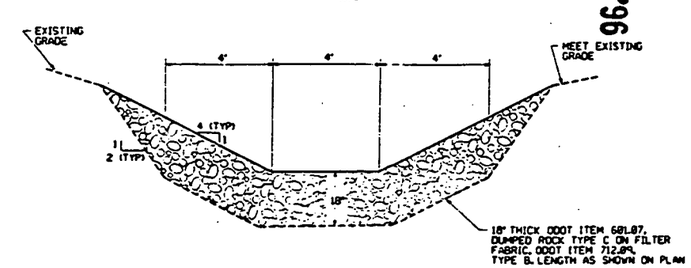
EMERGENCY SPILLWAY DETAIL
NTS



SEDIMENT BASIN #1 PRINCIPAL SPILLWAY
NTS



STRAW BALE CULVERT PROTECTION DETAIL
NTS



OUTFALL CHANNEL SECTION DETAIL
NTS

FOR INFORMATION ONLY 000186

NO.	REVISIONS	DATE	DWN.	BY	APPD.	NO.	REVISIONS	DATE	DWN.	BY	APPD.
						1	STRAW BALE CULVERT PROT. DETAIL NOT REQ'D. ADDED FILTER FABRIC APRON RISER PER DCN 1637-204	3/30	MET		MEF
						0	ISSUED CERTIFIED FOR CONSTRUCTION	5/30	MET		DJB

REF. DWG. NO.

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

PERFORMANCE GRADE 1 2 3 4 5
DATE 5/30/96

APPROVALS					
CIVIL & STR.	KNECHMANN	5/30	SAFETY ENG.		
ELECTRICAL			MAINTENANCE		
ENGINEER			QA		
ENVIRONMENT			TRM PROJECT		
MECHANICAL			WASTE MANAGE		
			SECURITY		
			CPU		
CHECKED	CEP		SOIL REM.	A.BEITROHER	5/30
APPROVED	G.E.PAUL	5/30			

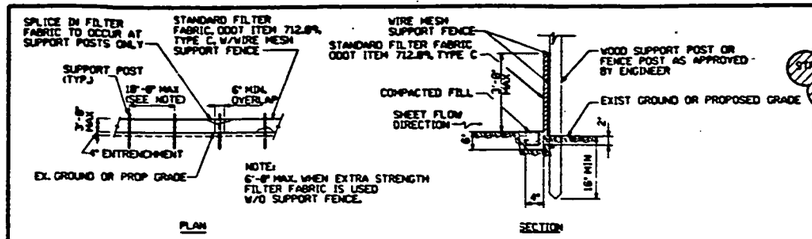
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

FEMP SOIL REMEDIATION
AREA 1 PHASE I (EAST) REMEDIAL ACTION PROJECT
DETAIL SHEET 1
NO SCALE

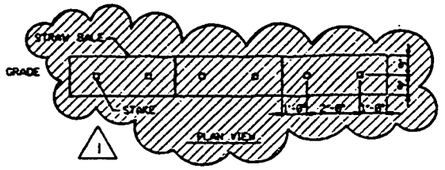
RES. 2968
DATE 5/30/96
DRAWN MJL TELLMAN

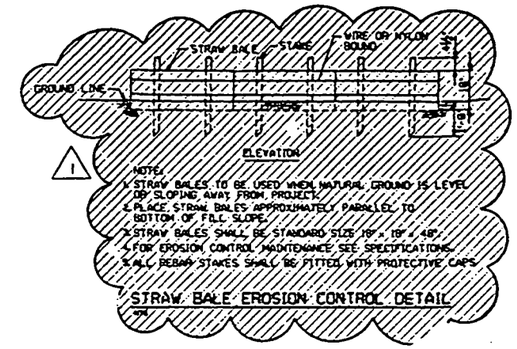
75X-5500-X-00450 | 1

75xx0450.m(3188.wall)Mark@wall, Wed Oct 2 11:44:19 EDT 1996

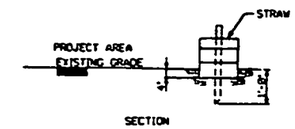


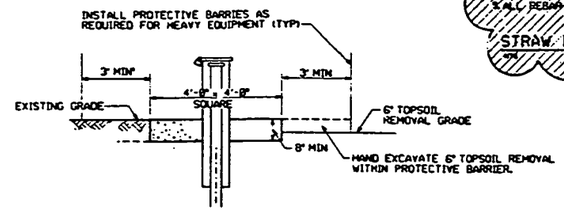
SILT FENCE DETAIL



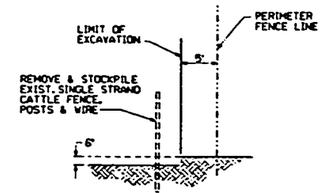


STRAW BALE EROSION CONTROL DETAIL

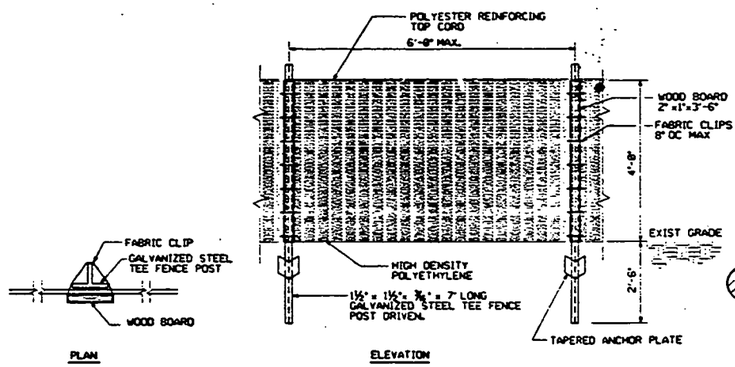




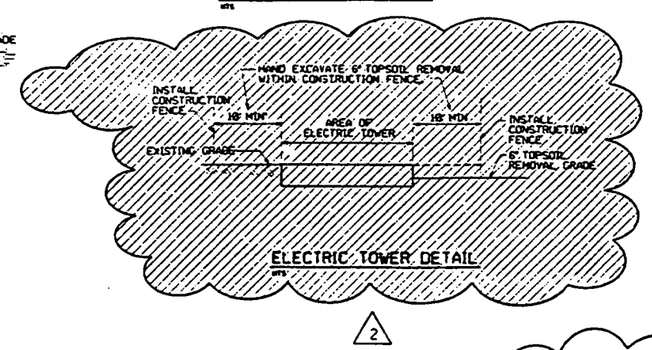
MONITORING WELL DETAIL



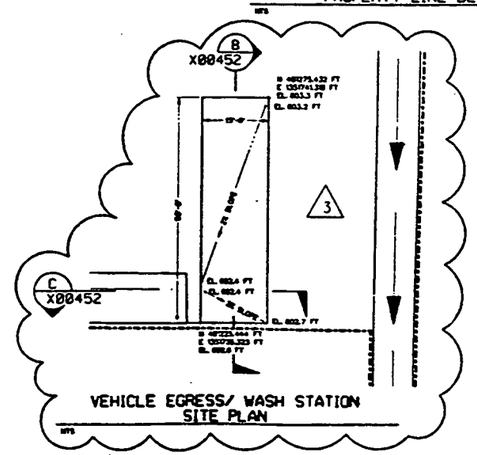
LIMIT OF 6" TOPSOIL REMOVAL ALONG PROPERTY LINE DETAIL



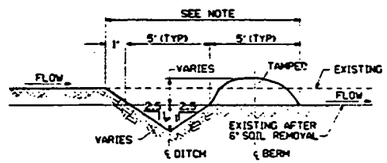
CONSTRUCTION FENCE DETAIL



ELECTRIC TOWER DETAIL

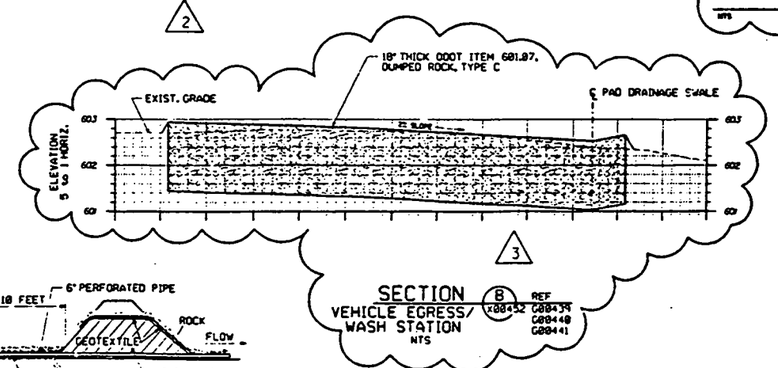


VEHICLE EGRESS/ WASH STATION SITE PLAN

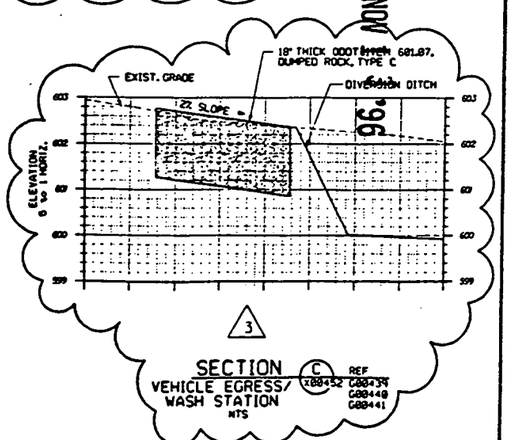


NOTE:
REMOVE 6" TOPSOIL PRIOR TO CONSTRUCTION OF DIVERSION

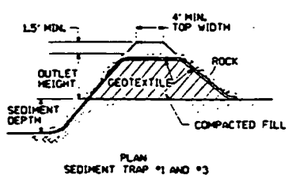
SECTION A DIVERSION NTS — REF X00452 G00439 G00440 G00441

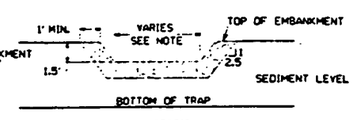


SECTION B VEHICLE EGRESS/ WASH STATION NTS — REF X00452 G00439 G00440 G00441

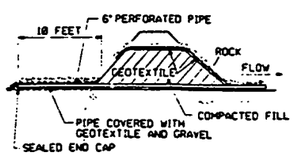


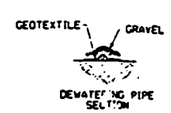
SECTION C VEHICLE EGRESS/ WASH STATION NTS — REF X00452 G00439 G00440 G00441





NOTE:
12" - SEDIMENT TRAP NO. 1
12" - SEDIMENT TRAP NO. 2
8" - SEDIMENT TRAP NO. 3





SEDIMENT TRAP OUTLET STRUCTURE DETAIL

FOR INFORMATION ONLY

000187

NO.	REVISIONS	DATE	DRN. BY	APPD.	NO.	REVISIONS	DATE	DRN. BY	APPD.	REF. DWG. NO.
					3	REVISED VEHICLE EGRESS/ WASH STATION PAD PER DCN 1697-ABM	8-2-96	MET	GEP	
					2	ELECTRIC TOWER DETAIL NO LONGER REQ'D PER DCN-1697-ANS	8-23-96	MET	GEP	
					1	STRAW BALE EROSION CONTROL DETAIL NO LONGER REQ'D PER DCN 1697-ABM	8-28-96	MET	GEP	
					0	ISSUED CERTIFIED FOR CONSTRUCTION	5/30	MET	DJB	

NOTE:
FEMPMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

PERFORMANCE GRADE: 1 2 3 4 5

APPROVALS

CIVIL & STR.	C. WEDMANN	SAFETY ENG.	
ELECTRICAL		QA	
ENGINEER		FEMP PROJECT	
ENVIRONMENT		WASTE MANAGE	
MECHANICAL		SECURITY	
		CRU	
CHECKED	GEP	SOIL REM.	
APPROVED	G.E. PAUL		

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

FEMP — SOIL REMEDIATION
AREA 1 PHASE 1 (EAST) REMEDIAL ACTION PROJECT
DETAIL SHEET 2
PHASE 1 - ACTION 1

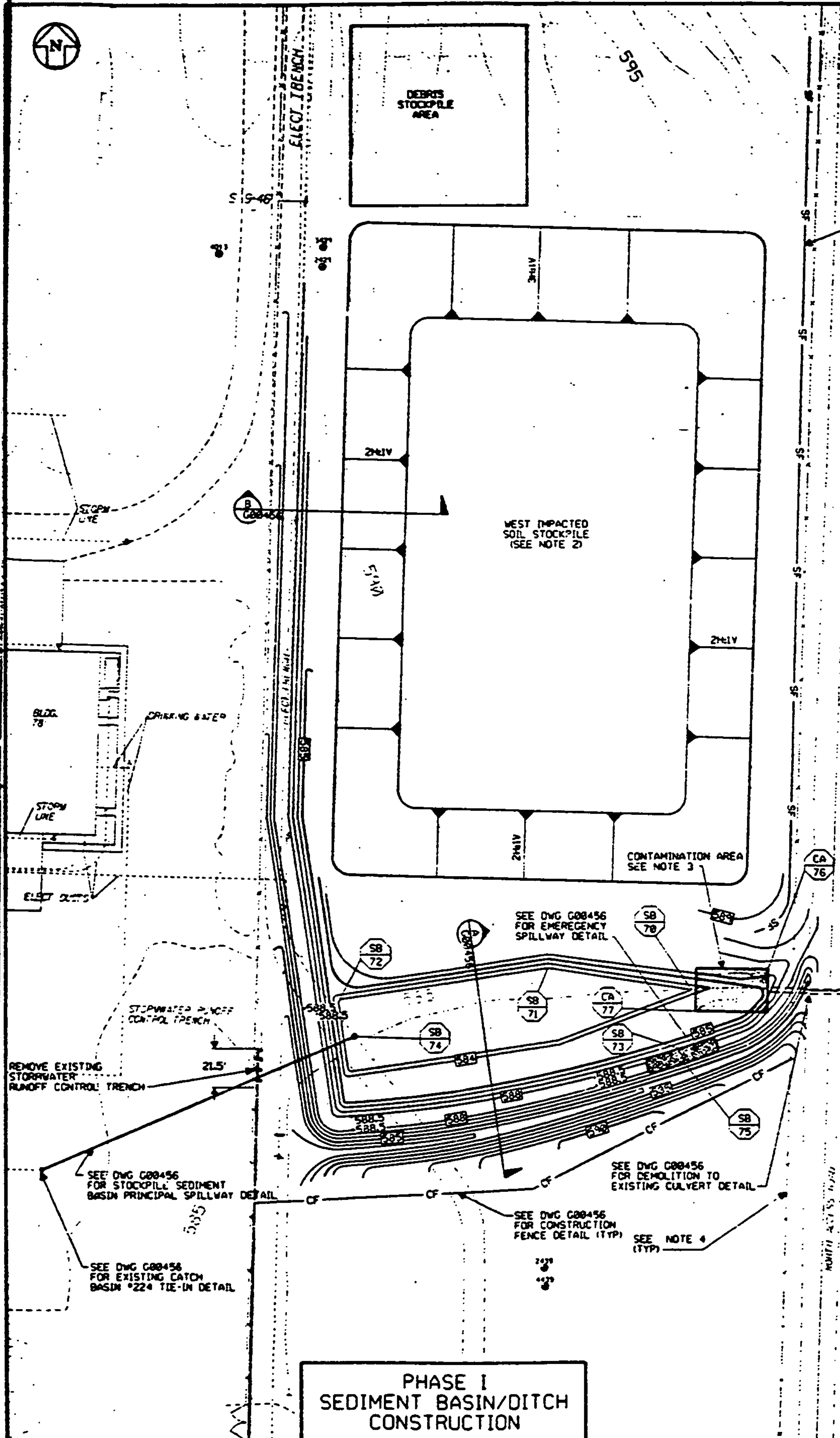
PROJECT No. 20701

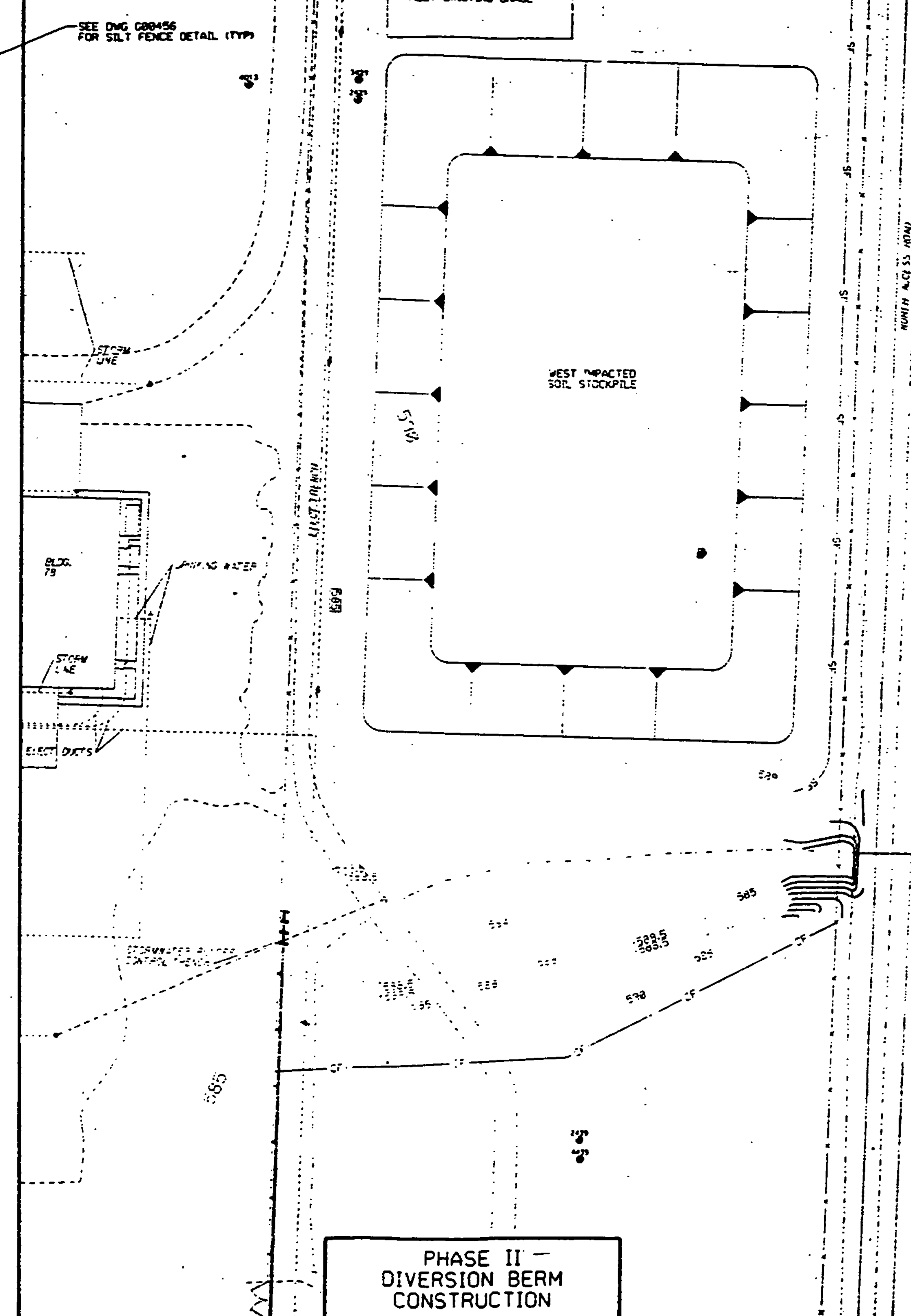
75X-5500-X-00452 | 3

FILE NAME: RES2966/75-0452.DGN

5.1.4

FOR INFORMATION ONLY





COORDINATES AND ELEVATIONS (NAD 83)

POINT	ABBR	NORTHING	EASTING	ELEVATION	DESCRIPTION
70	SB	481278.28	1358813.38	SEE SECTION	SEDIMENT BASIN
71	SB	481298.48	1358732.76	SEE SECTION	SEDIMENT BASIN
72	SB	481272.56	1358807.18	SEE SECTION	SEDIMENT BASIN
73	SB	481245.48	1358688.44	SEE DETAIL	℄ EMERGENCY SPILLWAY
74	SB	481252.37	1358623.68	SEE DETAIL	RISER
75	SB	481237.59	1358889.54	SEE DETAIL	℄ EMERGENCY SPILLWAY
76	CA	481289.73	1358855.56	SEE NOTE 3	CONTAMINATION AREA
77	CA	481266.27	1358815.24	SEE NOTE 3	CONTAMINATION AREA

* = MEET EXISTING GRADE

GENERAL NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.
   EXISTING SITE DATA SOURCE (IN PLANT FILES)

   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
2. FOR THIS PROJECT THE TERM 'IMPACTED MATERIAL' REFERS TO SOIL, DEBRIS, AND OTHER MATERIAL WHICH ARE WITHIN THE SCOPE OF THIS PROJECT.
3. LIMIT OF ABOVE ON SITE DISPOSAL FACILITY WASTE ACCEPTANCE CRITERIA SOIL EXCAVATION. EXCAVATED TO 4' DEPTH MAINTAINING 2H:1V SIDE SLOPES. EXCAVATION COMPLETION SHALL BE APPROVED BY FERMCO CCM PRIOR TO COMPLETION OF BASIN.
4. REMOVE EXISTING FENCE AS NECESSARY TO PERFORM GRADING AND REPLACE IN ACCORDANCE WITH SPECIFICATION 02831.

SYMBOLS LEGEND

EXISTING		PROPOSED
⦿	CATCH BASIN (CB)	
	GRAVEL ROADWAY/DRIVEWAY	
	ASPHALT ROADWAY/DRIVEWAY	
	CONCRETE PAD/ ROADWAY/DRIVEWAY	
	CHAIN LINK FENCE	
	CONSTRUCTION FENCE	—CF——CF—
	CENTERLINE DRAINAGE DITCH	
	RIVER/CREEK	
	FENCE GATE	
	EXISTING BUILDINGS/ TRAILERS	
	SILT FENCE	—SF——SF—

GRADING SYMBOLS

EXISTING		PROPOSED
	CONTOUR - MINOR	583
585	CONTOUR - MAJOR	585
·583.5	SPOT ELEVATIONS	·583.5
(TOE)	SLOPE INDICATOR	(TOE)

DESIGNATES CUTTING PLANE OF SECTION
SECTION IDENTIFICATION
A / G00001
DRAWING NUMBER WHERE SECTION IS DRAWN
DESIGNATES ABBREVIATIONS FOR DESCRIPTION
EXL / 3
COORDINATE POINT

NOTE:

ABBREVIATED DRAWING NUMBERS WILL BE USED FOR ALL SECTIONS, DETAILS, ELEVATIONS, AND WITHIN NOTES AND CALL OUTS IN THE BODY OF THE DRAWING.

FOR EXAMPLE: 95X-5900-G-00002 = DRAWING NUMBER
G00002 = ABBREVIATED DRAWING NUMBER

DIMENSIONING:

DIMENSIONS AND/OR ELEVATIONS MARKED THUS (+/-) SHALL BE VERIFIED IN THE FIELD BY SUBCONTRACTOR.

USE DIMENSIONS AS SHOWN, DO NOT SCALE.

NTS (NOT TO SCALE) IS SHOWN ONLY WHERE DIMENSION IS OBVIOUSLY OUT OF SCALE.

EDC CONTROLLED CERTIFIED

000188

GRAPHIC SCALE: 1"=30'

NO.	REVISIONS	DATE	DWN. BY	APPD

NO.	REVISIONS	DATE	DWN. BY	APPD.	REF. DWG. NO.
0	ISSUED CERTIFIED FOR CONSTRUCTION	6/19	JP		75X-5500-G-00456

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

PERFORMANCE GRADE 1 2 3 ④ 5

APPROVALS: CIVIL & STR., ELECTRICAL, ENGINEER, INSTRUMENT, MECHANICAL, SAFETY ENG, MAINTENANCE, Q.A., FIRE PROJECT, WASTE MANAGE, SECURITY, CRU, SOIL REM, CHECKED, APPROVED

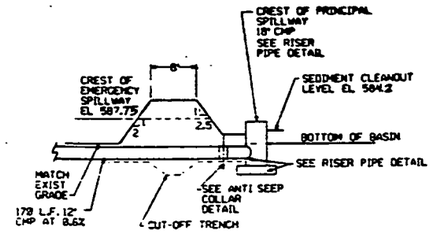
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

FEMP SOIL REMEDIATION
AREA 1 PHASE 1 (WEST) REMEDIAL ACTION PROJECT
SITE PLAN
SCALE: 1" = 30'-0"

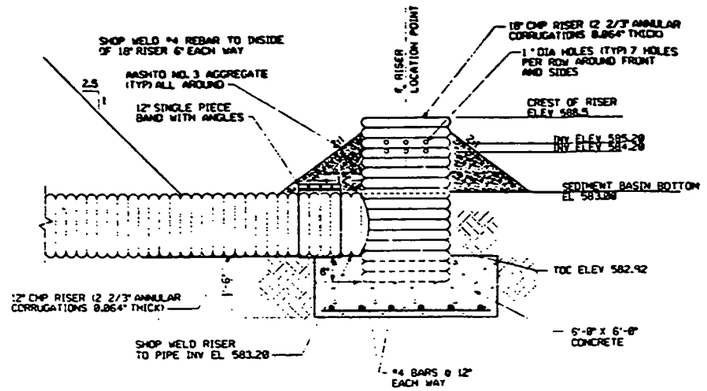
DRAWN J. PARSONS

75X-5900-G-00455 | 0

DO NOT SCALE REDUCED DRAWING

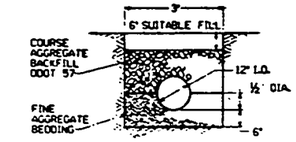


STOCKPILE SEDIMENT BASIN PRINCIPAL SPILLWAY DETAIL
NTS

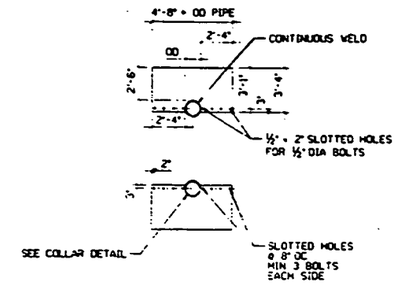


SIDE VIEW

RISER PIPE DETAIL
NTS



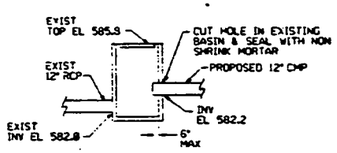
BARREL INSTALLATION DETAIL
NTS



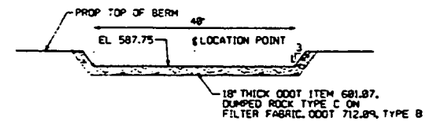
NOTE:

THE LAP BETWEEN THE PIPE AND COLLAR SHALL BE CAULKED WITH AN ASPHALTIC MASTIC AT TIME OF INSTALLATION.

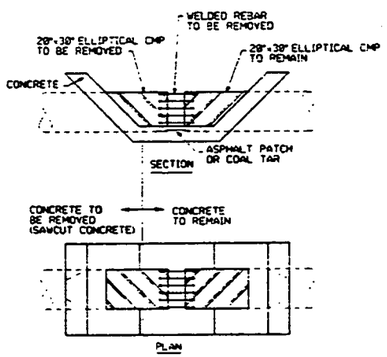
ANTI SEEP COLLAR
NTS



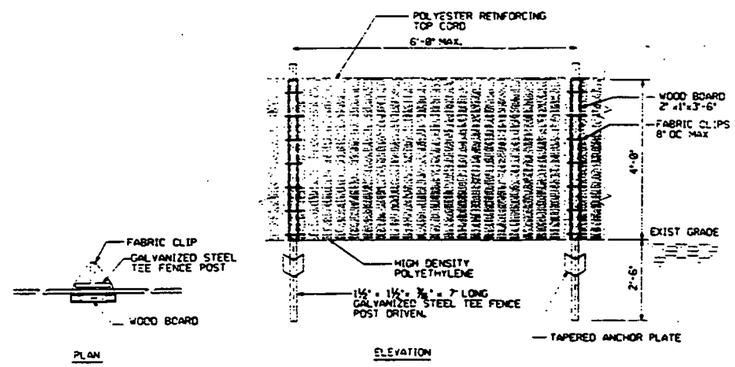
EXISTING CATCH BASIN #224 TIE-IN DETAIL
NTS



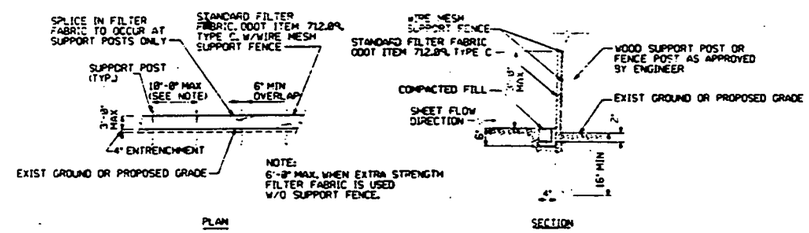
EMERGENCY SPILLWAY DETAIL
NTS



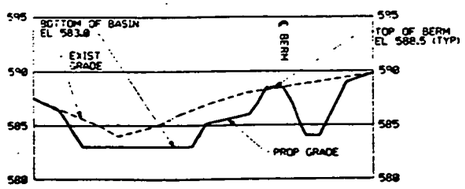
DEMOLITION TO EXISTING CULVERT DETAIL
NTS



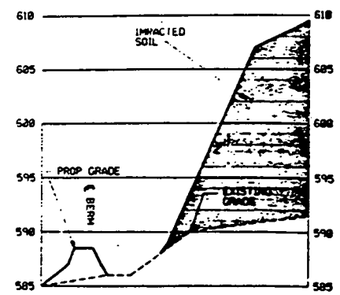
CONSTRUCTION FENCE DETAIL
NTS



SILT FENCE DETAIL
NTS



SECTION (A) REF C08456 C08455
SCALE: HOR 1"=20' VER 1"=5'



SECTION (B) REF C08456 C08455
SCALE: HOR 1"=20' VER 1"=5'

EDC CONTROLLED CERTIFIED

FOR INFORMATION ONLY

000189

NO.	REVISIONS	DATE	DWN	B	APPD
2	ISSUED CERTIFIED FOR CONSTRUCTION	6/96	JP	DJB	

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

PERFORMANCE GRADE 1 2 3 4 5

APPROVALS: CIVIL & STR, ELECTRICAL, PIPING, INSTRUMENT, MECHANICAL, CHECKED, APPROVED

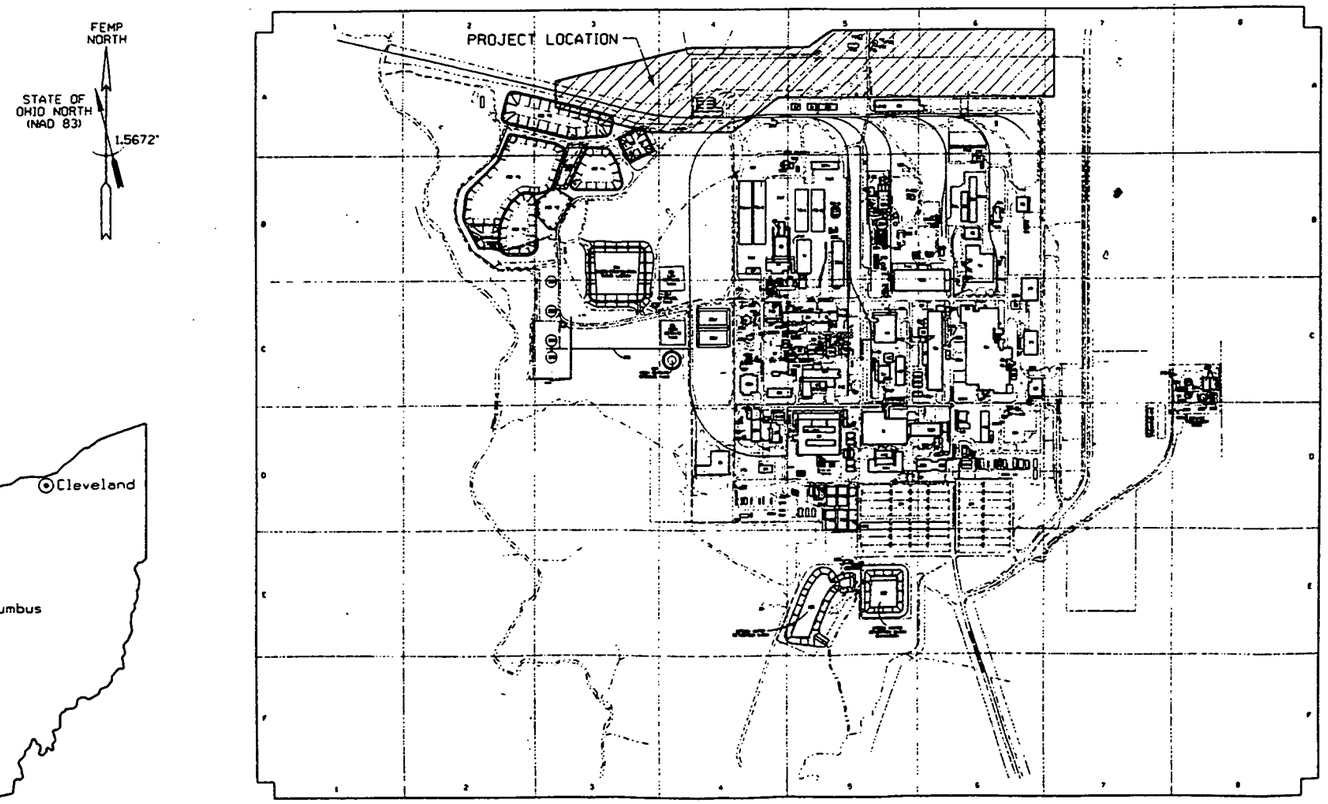
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

FEMP AREA 1 PHASE 1 REMEDIAL ACTION DETAIL SHEET NO.

UNITED STATES DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE
PROJECT ORDER 167



PARSONS

The Ralph M. Parsons Company • Parsons Main, Inc. • Engineering-Science, Inc.

ARCHITECTS - ENGINEERS
CINCINNATI, OHIO

NOTES

REF DWG NO.	DRAWING TITLE
91X-5900-X-00306	DRAWING INDEX

FOR INFORMATION ONLY

REV NO	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DWP
0	CERTIFIED FOR CONSTRUCTION		N/A	5/30/96

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE

DRAWING TITLE 000190
PROJECT TITLE SHEET

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. LINDGREN	02/27/96		5/30/96	K. GERARD	5/30/96

PLANT/BLDG NO	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERNCO CRU APPROVAL	FERNCO PROJECT NUMBER
Kathryn W. Rudel	N/A	10200

A-E DATE 5/30/96

A-E PROJECT NO	TOP PROJECT NO	DRAWING INDEX CODE NO	SHEET NO	REV NO
	WBS 1.1.1.1.1.3.1 00-90701	91X-5900-X-00305	X0001	0

PREPARED UNDER PARSONS PROJECT ORDER NUMBER
WPRAP/PO167

INDEX OF DRAWINGS

INDEX CODE NO.	DRAWING NO.	SHEET NO.	REVISION NO.	DRAWING TITLE	REMARKS
	91X-5900-X-00305	X0001	0	PROJECT TITLE SHEET	
	91X-5900-X-00306	X0002	0	DRAWING INDEX	
	91X-5900-X-00307	X0003	0	LEGEND AND SYMBOLS	
	91X-5900-G-00232	G0001	0	CIVIL - GRADING AND DRAINAGE - MASTER SITE PLAN	
	91X-5900-G-00233	G0002	0	CIVIL - GRADING AND DRAINAGE PLAN - SHEET 1 OF 3	
	91X-5900-G-00234	G0003	0	CIVIL - GRADING AND DRAINAGE PLAN - SHEET 2 OF 3	
	91X-5900-G-00235	G0004	0	CIVIL - GRADING AND DRAINAGE PLAN - SHEET 3 OF 3	
	91X-5900-G-00237	G0005	0	CIVIL - DETAILS - SHEET 1 OF 2	
	91X-5900-G-00238	G0006	0	CIVIL - DETAILS - SHEET 2 OF 2	
	91X-5900-G-00239	G0007	0	CIVIL - DETAILS AND SECTIONS	
	91X-5900-G-00240	G0008	0	CIVIL - STORM DRAIN PROFILES	

NOTES

FOR INFORMATION ONLY

REV NO	TITLE OR REVISION PURPOSE DESCRIPTION	A/E	FERNCO	DATE
0	CERTIFIED FOR CONSTRUCTION		N/A	5/30/96

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE

DRAWING TITLE
DRAWING INDEX 000191

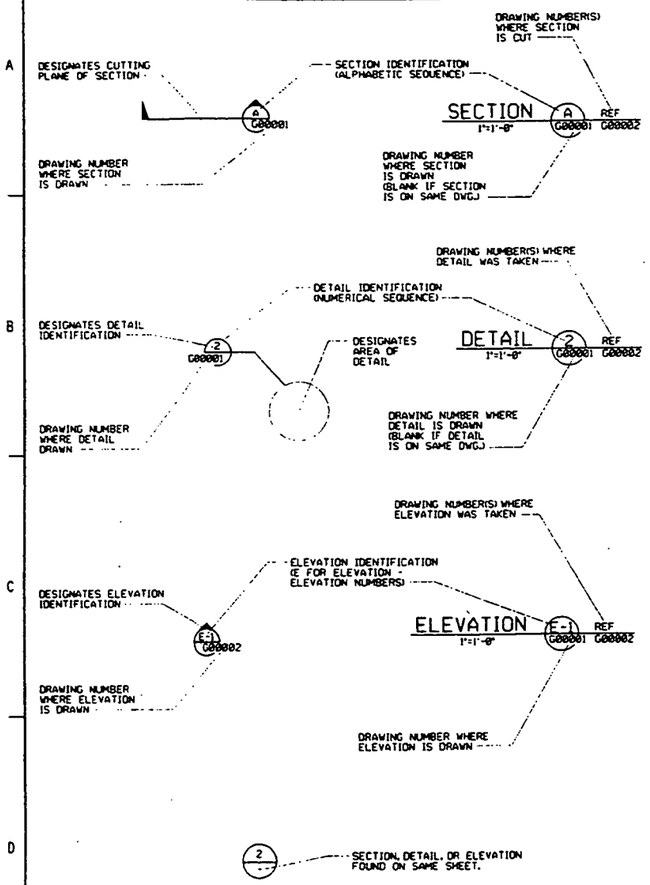
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. LINDGREN	02/27/96			K. GERARD	04/19/96

PLANT/BLDG NO	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERNCO CRU APPROVAL	FERNCO PROJECT NUMBER
Kathryn W. Riedel	N/A	10200

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	A/E PROJECT NO	FEMP PROJECT NO	DRAWING NUMBER (CODE NO)	SHEET NO	REV NO
WPRAP/P0167		WBS 1.1.1.1.1.31 00-90701	91X-5900-X-00306	X0002	0

GENERAL LEGEND



NOTE:

ABBREVIATED DRAWING NUMBERS WILL BE USED FOR ALL SECTIONS, DETAILS, ELEVATIONS, AND WITHIN NOTES AND CALL OUTS IN THE BODY OF THE DRAWING.

FOR EXAMPLE: 95X-5900-G-00002 = DRAWING NUMBER
G00002 = ABBREVIATED DRAWING NUMBER

DIMENSIONING:

DIMENSIONS AND/OR ELEVATIONS MARKED THUS (+/-) SHALL BE VERIFIED IN THE FIELD BY CONTRACTOR.

USE DIMENSIONS AS SHOWN, DO NOT SCALE.

NTS (NOT TO SCALE) IS SHOWN ONLY WHERE DIMENSION IS OBVIOUSLY OUT OF SCALE.

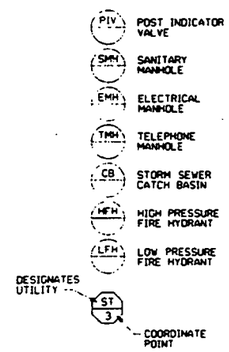
FUTURE / UNDER CONSTRUCTION

CONTOUR - MAJOR & MINOR
UTILITIES
BUILDING/TRAILER/PAD
ROADWAY/SIDEWALK

UTILITY SYMBOLS

EXISTING		PROPOSED
ST	STORM SEWER	ST
SN	SANITARY SEWER	SN
FG	FUEL GAS	FG
DW	DRINKING WATER	DW
FOI	FIRE PROTECTION	FOI
LS	LIVE STEAM	LS
WS	WATER SUPPLY	WS
WR	COOLING WATER RETURN	WR
TW	PROCESS WATER	TW
CE	CONTAMINATE WATER	CE
FT	FILTRATE OR EFFLUENT	FT
DF	DEIONIZED FEED	DF
PW	DEIONIZED WATER	PW
BR	BRINE	BR
RW	RAW WATER	RW
A	ALARM	A
CN	STEAM CONDENSATE	CN
VE	VENT LINES	VE
SD	SUB-SURFACE DRAINAGE	SD
SL	SUMP LIQUOR	SL
E	ELECTRICAL	E
OE	OVERHEAD ELECTRICAL	OE
T	TELEPHONE	T
G	ELECTRIC GROUND	G
PA	PLANT AIR	PA
SA	INSTRUMENT AIR SUPPLY	SA
	ABANDONED	

BALLOON LEGEND



GRADING SYMBOLS

EXISTING		PROPOSED
x 584.9	SPOT ELEVATION	x 585.4
584	CONTOUR - MINOR	584
585	CONTOUR - MAJOR	585
(TOE)	SLOPE INDICATOR	(TOE)

SYMBOLS LEGEND

EXISTING		PROPOSED
	POST INDICATOR VALVE (PIV)	
	FIRE HYDRANT (FH)	
	MANHOLE (MH)	S OR D
	CATCH BASIN (CB)	D
	LIGHT POLE	
	PIPE SUPPORT	
	ELECTRICAL MANHOLE	E
	TELEPHONE MANHOLE	T
	STREET WASHERS	
	VALVE BOX	
1313	MONITORING WELL	
	SURFACE DRAINAGE FLOW	
	POWER POLE	
	GRAVEL ROADWAY/DRIVEWAY	
	ASPHALT ROADWAY/DRIVEWAY	
	CONCRETE PAD/ ROADWAY/DRIVEWAY	
	BUILDING/TRAILER	
	RAILROAD TRACK	
	OU BOUNDARY	
	FENCE	
	TREE LINE	
	DECIDUOUS TREE	
	CONIFEROUS TREE	
	CENTERLINE DRAINAGE DITCH	
	RIVER/CREEK	
	TO BE REMOVED	
	SILT FENCE	
	ELECTRICAL TRANSFORMER	T
	TRANSMISSION TOWER	
	HEADWALL	OR
BM	BENCH MARK	
	CONSTRUCTION/WIND BARRIER FENCE	
	SIGN	
	BOLLARD/GUARD POST	
PB	ELECTRICAL PULL BOX	
	SURVEY CONTROL POINT	
	ROAD, DITCH, RAILROAD CENTERLINE OR BASELINE	
	BEND	OR
	TEE	
	THRUST BLOCK	
W OR U	UNKNOWN	
	STRAW BALE SILT BARRIER	
	FENCE GATE	
	FLARED END SECTION	

NOTES

ABBREVIATIONS

℄	CENTERLINE
CMP	CORRUGATED METAL PIPE
DWG	DRAWING
EXIST	EXISTING
GALV	GALVANIZED
MIN	MINIMUM
ODOT	OHIO DEPARTMENT OF TRANSPORTATION
PC	POINT OF CURVATURE
PF	½" POINT OF FROG
POE	POINT OF ENDING
PS	POINT OF SWITCH
PT	POINT OF TANGENCY
R	RADIUS OF CURVE
RR	RAILROAD
TK	TRACK
TYP	TYPICAL

REF DWG NO.	DRAWING TITLE
91X-5900-X-00306	DRAWING INDEX

FOR INFORMATION ONLY

REV NO	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
0	CERTIFIED FOR CONSTRUCTION		N/A	5/30/96

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MADI, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE

DRAWING TITLE
LEGEND AND SYMBOLS

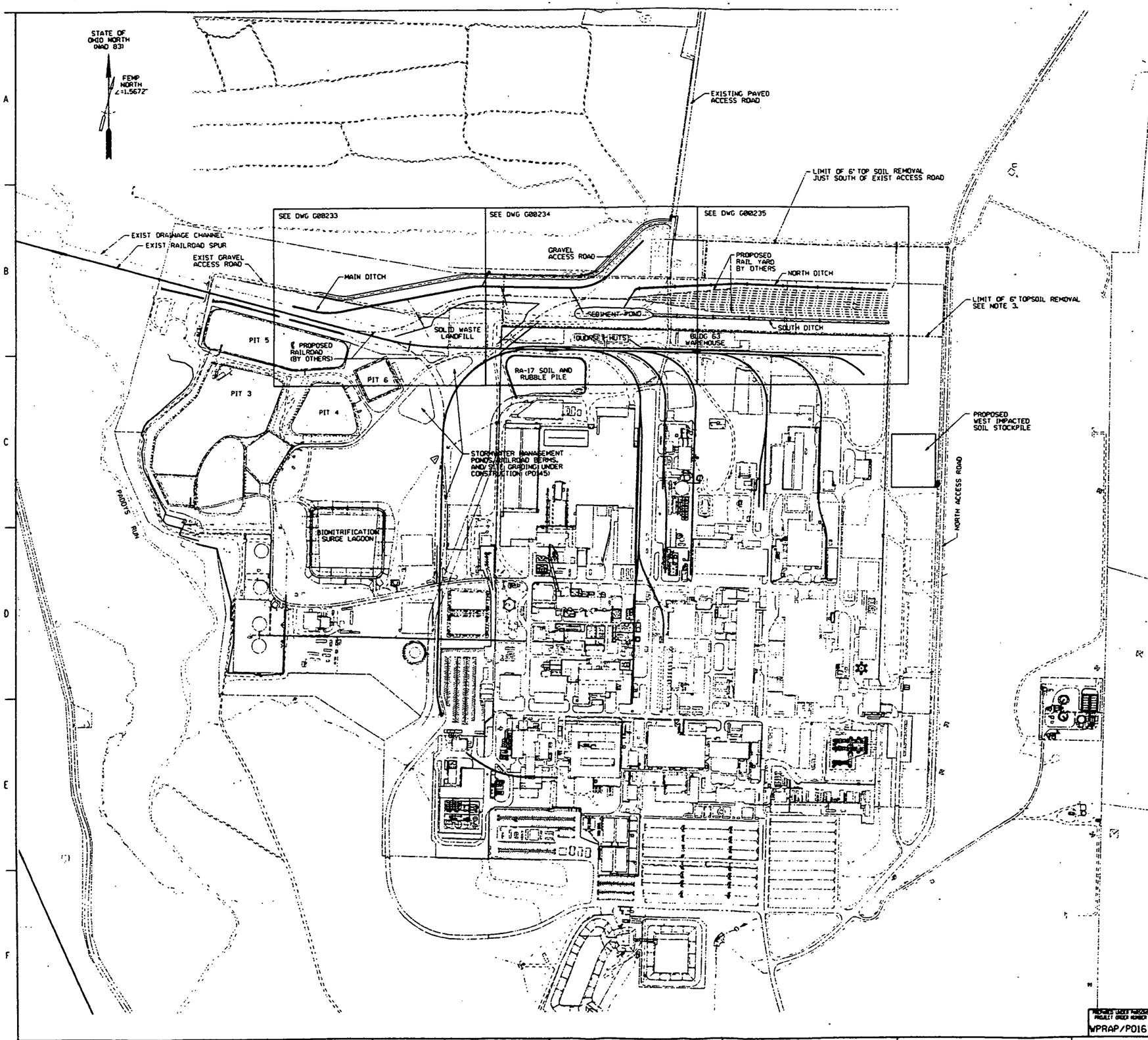
000192

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. LINDGREN	02/27/96		5/30/96	E. GERARD	04/17/96

PLANT/BLDG NO	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERNCO CRD APPROVAL	FERNCO PROJECT NUMBER
Kathryn W. Rudd	N/A	10200

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	LEAD PROJECT NO	FERF PROJECT NO	DRAWING REF. FILE NO.	SHEET NO	REV NO
WPRAP/P0167		WBS 1.1.1.1.3.1 00-90701	91X-5900-X-00307	Y0003	0



NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. THE SEDIMENT BASIN AND THE SOUTH DITCH LEADING TO THE SEDIMENT BASIN SHALL BE EXCAVATED PRIOR TO THE 6" TOP SOIL EXCAVATION. CONTRACTOR IS TO REMOVE ALL SEDIMENT FROM THE SEDIMENT BASIN TO THE PROPOSED GRADE AT THE COMPLETION OF THE CONSTRUCTION ACTIVITIES.

3. THE EXCAVATED 6" TOP SOIL SHALL BE PILED AT THE WEST IMPACTED SOIL STOCKPILE. LIMIT, CONFIGURATION AND SEDIMENT CONTROL MEASURES FOR THE STOCK PILE WILL BE ESTABLISHED BY FERMCO.

4. THE FOLLOWING 8 MONITORING WELLS (4436, 2436, 3423, 2423, 1898, 2037, 3037, 2949) TO REMAIN IN USE. THE 6" TOP SOIL EXCAVATION SHALL BE WORKED AROUND THEM. ALL OTHER WELLS AND BORINGS INSIDE THE PROJECT AREA, SHOWN ON PLANS, ARE EITHER REMOVED OR THEY ARE CURRENTLY BEING REMOVED (BY OTHERS).

REF DWG NO.	DRAWING TITLE
91X-5900-X-00306	DRAWING INDEX
91X-5900-X-00307	LEGEND AND SYMBOLS
91X-5900-G-00233	GRADING AND DRAINAGE PLAN - SHEET 1 OF 3
91X-5900-G-00234	GRADING AND DRAINAGE PLAN - SHEET 2 OF 3
91X-5900-G-00235	GRADING AND DRAINAGE PLAN - SHEET 3 OF 3

FOR INFORMATION ONLY

REV NO	ISSUE OR REVISION PURPOSE - DESCRIPTION				DETAILS AND DATE
0	CERTIFIED FOR CONSTRUCTION		N/A		5/20/96

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE

DRAWING TITLE
CIVIL
GRADING AND DRAINAGE
MASTER SITE PLAN

000193

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. LINDGREN	8/22/96			R. GERARD	8/21/96

PLANT/BLDG NO | FLOOR | SCALE 1"=200' | CLASS

SUBMITTED FOR APPROVAL: Rodney W. Riedel
FERMCO CRU APPROVAL: N/A
FERMCO PROJECT NUMBER: 10200

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO	DATE	FEMP PROJECT NO	DATE	DRAWING REF CODE NO	SHEET NO	REV NO
WPRAP/P0167		5/20/96	WBS 1.1.1.1.1.1 00-90701		91X-5900-G-00232	G0001	0

CENTERLINE ACCESS ROAD (CR)			
POINT	NORTHING	EASTING	DESCRIPTION
1	482414.51	1347363.65	BEGIN ROAD
2	482393.36	1347467.68	PC OF ROAD
3	482392.80	1347544.48	PT OF ROAD
4	482504.64	1348138.51	PC OF ROAD
5	482512.24	1348233.98	PT OF ROAD

ROAD CENTERLINE CURVE DATA				
CURVE	RADIUS	LENGTH	DELTA	TANGENT
1	200.00'	77.35'	22°09'48"	39.17'
2	450.00'	95.87'	12°12'21"	48.11'

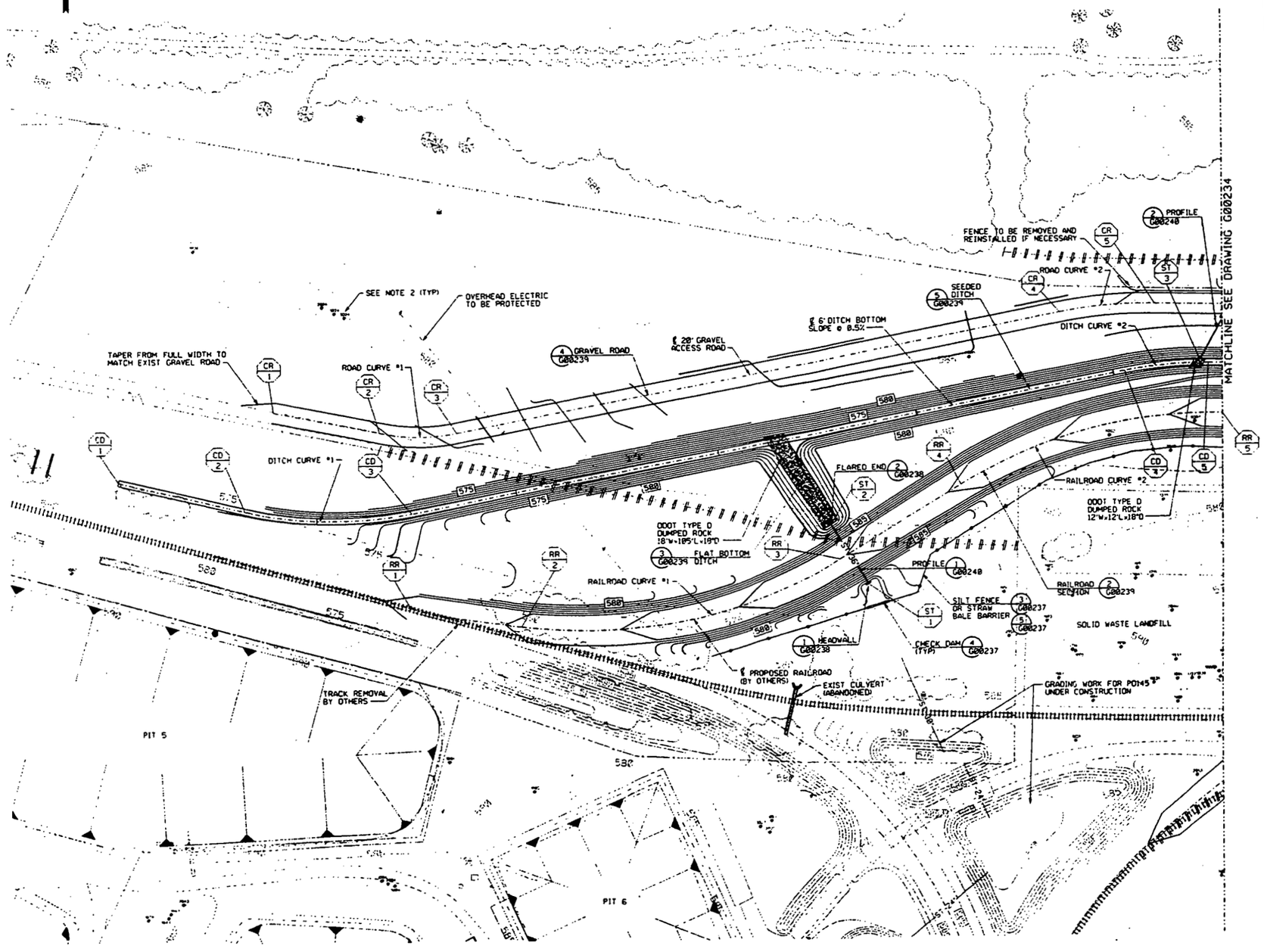
CENTERLINE DITCH COORDINATES (CD)			
POINT	NORTHING	EASTING	DESCRIPTION
1	482346.80	1347209.20	BEGIN DITCH
2	482317.63	1347333.69	PC OF DITCH
3	482314.00	1347498.95	PT OF DITCH
4	482446.74	1348203.89	PC OF DITCH
5	482453.53	1348287.45	PT OF DITCH

DITCH CENTERLINE CURVE DATA				
CURVE	RADIUS	LENGTH	DELTA	TANGENT
1	400.00'	166.48'	23°51'06"	84.47'
2	400.00'	83.98'	12°01'52"	42.15'

CENTERLINE RAILROAD COORDINATES (RR)			
POINT	NORTHING	EASTING	DESCRIPTION
1	482221.37	1347497.49	PS N. LEG WYE
2	482282.18	1347607.85	PC OF CURVE 1
3	482265.20	1347919.51	PT OF CURVE 1
4	482336.54	1348038.81	PC OF CURVE 2
5	482404.85	1348301.81	PT OF CURVE 2

RAILROAD CENTERLINE CURVE DATA				
CURVE	RADIUS	LENGTH	DELTA	TANGENT
1	478.34'	324.39'	38°55'34.59"	169.84'
2	478.34'	273.99'	32°52'45.64"	141.14'

STORM SEWER COORDINATES (ST)			
POINT	NORTHING	EASTING	DESCRIPTION
1	482248.56	1347947.35	HEADWALL
2	482298.96	1347910.53	FLARED END
3	482456.64	1348279.23	END PIPE



NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. FOR MONITORING WELLS SEE NOTE 4 ON DWG G00232.

FOR INFORMATION ONLY

REF DWG NO.	DRAWING TITLE
91X-5900-X-00386	DRAWING INDEX
91X-5900-X-00387	LEGEND AND SYMBOLS
91X-5900-G-00232	GRADING AND DRAINAGE - MASTER SITE PLAN
91X-5900-G-00234	GRADING AND DRAINAGE PLAN - SHEET 2 OF 3
91X-5900-G-00237	DETAILS - SHEET 1 OF 2
91X-5900-G-00238	DETAILS - SHEET 2 OF 2
91X-5900-G-00239	DETAILS AND SECTIONS
91X-5900-G-00240	STORM DRAIN PROFILES

REV NO	ISSUE OF REVISION PURPOSE - DESCRIPTION	A E	PRINCIPAL	DATE
0	CERTIFIED FOR CONSTRUCTION		N/A	5/30/96

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE

DRAWING TITLE
CIVIL **000194**
GRADING AND DRAINAGE PLAN
SHEET 1 OF 3

DRAWN BY	DATE	LEAD CHECKED	DATE	CHECKED BY	DATE
R. LINDGREN	03/21/96		5/30/96	R. GERARD	04/19/96

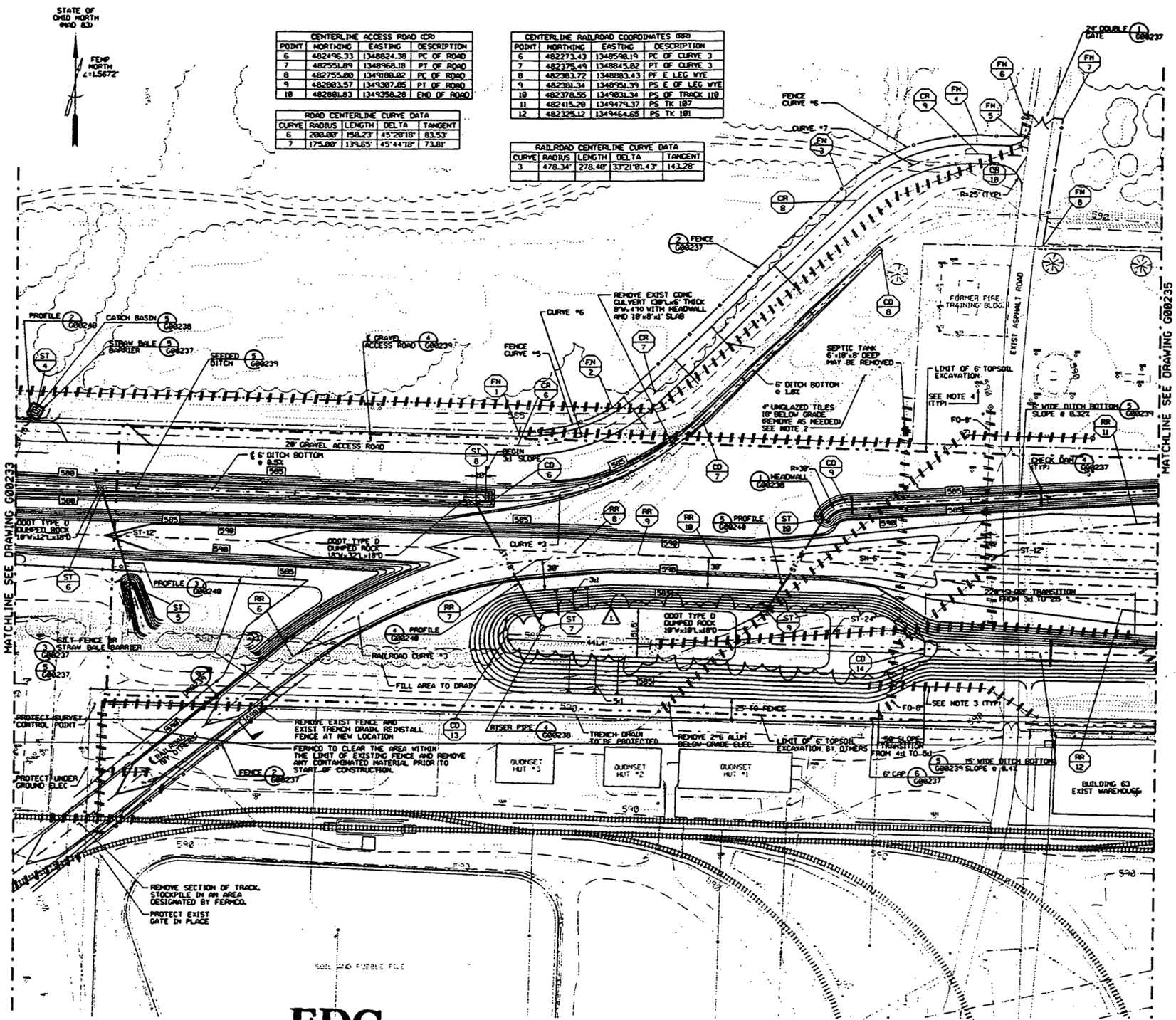
PLANT/BLDG NO	FLOOR	SCALE	CLASS
		1"=40'	

SUBMITTED FOR APPROVAL	FEMPCO CNV APPROVAL	FERNALD PROJECT NUMBER
	N/A	10200

DOE PROJECT NO	DATE	FEMP PROJECT NO	DRAWING REF/ PROP NO	SHEET NO	REV NO
		WBS LLLLLL.LL 00-90701	91X-5900-G-00233	G0002	0

PREPARED UNDER FEMPCO PROJECT ORDER NUMBER
WPRAP/P0167

R91g00234.m po167@ws412. Tue Jul 9 15:30:26 CDT 1996



CENTERLINE ACCESS ROAD (CR)			
POINT	NORTHING	EASTING	DESCRIPTION
6	482496.33	1348824.38	PC OF ROAD
7	482551.89	1348968.18	PT OF ROAD
8	482755.00	1349188.02	PC OF ROAD
9	482883.57	1349307.05	PT OF ROAD
10	482881.83	1349358.26	END OF ROAD

ROAD CENTERLINE CURVE DATA				
CURVE	RADIUS	LENGTH	DELTA	TANGENT
6	200.00'	158.23'	45°28'18"	83.53'
7	175.00'	139.65'	45°44'18"	73.81'

CENTERLINE RAILROAD COORDINATES (RR)			
POINT	NORTHING	EASTING	DESCRIPTION
6	482273.43	1348598.19	PC OF CURVE 3
7	482375.49	1348845.82	PT OF CURVE 3
8	482383.72	1348883.43	PF E LEG WYE
9	482381.34	1348951.39	PS E OF LEG WYE
10	482378.55	1349031.34	PS OF TRACK 110
11	482415.20	1349479.37	PS TK 107
12	482325.12	1349464.65	PS TK 101

RAILROAD CENTERLINE CURVE DATA				
CURVE	RADIUS	LENGTH	DELTA	TANGENT
3	478.34'	278.40'	33°21'01.43"	143.28'

NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. DISPOSE OF ALL SANITARY WASTES IN THE FIELD PIPES IN A PROPER MANNER AS APPROVED BY FERNCO.

3. ALL UTILITIES, UTILITY STRUCTURES, FENCES AND CONCRETE CURB SHALL BE REMOVED AS INDICATED ON THE DRAWING.

4. FOR MONITORING WELLS SEE NOTE 4 ON DRAWING 91X-5900-G-00232.

STORM SEWER COORDINATES (ST)			
POINT	NORTHING	EASTING	DESCRIPTION
4	482531.28	1348321.11	CATCH BASIN
5	482348.13	1348421.34	END PIPE
6	482448.02	1348393.53	END PIPE
7	482384.35	1348852.04	RISER PIPE
8	482438.55	1348784.78	HEADWALL
9	482323.75	1349089.02	END PIPE
10	482428.55	1349149.24	HEADWALL PC CURVE

CENTERLINE DITCH COORDINATES (CD)			
POINT	NORTHING	EASTING	DESCRIPTION
6	482441.23	1348882.98	PC
7	482524.60	1349017.78	PT
8	482784.94	1349285.82	END DITCH
9	482434.68	1349173.27	PT
13	482297.86	1348815.18	END SEDIMENT POND
14	482283.53	1349256.37	END DITCH

DITCH CENTERLINE CURVE DATA				
CURVE	RADIUS	LENGTH	DELTA	TANGENT
3	300.00'	236.46'	45°09'53"	124.77'
4	125.00'	99.51'	45°37'36"	52.58'

FENCE COORDINATES (FN)			
POINT	NORTHING	EASTING	DESCRIPTION
1	482511 ±	1348825 ±	TIE TO EXIST
2	482536.78	1348923.53	CORNER
3	482768.82	1349165.54	CORNER
4	482823.60	1349386.39	CORNER
5	482822.06	1349351.18	CORNER
6	482845.97	1349354.62	CORNER
7	482848.00	1349396.00	CORNER
8	482787.72	1349376.93	CORNER

FENCE CURVE DATA				
CURVE	RADIUS	LENGTH	DELTA	
5	185.00'			
6	195.00'			

REF DWG NO.	DRAWING TITLE
91X-5900-X-00386	DRAWING INDEX
91X-5900-X-00387	LEGEND AND SYMBOLS
91X-5900-G-00232	GRADING AND DRAINAGE - MASTER SITE PLAN
91X-5900-G-00233	GRADING AND DRAINAGE PLAN - SHEET 1 OF 3
91X-5900-G-00235	GRADING AND DRAINAGE PLAN - SHEET 3 OF 3
91X-5900-G-00237	DETAILS - SHEET 1 OF 2
91X-5900-G-00238	DETAILS - SHEET 2 OF 2
91X-5900-G-00239	DETAILS AND SECTIONS
91X-5900-G-00240	STORM DRAIN PROFILES

FOR INFORMATION ONLY

REV. NO.	REASON FOR REVISION - DESCRIPTION	PREPARED	REVIEWED	DATE
1	ADDED POND DIMENSIONS		N/A	
0	CERTIFIED FOR CONSTRUCTION	KR	N/A	5/30/96

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS H&M, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE

DRAWING TITLE
CIVIL
GRADING AND DRAINAGE PLAN
SHEET 2 OF 3

000195

DRAWN BY	DATE	LEAD DESIGNER	DATE	CHECKED BY	DATE
R. LINDORCH	10/21/95	ED J. KUBISH	5/30/96	K. GENARO	06/17/96

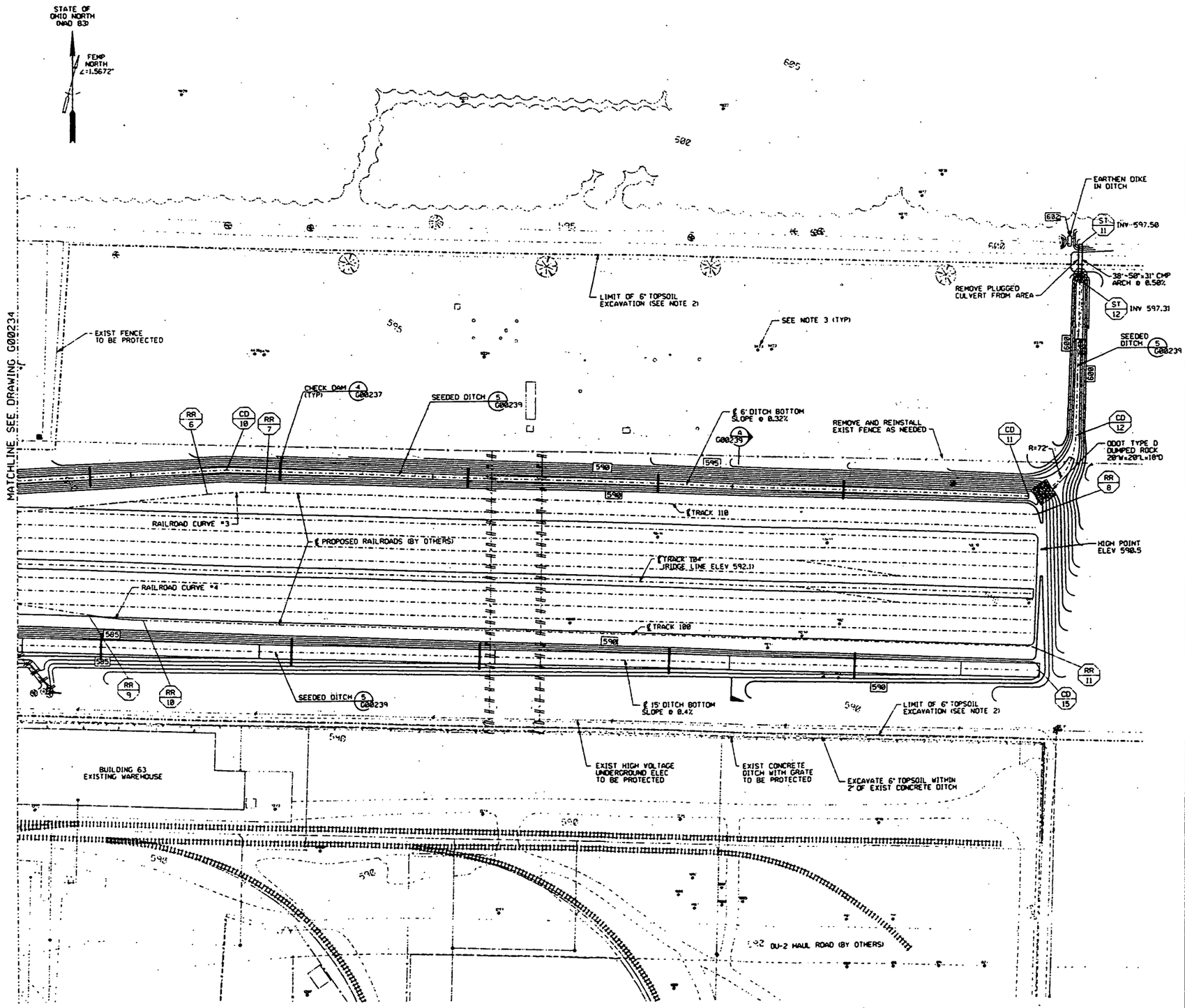
PORTRAIT NO.	FILENAME	SCALE	CLASS
		1"=40'	

SUBMITTED FOR APPROVAL	FERNCO CHIEF ENGINEER	FERNCO PROJECT NUMBER
KATHIE RIEDEL	N/A	10200

DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING PREFIX CODE NO.	SHEET NO.	REV. NO.
	WBS 1.1.1.1.3.1 00-90701	91X-5900-G-00234	G0003	1

WPRAP/PO167

EDC CONTROLLED CERTIFIED



NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. FOR OVERALL LIMITS OF 6" TOPSOIL EXCAVATION AND LIMITS OF NEW FENCING SEE DRAWING 91X-5900-C-00232.

3. FOR MONITORING WELLS SEE NOTE 4 ON DWG G00232.

STORM SEWER COORDINATES (ST)			
POINT	NORTHING	EASTING	DESCRIPTION
11	482694.36	1350635.40	END PIPE
12	482656.36	1350634.42	END PIPE

CENTERLINE DITCH COORDINATES (CD)			
POINT	NORTHING	EASTING	DESCRIPTION
10	482461.23	1349723.03	ANGLE IN DITCH
11	482427.89	1350578.61	BEGIN DITCH
12	482491.79	1350638.19	PC
15	482242.58	1350590.32	BEGIN DITCH

CENTERLINE RAILROAD COORDINATES (RR)			
POINT	NORTHING	EASTING	DESCRIPTION
6	482435.40	1349703.38	PC OF CURVE 5
7	482437.05	1349763.84	PT OF CURVE 5
8	482488.28	1350586.48	POE TK 110
9	482387.23	1349575.62	PC OF CURVE 6
10	482381.43	1349635.84	PT OF CURVE 6
11	482268.36	1350581.68	POE TK 100

RAILROAD CENTERLINE CURVE DATA				
CURVE	RADIUS	LENGTH	DELTA	TANGENT
3	478.34'	59.61'	7°09'10.00"	29.90'
4	478.34'	59.61'	7°09'10.00"	29.90'

REF DWG NO.	DRAWING TITLE
91X-5900-X-00306	DRAWING INDEX
91X-5900-X-00307	LEGEND AND SYMBOLS
91X-5900-G-00232	GRADING AND DRAINAGE - MASTER SITE PLAN
91X-5900-G-00234	GRADING AND DRAINAGE PLAN - SHEET 2 OF 3
91X-5900-G-00237	DETAILS - SHEET 1 OF 2
91X-5900-G-00239	DETAILS AND SECTIONS

FOR INFORMATION ONLY

REV NO.	ISSUE OR REVISION PURPOSE DESCRIPTION	A-E	CHECKED	DATE
0	CERTIFIED FOR CONSTRUCTION		N/A	5/30/96

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. · PARSONS, MAIN, INC. ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE

DRAWING TITLE
CIVIL
GRADING AND DRAINAGE PLAN
SHEET 3 OF 3

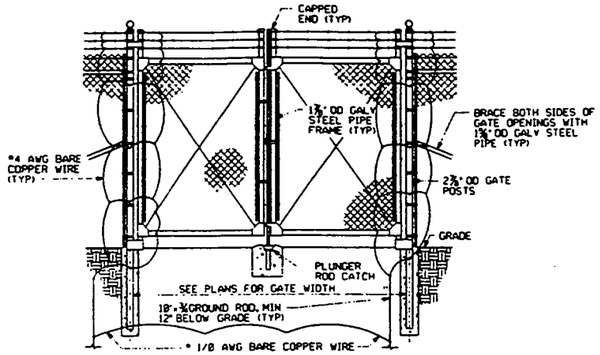
000196

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. L. DIDDEN	03/21/96	[signature]	5/30/96	K. GERARD	04/19/96

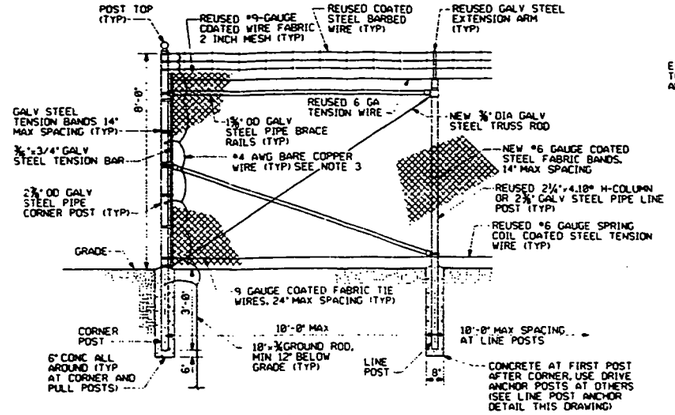
PLANT/BLDG NO	FLOOR	SCALE	PLANS
		1"=40'	

SUBMITTED FOR APPROVAL	FERNCO CRU APPROVAL	FERNCO PROJECT NUMBER
Kathryn W Rudel DATE 5/30/96	N/A	10200

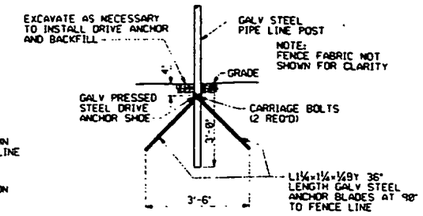
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO	FEMP PROJECT NO	DRAWING REF. CODE NO	SHEET NO	REV NO
WPRAP/P0167		WBS 1.1.1.1.1.3.1 00-90701	91X-5900-G-00235	00004	0



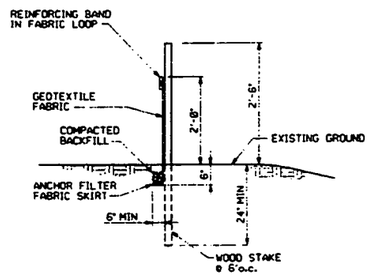
DOUBLE GATE DETAIL (1) REF G00237 G00234
NTS



DETAIL (2) REF G00237 G00234 G00235
NTS

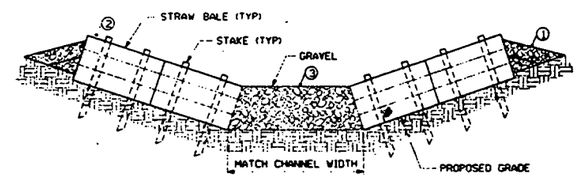


LINE POST DRIVE ANCHOR DETAIL
NTS



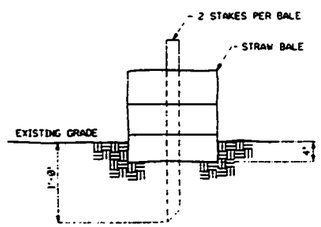
NOTES:
1. OVERLAP FABRIC AT JOINTS TO PREVENT LEAKAGE OF SILT AT SEAM.
2. SUB-CONTRACTOR MAY IN GENERAL USE EITHER SEDIMENT FENCE OR STRAW BALES INTERCHANGEBLY FOR SEDIMENT CONTROL WHERE INDICATED ON THE DRAWING.
3. SILT FENCE TO BE SEMILLAR TO AMOCO 2125.

TEMPORARY SILT FENCE DETAIL (3) REF G00237 G00233 G00234
NTS



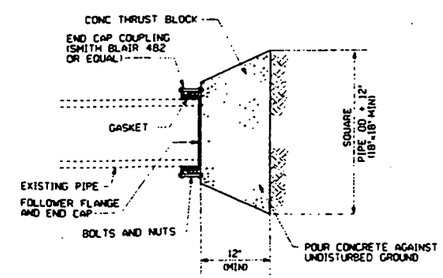
1. ODOT ITEM 304 STABILIZED CRUSHED AGGREGATE (2-6" COURSES) ON FILTER FABRIC, ODOT ITEM 712.09, TYPE D.
2. INSTALL STRAW BALE WHERE SHOWN ON DRAWINGS.
3. GRAVEL TO BE ODOT ITEM 601.07, TYPE D DUMPED ROCK, TOP WIDTH TO BE SAME AS STRAW BALES.

CHECK DAM DETAIL (4) REF G00237 G00233 G00234 G00235
NTS



NOTE:
1. STRAW BALES TO BE USED WHEN NATURAL GROUND IS LEVEL OR SLOPING AWAY FROM PROJECT.
2. PLACE STRAW BALES APPROXIMATELY PARALLEL TO BOTTOM OF FILL SLOPE AND AROUND THE CATCH BASINS INLETS.
3. STRAW BALES SHALL BE STANDARD SIZE 18"x18"x48".
4. FOR EROSION CONTROL MAINTENANCE SEE SPECIFICATIONS.

STRAW BALE BARRIER (5) REF G00237 G00233 G00234
NTS



END CAP (6) REF G00237 G00234
NTS

NOTE:
CONTRACTOR TO FIELD MEASURE EXIST PIPE OD BEFORE ORDERING CORRECT SIZE OF END CAP COUPLING.

NOTES

1. CONCRETE SHALL HAVE A MINIMUM 28 DAY STRENGTH OF 3000 PSI UNLESS NOTED OTHERWISE.

REF DWG NO.	DRAWING TITLE
91X-5900-X-00306	DRAWING INDEX
91X-5900-X-00307	LEGEND AND SYMBOLS
91X-5900-G-00233	GRADING AND DRAINAGE PLAN - SHEET 1 OF 3
91X-5900-G-00234	GRADING AND DRAINAGE PLAN - SHEET 2 OF 3
91X-5900-G-00235	GRADING AND DRAINAGE PLAN - SHEET 3 OF 3

FOR INFORMATION ONLY

REV NO	ISSUE OR REVISION PURPOSE DESCRIPTION	A-E	FERNCO	DATE
0	CERTIFIED FOR CONSTRUCTION		N/A	5/30/96

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. · PARSONS MAIN INC. · ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE

DRAWING TITLE
CIVIL DETAILS
SHEET 1 OF 2

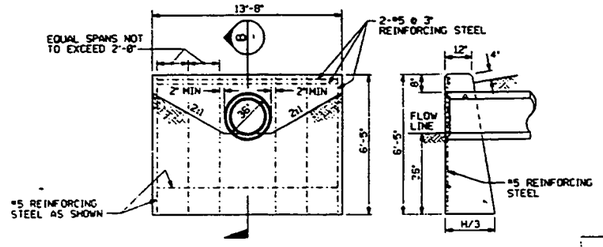
000197

DRAWN BY	DATE	LEAD DRAFTER	DATE	CHECKED BY	DATE
R. LINDGREN	04/02/96			F. GERARD	4/28/96

PLANT/BLDG NO	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERNCO CRU APPROVAL	FERNCO PROJECT NUMBER
Kathryn W Redd	N/A	10200

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO	TEMP PROJECT NO	DRAWING INDEX CODE NO	SHEET NO	REV NO
WPRAP/P0167		WBS 1.1.1.1.1.3.1 00-90701	91X-5900-G-00237	G0005	0



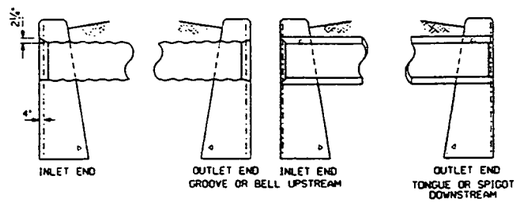
ELEVATION
NTS

SECTION B
NTS

DIMENSIONS		
DIAMETER	H	L
24"	5'-11"	11'-0"
36"	7'-0"	16'-4"

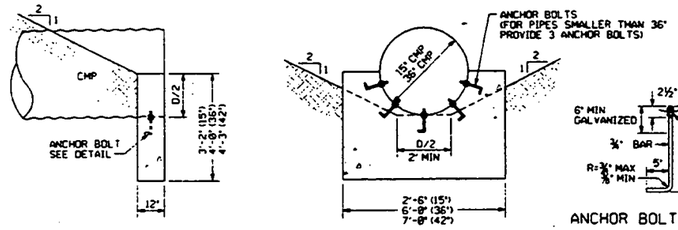
NOTES

1. CONCRETE SHALL BE ODOT CLASS "C". REINFORCING STEEL SHALL BE #5 AS SHOWN.
2. CHAMFER ALL EXPOSED CORNERS ¾ OF AN INCH.

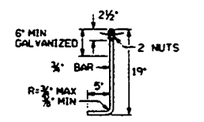


END TREATMENT AT HEADWALL

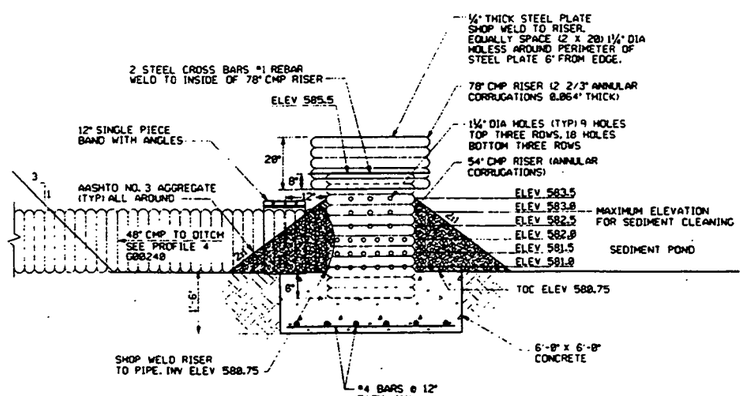
HEADWALL DETAIL 1 REF G00238 G00233 G00234 G00240
NTS



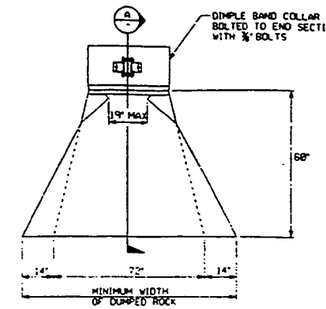
ENDWALL DETAIL 3 REF G00238 G00233 G00234
NTS



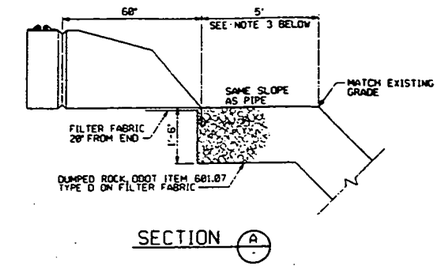
ANCHOR BOLT DETAIL



RISER PIPE DETAIL 4 REF G00238 G00234
NTS



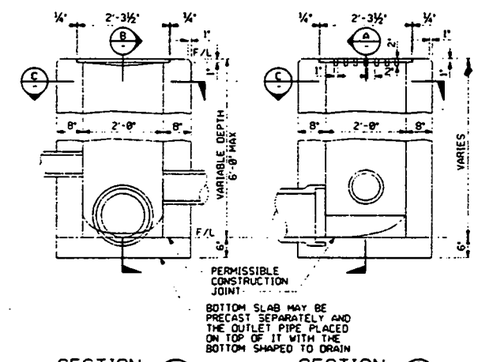
PLAN



SECTION A

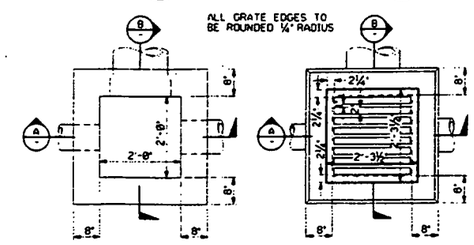
FLARED END DETAIL 2 REF G00238 G00233
NTS

1. INSTALL PER MANUFACTURER'S INSTRUCTIONS.
2. MATERIAL TO BE GALVANIZED STEEL.
3. LENGTH OF DUMPED ROCK IS 5' UNLESS NOTED OTHERWISE ON GRADING AND DRAINAGE PLANS



SECTION A
NTS

SECTION B
NTS



SECTION C
NTS

PLAN VIEW

ODOT 2-2B CATCH BASIN 5 REF G00238 G00234
NTS

NOTES:

1. LOCATION AND ELEVATION WHEN GIVEN ON THE PLANS OR PROFILE IS TOP CENTER OF THE GRATE.
2. GRATING - THE DESIGN SHALL BE ESSENTIALLY THE SAME AND EQUALLY AS STRONG AS THE ONE SHOWN HEREON. WEIGHT OF GRATE, 20 LBS MINIMUM.
3. BRICK, CONCRETE BLOCK OR CAST-IN-PLACE WALLS MAVE A NOMINAL THICKNESS OF 8 INCHES, PRECAST WALLS SHALL MAVE A MINIMUM THICKNESS OF 6 INCHES AND BE REINFORCED SUFFICIEATLY TO PERMIT SHIPPING AND HANDLING WITHOUT DAMAGE.
4. CONCRETE, CAST-IN -PLACE, TO BE CLASS C. ALL PRECAST CONCRETE SHALL MEET THE REQUIREMENTS OF 706.13 WITH 6 +/- 2% AIR VOID CONTENT IN THE HARDEHED CONCRETE AND BE MARKED WITH CATCH BASIN NUMBER.
5. OPENINGS FOR PIPES SHALL BE O.D. +2" WHEN FABRICATED OR FIELD CUT.

NOTES

1. UNLESS OTHERWISE NOTED ALL MATERIALS SHALL CONFORM TO THE STATE OF OHIO DEPARTMENT OF TRANSPORTATION (ODOT) CONSTRUCTION AND MATERIAL SPECIFICATIONS DATED JANUARY 1, 1995.
2. CONCRETE SHALL MAVE A MINIMUM 28 DAY STRENGTH OF 3000 PSI UNLESS NOTED OTHERWISE.

REF DWG NO.	DRAWING TITLE
91X-5900-X-00386	DRAWING INDEX
91X-5900-X-00387	LEGEND AND SYMBOLS
91X-5900-G-00233	GRADING AND DRAINAGE PLAN - SHEET 1 OF 3
91X-5900-G-00234	GRADING AND DRAINAGE PLAN - SHEET 2 OF 3
91X-5900-G-00240	STORM DRAIN PROFILE

FOR INFORMATION ONLY

REV NO	ISSUE OR REVISION PURPOSE DESCRIPTION	A-E	PRINCIPAL	DATE
0	CERTIFIED FOR CONSTRUCTION		N/A	5/30/96

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. · PARSONS MAIN, INC. · ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE

DRAWING TITLE
CIVIL DETAILS SHEET 2 OF 2

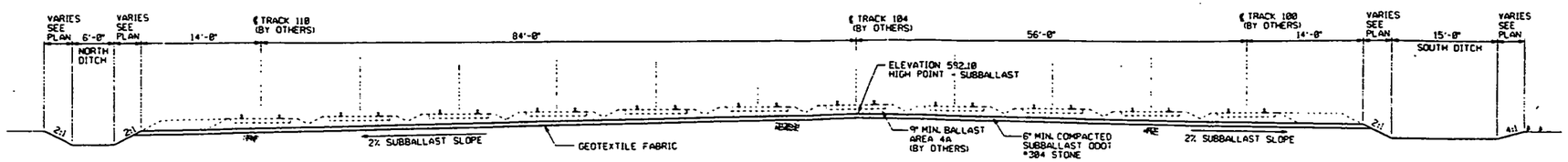
000198

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. LINDGREN	10/28/95	[signature]	5/30/96	K. GERARD	4/28/96

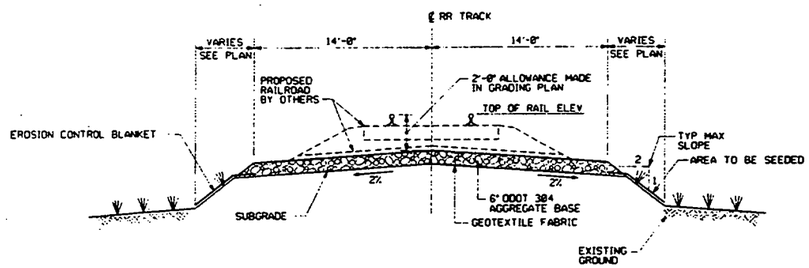
PLANT	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERNALD CRU APPROVAL	FERNALD PROJECT NUMBER
Kathryn W. Rudel	N/A	10200

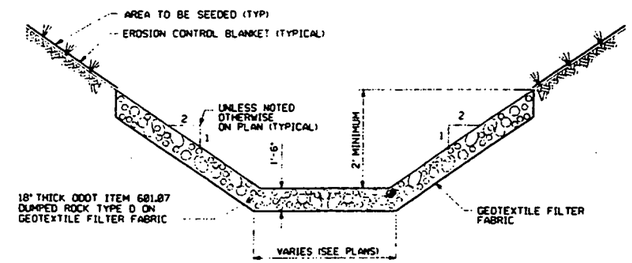
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	CCR PROJECT NO	TOP PROJECT NO	DRAWING INDEX CODE NO	SHEET NO	REV NO
WPRAP/P0167		WBS 1.1.1.1.1.3.1 00-90701	91X-5900-G-00238	G0006	0



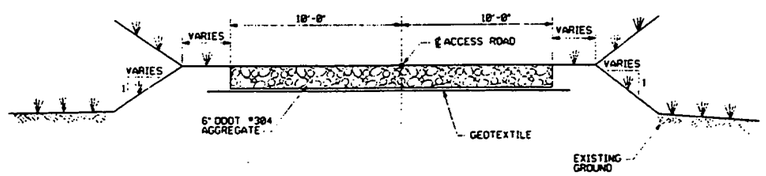
SECTION (A) REF G00239 G00235
RAILROAD YARD
NTS



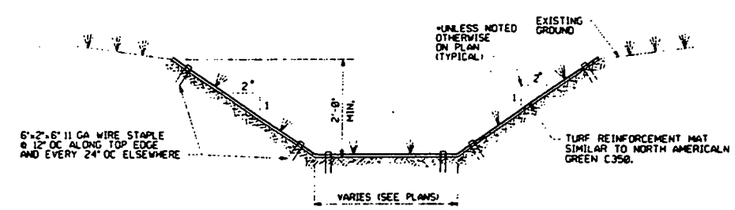
SECTION (B) REF G00239 G00233 G00234
RAILROAD SINGLE TRACK
NTS



FLAT BOTTOM DITCH DETAIL (3) REF G00239 G00233 G00234 G00235
NTS



GRAVEL ACCESS ROAD DETAIL (4) REF G00239 G00233 G00234
NTS



NOTE:
1. FOR DITCH INVERT ELEVATION SEE PLANS

SEEDED DITCH DETAIL (5) REF G00239 G00233 G00234 G00235
NTS

NOTES

REF DWG NO.	DRAWING TITLE
91X-5900-X-00306	DRAWING INDEX
91X-5900-X-00307	LEGEND AND SYMBOLS
91X-5900-G-00233	GRADING AND DRAINAGE PLAN - SHEET 1 OF 3
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91X-5900-G-00235	GRADING AND DRAINAGE PLAN - SHEET 3 OF 3

FOR INFORMATION ONLY

REV NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A.F.	FERMCO	DATE
0	CERTIFIED FOR CONSTRUCTION		N/A	5/30/96

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

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PARSONS
THE RALPH M. PARSONS CO. · PARSONS MAIN, INC. · ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE

DRAWING TITLE
CIVIL
DETAILS AND SECTIONS

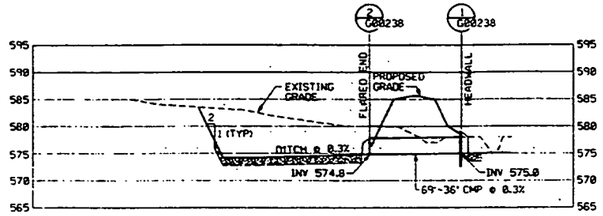
000199

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. LINDGREN	03/28/96	[signature]	5/30/96	R. GERARD	4/28/96

PLANT/BLDG NO	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	FERMCO PROJECT NUMBER
Kathryn W Rudd	N/A	10200

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO	FEMP PROJECT NO	DRAWING INDEX CODE NO	SHEET NO	REV NO
WPRAP/P0167		WBS 1.1.1.1.3.1 00-90701	91X-5900-G-00239	G0007	0



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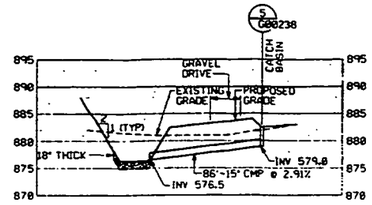

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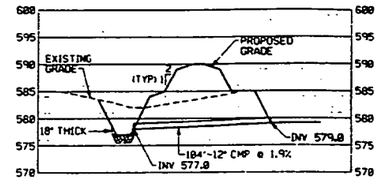

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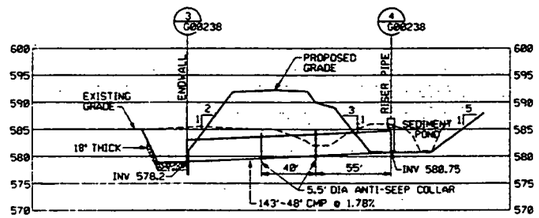

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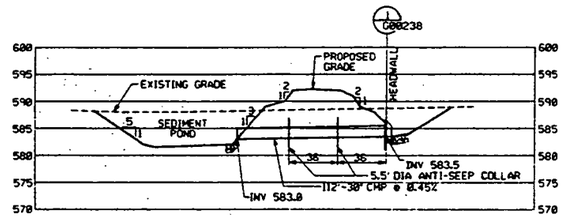

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NOTES

REF DWG NO.	DRAWING TITLE
91X-5900-X-00306	DRAWING INDEX
91X-5900-X-00307	LEGEND AND SYMBOLS
91X-5900-G-00233	GRADING AND DRAINAGE PLAN - SHEET 1 OF 3
91X-5900-G-00234	GRADING AND DRAINAGE PLAN - SHEET 2 OF 3
91X-5900-G-00238	DETAILS - SHEET 2 OF 2

FOR INFORMATION ONLY

REV NO	ISSUE OR REVISION PURPOSE DESCRIPTION	A-E	PERFORM	DATE
B	CERTIFIED FOR CONSTRUCTION		N/A	5/30/96

DETAILS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
SITE RAIL SYSTEM IMPROVEMENTS
GRADING AND DRAINAGE PACKAGE

DRAWING TITLE
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STORM DRAIN PROFILES

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PLANT/BLDG NO	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	PERFORM ON APPROVAL	PERMIT PROJECT NUMBER
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APPENDIX B

APPENDIX B
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED REQUIREMENTS FOR THE AREA 1, PHASE I WORK PLAN

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LIST OF ACRONYMS

ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
BAT	best available technology
CAMU	corrective action management unit
CEDE	committed effective dose equivalent
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
CWA	Clean Water Act
DCG	derived concentration guide
DOE	U. S. Department of Energy
EPA	U. S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FHBM	flood hazard boundary map
FIRM	flood insurance rate map
FRL	free release level
HWMU	hazardous waste management unit
LDR	land disposal restriction
MCL	maximum concentration limit [under RCRA]
mrem	millirem
MTR	minimum technology requirements
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NWP	Nationwide Permit [Program]
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency

LIST OF ACRONYMS (Continued)

ORC	Ohio Revised Code
OSWER	Office of Solid Waste and Emergency Response (EPA)
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi	picocurie
ppb	parts per billion
ppm	parts per million
RAWP	remedial action work plan
RCRA	Resource Conservation and Recovery Act
RD	remedial design
ROD	record of decision
SHPO	State Historic Preservation Office
TBC	to be considered
TSCA	Toxic Substances Control Act
UST	underground storage tank
VOC	volatile organic compound

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED REQUIREMENTS FOR SOIL REMEDIATION

The tables in this appendix identify the subset of chemical-, location-, and action-specific applicable or relevant and appropriate requirements (ARARs) selected for the Area 1, Phase I remedial action from the full set of ARARS listed for the selected remedy in Appendix B of the Operable Unit 5 Record of Decision (ROD). Section 3 describes the justification for defining the subset of ARARs that are provided in this appendix.

Tables B-1, B-2 and B-3 identify the regulations that are ARARs or to be considered (TBC) criteria for the expected Operable Unit 5 remedial activities at the FEMP, including: 1) an explanation of what the requirement is about, 2) identification as an ARAR or TBC, and 3) why it is an ARAR or TBC. Note that the requirement column in these tables provides only a summary; the regulation, statute, or Federal Register citation listed should be consulted for a full description of the requirement. The column under the heading "ARAR/TBC" indicates the status of the regulation at the FEMP under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The column designated as "Rationale/Compliance" indicates the status of the ARAR for Operable Unit 5 and the cross-reference of how compliance with the ARAR will be achieved for this remedial action work plan (RAWP).

Note to reviewers:

> The appropriate set of Operable Unit 5 ARARs are also intended to accompany the October 1996 submittal of the Site-Wide Excavation Plan. The ARARs presented in that document would support all subsequent remedial design packages. Potential variations of ARARs for individual design packages would be described in each subsequent work plan.

TABLE B-1
CHEMICAL SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
SURFACE WATER			
Discharges of Liquid Waste to Surface Waters			
Ohio Water Quality Standards OAC 3745-1-04	"Five Freedoms" for Surface Water are provided by the State of Ohio: All surface waters of the State shall be free from: • Objectionable suspended solids • Floating debris, oil and scum • Materials that create a nuisance • Toxic, harmful or lethal substances • Nutrients that create nuisance growth	Relevant and Appropriate	OAC 3745-1-04 pertains to both discharges to surface waters of the State as a result of remediation and any on-site surface waters affected by site conditions. Compliance will be met through the National Pollutant Discharge Elimination System (NPDES) permit and the FEMP Stormwater Pollution Prevention Plan.
Use Designation of Surface Water			
Ohio Water Quality Standards OAC 3745-1-21	Paddys Run and the Great Miami River are designated as: • Warm water aquatic life habitat • Agricultural and industrial water supply • Primary contact recreation	Applicable	The Great Miami River between Ross Road [River Mile (RM) 95.7] to Taylorsville Dam (RM 92.6) is a state resource water and RM 130 and 118 are public water supplies. Discharges to the Great Miami River and Paddys Run must not cause a violation of applicable numeric or narrative water quality standards for these designations. Compliance will be met through the NPDES permit and the FEMP Stormwater Pollution Prevention Plan

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
Warm Water Habitat Water Quality Criteria			
Ohio Water Quality Standards OAC 3745-1-07	Surface waters in the State of Ohio must comply with the maximum concentrations of each contaminant listed below for inside and outside the mixing zones of the receiving water to protect warm water aquatic habitats. "Outside Mixing Zone" shall be met after the effluent and the receiving water have been determined to be reasonably well mixed based upon information readily available to the Director. The criteria listed as "Inside Mixing Zone Maximum" shall be applicable as end-of-pipe maximum effluent limits or as criteria to be met within a short distance of the effluent pipe if it can be demonstrated that discharge-induced mixing occurs as per the definition of "area of initial mixing" in rule OAC 3745-1-02.	Applicable	OAC 3745-1-07 is applicable because the site is bordered by the Great Miami River and Paddys Run. Compliance will be met through the NPDES permit and the FEMP Stormwater Pollution Prevention Plan

Parameter (µg/L or as marked)	Outside Mixing Zone Max.	Outside Mixing Zone 30-Day Avg.	Inside Mixing Zone Max.
Antimony (total)	650	190	1,300
Arsenic	360	190	720
Benzene	1,100	560	2,100
Beryllium (total)	520	23	1,000
Bis(2-ethylhexyl) phthalate	1,100	8.4	2,200
Cadmium	5.6	1.4	11
Carbon tetrachloride	1,800	280	3,500
Chlordane	NA	0.01	NA
Chlorobenzene	590	26	1,200
Chromium	1,800	210	3,600
Chloroform	1,800	79	3,600
2-Chlorophenol	200	8.8	400
Copper (total)	18	12	35
Cyanide (free)	46	12	92
1,2-Dichloroethane	12,000	3,500	24,000
Dieldrin	NA	0.005	NA

NA = Not Available

Beryllium is based on a presumed water hardness of 100 mg/L calcium carbonate ($CaCO_3$).

Copper is based on a presumed water hardness of 100 mg/L $CaCO_3$.

Parameter (µg/L or as marked)	Outside Mixing Zone Max.	Outside Mixing Zone 30-Day Avg.	Inside Mixing Zone Max.
Lead (total)	130	6.9	260

Lead is based on a presumed water hardness of 100 mg/L $CaCO_3$.

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement				ARAR/TBC	Rationale/Compliance
	Mercury (total)	1.1	0.2	2.2		
	Methylene chloride	9,700	430	19,000		
	Warm Water Habitat Water Quality Criteria (Continued)					
	Nickel (total)	1,600	170	3,100		Nickel is based on a presumed water hardness of 100 mg/L $CaCO_3$.
	Pentachlorophenol	5.3	3.2	11		
	Polychlorinated Biphenyls (PCBs)	NA	0.001	NA		
	Selenium (total)	20	5.0	40		
	Silver (total)	1.6	1.3	3.2		Silver is based on a presumed water hardness of 100 mg/L $CaCO_3$.
	Tetrachloroethylene 540	73	1,100			
	Trichloroethylene	1,700	75	3,400		
	Thallium (total)	71	16	140		
	Zinc (total)	120	110	230		Zinc is based on a presumed water hardness of 100 mg/L $CaCO_3$.

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
Human Health and Agricultural Water Supply Criteria			
Ohio Water Quality Standards OAC 3745-1-07	See previous requirement for explanation of inside/outside mixing zones. The maximum (outside mixing zone) concentrations for contaminants listed below are based on the designated use of the surface water body as Human Health or Agricultural. Outside Mixing Zone 30-Day Average Parameter (µg/L or as marked) — Human Health — Agricultural Antimony (total) — 4,300 — NA Arsenic — NA — 100 Benzene — 710 — NA Beryllium (total) — 1.17 — 100 beta-BHC — 0.55 — NA Bis(2-ethylhexyl) phthalate — 59 — NA Cadmium — NA — 50 Carbon tetrachloride — 44 — NA Chromium (total) — 3,433,000 — 100 Copper (total) — NA — 500 1,2-Dichloroethane — 990 — NA Dieldrin — 0.00076 — NA Fluoride (mg/L) — NA — 2.0 Lead (total) — NA — 100 Mercury (total) — 0.012 — 10 Nickel (total) — 4,600 — 200 N-Nitrosodi-n-propylamine — 12.4 — NA PCBs — 0.00079 — NA PAHs — 0.31 — NA Selenium (total) — NA — 50 Thallium (total) — 48 — NA Vinyl chloride — 5,250 — NA Zinc Total — NA — 25,000	Applicable	OAC 3745-1-07 is applicable because the site is bordered by the Great Miami River and Paddys Run. Compliance will be met through the NPDES permit and the FEMP Stormwater Pollution Prevention Plan. NA = Not Available

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
Human Health and Agricultural Water Supply Criteria (Continued)			
Management and Control of Radioactive Materials in Liquid Discharges DOE Order 5400.5 Chapter II, (3) Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (3)(a) 10 CFR 834 (PROPOSED)	In addition to the requirements to limit dose to members of the public (on site and off site) in accordance with the standards established in paragraphs II (1)(a) and II (1)(d), further controls are imposed on liquid releases to protect resources such as surface water. Derived concentration guides (DCGs) are not release limits, but rather are screening values for considering best available technology (BAT) for these discharges and for making dose estimates. These requirements apply at the point of discharge from the conduit to the environment (see DCGs in DOE Order 5400.5 Chapter III (3)). The BAT is the prescribed level of treatment for liquid radioactive discharges to surface water that would otherwise contain radioactive concentrations greater than the DCG values. Implementation of the BAT process is not required for waste streams that contain radionuclide concentrations of not more than the DCG values at the point of discharge to a surface waterway. Residual concentrations of radionuclides in water that may be ingested are listed in tabular form in DOE Order 5400.5 Chapter III. The DCGs for the Constituents of Concern (COCs) are based on a committed effective dose equivalent (CEDE) of 100 mrem/yr, assuming ingestion of 2 liters/day. Note that these DCGs apply only if ingestion is the single pathway of exposure.	TBC	DOE Orders are not ARARs because they are not promulgated. This DOE order is a TBC because of the potential to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule. Compliance with this TBC requirement is addressed in the Stormwater Pollution Prevention Plan and Section 4.0 of this RAWP.
DOE Order 5400.5 Chapter II (3)(a)(5) 10 CFR 834 (PROPOSED)	The absorbed dose to native aquatic animal organisms shall not exceed 1 rad per day from exposure to the radioactive material in liquid wastes discharged to natural waterways.	TBC	DOE Orders are not ARARs because they are not promulgated. This DOE Order is a TBC because of the potential to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule. Compliance will be met through the NPDES permit, and as described in Section 6.2 of this RAWP.

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
RADIATION LIMITS			
Dose Limits for Individual Members of the Public			
Ohio General Radiation Protection Standards OAC 3701-38-15 (A)(1),(B) DOE Order 5400.5 Chapter II (1)(a) 10 CFR 834 (PROPOSED)	Operations causing air emissions shall be conducted such that: • The total effective dose equivalent to individual members of the public from the operation does not exceed 0.1 rem (100 mrem) in a year • The dose in any unrestricted area from external sources does not exceed 0.002 rem (2mrem) in any one hour	Relevant and Appropriate	This OAC standard is not applicable because it applies to radiation sources which are not regulated by the U.S. Atomic Energy Act authority. However, this standard is relevant and appropriate because of the potential to result in the exposure to members of the public. NESHAP 40 CFR 61.91 will assure compliance with the first bullet. The second bullet is not found in NESHAP or in DOE Orders. 10 CFR 834 is included as a TBC because it is presently a proposed rule. Fugitive Emission Controls are addressed in Section 4.0 of this RAWP.
Radiation Dose Limit Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter II (1) DOE Order 5400.5, Chapter II (1)(a) DOE Order 5400.5, Chapter II (1)(a)(3) 10 CFR 834 (PROPOSED)	The public dose limits include consideration of all exposure modes from all DOE activities (including remedial activities). The radiation dose limit is the sum of the effective dose equivalent (weighted summation of doses to various organs of the body) from exposures to radiation sources external to the body during the year plus the committed effective dose equivalent from radionuclides taken into the body during the year. Medical sources, consumer products, residual fallout from past nuclear accidents and weapons tests and naturally occurring radiation sources are not included in this summation. The exposure of members of the public to radiation sources as a consequence of all routine DOE activities shall not cause, in a year, an effective dose equivalent of more than 100 mrem for all exposure pathways. If unusual circumstances affect a DOE activity in such a manner that the potential public dose could exceed an effective dose equivalent of 0.1 rem (100 mrem) in a year, DOE may authorize a temporary increase of the dose limit up to 0.5 rem (500 mrem).	TBC	DOE Orders are not ARARs because they are not promulgated. This DOE Order is a TBC because of the potential to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule. Fugitive Emission Controls are addressed in Section 4.0 of this RAWP.

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
Dose Limits for Individual Members of the Public (Continued)			
As Low As Reasonably Achievable (ALARA) DOE Order 5400.5 Chapter II, 2. 10 CFR 834 (PROPOSED)	Field elements shall develop a program and shall require contractors to implement an ALARA process for DOE activities and facilities that have the potential to cause radiation exposure to the public.	TBC	DOE orders are not ARARs because they are not promulgated. This DOE order is a TBC because of the potential to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule. Compliance is met through the approved selected remedy. An ALARA goal is set for the total uranium Free Release Level.
STORAGE OF RADIOACTIVE MATERIAL			
Control of Residual Radioactive Material DOE Order 5400.5 Chapter IV (6)(b) 10 CFR 834 (PROPOSED)	Interim storage must provide: 1) Control and stabilization features shall be designed to provide, to the extent reasonably achievable, an effective life of 50 years with a minimum life of at least 25 years. 2) Controls shall be designed such that radon-222 concentrations in the atmosphere above facility surfaces or openings in addition to background levels, will not exceed: (a) 100 pCi/L at any given point; (b) An annual average concentration of 30 pCi/L over the facility site; and (c) An annual average concentration of 3 pCi/L at or above any location outside the facility site. (d) Flux rates from the storage of radon producing wastes shall not exceed 20 pCi/m^2/sec, as required by 40 CFR Part 61. 3) Controls shall be designed such that concentrations of radionuclides in the groundwater and quantities of residual radioactive material will not exceed applicable federal or state standards. 4) Access to a property and use of on-site material contaminated by residual radioactive material should be controlled through appropriate administrative and physical controls such as those described in 40 CFR Part 192. These control features should be designed to provide, to the extent reasonable, an effective life of at least 25 years.	TBC	The selected remedy will provide for the interim storage of contaminated materials. 10 CFR 834 is included as a TBC because it is presently a proposed rule. Compliance will be addressed as described in Section 4.0 of this RAWP.

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
AIR			
National Emissions Standards for Emissions of Radionuclides Other than Radon From DOE Facilities			
National Emission Standards for Hazardous Air Pollutants 40 CFR 61.190, 61.192 Subpart Q	No source at a DOE facility shall emit more than 20 pCi/m²/sec of radon-222 as an average for the entire source into the air.	Applicable	This requirement is applicable because the FEMP presently and/or will continue to be a storage and disposal facility for radium-bearing material. This requirement explicitly includes the FEMP in its designation of facilities. Fugitive Emission Controls are addressed in Section 4.0 of this RAWP.
National Emission Standards for Hazardous Air Pollutants 40 CFR 61.90, 61.91 and 61.92 - .97 Subpart H	These requirements are applicable to DOE-owned and operated facilities that emit any radionuclides other than radon-222 and radon-220 into the air. Emissions of radionuclides (except radon-220 and radon-222) to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr. To determine compliance with the standard, radionuclide emissions shall be determined and effective dose equivalent values to members of the public calculated using EPA-approved sampling procedures, computer models CAP-88 or AIRDOS-PC, or other procedures for which EPA has granted prior approval.	Applicable	The selected remedy has the potential to release radionuclides to the atmosphere through fugitive dust and/or point source emissions. Fugitive Emission Controls are addressed in Section 4.0 of this RAWP.
Control of Radon Emissions			
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR 192.06 (b) Subpart A 40 CFR 192.32 (b)(1)(ii) Subpart D National Emission Standards for Hazardous Air Pollutants, Radon-222 Emissions 40 CFR 61, Subpart Q	The following standards apply to the: • Control of residual radioactive materials from inactive uranium processing sites. • Management of uranium byproduct materials after closure of a disposal area. • Long-term management of uranium, thorium, and their decay products. Controls shall be designed to provide reasonable assurance that releases of radon-222 from the above materials to the atmosphere will not: • Exceed an average release rate of 20 pCi/m²/sec (averaged over the entire surface of the disposal site and over at least a one-year period). • Increase the annual average concentration of radon-222 in air or above any location outside the disposal site by more than 0.5 pCi/L.	Relevant and Appropriate	Radioactive materials in this operable unit are a result of releases from uranium processing. Contaminated soil and sediment are similar in characteristic to materials addressed by these regulations. Requirements for design of controls for on-property disposal should be consistent with design for control of other residual radioactive materials such as mill tailings. Fugitive Emission Controls are addressed in Section 4.0 of this RAWP.

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
AIR EMISSION STANDARDS			
Lead in Air EPA Regulations on National Primary and Secondary Ambient Air Quality Standards 40 CFR 50.12 Ohio Ambient Air Quality OAC 3745-17-08	Lead and its compounds measured as elemental lead should not exceed 1.5 micrograms per cubic meter, maximum arithmetic mean averaged over a calendar quarter.	Relevant and Appropriate	The federal regulation at 40 CFR 50.12 is relevant and appropriate because it sets a standard for lead in air and lead has been identified as a contaminant of concern at Operable Unit 5. The selected remedy has a potential to release quantities of lead-bearing soil as fugitives during excavation and disposal operations. Additionally, lead could be a contaminant in particulate emissions from point source discharges from sludge dewatering and soil treatment/stabilization. Fugitive Emission Controls are addressed in Section 4.0 of this RAWP.
Definition of Derived Concentration Guides for Radionuclides DOE Order 5400.5 Chapter III 10 CFR 834 (PROPOSED)	The derived concentration guides (DCGs) are provided as reference values for conducting radiological environmental protection programs at operational DOE facilities and sites. • Ingestion of water • Inhalation of air • Immersion in a gaseous cloud The DCG values for internal exposure are based on a committed effective dose equivalent of 100 mrem for the radionuclide taken into the body by ingestion or inhalation during one year. The DCG values account for only three exposure pathways (ingested water <u>or</u> inhaled air <u>or</u> air immersion) and do not include other potentially significant pathways. When more complex environmental pathways are involved, a more complete pathway analysis is required for calculating public radiation doses resulting from the operation of DOE facilities.	TBC	DOE Orders are not ARARs because they are not promulgated. This DOE order is a TBC because of the potential of remedial actions to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule. Fugitive Emission Controls are addressed in Section 4.0 of this RAWP.

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
AIR EMISSION STANDARDS (Continued)			
Derived Concentration Guides for Radionuclides DOE Order 5400.5 Chapter III, 3 10 CFR 834 (PROPOSED)	The DCGs are given for different lung retention classes (noted as D,W, or Y, where D equals a removal half-time of 0.5 days, W equals a removal half-time of 50 days, and Y equals a removal half-time of 500 days). Derived Concentration Guide ISOTOPE µCi/mL — D — W — Y Uranium-235 — 5×10^{12} — 2×10^{12} — 1×10^{13} Uranium-236 — 5×10^{12} — 2×10^{12} — 1×10^{13} Uranium-238 — 5×10^{12} — 2×10^{12} — 1×10^{13} Exposure conditions assume an inhalation rate of 8400 m^3 of air per year (based on an exposure over 24 hours per day, 365 days per year).	TBC	DOE Orders are not ARARs because they are not promulgated. This DOE order is a TBC because of the potential for remedial actions to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule. Fugitive Emission Controls are addressed in Section 4.0 of this RAWP.
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter III 10 CFR 834 (PROPOSED)	Residual concentrations of radionuclides in air in an uncontrolled area are limited to the following (for known mixtures of radionuclides, the sum of the ratios of the observed concentration of each radionuclide to its corresponding limit must not exceed 1.0). Derived Concentration Guide ISOTOPE µCi/mL — D — W — Y Actinium-227 — 2×10^{15} — 7×10^{15} — 1×10^{14} Lead — 9×10^{13} — --- — --- Polonium-210 — 1×10^{12} — 1×10^{12} — --- Protactinium-231 — --- — 9×10^{15} — 1×10^{14} Radium-224 — --- — 4×10^{12} — --- Radium-226 — --- — 1×10^{12} — --- Radium-228 — --- — 3×10^{12} — --- Technetium-99 — 1×10^{8} — 2×10^{9} — --- Strontium-90 — 5×10^{11} — --- — --- Thorium-228 — --- — 5×10^{14} — 4×10^{14} Thorium-230 — --- — 4×10^{14} — 5×10^{14} Thorium-232 — --- — 7×10^{15} — 1×10^{14} Uranium-234 — 4×10^{12} — 2×10^{12} — ---	TBC	DOE Orders are not ARARs because they are not promulgated. This DOE order is a TBC because of the potential for remedial actions to result in exposure to members of the public. 10 CFR 834 is included as a TBC because it is presently a proposed rule. Fugitive Emission Controls are addressed in Section 4.0 of this RAWP.

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
SOIL AND CONTAMINATED MATERIALS			
Cleanup of Soil Contaminated with Residual Radioactive Materials			
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR 192.02 Subpart A 40 CFR 192.12(a) Subpart B 40 CFR 192.20 Subpart C	Remedial actions shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials, the concentration of radium-226 in land averaged over any area of 100 m^2 shall not exceed the background level by more than: • 5 pCi/g averaged over the first 15 cm of soil below the surface, and • 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface. Compliance with this requirement should be shown through measurements performed within the accuracy of currently available types of field and laboratory instruments in conjunction with reasonable survey and sampling procedures.	Relevant and Appropriate	The contaminated materials associated with Operable Unit 5 are similar in characteristics to uranium mill tailings. This regulation is not applicable as the FEMP is not a designated uranium mill tailings facility. This ARAR was considered in the development of the selected remedy (Operable Unit 5 ROD). It is addressed by more stringent clean-up levels for radium-226 of 1.7 pCi/g as opposed to 5.0 pCi/g.
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings 40 CFR 192.21 (f) and 192.22 (b) Subpart C	Where radionuclides other than radium-226 and its decay product are present in sufficient quantity and concentration to constitute a significant radiation hazard from residual radioactive materials, remedial actions shall, in addition to satisfying the standards of 40 CFR 192.02, Subpart A and 192.12, Subpart B (both listed above), reduce other residual radioactivity to levels that are ALARA.	Relevant and Appropriate	Contaminated material associated with Operable Unit 5 are similar in characteristics to uranium mill tailings. This ARAR was considered in the development of the selected remedy (Operable Unit 5 ROD). Compliance of this ARAR is addressed in Section 4.0. Radionuclides other than radium have been assessed for risk and FRLs have been developed for those that have demonstrated risk in excess of conservative criteria.
Postclosure Standards for Uranium and Thorium Mill Tailings 40 CFR 192.32 (b)(2) Subpart D	The requirements for the management of uranium byproduct materials after closure of a disposal area (40 CFR 192.32 (b)(1)) shall not apply to any portion of a disposal site which contains a concentration of radium-226 in land, averaged over areas of 100 m^2, which, as a result of uranium byproduct material, does not exceed the background level by more than: • 5 pCi/g averaged over the first 15 cm of soil below the surface, and • 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface.	Relevant and Appropriate	Contaminated materials associated with Operable Unit 5 are similar in characteristics to uranium mill tailings. This ARAR was considered in the development of the selected remedy (Operable Unit 5 ROD). It is addressed by a more stringent clean-up level of 1.7 PcI/g for total radium, not including background. Averaging areas of in situ detecting equipment are less than the 100 m^2 area. Compliance of this ARAR is addressed in Section 4.0.

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
Cleanup of Soil Contaminated with Residual Radioactive Materials (Continued)			
Management of Thorium Mill Tailings 40 CFR 192.40-192.42 Subpart E	The following are requirements for the management of thorium byproduct materials: • The provisions for the management of uranium byproduct material (40 CFR 192.32) shall apply to thorium byproduct material and: - Provisions applicable to the element uranium shall also apply to the element thorium - Provisions applicable to radon-222 shall also apply to radon-220 - Provisions applicable to radium-226 shall also apply to radium-228 With the concurrence of EPA, alternative provisions may be substituted for any of the above requirements provided the alternative provisions will provide at least an equivalent level of protection for human health and environment.	Relevant and Appropriate	Contaminated material associated with Operable Unit 5 are similar in characteristics to uranium mill tailings. This ARAR was considered in the development of the selected remedy (Operable Unit 5 ROD). Compliance of this ARAR is addressed in Section 4.0.
Hot Spots			
Radiation Protection of the Public and the Environment - Soil Contamination DOE Order 5400.5 Chapter IV (4)(a)(1) 10 CFR 834 (PROPOSED)	If the average residual concentration of radionuclides in any surface soil or below surface area less than or equal to 25 m^2 exceeds the limit or guideline by a factor of $(100/A)^{0.5}$ [where A is the area (in square meters) of the region in which the concentrations are elevated], limits for "hot spots" shall also be developed and applied. Procedures for calculating these hot spots limits, which depend on the extent of the elevated local concentrations, are given in DOE/CH-8901. In addition, reasonable efforts shall be made to remove any source of radionuclide that exceeds 30 times the appropriate limit in the soil, irrespective of the average concentration in the soil.	TBC	The selected remedy involves the excavation of contaminated soil and sediment. DOE Orders provide guidance on addressing contaminated soil and sediment at DOE facilities. DOE Orders are TBCs, rather than ARARs because they are not promulgated. 10 CFR 834 is included as a TBC because it is presently a proposed rule. This ARAR was considered in the development of the selected remedy Operable Unit 5 ROD.
Radiation Protection of the Public and the Environment DOE Order 5400.5 Chapter IV (4)(a)(2)(3) 10 CFR 834 (PROPOSED)	The generic guidelines for residual concentrations of radium-226, radium-228, thorium-230, and thorium-232 are: • 5 pCi/g, averaged over the first 15 cm of soil below the surface; and • 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface. These guidelines take into account ingrowth of radium-226 from thorium-230 and of radium-228 from thorium-232, and assume secular equilibrium. If both thorium-230 and radium-226, or both thorium-232 and radium-228, are present and not in secular equilibrium, the appropriate guideline is applied as a limit for the radionuclide with the higher concentration. If other mixtures of radionuclides occur, the concentrations of individual radionuclides shall be reduced so that either the dose for the mixture will not exceed the basic dose limit or the sum of the ratios of the soil concentration of each radionuclide to the allowable limit for that radionuclide will not exceed 1. Explicit formulas for calculating residual concentrations guidelines for mixtures are given in DOE/CH-8901.	TBC	Radionuclides are COCs for soil within the scope of Operable Unit 5. DOE Orders are TBC rather than ARARs because they are not promulgated. This citation is included as a TBC as it is more restrictive than the federal standard in 40 CFR 192, .02, .12(a), .20, .21(f), .22(b), .32(b)(2), .40-.42. 10 CFR 834 is included as a TBC because it is presently a proposed rule. This requirement was considered in the development of the selected remedy Operable Unit 5 ROD.

TABLE B-1 (Continued)
CHEMICAL-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
Hot Spots (Continued)			
Guidelines for Residual Radioactive Material--Surface contamination DOE Order 5400.5, Chapter IV (4)(d) 10 CFR 834 (PROPOSED)	These generic surface contamination guidelines are applicable to existing structures and equipment. These guidelines are generally consistent with standards of the NRC (1982) and functionally equivalent to Section 4, "Decontamination for Release for Unrestricted Use," of Regulatory Guide 1.86, but apply to nonreactor facilities. These limits apply to both interior equipment and building components that are potentially salvageable or recoverable scrap. If a building is demolished, the guidelines in paragraph IV (6)(a) are applicable to the resulting contamination in the ground.	TBC	These criteria will be used for any process facility building built and/or used for the remedial action, including the AWWT, soil washing, soil staging, etc., structures and buildings. DOE Orders are not ARARs because they are not promulgated. This DOE order is a TBC because of the potential of remedial actions to result in structures and equipment containing residual radioactivity. 10 CFR 834 is included as a TBC because it is presently a proposed rule. Compliance is addressed in Section 4.0.
Lead Soil Cleanup Standards			
Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities OSWER Directive # 9355.4-12	This lead soil guidance states the following: • Screening level of 400 ppm for lead in soil is proposed for residential land use; • Site-specific preliminary remediation goals (PRGs) at CERCLA sites and media cleanup standards (MCLs) at RCRA corrective action facilities for residential land use are described; and • A plan for soil lead cleanup at CERCLA sites and RCRA Corrective Action facilities that have multiple sources of lead is described.	TBC	This policy is not ARAR because it is not a promulgated regulation. This interim directive is a TBC because it establishes an approach for determining protective levels for lead in soil at CERCLA sites and RCRA facilities that are subject to corrective action under RCRA Section 3004(v) or 3008(h). Compliance will be met as addressed in Section 4.0 of this RAWP.
PCB Soil Cleanup Standards			
PCB Spill Cleanup Policy 40 CFR 761.125 40 CFR 761.125 (c)	PCBs at concentration of greater than 50 ppm are subject to Toxic Substances Control Act (TSCA) decontamination requirements in 40 CFR 761.120 (b). Soil in nonrestricted access areas contaminated by a PCB spill will be decontaminated to 10 ppm PCBs by weight, provided that the soil is excavated to a minimum depth of 10 inches. The excavated soil will be replaced with clean soil, i.e., containing less than 1 ppm PCBs, and the spill site will be restored (e.g., replacement of turf) [761.125 (c)(4)(v)]. For soil in restricted access areas, decontamination will be to 25 ppm PCBs by weight [761.125(c)(3)(v)].	TBC	PCBs are a COC in soil for Operable Unit 5. Concentrations of PCBs at Operable Unit 5 are expected to be less than 50 ppm. Although published in the Code of Federal Regulations, this is a policy, not a promulgated rule, and hence a TBC. This TBC is pertinent to all Operable Unit 5 final remediation levels for soil containing PCBs as CERCLA wastes, per the National Oil Pollution and Hazardous Substances Contingency Plan (NCP). Compliance will be met as addressed in Section 4.0 of this RAWP in accordance with the FRL of 0.13 ppm.

TABLE B-2
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
THREATENED & ENDANGERED SPECIES			
HABITAT PROTECTION			
Procedures for Implementing the National Environmental Policy Act 40 CFR 6.302(h) 10 CFR 1021 Endangered Species Act 16 U.S.C. §1531, et seq. Endangered and Threatened Wildlife and Plants 50 CFR 17.21, 17.31, 17.61, 17.71, and 17.94 Interagency Cooperation-Endangered Species Act 50 CFR 402.01	All federal agencies must ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of the constituent elements essential to the conservation of a listed species within a defined critical habitat. Additional requirements apply if it is determined that a proposed activity could adversely affect these species or their habitat.	Applicable	In 1993 and 1994 updated surveys at the FEMP determined the presence of the state-listed Sloan's crayfish (*Orconectes sloanii*) in Paddys Run. Additionally, it was determined that good habitat exists for the federally listed endangered Indiana bat (*Myotis sodalis*) along Paddys Run and the storm sewer outfall ditch. Moderate and marginal habitat exist in a very limited area for the state-listed endangered cave salamander (*Eurycea lucifuga*). Suitable habitat for the state-listed threatened Spring Coral Root (*Corallrhiza Wisteriana*) also exists nearn the western edge of the northern woodlands. Surveys did not locate habitat or populations for the federally listed endangered running buffalo clover (*Trifolium stoloniferum*) or the state-listed endangered mountain bindweed (*Polygonum cilinode*) and slender fingergrass (*Digitaria filiformis*). In addition, neither habitat nor populations of the state-listed threatened spring coralroot (*Corallorhiza wisteriana*) were found on FEMP property. Compliance with this requirement is addressed in the 1993 and 1994 FEMP surveys.
Interagency Cooperation-Endangered Species Act 50 CFR 402.12 (a),(b)	A biological assessment shall evaluate the potential effects of the action on listed and proposed critical habitat and determine whether any such species or habitat are likely to be adversely affected by the action and is used in determining whether formal consultation or a conference is necessary.	Applicable	These procedures are required for federal actions that are "major construction activities." Compliance with this requirement is addressed in the 1993 and 1994 FEMP surveys.

TABLE B-2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
SPECIES PROTECTION			
Ohio Endangered Species Regulations ORC 1531.25	No person shall take or possess any native species of wild animal, or any eggs or offspring thereof, that is endangered with state-wide extinction.	Applicable	Updated surveys in 1993-94 found state-listed threatened Sloan's crayfish (*Orconectes sloanii*) populations in sections of Paddys Run. Moderate habitat for the state-listed endangered cave salamander (*Eurycea lucifuga*) was also determined during a 1993 survey of the FEMP. Compliance with this requirement is addressed in the 1993 and 1994 FEMP surveys.
Ohio Endangered Species Regulations ORC 1518.02 OAC 1501:18-1	No person shall root-up, injure, destroy, remove, or carry away on or from public highways, public property, or waters of the state, or on or from the property of another, without the written permission of the owner, lessee, or other person entitled to possession, any endangered plant listed in OAC 1501:18-1.	Applicable	Surveys in 1994 did not locate the federally listed endangered running buffalo clover (*Trifolium stoloniferum*), the state-listed endangered mountain bindweed (*Polygonum cilinode*) or slender finger grass (*Digitaria filiformis*), or state-listed threatened spring coralroot (*Corallorhiza wisteriana*). Compliance with this requirement is addressed in the 1993 and 1994 FEMP surveys.

HISTORIC AND CULTURAL RESOURCE PROTECTION

ANTIQUITY AND HISTORIC SITE PRESERVATION			
Antiquities Act of 1906 16 U.S.C. §431-433 and Historic Sites Preservation Act 16 U.S.C. §461-467	No person may appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity situated or controlled by the Government of the United States without an applicable permit. Identification and preservation of cultural resources on federal lands is required, including natural landmarks.	Applicable	Proposed areas of disturbance associated with Operable Unit 5 remedial actions will be surveyed and the Advisory Council on Historic Preservation and the State Historic Preservation Office (SHPO) will be consulted as agreed upon in a programmatic agreement with DOE, SHPO, and the Advisory Council. This regulation is applicable to soil excavation.

TABLE B-2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
ARCHAEOLOGICAL RESOURCE RECOVERY AND PRESERVATION			
Procedures for Implementing the National Environmental Policy Act 40 CFR 6.301 (c) Archaeological Resources Protection Act (16 USC § 47099-47011) Protection of Archaeological Resources 43 CFR 7.4(a)	No person may excavate, remove, damage, or otherwise alter or deface or attempt to excavate, remove, damage, or otherwise alter or deface any archaeological resource located on public lands unless such activity is pursuant to a permit.	Applicable	All archaeological work at the FEMP will be associated with the management of archaeological resources. No permit is required. Sensitive provisions of 4.0 are not under the procurement process. Requirements of 4.0 are met through compliance with the Native American Graves Protection and Repatriation Act (NAGPRA) and its implementing regulations (43 CFR 10).
HISTORIC PRESERVATION			
National Historic Preservation Act 16 USC § 470 Consideration of Historic Properties 36 CFR 800	DOE must take into account the effect of an undertaking on historic properties and accord the Advisory Council on Historic Preservation a reasonable opportunity to comment. Historic properties are defined as any prehistoric or historic district, building, site, structure, or object included in or eligible for inclusion in the National Register of Historic Places. This term includes artifacts, records, and persons released to and located within such properties. Historic properties that are to be substantially altered or demolished must be recorded for future use and reference.	Applicable	Areas of disturbance associated with Operable Unit 5 remedial activities will be surveyed to determine applicable requirements and the Advisory Council will be consulted, as agreed upon in a programmatic agreement with DOE, SHPO, and the Advisory Council. DOE will conduct data recovery of historic site properties that will be considered for each.
Archaeological and Historic Preservation Act 16 U.S.C. §469	Upon discovery that a project may cause the irreparable loss, destruction, significant scientific finding, prehistorical finding, or loss of historical or archaeological data, DOE must notify the Dept. of the Interior in writing and provide appropriate information concerning the project. DOE must, with possible assistance from SHPO, undertake recovery, protection, and preservation of the data.	Applicable	Met through compliance with NHPA.

TABLE B-2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
HISTORIC PRESERVATION (continued)			
American Indian Religious Freedom Act 42 U.S.C. §1996	Provides for tribal access by native peoples to grave sites and sites of cultural, symbolic, or religious significance.	Applicable	See previous comment.
NAGPRA 25 U.S.C. §3001 43 CFR 10	Identification and preservation of cultural resources on federal lands is required, including natural landmarks. DOE must consult with appropriate Indian tribes before the intentional excavation or removal after an inadvertent discovery of Native American cultural items, including human remains and objects of cultural significance.	Applicable	DOE will consult with likely culturally arrived tribes to determine the excavation, treatment, analysis and preparation of any extra reviews, associated funerary objects, unassociated funerary objects, sacred objects, or objects of cultural patrimony. Consultation will be coordinated with NHPA compliance when possible.

SENSITIVE ENVIRONMENTAL LOCATIONS

FLOODPLAIN/WETLANDS			
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 10 CFR 1022.11 (a), (b), (c)	Concurrent with its review of a proposed action to determine appropriate NEPA requirements, DOE shall determine applicability of the floodplain management and wetlands protection requirements of this part. In making a floodplain determination, DOE shall utilize the Flood Insurance Rate Maps (FIRMs) or the Flood Hazard Boundary Maps (FHBMs) prepared by the Federal Insurance Administration of the Department of Housing and Urban Development to determine if a proposed action is located in the base or critical action floodplain, as appropriate. For a proposed action in an area of predominately federal or state land holdings where FIRM or FHBM maps are not available, information shall be sought from the land administering agency (e.g., Bureau of Land Management, Soil Conservation Service, etc.) or from agencies with floodplain analysis expertise.	Applicable	These are the DOE implementing regulations for Executive Orders §988 and §990. Impacts to floodplains and wetlands will be identified through the preparation of a floodplain/wetland assessment.
DOE Compliance with Floodplain/Wetlands Assessments 10 CFR 1022.12(a)	Before any proposed remedial action, DOE shall prepare a floodplain/wetlands assessment.	Applicable	Floodplain/wetland assessments will be prepared as required. Wetlands assessment was conducted in OU5 FS.

TABLE B-2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
FLOODPLAIN/WETLANDS (Continued)			
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 10 CFR 1022.15(a)	If DOE finds that no practicable alternative to locating in the floodplain/wetland is available, consistent with the policy set forth in Executive Order 11988, DOE shall, before taking action, design, or modify its action in order to minimize potential harm to or within the floodplain or wetland.	Applicable	Floodplain/wetland impacts will be avoided and minimized to the maximum extent practicable. Mitigation of wetlands will be addressed through a Natural Resource Restoration Plan during remediation.
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 10 CFR 1022.3(a), (b)(1),(2),(3),(5),(6),(c), (d),(e)	DOE shall exercise leadership and take action to: • Avoid to the extent possible the long- and short-term adverse impacts associated with the destruction of wetlands and the occupancy and modification of floodplains and wetlands, and avoid direct and indirect support of floodplain and wetland development wherever there is a practicable alternative. • Incorporate floodplain management goals and wetlands protection considerations into its planning, regulatory, and decision-making processes and shall to the extent practicable: - Reduce the hazard and risk of flood loss. - Minimize the impact of floods on human safety, health, and welfare. - Restore and preserve natural and beneficial values served by the floodplain. - Minimize the destruction, loss, or degradation of wetlands. - Preserve and enhance the natural and beneficial values of wetlands. • Undertake a careful evaluation of the potential effects of any DOE action taken in a floodplain and any new construction undertaken by DOE in wetlands not located in a floodplain. • Identify, evaluate, and as appropriate, implement alternative actions which may avoid or mitigate adverse floodplain/wetlands impacts. • Provide opportunity for early public review of any plans or proposals for actions in floodplains and new construction in wetlands.	Applicable	Short and long term impacts associated with Operable Unit 5 remedial activities will be avoided and minimized to the maximum extent practicable. Remediation decisions included avoidance minimization to wetlands impacts. Any unavoidable impacts will be addressed through a Natural Resource Restoration Plan.

TABLE B-2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
FLOODPLAINS/WETLANDS (Continued)			
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements 10 CFR 1022.5(b),(h)	This part shall apply to all proposed floodplain/wetlands actions, including those sponsored jointly with other agencies, where practicable alternatives to the proposed actions are still available. The policies and procedures of this part which are applicable to floodplain actions shall apply to all proposed actions which occur in a wetlands located in a floodplain.	Applicable	Short and long term impacts associated with Operable Unit 5 remedial activities will be avoided and minimized to the maximum extent practicable.
WETLANDS			
Procedure for Implementing the National Environmental Policy Act 40 CFR 6.302(a) [Executive Order 11990]	Federal agencies conducting certain activities must avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands when a practicable alternative exists.	Applicable	Approximately 35.9 acres of jurisdictional wetlands and 8.9 acres of waters of the United States were identified on site as a result of the 1993 FEMP Wetland Delineation. The U.S. Army Corps of Engineers officially approved the delineation on August 19, 1993. Wetland impacts associated with Operable Unit 5 remedial activities will be minimized and avoided to the maximum extent practicable.
Executive Order 11990, Protection of Wetlands	This order requires that federal agencies take action to avoid adversely impacting wetlands wherever possible, to minimize wetland destruction and to preserve the values of wetlands.	Applicable	Wetland impacts associated with Operable Unit 5 remedial activities will be avoided and minimized to the maximum extent practicable.

TABLE B-2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
Nationwide Permit (NWP) Program 33 CFR 330	The U.S. Army Corps of Engineers has authorized certain categories of activities involving the discharge of dredged and fill material into wetlands and waters of the United States under the NWP program. Impacts involving the discharge of dredged and fill material will be conducted in accordance with the substantive requirements of applicable NWPs as required. Discharges not authorized by NWP will be conducted in accordance with the substantive requirements of 33 CFR 323 and 40 CFR 230.	Applicable	Approximately 35.9 acres of jurisdictional wetlands and 8.9 acres of waters of the United States have been identified on site. Impacts to these areas will be avoided and minimized to the maximum extent practicable. Discharges of dredged and fill material authorized by NWPs will be conducted in accordance with the substantive requirements of the respective permits. Specific information on the requirements in which subsequent permitting will be addressed will be provided in accordance with the schedule established under the Operable Unit 5 Remedial Design (RD) Work Plan.

TABLE B-2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
WETLANDS (Continued)			
Permits for the Discharge of Dredged and Fill Material into waters of the United States 33 CFR 323	Remedial actions involving the discharge of dredge and fill material into these areas shall meet the substantive requirements of this section and 40 CFR 230.	Applicable	Discharges of dredged and fill material not authorized by NWP will be conducted in accordance with the substantive requirements of these regulations. Discharges of dredged and fill material associated with Operable Unit 5 remedial actions will be evaluated and conducted against the substantive requirements of these regulations. Discharges of dredged and fill material associated with Operable Unit 5 remedial actions will meet the substantive requirements of these regulations, as addressed in Section 4.0.
Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged and Fill Material 40 CFR 230	40 CFR 230 sets guidelines for evaluation of discharges of dredged and fill material into wetlands and waters of the United States. The requirements specify that no discharge of dredged or fill material shall take place unless the permit authorizing agency makes a determination of the short-term effects of the discharge on the environment of the site, and if: 1. There is no practicable alternative to the action; 2. A state water quality standard will not be violated; and 3. It does not contribute to or causes the significant degradation of waters of the United States.	Applicable	Discharges of dredged and fill material associated with Operable Unit 5 remedial actions will meet the substantive requirements of these regulations, as addressed in Section 4.0.
Section 401 State Water Quality Certifications OAC 3745-32	Section 401 State Water Quality Certification is required to conduct dredge and fill activities within wetlands or waters of the United States. State Water Quality Certification is granted provided: 1. The discharge does not prevent or interfere with the attainment or maintenance of applicable water quality standards; and 2. The discharge does not result in a violation of any applicable provisions of the Clean Water Act (CWA).	Applicable	Discharges of dredged and fill material associated with Operable Unit 5 remedial actions will meet the substantive requirements of these regulations, as addressed in Section 4.0.

TABLE B-2 (Continued)
LOCATION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Rationale/Compliance
WETLANDS (Continued)			
Protection of Wetlands 40 CFR 258.12	New municipal solid waste landfill units must not be located in wetlands unless Ohio approves otherwise.	Applicable	Wetland impacts associated with Operable Unit 5 remedial actions will be avoided and minimized to the maximum extent practicable. Discharges of dredged and fill material associated with Operable Unit 5 remedial actions will meet the substantive requirements of these regulations, as addressed in Section 4.0.

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TABLE B-3
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks/Compliance
HAZARDOUS WASTES			
HAZARDOUS WASTE MANAGEMENT AND DISPOSAL			
Preparing and Transporting Hazardous Waste Off-Site RCRA 40 CFR 262.20 through .23, .30 and .33 Subparts B and C OAC 3745-53-20 through 31 OAC 3745-52-30 and 33	General requirements for transporting hazardous waste for off-site disposal require a manifest. Pretransporting requirements include appropriate packaging, labeling, marking, and placarding.	Applicable	Any residues determined to be RCRA hazardous waste destined for off-site disposal are subject to manifest requirements. Remedial actions involving off-site disposal of RCRA wastes will be subject to this requirement. Compliance for waste that is dispositioned for off-site disposal is addressed in the Operable Unit 1 Design Criteria Package.
CLOSURE UNDER RCRA			
Contained-In Policy RCRA 58 FR 48092 9/14/93 Proposed rule. 58 FR 59976 11/12/93 Notice to extend comment. 59 FR 10778 3/8/93 Clarification, partial withdrawal.	Hazardous soil means soil that contains RCRA hazardous waste(s) listed in 40 CFR 261, Subpart D, or that exhibits one or more of the characteristics of a hazardous waste as defined in 40 CFR 261, Subpart C. This proposed rule recommends contained-in determinations for hazardous debris, hazardous soil and other environmental media. Any person may petition the Regional Administrator to exclude, under 261.(f)(2) or 261.3(g) of this chapter, hazardous debris and hazardous soil or other environmental media, including but not limited to groundwater, surface water, and sediment, from regulation as hazardous waste. The petition for a contained-in determination must include information sufficient to demonstrate that specific constituent concentrations in the hazardous debris, hazardous soil, or other environmental media to be excluded do not pose a hazard to human health and the environment at that site. (Such a petition is not necessary for remedial actions conducted pursuant to RCRA or CERCLA authorities provided that a similar determination is made by the Regional Administrator based on information substantially equivalent to the information listed below including public notice and comment requirements.)	TBC	Policies are not promulgated and therefore cannot be ARARs. This policy will be considered for managing treated soil that is contaminated with RCRA waste. Compliance with this policy is adopted in the selected remedy, as described in the Operable Unit 5 ROD.

TABLE B-3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks/Compliance
	LANDFILL CLOSURE AND CORRECTIVE ACTION		
Corrective Action Management Unit RCRA 40 CFR 264.552 Subpart S 58 FR 865829 2/16/93	Corrective action management unit, or CAMU, means an area within a facility that is designated by the Regional Administrator under part 264 Subpart S, for the purpose of implementing corrective action requirements under Sec. 264.101 and RCRA Section 3008(h). A CAMU shall only be used for the management of remediation wastes pursuant to implementing such corrective action requirements at the facility. For the purpose of implementing remedies under Sec. 264.101 or RCRA Section 3008(h), the Regional Administrator may designate an area at the facility as a corrective action management unit, as defined above. One or more CAMUs may be designated at a facility under the following conditions: 1) Emplacement of remediation wastes into or within a CAMU does not constitute land disposal of hazardous wastes. 2) Consolidation or emplacement of remediation wastes into or within a CAMU does not constitute creation of a unit subject to minimum technology requirements. The owner/operator shall provide sufficient information to enable the Regional Administrator to designate a CAMU in accordance with the criteria in Sec. 264.552. **Note:** RCRA regulated hazardous waste management units (HWMUs) within a CAMU are fully subject to RCRA closure regulations.	Applicable	The CAMU concept is applicable to the remedial action for RCRA wastes. "Placement" as defined in HSWA does not occur in a CAMU. Therefore, land disposal restrictions (LDRs) and minimum technology requirements (MTRs) are not "triggered" as ARARs during and after the remedial activity within the boundaries of the CAMU. Compliance with this policy is adopted in the selected remedy, as described in the Operable Unit 5 ROD.

RADIOACTIVE WASTES

	MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE		
Low-level Radioactive Waste Generation DOE Order 5828.2A, Chapter III (3)(c)	Technical and administrative controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal. Waste reduction efforts shall include consideration of process modification, process optimization, materials substitution, and decontamination. All DOE low-level waste generators shall establish auditable programs to assure that the amount of low-level waste generated and/or shipped for disposal is minimized. Each DOE low-level waste generator shall separate uncontaminated waste from low-level waste to facilitate cost-effective treatment and disposal. Each DOE low-level waste generator preparing a design for a new process or process change shall incorporate principles into the design that will minimize the generation of low-level waste.	TBC	This requirement is a TBC because it is not promulgated. It will be considered for on-site disposal. Compliance with this requirement was considered in the Operable Unit 5 ROD.

TABLE B-3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks/Compliance
UNDERGROUND STORAGE TANKS (USTs)			
	UST CLOSURE		
Ohio Petroleum Contaminated Soil Policy OPEA Policy PP 01 03 200 PP.01-03-200	The basis of the "contained in" policy is that environmental media, such as soil or groundwater, are not considered to be waste material. Because they are not a solid waste, the mixture rule, as set forth in OAC 3745-51-03, does not apply when they become contaminated with a listed hazardous waste but only contains the waste. The result of this policy is that if the waste constituents can be removed, the soil is no longer considered to contain a hazardous waste. Therefore, since soil is not a waste material it does not have to be delisted in order for it to be used for its intended purpose. However, as long as the soil contains the waste material, it must be managed as a hazardous waste. If this concept is applied to petroleum-contaminated soil, the soil containing a petroleum hydrocarbon would not need to be managed as a solid waste if the contaminants was removed.	TBC	This policy allows for treated/cleaned soil to be backfilled at the excavation site. Operable Unit 5 will consider this policy for all soil treated below final remediation levels to be backfilled as clean soil. Compliance with this policy is addressed as part of the selected remedy, described in the Operable Unit 5 ROD.
	BEST MANAGEMENT PRACTICES PROGRAM		
Best Management Practices (BMP) Programs Clean Water Act 40 CFR 125.104 Subpart K	BMP programs shall be developed in accordance with good engineering practices and: 1) Be documented in narrative form and include any necessary plot plans, drawings or maps; 2) Establish specific objectives for the control of toxic and hazardous pollutants: (a) Each facility component or system shall be examined for its potential for causing a release of significant amounts of toxic or hazardous pollutants to waters of the United States due to equipment failure, improper operation, natural phenomena such as rain or snowfall, etc. (b) Where experience indicates a reasonable potential for equipment failure (e.g., a tank overflow or leakage), natural condition (e.g., precipitation), or other circumstances to result in significant amounts of toxic or hazardous pollutants reaching surface waters, the program should include a prediction of the direction, rate of flow and total quantity of toxic or hazardous pollutants which could be discharged from the facility as a result of each condition or circumstance; 3) Establish specific BMPs to meet the objectives identified in (2) above, addressing each component or system capable of causing a release of significant amounts of toxic or hazardous pollutants to the waters of the United States.	Applicable	Substantive requirements of this regulation are applicable to any release of contaminants to waters of the United States if BMPs are not implemented. Compliance with this policy is addressed as part of the selected remedy, described in the Operable Unit 5 ROD.

TABLE B-3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks/Compliance
AIR			
	STATIONARY SOURCE AIR EMISSIONS		
General Provisions on Air Pollution Control OAC 3745-15-07 ORC 3704.01-.05	Measures shall be taken to adopt and maintain a program for the prevention, control, and abatement of air pollution in order to protect and enhance the quality of the state's air resource so as to promote the public health, welfare, and economic vitality of the people of the state. The emission or escape into open air from any source whatsoever of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, odors and combinations of the above in such a manner or in such amounts as to endanger the health, safety, and welfare of the public, or to cause unreasonable injury or damage to property shall be declared to be a public nuisance. It is unlawful for any person to cause, permit, or maintain any such public nuisance.	Applicable	During the remedial action, the potential exists for emissions of radionuclides and toxic chemicals to air, which might endanger individuals or damage property. Compliance with this policy is addressed in Section 4.0 of this RAWP.
	FUGITIVE AIR EMISSION STANDARDS		
Visible Particulates in Air EPA Regulations on National Primary and Secondary Ambient Air Quality Standards 40 CFR 50.6(a),(b),(c) Ohio Ambient Air Quality OAC 3745-17-07 (A)	The level of the national primary and secondary 24-hour ambient air quality standards for particulate matter is a 150 $\mu g/m^3$, 24-hour average concentration. Visible particulate emissions from any stack may exceed 20 percent capacity, as a six-minute average, for not more than six consecutive minutes in any 60 minutes, but shall not exceed 60 percent capacity, as a six-minute average, at any time. The standards for national primary and secondary standards must be $\leq 50\ \mu g/m^3$, annual arithmetic average. Particulate matter shall be measured in the gradient air as PM_{10} (particles with an aerodynamic diameter less than or equal to a nominal 10 μm).	Applicable	The federal standard at 40 CFR 50.6 for particulate matter in air is applicable to remedial actions at Operable Unit 5 because remedial activities may contribute, at least temporarily, to particulate matter in the air. Particulate emissions may be generated through fugitive emissions from excavations and disposal activities and point source discharges from wastewater sludge dewatering or soil treatment/stabilization. The Ohio standard for particulates in air is not an ARAR because it is not more stringent than the federal standard at 40 CFR 50.6. Compliance with this policy is addressed in Section 4.0 of this RAWP.

TABLE B-3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks/Compliance
Particulate Ambient Air Quality Standards OAC 3745-17-02 (C)(D)	The level of ambient air quality standards for total suspended particles is a 150 $\mu g/m^3$, 24-hour average concentration. The level of the primary and secondary annual standards for total suspended particulates is 50 $\mu g/m^3$.	Applicable	This requirement is applicable for the escape of particulates. This includes excavation, demolition, cleaning and scrubbing. Compliance with this policy is addressed in Section 4.0 of this RAWP.
Particulate Non-Degradation Policy OAC 3745-17-05	Degradation of air quality in any area where the air quality is better than required in 3745-27-02 (described above) is prohibited.	Applicable	See comments above.
FUGITIVE AIR EMISSION STANDARDS (Continued)			
Control of Visible Particulate Emissions for Fugitive Dust OAC 3745-17-07 (B)(4),(5),(6)	There shall be no visible particulate emissions from any payed roadway or parking area except for a period of time not to exceed six minutes during any 60-minute observation period. There shall be no visible particulate emissions from any unpaved roadway or parking area except for a period of time not to exceed 13 minutes during any 60-minute observation period. There shall be no visible particulate emissions from any material storage piles except for a period of time not to exceed 13 minutes during any 60-minute observation period.	Relevant and Appropriate	Paved and unpaved roadways, parking areas, and material storage piles will be in use during the remedial action. This requirement is not applicable as the FEMP is not located within a city or township subject to the rule; however, the requirement is relevant and appropriate for site activities during the remedial action. Grading, loading, and construction operations will occur during soil excavation, soil backfilling and during construction and capping of the disposal facility. Compliance with this policy is addressed in Section 4.0 of this RAWP.
Ambient Air Quality Standards for Non-methane Hydrocarbons OAC 3745-21-02(C) and OAC 3745-21-03(D)	The ambient air quality guidelines for nonmethane hydrocarbons is a maximum three hour arithmetic mean concentration of 160 $\mu g/m^3$, not to be exceeded between the hours of six and nine a.m. Hourly and three-hour concentrations must be determined in accordance with prescribed methods.	Applicable	These requirements are applicable to hydrocarbon emissions. Compliance with this policy is addressed in Section 4.0 of this RAWP.

TABLE B-3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks/Compliance
	FUGITIVE AIR EMISSION STANDARDS (Continued)		
Restriction of Emission of Fugitive Dust OAC 3745-17-08 (B)	No person shall cause or permit any fugitive dust source to be operated; or any materials to be handled, transported, or stored; or a building (or its appurtenances) or a road to be used, constructed, altered, repaired, or demolished without taking or installing reasonably available control measures to prevent fugitive dust from becoming airborne. Such reasonably available control measures shall include, but are not limited to, one or more of the following which are appropriate to minimize or eliminate visible particulate emissions of fugitive dust. - The use of water or other suitable dust suppression chemicals for the control of fugitive dust from the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land; or - The periodic application of asphalt, oil, water, or other suitable dust suppression chemicals on dirt or gravel roads and parking lots, and any other surfaces that may cause emissions of fugitive dust.	Relevant and Appropriate	This requirement is not applicable as the FEMP is not located within a city or township subject to the rule; however, the requirement is relevant and appropriate for site activities during the remedial action. Grading, loading, and construction operations will occur during soil excavation, soil backfilling and construction of the disposal facility. Compliance with this policy is addressed in Section 4.0 of this RAWP.
SOLID WASTES			
	SOLID WASTE DISPOSAL		
Open dumping or burning ORC 3734.03 OAC 3745-27-05 40 CFR 257.3-7	Open dumping or burning of solid waste or infectious wastes is prohibited.	Applicable	This requirement is applicable to site remediation. Compliance with this requirement is addressed through the description of the Operable Unit 5 selected remedy.
WATER			
	SURFACE WATER		
Pollution to Waters of the State ORC 6111.04	Pollution to waters of the state is prohibited.	Applicable	This requirement is applicable to any discharge to waters of the state. Compliance with this policy is addressed in Section 4.0 of this RAWP.

TABLE B-3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks/Compliance
Compliance with Water Pollution Control Requirements ORC 6111.07 (A)(C)	Failure to comply with water pollution control requirements is prohibited.	Applicable	See comments above.

TABLE B-3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks/Compliance
SURFACE WATER (Continued)			
Ohio NPDES Permits CWA OAC 3745-33-05 ORC 6111.042 40 CFR 122.41 Subpart C	The point source must be equipped with instrumentation to monitor and record data and other information about the operation of the point source. The permittee shall maintain in good working order and operate at optimum levels in accordance with good engineering practices any wastewater treatment facilities or control systems regardless of the quality of the effluent. The permittee shall provide adequately trained and qualified personnel to operate the wastewater treatment facility.	Applicable	The Ohio NPDES permit is applicable because these requirements are more stringent than the federal regulations under the Clean Water Act. These requirements are applicable for point source discharges to the Great Miami River. Compliance is addressed in Section 4.0 of this RAWP and in the site NPDES permit.
Storm Water Discharges Associated with Industrial Activity 40 CFR 122.26(a)(l)(ii) 40 CFR 122.26(b)(4) and OAC 3745-38	A discharge composed entirely of storm water associated with industrial activity must obtain a NPDES permit. These categories of facilities are considered to be engaging in "industrial activity": • Landfills, land application sites, and open dumps that receive or have received any industrial wastes (waste that is received from any of the facilities described under this subsection), including those that are subject to regulation under Subtitle D of RCRA; and • Construction activities including clearing, grading, and excavation that disturbs five acres or more of total land area.	Applicable	The Ohio NPDES permit is applicable because these requirements are more stringent than the federal regulations under the Clean Water Act. These requirements are applicable for point source discharges to the Great Miami River. Compliance is addressed in Section 4.0 of this RAWP and in the site NPDES permit.
Antidegradation Policy OAC 3745-1-05 CWA 40 CFR 131.12	Existing instream water uses as defined in Rule 3745-1-07 of the Administrative Code and designated in Rules 3745-1-08 to 3745-1-32 of the Administrative Code, shall be maintained and protected. No further water quality degradation which would interfere with or become injurious to existing designated uses is allowable.	Applicable	This requirement is applicable for wastewater discharges to the Great Miami River. Under CERCLA, the State of Ohio has the overriding authority for the antidegradation of surface waters. Compliance with this policy is addressed in Section 4.0 of this RAWP.

TABLE B-3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks/Compliance
SURFACE WATER (Continued)			
Analytical and Collection Procedures OAC 3745-01-03	Analytical methods and collection procedures for surface water discharge sampling are specified.	Applicable	This requirement is applicable to both discharges to surface waters as a result of remediation and any on-site surface waters affected by site conditions. Compliance with this policy is addressed in Section 4.0 of this RAWP.
NPDES; Wastewater Discharges Resulting From Clean-up of Response Action Sites Contaminated with Volatile Organic Compounds OEPA Policy #DSW-DERR 0100.027	Establishes response action guidelines for treatment technologies and discharge criteria for volatile organic compounds (VOCs) to be discharged to surface water.	TBC	This OEPA policy provides guidance for wastewater discharges which contain VOCs. Compliance with this policy is addressed in Section 4.0 of this RAWP.
GROUNDWATER WELLS			
WELL ABANDONMENT			
Abandonment of Test Holes and Wells OAC 3745-09-10	Upon completion of testing, a test hole shall be either completely filled with grout or such other material as will prevent contaminants from entering groundwater.	Applicable	This requirement is applicable to all groundwater wells on the site that either will be installed or have been installed since February 15, 1975.

TABLE B-3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks/Compliance
POLYCHLORINATED BIPHENYLS (PCBs)			
PCB DISPOSAL			
Disposal Requirements TSCA 40 CFR 761.60(a)(4) Subpart D	Any nonliquid PCBs at concentrations 50 ppm or greater in the form of contaminated soil, rags, or other debris shall be disposed of in an incinerator or in a chemical waste landfill.	Applicable	In the event soil containing PCBs above 50 ppm is excavated, this requirement is applicable. PCBs were detected in soil beneath the Fire Training Facility. Compliance with this policy is addressed in Section 4.0 of this RAWP.
PCB TREATMENT			
TSCA 40 CFR 761.60(e) Subpart D	Any person who is required to incinerate PCBs or PCB items under this subpart and who can demonstrate that an alternate method of destroying PCBs or PCB items can achieve a level of performance equivalent to the requirements under 40 CFR 761.70 may submit a written request to either the Regional Administrator or the Director, Exposure Evaluation Division, for an exemption from the incineration requirements of 761.70 or 761.60. The applicant must show that the alternate method of destroying PCBs will not present an unreasonable risk of injury to health or the environment.	Applicable	This requirement is applicable only if PCB contaminated soil is greater than 50 ppm and is treated on-property using a method besides incineration. Compliance with this policy is addressed in Section 4.0 of this RAWP.
PCB STORAGE			
Storage for Disposal TSCA 40 CFR 761.65 Subpart D	This section applies to the design of storage areas to be used for later disposal of PCBs at concentrations of 50 ppm or greater.	Applicable	This requirement is applicable for storage of PCB-contaminated soil at 50 ppm or greater. Compliance with this policy is addressed in Section 4.0 of this RAWP.

TABLE B-3 (Continued)
ACTION-SPECIFIC REQUIREMENTS FOR THE OPERABLE UNIT 5 SELECTED REMEDY

Citation	Requirement	ARAR/TBC	Remarks/Compliance
OTHER REGULATIONS			
NOISE CONTROL			
Noise Control Act, as amended 42 USC 4901, et seq. Noise Pollution and Abatement Act 42 USC 7641	The public must be protected from noises that jeopardize health and welfare.	Applicable	Because equipment and vehicles would be involved in certain aspects of the proposed action, all substantive requirements of the act are applicable. However, appropriate engineering controls and best management practices will be implemented to reduce nuisance noise to the maximum practicable extent during conduct of the proposed actions. Compliance with this requirement is addressed in Section 4.0.
HAMILTON COUNTY EARTHWORK REGULATIONS			
Erosion Control Specifications Hamilton County Earthwork Regulations	Department of Public Works -- temporary and/or permanent erosion and sediment control features and devices shall be designed and constructed in accordance with the State of Ohio Temporary Erosion Control Specifications.	TBC	This requirement is not an ARAR because it is not promulgated. This requirement will be considered for activities that involve excavation, erosion, and sediment control features. Compliance with this requirement is addressed in Section 4.0.

APPENDIX C

APPENDIX C
DATA QUALITY OBJECTIVES

Control Number _____

Fernald Environmental Management Project

Data Quality Objectives

Title: Certification Sampling and Analysis In Area 1 Phase 1

Number: SL-023

Revision: 2

Effective Date: 11/07/96

Contact Name: Keith A. Nelson

UNCONTROLLED

Approval: William D. Kelley Date: 11-7-96
William D. Kelley
DQO Coordinator

Approval: _____ Date: 11/07/96
Keith A. Nelson
Project Manager

Rev. #	0	1	2		
Effective Date:	10/17/96	11/5/96	11/7/96		

DATA QUALITY OBJECTIVES
Site Soils Certification Sampling and Analysis

1.0 Statement of Problem

Members of Data Quality Objectives (DQO) Scoping Team
The members of the scoping team included the manager of Soil Characterization, individuals with expertise in various in situ radiological methods, individuals with expertise in analytical methods, a field construction manager, a statistician, a risk assessor, and representatives from the Department of Energy - Fernald Office (DOE-FN).

Conceptual Model of the Site
Contaminated soil is defined as a certification unit (CU) that has an average surface soil concentration of at least one area-specific constituent of concern [ASCOC (see Section 5.0 of the Area 1 Phase 1 (A1P1) Work Plan)] greater than the final remediation levels (FRLs). The primary source of contamination in site soils as defined in the Sitewide Excavation Plan (SEP) and Independent Design Work Packages (IDWPs) is airborne deposition from the former production area of the Fernald Environmental Management Plant (FEMP). The extent of soil contamination was estimated and published in the Operable Unit 5 Feasibility Study (FS). These estimates were based on kriging analysis of available uranium data for soil collected during the Remedial Investigation (RI) effort and from other environmental studies conducted at the FEMP (Fernald Environmental Management Project). Maps outlining contaminated soil boundaries were generated for the Operable Unit 5 FS by overlaying the results of the kriging analysis of uranium data with isoconcentration maps of the other constituents of concern (COCs) as presented in the Operable Unit 5 RI report, and further modified by spatial analysis of maps reflecting the most current soil characterization data. A sequential remediation plan has been presented which subdivides the FEMP into seven (7) construction areas. Extensive historical sampling has demonstrated that in each of the seven areas only a subset of the ASCOCs are present, and therefore need to be evaluated in the certification process for the individual construction areas. The certification sampling and analysis program is a step-by-step sequential process of documenting that each of these 7 construction areas or Phase areas within the construction areas have met their relevant FRLs established in the Operable Unit Five Record Of Decision (OU5 ROD).

Exposure to Soils
The cleanup standards, or FRLs, were developed for a final site land use as an undeveloped park. Under this exposure scenario, receptors will be exposed to contaminated soils through dermal contact (nonradiological COCs) or external radiation (radionuclides), incidental ingestion, and inhalation of fugitive dust while visiting the park. Exposure to contaminated soil is expected to occur at random locations within the boundaries of the FEMP and would not be limited to any single area. Benchmark Toxicity Values (BTVs) are also being considered in the clean up process by assessing habitat impact for individual BTVs under post-remedial

conditions.

Available Resources
Time: Certification I must be completed in time to release the areas identified in the respective IDWPs for construction or regrading. Ideally the certification schedule should allow sufficient time in the event additional remediation is required to demonstrate certification of FRLs. Certification sampling will have to be completed and analytical results returned prior to submission of a certification report to the Regulatory Agencies.

Project Constraints: The primary constraints for certification of soil on the FEMP are an accelerated schedule and budget limitations. Construction areas are prioritized for certification sampling and analysis according to the date required for initiation of sequential construction activities in those areas. Remediation is scheduled to begin with the excavation of Area 1 Phase 1 in the Fall of 1996. Fluor Daniel-Fernald (FD-F) and DOE must demonstrate post-remedial compliance with the FRLs in designated construction areas to release the areas for planned construction activities and regrading.

2.0 Identify the Decision

Decision
Demonstrate whether the estimated average concentration of each ASCOC is at or below the FRL for designated CUs at or above the agreed limits of confidence in areas to be certified.

Possible Results

1. The average concentration of ASCOCs will be below the FRLs at the given confidence level, and the CU will be certified as having achieved cleanup standards

2. The average concentration of ASCOCs for the CU will be equal or greater than the FRL and additional remediation will be required prior to recertification of the CU or fraction thereof.

3. The average concentration of ASCOCs for the CU cannot be demonstrated to be less than the FRL at a specified confidence level. Additional certification sampling and/or remediation will be required prior to recertification of the CU or fraction thereof. In this event, additional excavation and/or resampling will be performed as specified in the A1P1 Work Plan.

3.0 Inputs That Affect the Decision

Required Information
The estimated average soil concentrations and associated estimated variabilities of ASCOCs in individual CUs based on the analytical results of the certification

sampling.

Source of Information
Analysis of certification sampling for ASCOCs will be conducted at ASL B in accordance to methods and QA/QC standards in the FEMP Sitewide CERCLA Quality Assurance Project Plan [SCQ (DOE 1993)]. The QA/QC standards include field duplicate samples with 10 percent receiving a full raw-data validation

Contaminant-Specific Action Levels
The cleanup levels are the FRLs published in the Operable Unit 5 ROD. BTVs that are being considered are published in the Operable Unit 5 Ecological Risk Assessment (see Table C.1-1). Currently listed are the compounds identified as ASCOCs in areas identified to date. As future areas are evaluated, additional ASCOCs for construction areas or phased areas will be added as required.

Methods of Sampling and Analysis
Laboratory analysis for ASCOCs will be conducted at ASL B using QC/QA protocols specified in the SCQ. Methodologies will be evaluated prior to use to insure that they have the required precision and detection capabilities to evaluate whether the needed FRLs have been achieved. Where the technology does not exist to obtain the required cleanup level and also provide the required precision and confidence, the issue will be discussed with the Regulators.

4.0 The Boundaries of the Situation

Spatial Boundaries
Domain of the Decision: The boundaries of this certification DQO are limited to areas that are undergoing certification, to be defined in the SEP and subsequent IDWPs.

Population of Soils: Surface soil includes freshly excavated surfaces as well as undisturbed soils in areas undergoing certification sampling and analysis.

Scale of Decision Making
Based on pre-excavation estimated contamination levels, areas to be certified will be subdivided into Class I sections (not to exceed 1 acre) Class II sections (not to exceed 4 acres) and homogeneous zones (not to exceed 15 acres). Both Class I and Class II CU sizes reflect reasonable averaging areas considering the exposure scenario under which the FRLs were developed and the final land use of the site. The use of Class I and Class II CUs provide more stringent sampling density for areas of demonstrated or suspected contamination. The homogeneous certification areas are used to demonstrate that larger relatively unimpacted areas meet the FRLs for the primary radiological ASCOCs and inorganics.

Temporal Boundaries
Time frame: Certification sampling must be performed in time to sequentially release

certified areas for scheduled construction and final land use regrading activities. Certification sampling data must be received from the laboratory, evaluated and compiled, and final certification reports written, issued, and approved by the Regulatory Agencies prior to release of the areas for construction or regrading in preparation for final land use.

Time Constraints on Sampling: The scheduling of certification must allow time for the collection of samples, analysis, data verification, and development of the certification reports. The certification report must be submitted to the regulators for their approval prior to the beginning of construction and/or regrading in the applicable work area, unless an informed decision is made to "work at risk".

Practical Considerations: Some areas undergoing remediation are open grassland or will be cleared during excavation and made readily accessible. Areas may require preparation, such as cutting of grass or removal of undergrowth prior to surveying and certification sampling, thus requiring coordination with FEMP Maintenance personnel. Specific approaches for certifying areas of deep excavation, structures, waste pits , and landfills, will be addressed in the SEP and individual IDWPs.

5.0 Decision Rule

Parameters of Interest

The parameters of interest are the estimated average surface soil concentrations and variabilities, per CU, for ASCOCs in the Class I, Class II, and homogeneous averaging areas (See Table C.1-3). As previously mentioned, currently listed are the compounds identified as ASCOCs in areas identified to date. When future areas are evaluated, additional listing of ASCOCs will be added to this document as required.

Action Levels

The action levels are the soil FRLs published in the OU5 ROD (See Table C.1-3).

Decision Rules

If the average radiological and chemical contamination in each CU is demonstrated to be below the FRLs within the agreed confidence level, then the CU can be certified as complying with the cleanup criteria. If not, the CU will require additional assessment and/or remediation prior to recertification sampling.

6.0 Limits on Decision Errors

Range of Parameter Limits

The expected and reasonable range of ASCOC concentrations in soils undergoing certification sampling is from natural background (if background is relevant) to three times the respective action level (post-remedial hot-spot criteria).

Types of Decision Errors and Consequences

Definition

Decision Error 1: This decision error occurs when the decision maker decides a CU is in compliance with FRLs (average below the FRL) when in reality the actual average is still above one or more action levels. This situation could result in an increased risk to human health and the environment. In addition, this type of error could result in regulatory fees and penalties. This decision error would be unfavorable.

Decision Error 2: This decision error occurs when the decision maker decides a CU is contaminated (average at or above the FRL) when the CU average is actually below the action level(s). An error in this directions would be unfavorable from a cost and schedule perspective, but not as serious as decision error 1. This would result in added costs due to the excavation of allowable residual soils and increased volume of soils assigned to the OSDF. The cost of the additional excavation is partially offset by additional, although probably minimal, reduction in human health risk. The burden of proof is to demonstrate that the CU meets the FRLs and therefore CUs will be designated as contaminated if, e.g., statistical analysis of certification data is insufficient to demonstrate successful remediation.

True State of Nature for the Decision Errors

The true state of nature for Decision Error 1 is that the actual average concentration of an ASCOC in soil is greater than the action level. The true state of nature for Decision Error 2 is that the actual average concentration of an ASCOC is below the action level.

Null Hypothesis

H_o: The average concentration of the ASCOCs in the CU is equal to or greater than the action levels.

H_1: The average concentration of the ASCOCs in the CU is less than the action levels.

False Positive and False Negative Errors

A false positive is Decision Error 1: less than or equal to 5 percent is considered the acceptable decision error.

A false negative is Decision Error 2: less than or equal to 20 percent is considered the acceptable decision error. This was controlled through the determination of sample sizes (See Section 7.0, Resource Effective Design subsection.)

7.0 Design for Obtaining Quality Data

General Sampling and Analysis Design

A spatially intensive design was developed which would gather discrete samples from each CU (see below). Discrete samples will be collected using a systematic random sampling grid in accordance to the FEMP SCQ. Each sample will be collected using approved methodology as described in the Project Specific Plans

(PSPs) to obtain the specified quantity of soil to be obtained from each sample point.

Each sample will be submitted to an accepted laboratory or laboratories for the appropriate ASL B or equivalent analysis (acceptable analytical methods are defined in the FEMP SCQ). The laboratory will also be provided the appropriate number and type of QA/QC samples based on the type of analysis and number of samples as defined in the SCQ. Laboratory data deliverables will include summary forms and raw data. A 100% review of the data will be performed by either the project data management team, and/or FD-F validation team or subcontracted validation team.

Based on the analytical data, the following formula will be used to test the null hypothesis within each CU:

$$t = \frac{FRL - \bar{x}_i}{\sqrt{S_i^2/(n-1)}}$$

Where:
FRL = remedial goal
$\bar{x}_i$ = mean of the ith CU
S^2_i = sample variance of the ith CU
n = number of samples from the ith CU.

If the computed value (t) exceeds the critical value of a t-distribution for alpha = 0.05 then the null hypothesis is rejected and the CU is certified as having average ASCOC concentrations below the applicable FRL.

Resource Effective Design

The number of samples required to demonstrate statistical confidence will be determined based on existing variability of sample data in areas not contaminated above the FRLs. For example, in Area 1, Phase 1 the 12 primary and nine secondary ASCOC samples determined per CU (see Table C.1-3) represents the number of samples required to minimize decision errors in the estimate of the mean under a discrete sampling program. This sampling program is based on the assumptions of variability, maximum expected mean soil concentrations, and acceptable probabilities of error. For simplicity, and to assure that the ASCOCs will be adequately sampled to achieve acceptable confidence levels, the maximum number of samples required to meet the confidence level for the primary COCs and secondary COCs will be

selected to achieve the desired confidence for all COCs within primary and secondary groups. For example, in Area 1, Phase 1, this minimum number of samples for secondary ASCOCs is nine per CU. The minimum number of samples for primary ASCOCs in Area 1, Phase 1 is 12 per CU based on the described assumptions.

Details and Assumptions of the Design

The number of samples required to achieve statistical confidence was determined from the following equation:

$$n = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{\left(\frac{FRL - \bar{x}_{target}}{S_{CA}}\right)^2}$$

where

α = *probability of a Type I Error* (.05)
β = *probability of a Type II Error* (.20)
FRL = *the FRL for the given analyte*
$\bar{x}_{target}$ = *target clean-up level mean*
= *75% of the FRL*
S_{CA} = *standard deviation estimated from Clean Areas*

The target clean-up level during precertification is 75 percent of the FRL. At this target clean-up level the maximum expected value (average level) would be no greater than 75% of the FRL. As a conservative estimate we chose to use 75% of the FRL as the target clean-up level mean.

An estimate of the variability for post-remedial conditions was based on estimates calculated from existing data in "clean areas". The concept was that the variability demonstrated in unimpacted areas would be similar to post-remedial conditions in impacted areas as well. The procedure used to estimate the clear area variability is as follows:

1. The site was divided into 100 ft. by 100 ft. blocks. This was accomplished by simply dividing the Northing and Easting coordinate by 100 since these coordinates are presented in feet.
2. Block averages were calculated for each 100x100 block.
3. Blocks were then categorized as either impacted (average greater than or equal to the FRL) or unimpacted (average less than the FRL).

4. All sample locations that were located in a impacted blocks were then eliminated from consideration.
5. The final screening removed any sample that was in excess of three times the FRL since these sample values would immediately trigger a localized remedial effort.
6. From the data remaining (unimpacted areas), the variability used in the calculations was calculated.

Using this methodology we hoped to best develop an estimate of post-remedial variability. Under these assumptions and methods the estimated sample sizes are 12 for primary COCs and nine for secondary COCs. Table C.1-3 provides the calculated sample sizes and estimated standard deviations used in the calculations.

Data Quality Objectives
Site Soils
Certification Sampling and Analysis

1A Task/Description: Certification Sampling Analysis

1.B Project Phase: (Put an X in the appropriate selection.)

RI ☐ FS ☐ RD ☐ RA ☒ R_vA ☐ OTHER

1.C. DQO No.: SL-023 DQO Reference No.: N/A

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2. Media Characterization: (Put an X in the appropriate selection.)

Air ☐ Biological ☐ Groundwater ☐ Sediment ☐ Soil ☒

Waste ☐ Wastewater ☐ Surface water ☐ Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Put an X in the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization
A ☐ B ☒ C ☐ D ☐ E ☐

Risk Assessment
A ☐ B ☐ C ☐ D ☐ E ☐

Evaluation of Alternatives
A ☐ B ☐ C ☐ D ☐ E ☐

Engineering Design
A ☐ B ☐ C ☐ D ☐ E ☐

Monitoring during remediation activities
A ☐ B ☐ C ☐ D ☐ E ☐

Other
A ☐ B ☐ C ☐ D ☐ E ☐

4.A. Drivers: Area 1 Phase 1 Remedial Action Work Plan (RAWP), Applicable or Relevant and Appropriate Requirements (ARARs) and Operable Unit 5 Record of Decision (ROD)

4.B. Objective: Confirmation that excavation activities have remediated the site to below the Final Remediation Level (FRL) for area-specific constituents of concern.

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5. Site Information (Description):

The OU2 and OU5 RODs have identified areas at the FEMP that require soil remediation activities. The RODs specify that the soils in these areas will be demonstrated to be below the FRLs. Certification will be necessary for areas of the site with soils that have been remediated to demonstrate that the residual soils do not contain contamination exceeding these levels at a specified confidence level.

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and SCQ Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the SCQ Section.)

1.	pH	☐	2.	Uranium	☒*	3.	BTX ☐
	Temperature	☐		Full Radiological	☒**		TPH ☐
	Specific Conductance	☐		Metals	☒		Oil/Grease ☐
	Dissolved Oxygen	☐		Cyanide	☐		
	Technetium-99	☐		Silica	☐		

4.	Cations	☐	5.	VOA	☐	6. Other (specify)
	Anions	☐		BNA	☒**	
	TOC	☐		Pesticides	☒**	
	TCLP	☒		PCB	☒**	
	CEC	☐				
	COD	☐				

* Total Uranium
** See Attached List. **NOTE: other ASCOCs may be added as future areas are evaluated.**

6.B. Equipment Selection and SCQ Reference:

Equipment Selection		Refer to SCQ Section
ASL A		SCQ Section:
ASL B	Per. SCQ	SCQ Section: APP. G , Table 1
ASL C		SCQ Section:
ASL D		SCQ Section:
ASL E		SCQ Section:

7.A. Sampling Methods: (Put an X in the appropriate selection.)

Biased ☐ Composite ☐ Environmental ☐ Grab ☒ Grid ☐

Intrusive ☒ Non-Intrusive ☐ Phased ☐ Source ☐

DQO Number: SL-023

7.B. Sample Work Plan Reference: The DQO is being established prior to completion of the work plan.

Background samples: Area 1 Phase 1 Remedial Action Work Plan

7.C. Sample Collection Reference:

Sample Collection Reference: ASTM D420-87, D4448-85a, D4700-91, D5299-92

8. Quality Control Samples: (Place an "X" in the appropriate selection box.)

8.A. Field Quality Control Samples:

Trip Blanks	☐	Container Blanks	☐
Field Blanks	☐ **	Duplicate Samples	☒
Equipment Rinsate Samples	☐ **	Split Samples	☒ ***
Preservative Blanks	☐	Performance Evaluation Samples	☐

Other (specify) ** Rinsates of the casings will be analyzed for metals and other applicable analytes of concern to prequalify the casings as not containing contaminant levels that would impact the levels of concern. Field blanks and rinsates are not applicable to this type of sampling analysis. *** Split samples will be collected where required to meet Ohio EPA (OEPA) and/or DOE-EML requirements.

8.B. Laboratory Quality Control Samples:

Method Blank	☒	Matrix Duplicate/Replicate	☒
Matrix Spike	☒	Surrogate Spikes	☒

Other (specify) _____

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

In-situ soil sampling methods will be used to identify area boundaries of soil containing COCs above the FRL and selected for further remediation.

Sample density will be dependent upon the class of certification unit for an area. Proposed certification units will be identified in Project Specific Plans for each area.

TABLE C.1-1
SUMMARY OF AREA SPECIFIC CONSTITUENTS OF CONCERN IN AREA 1 PHASE 1

Constituent of Concern	Figure Reference	Driver
Primary COCs		
Uranium, total	E-1	FRL, BTV[a]
Radium-226	E-2	FRL
Radium-228	E-3	FRL
Thorium-228	E-4	FRL
Thorium -232	E-5	FRL
Secondary COCs		
Arsenic	E-13	FRL
Thorium-230	E-12	FRL
Aroclor-1260	E-17	FRL
Beryllium	E-14	FRL
Cesium-137	E-6	FRL
Molybdenum	E-53	FRL*
BTV COCs		
Aluminum	E-41	BTV[b]

* No site exceedences noted, therefore is a BTV concern only.

[a]FRL, BTV - The ASCOC has a FRL and BTV, the FRLs will drive remediation and necessitate certification. BTVs will be evaluated for habitat impact evaluation.

[b]BTV - The ASCOC does not have a corresponding FRL, but will be included in the analytical suite for data acquisition. The BTVs will not drive remediation in Area 1 Phase 1

TABLE C.1-2
SUMMARY OF CERTIFICATION UNITS

Classification	Justification for Designation	Scale
Class I	Areas representing pre-remediation known or suspected ASCOC contamination	200 x 200 foot
Class II	Areas representing inconsistent radiological contamination	400 x 400 foot
Homogenous Zones	Areas which are not considered contaminated (primary COC only) and areas of inconsistent contamination (metals only).	Not to exceed 15 acres

NOTE: Modification to dimensions of CUs will be necessary in some instances to "fit" irregularities of areas undergoing certification. These modifications will be specified in the individual IDWPs for approval.

TABLE C.1-3
SUMMARY OF ESTIMATE OF NUMBER OF SAMPLES PER CERTIFICATION UNIT IN AREA 1 PHASE 1 TO ACHIEVE ACCEPTABLE CONFIDENCE LEVELS

ASCOC	FRL	Number of Samples Used in Model	Standard Deviation	Maximum Expected Average Soil Concentration after Excavation [2]	Number of Samples Required
Aroclor-1254	0.13 mg/Kg	1036	0.034	0.098	5
Aroclor-1260	0.13 mg/Kg	641	0.035	0.098	8
Arsenic	12 mg/Kg	983	3.475	9.00	9
Beryllium	1.5 mg/Kg	999	0.397	1.12	7
Lead	400 mg/Kg	1149	43.478	300	2
Cesium-137	1.4 mg/Kg	2595	0.381	1.05	8
Radium-226	1.7 pCi/g	2224	0.574	1.28	12
Radium-228	1.8 pCi/g	1508	0.441	1.35	6
Technetium-99	30 pCi/g	1511	3.153	22.5	2
Thorium-228	1.7 pCi/g	1514	0.471	1.28	8
Thorium-230	280 pCi/g	2034	29.472	210	2
Thorium-232	1.5 pCi/g	2258	0.503	1.12	12
Uranium, Total	82 mg/Kg	4211	23.166	50.0 [1]	9

[1] Uranium level is based on As Low As Reasonably Achievable (ALARA) goals. 75% of the FRL for uranium is 61.5mg/Kg U_{total}

[2] Assumptions:
- Estimated average soil concentration after excavation is 75 percent of the FRL.
- Alpha = 0.05, beta = 0.2

Control Number _____

Fernald Environmental Management Project

Data Quality Objectives

Title: Area 1, Phase I - Precertification Sampling and Analysis

Number: SL-024

Revision: 2

Date: 11/07/96

Contact Name: Keith A. Nelson

UNCONTROLLED

Approval: William D. Kelley Date: 11-7-96
DQO Coordinator
William D. Kelley

Approval: _____ Date: 11/07/96
Project Manager
Keith A. Nelson

Rev. #	0	1	2		
Date:	8/13/96	10/10/96	11/07/96		

Data Quality Objectives
Area 1, Phase I
Precertification Sampling and Analysis

1.0 Statement of Problem

Members of Data Quality Objectives (DQO) Scoping Team

The members of the scoping team included the manager of Soil Engineering, individuals with expertise in various in-situ radiological methods, individuals with expertise in analytical methods, field construction manager, a statistician, a risk assessor, and a representative(s) from the Department of Energy - Fernald Office (DOE-FN).

Conceptual Model of the Site

Contamination is defined as an average soil concentration of an area-specific constituent(s) of concern (ASCOCs) in a certification unit (CU) greater than the final remediation levels (FRLs). Additionally, soil can be identified as exceeding the waste acceptance criteria (WAC). The source of contamination in peripheral or boundary areas is primarily from airborne deposition from the former production area of the FEMP. The extent of soil contamination was estimated and published in the Operable Unit 5 Feasibility Study (FS). These estimates were based on kriging analysis of available uranium data for soil collected during the Remedial Investigation (RI) effort and from other environmental studies conducted at the FEMP. Maps outlining contaminated soil boundaries were generated for the Operable Unit 5 FS by overlaying the results of the kriging analysis of uranium data with isoconcentration maps of the other constituents of concern (COCs) as presented in the Operable Unit 5 RI report, then comparing this with spatial maps of recently acquired data.

Exposure to Soils

The cleanup standards, or FRLs, were developed for a final site land use as an undeveloped park. Under this exposure scenario, receptors will be exposed to contaminated soils through direct radiation, dermal contact, incidental ingestion, and inhalation of fugitive dust of both radiological and non-radiological COCs.

Available Resources

Time: Precertification for areas scheduled for remediation must be accomplished by the field team of samplers and real-time instrumentation operators before and during the process of excavation to provide the required information in a timely manner to support the certification effort (see Appendix C-1).

Project Constraints: FEMP remediation activities are under severe time and budget constraints to comply with construction and excavation scheduling. Precertification

sampling and analytical testing must be performed with existing manpower and instrumentation to support the remediation schedule. Remediation, certification, and regrading of the site to meet final land use commitments is dependent on successful completion of this work.

Summary of Contamination Problem

Site remediation commencing with the Area 1, Phase I is scheduled for excavation beginning in summer of 1996 in support of the construction of the On-Site Disposal Facility (OSDF), the relocated North Access Road, and rail yard. FERMCO and DOE require an accurate assessment of excavation effectiveness so they can accurately characterize the surface soil remaining after excavation efforts. The soil will be classified as clean (meeting the FRLs), contaminated (exceeding the FRLs) or unacceptable for disposal in the OSDF (exceeding WAC without additional treatment). Existing data indicates a small zone of above-WAC material in Area D of Area 1, Phase I and other areas on site. Identification and delineation of this soil are priorities for precertification.

2.0 Identify the Decision

Decision

Four decision processes will be reached as a result of precertification sampling and analytical testing. Those decision processes are as follows:

1. Identify WAC for uranium only to support removal and off-site disposition prior to remediation.

2. Verify excavation design prior to remediation by developing isoconcentration gradient maps of the primary constituents using data output from Sodium Iodide (NaI) detectors (mounted on RTRAK vehicle) and strategic High Purity Germanium detector (HPGe) readings, and for secondary constituents by field, quick turnaround, or conventional laboratory methods.

3. Identify levels exceeding FRLs in adjacent upgradient areas to assess need for water runon controls such as diversion ditching.

4. Provide assurance that postremedial and unexcavated areas are prepared for certification by:

   - Achievement of 75 percent of the FRLs of area-specific COCs (ASCOCs) in areas to be certified. This is known as the "target level" and represents the concentration of a COC that is assumed to be present in soil under post-

remedial conditions.

- Detection, definition, and explanation of irregularities or unexplained anomalies in the surface soil contamination pattern.

- "Hot Spot" identification at three times the FRLs of the primary COCs, which is a not to exceed level for the RTRAK and HPGe 12 m^2 read areas.

- Discrete sampling and analytical testing, where necessary, to confirm the real-time readings of radionuclide concentrations in the soil.

Possible Results

1. Soil exceeds the WAC and must be defined and excavated to a defined threshold limit of confidence and stored for eventual off-site disposition.

2. Soil does not exceed the WAC threshold but is contaminated above the FRL(s) with one or more area-specific contaminants of concern (ASCOCs). Soil identified as such must then be integrated into remediation plans for excavation, stockpiling, and eventual disposal in the OSDF.

3. Upgradient areas are contaminated above the FRL(s) with one or more ASCOCs, and a decision is made to construct or augment engineering structures to divert potentially contaminated runon away from remediated area(s) until upgradient remediation can be performed.

4. One or more read areas is flagged as being a "hot spot" and this area is further delineated and removed prior to certification.

5. The target levels of 75 percent of the FRL(s) are achieved, which is the condition necessary to successfully conduct certification testing, and the surveyed area is considered prepared for certification testing.

3.0 Identify Inputs That Affect the Decision

Required Informational Input

Estimates of average surface soil concentration and estimates of variance for each ASCOC in areas undergoing remediation will be obtained from precertification analytical methods.

Source of Informational Input

Precertification sampling for gamma discernible radiological COCs will involve readings from mobile and stationary in situ equipment. Non-gamma discernible constituents will be analyzed from discrete soil samples employing field instrumentation such as the x-ray fluorescence (XRF) and/or test kits, quick turnaround laboratory methods, or conventional laboratory analysis.

Contaminant-Specific Action Levels

The FRLs, WAC, and as low as reasonably achievable (ALARA) levels are published in the Operable Unit 5 Record of Decision [ROD (see Table C-1)]. The FRLs were developed to account for health risks, cross media impact, background concentrations, and applicable or relevant and appropriate requirements (ARARs) and represent not-to-be exceeded contaminant-specific average soil concentrations. Benchmark toxicity value (BTV) levels were established in the Operable Unit 5 FS and are also in Table C-1. BTVs are considered to represent concentrations or levels that are protective of ecological receptors for specified constituents, and will represent the FRL for those specified constituents, being the more restrictive requirement.

In the Operable Unit 5 ROD, an ALARA commitment of 50 parts per million (ppm) for total uranium was specified. This value will be used as a target level for precertification of total uranium. The ALARA level is more conservative than the target level of 62 ppm (which is 75 percent of the total uranium FRL of 82 ppm).

Methods of Sampling and Analysis

Whenever possible, the most cost-effective practical field instrumentation and analytical methods will be employed to meet the needs of precertification. A mobile NaI RTRAK system will be utilized for complete semiquantitative coverage of the areas of concern, and additional quantitative information will be obtained from strategic stationary readings from HPGe systems. Analysis and data management for the NaI and HPGe systems will be conducted at ASL E. The RTRAK will be utilized to establish general radiological concentration isolines and detect hot spots. The HPGe gamma detectors will be used when more refined supporting quantitative resolution is required. Daily source checks will be conducted as directed in the systems' operational procedure. Sample data will be reviewed at least daily by Field Supervisor for the sampling.

Laboratory analysis for non-gamma discernible radiological, inorganic, and organic COCs from discrete soil samples will be conducted at analytical support level (ASL) A/B using field methods or quick turn-around lab methods if field methods are not available for a given COC. Field immunoassay test kits will be used when appropriate to test for constituents such as polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs).

4.0 The Boundaries of the Situation

Spatial Boundaries

Domain of the Decision: The boundaries of precertification sampling are limited to surface soils in the designated certification zones and adjacent areas as designated in the individual work plans.

Population of Soils: The soils affected are surface soils (to a nominal depth of 6 inches), which include freshly excavated surfaces and undisturbed soils associated with work areas or certification units (CUs) as designated in the individual work plans.

Scale of Decision Making

Based on considerations of the final certification units and output from the COC evaluation process which retains or eliminates COCs for a specific area, the areas undergoing excavation will be evaluated as to whether the CU is prepared for certification in the same units that are planned during the certification sampling. Adjacent areas will be qualitatively assessed for runon threat. For Class I certification areas, the precertification units (CUs) will be 200 by 200 foot areas for each retained ASCOC. For Class II certification areas, the CUs will be 400 by 400 foot areas for each retained ASCOC. Homogenous zones will not exceed 15 acres in area for each retained ASCOC.

Temporal Boundaries

Time frame: Precertification sampling efforts must be conducted both before and during initial excavation, and analytical results must be returned in time for the information to be useful within the current remediation schedule.

Time Constraints on Sampling: The scheduling of precertification sampling is closely associated with the excavation schedule. Sampling should be performed before and during excavation while not interfering with or delaying planned construction work.

Practical Considerations: In situ gamma spectrometry measurements cannot be made during snow coverage, saturated soil conditions, or during and immediately after precipitation. Field analytical methods should also be limited to unsaturated soils. Most areas of concern are flat open terrain and readily accessible. Some areas may require preparation, such as cutting of grass or removal of undergrowth, fencing and other obstacles. In situ measurements will require coordination with appropriate maintenance personnel for site preparation. Physical and environmental parameters will be recorded and assessed during data collection.

5.0 Develop a Logic Statement

Parameters of Interest

The precertification units on the FEMP are based on the certification unit (CU) designations. The average surface soil concentration of ASCOCs in these CUs is the parameter of interest.

Precertification Target Levels

The target level is 75 percent of the FRL or BTV action levels for each ASCOC (see Table 7-1 in the Area 1, Phase I Work Plan). This target level of 75 percent is based on statistical assessment of data variability and viable sample sizes used to develop the final certification criteria in Area 1, Phase I with a given level of confidence.

Decision Rules

If radiological contamination above the uranium, thorium, and radium FRLs in any 12 square meter (m^2) area is identified by the RTRAK, the area will be subjected to more quantitative analysis using the HPGe system and will be further excavated if the estimated concentrations exceed the action levels for the primary radionuclide ASCOCs.

If the average concentration of secondary ASCOCs in surface soil within a CU is greater than the action level the field manager will initiate one of the following:

- Decide that the ASCOC presence is not a concern and the material can be left in place without violating the FRL criteria or jeopardizing certification. This decision may be supported with the collection of additional random or biased samples.
- Perform sampling to delineate the contamination and refine additional removal efforts to be performed prior to resampling the area under precertification.
- Remove an additional quantity of surface soil from the impacted area or areas, designate for disposal in the OSDF or off-site disposal, and resample and analyze under precertification.

6.0 Establish Constraints on the Uncertainty of the Decision

Range of Parameter Limits

The range of soil concentrations anticipated after excavation of the top 6 inches of soil in peripheral areas for one or more ASCOCs will be from background (natural concentrations or zero depending on ASCOC), to greater than the maximum subsurface value indicated in the RI database.

Types of Decision Errors and Consequences

Definition

Decision Error 1: This decision error occurs when the decision maker decides a CU has been adequately remediated for certification when the average soil concentration in a CU is still above one or more FRLs, WAC, or upgradient areas pose a potential runon threat. If the CU fails certification due to this decision error:

- If upgradient areas above the FRLs remain undetected appropriate surface water engineering controls may not be installed, and runon may pose a threat of recontaminating excavated areas.

- If a CU fails certification sampling and analytical testing, remobilization and further excavation, precertification, and certification sampling would be necessary.

Decision Error 2: This decision error occurs when the decision maker continues excavation or directs soils to the OSDF when they are actually below the FRLs, when he/she directs materials off-site if they are below the WAC, or when he/she directs that unnecessary engineering controls be built to prevent runon. This would result in added costs due to the excavation of clean soils, increased volume in the OSDF or off-site facilities, or unnecessary construction of engineering controls. This is not as severe as Decision Error 1. The addition of clean soil to the OSDF would result in further reduction, although minimally, to human health risk in the remediated areas.

Decision Error 1 would be the more severe error.

True State of Nature for the Decision Errors

The true state of nature for Decision Error 1 is that the actual concentration of ASCOCs are greater than their FRLs or WAC. The true state of nature for Decision Error 2 is that the true concentrations of ASCOCs are below their FRLs or WAC.

Null Hypothesis

H_o: Mean surface soil concentration in the CU is greater than the action level.
H_1: Mean surface soil concentration in the CU is less than or equal to the action level.

7.0 Optimize a Design for Obtaining Quality Data

The areas that have been excavated will be sampled under precertification sampling according to the final configuration of the certification sampling plan.

Gamma Discernible ASCOCs

As a result of precertification, radiological information will be generated by two complimentary gamma detection methods employed to characterize the concentration of primary radiological ASCOCs in remediated areas in preparation for certification. The two methods will consist of the mobile sodium iodide (NaI) detection system currently mounted on the RTRAK which will provide semiquantitative activities of uranium, thorium, and radium, and the high purity germanium (HPGe) systems that will provide stationary readings and quantitative measurements of all gamma discernible radiological COCs. The NaI and HPGe systems will be employed during precertification sampling and analysis in the following manner.

Sodium Iodide (NaI) System

The NaI system currently mounted on the RTRAK will be used to cover 100 percent of an area to detect uranium levels above WAC and detect hot spots. The NaI detector(s) coupled to a multichannel analyzer (MCA) and software is calibrated to detect uranium, thorium, and radium. The system will be used in a roving mode at a nominal speed of 2 miles per hour (mph) and minimum count times of 2 seconds. At this speed and count time, a gamma reading will be made and recorded every 12 m^2. The mobile system will be electronically coupled with a global positioning satellite (GPS) rover and base unit to record the location of every reading. Counting and positioning information will be recorded continuously on a field personal computer (PC) and stored on disk or hard drive for future downloading on the site soil database and Geographic Information System (GIS) system.

Prior to excavation, the RTRAK will cover areas determined to be at risk of exceeding the WAC for total uranium. This material will be excavated and stored for off-site disposal. Adjacent areas will be assessed for threat of runon. After excavation of the stipulated 6 inches has been performed on the areas specified to support construction or remediation of contamination, the RTRAK will cover all excavated and unexcavated areas with an interlocking pattern of readings. A detection three times the FRL for uranium, thorium, or radium will be identified and recorded as a hot spot. Information from the NaI/GPS system will be recorded on the PC and transferred to the Unix system through the local area network on a regular (at least daily) basis. The information will then be plotted on the FEMP GIS system and isolines and hot spots identified for review the next day. The RTRAK system will provide complete coverage of the area. With the output, isolines of "relative" contamination can be developed and hot spot locations identified.

In Situ HPGe Detectors

The HPGe system(s) will be used in conjunction with the NaI system to quantify concentrations of uranium potentially in excess of WAC, and the isolines and hot spots will be plotted on the GIS. Based on the appearance of the mapped

radiological contours and the discretion of the field manager and/or project manager, HPGe readings will be obtained from hot spots, concentrations exceeding WAC, and isolines within the individual CUs, in accordance with methods and protocol described in procedures and the FEMP SCQ. The number of HPGe readings will vary from CU to CU based on the NaI results and management input, but an average of six HPGe readings per CU is anticipated in Area 1, Phase I precertification. HPGe readings will be downloaded nightly to the FEMP network for review and evaluation. All quality assurance/quality control (QA/QC) will follow site procedural requirements. These requirements will eventually be added to the FEMP SCQ.

Radiological Soil Sampling

The project manager may determine that physical radiological soil sampling and laboratory analysis is necessary to support insitu measurements in some instances. Criteria for obtaining physical samples will be specified in the Project Specific Plan directing collection of sufficient samples of appropriate data quality to satisfy the decision criteria. The minimum data quality acceptable for this purpose will be ASL B. Archiving of samples may be necessary. All sampling activities will meet requirements as outlined in the FEMP SCQ. The project team will evaluate the data to ensure it is acceptable from the standpoints of historical and internal consistency.

Non-Gamma Discernible ASCOCs

Some ASCOCs retained for evaluation and certification will not be detected by the NaI or HPGe in-situ gamma instrumentation. Testing for these ASCOCs will be completed during precertification using available field or quick turnaround methods with the required resolution. The analytical methods used for this process will have an optimal turnaround of no more than 24 hours from sample delivery to reporting, so information obtained can be utilized to direct field crews.

Certification units that have been identified for these ASCOCs will be sampled after the excavation has been performed by obtaining four core samples to a depth of 6 inches. One sample should be obtained from the center of each quadrant of the CU. If the field manager has concerns about a particular area, he/she will have the flexibility to collect biased samples. Sample collection and analysis will follow the FEMP SCQ protocol. QA/QC will meet all SCQ requirements.

Determining Average Level

The average of the in situ measurements made during precertification will be compared to the target level of each gamma discernable radiological COC. The average of COC concentrations obtained from discrete samples collected for non-radiological COCs during precertification will also be compared to their respective target levels. If the average of the samples for an ASCOC in the CU is greater than the target levels, the remediation manager may take one of the following three actions:

- Decide that the ASCOC presence is not a concern and the material can be left in place without violating the FRL, BTV, or WAC, or jeopardizing certification. This decision may be supported with the collection of additional biased samples.

- Perform sampling to delineate the contamination and to refine additional removal efforts to be performed prior to resampling the area under precertification.

- Remove necessary additional surface soil from the impacted area or areas and resample as per precertification protocol.

Data Quality Objectives
Area 1, Phase I
Precertification Sampling and Analysis

1A Task/Description: Pre-Certification Sampling Analysis

1.B Project Phase: (Put an X in the appropriate selection.)

RI ☐ FS ☐ RD ☐ RA ☒ R,A ☐ OTHER

1.C. DQO No.: SL-024 DQO Reference No.: N/A

---

2. Media Characterization: (Put an X in the appropriate selection.)

Air ☐ Biological ☐ Groundwater ☐ Sediment ☐ Soil ☒

Waste ☐ Wastewater ☐ Surface water ☐ Other (specify) _____

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3. Data Use with Analytical Support Level (A-E): (Put an X in the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization
A ☒ B ☒ C ☐ D ☐ E ☒

Risk Assessment
A ☐ B ☐ C ☐ D ☐ E ☐

Evaluation of Alternatives
A ☐ B ☐ C ☐ D ☐ E ☐

Engineering Design
A ☐ B ☐ C ☐ D ☐ E ☐

Monitoring during remediation activities
A ☐ B ☐ C ☐ D ☐ E ☐

Other
A ☐ B ☐ C ☐ D ☐ E ☐

4.A. Drivers: Area 1 Phase 1 Remedial Action Work Plan (RAWP), Applicable or Relevant and Appropriate Requiremnts (ARARs) and Operable Unit 5 Record of Decision (ROD)

4.B. Objective: To verify excavation design prior to remediation or confirm that excavation activities have remediated the site to below the FRL for ASCOCs.

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5. Site Information (Description):

The OU2 and OU5 RODs have identified areas at the FEMP that require remediation activities. The RODs specify that the soils in these areas will be clean and demonstrated to be below the FRLs. Pre-Certification will be necessary for areas of the site with soils that are scheduled for remediation or excavation, and placement in the OSDF; areas that have been excavated; and adjacent reas which could affect the remediated or excavated site.

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and SCQ Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the SCQ Section.)

1.	pH	☐	2.	Uranium	☐	3. BTX	☐
	Temperature	☐		Full Radiologic	☒	TPH	☐
	Specific Conductance	☐		Metals	☒	Oil/Grease	☐
	Dissolved Oxygen	☐		Cyanide	☐		
	Technitium-99			Silica	☐		
4.	Cations	☐	5.	VOA	☐	6. Other (specify)	
	Anions	☐		ABN	☐	See C-2	
	TOC	☐		Pesticides	☐		
	TCLP	☐		PCB	☒		
	CEC	☐					
	COD	☐					

6.B. Equipment Selection and SCQ Reference:

Equipment Selection	Refer to SCQ Section
ASL A Field Test Kits, XRF Detector	SCQ Section:
ASL B ICP	SCQ Section: APP. G , Table 1
ASL C	SCQ Section:
ASL D	SCQ Section:
ASL E NaI Detector, HPGe Detector	SCQ Section:

7.A. Sampling Methods: (Put an X in the appropriate selection.)

Biased	☐	Composite	☒	Environmental	☐	Grab	☒	Grid	☐
Intrusive	☒	Non-Intrusive	☒	Phased	☐	Source	☐		

DQO Number: SL-024

7.B. Sample Work Plan Reference: The DQO is being established prior to completion of the work plan.

Background samples: Area 1 Phase 1 Remedial Action Work Plan

7.C. Sample Collection Reference:

Sample Collection Reference: ASTM D420-87, D4448-85a, D4700-91, D5299-92

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8. Quality Control Samples: (Place an "X" in the appropriate selection box.)

8.A. Field Quality Control Samples:

Trip Blanks	☐	Container Blanks	☐
Field Blanks	X	Duplicate Samples	X
Equipment Rinsate Samples	X	Split Samples	☐
Preservative Blanks	☐	Performance EvaluationSamples	☐

Other (specify) _____

8.B. Laboratory Quality Control Samples:

Method Blank	X	Matrix Duplicate/Replicate	☐
Matrix Spike	X	Surrogate Spikes	☐

Other (specify) _____

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

In-situ soil sampling methods will be used to identify area boundaries of soil containing COCs above the FRL and selected for further remediation.

Sample density will be dependent upon the class of certification unit for an area. Proposed certification units will be identified in Project Specific Plans for each area.

TABLE C-1
SUMMARY OF SITEWIDE CONSTITUENTS OF CONCERN

Constituent of Concern	Driver	Constituent of Concern	Driver
		Primary COCs	
Uranium, total	FRL, BTV[a]	Thorium-228	FRL
Radium-226	FRL[b]	Thorium-232	FRL
Radium-228	FRL		
		Secondary COCs	
Aluminum[c]	BTV	Dieldrin	FRL
Antimony	BTV	Heptachlorodibenzo-p-dioxin	FRL
Aroclor-1254	FRL	Indeno(1,2,3-cd)pyrene	BTV, FRL
Aroclor-1260	FRL	Lead	BTV, FRL
Arsenic	FRL	Lead-210	FRL
Benzo(a)anthracene	BTV, FRL	Manganese	BTV, FRL
Benzo(a)pyrene	BTV, FRL	Molybdenum	BTV*
Benzo(g,h,i)perylene[c]	BTV	Neptunium-237	FRL
Benzo(b)fluoranthene	BTV, FRL	Octachlorodibenzo-p-dioxin	FRL
Benzo(k)fluoranthene	BTV	Plutonium-238	FRL
Beryllium	FRL	Silver	BTV
Cadmium	BTV	Strontium-90	FRL
Carbazole	FRL	Technetium-99	FRL
Cesium-137	FRL	Tetrachloroethene	FRL
Chrysene	BTV[d]	Thorium-230	FRL
Dibenzo(a,h)anthracene	BTV, FRL[e]	Trichloroethene	FRL
1,1-dichloroethene	FRL	Zinc	BTV

* No site exceedences noted, therefore is a BTV concern only.
[a] FRL, BTV - The COC is a concern both to FRL and BTV, however, the FRL is the primary remediation driver.
[b] FRL - The COC is a concern only to FRL and the FRL is the primary remediation driver.
[c] Aluminum and benzo(g,h,i)perlyene do not have published FRLs.
[d] BTV - The COC is a concern only to BTV and the BTV is the primary remediation driver.
[e] BTV, FRL - The COC is a concern both to FRL and BTV, however, the BTV is the primary remediation driver.

TABLE C-2
SUMMARY OF AREA 1, PHASE I CONSTITUENTS OF CONCERN

Analytical Suites	Area 1, Phase I Contaminants of Concern	Certification Level (FRL or BTV)
Primary COCs		
Gamma discernable radiological	Total uranium	82 mg/kg FRL
	Radium-226	1.7 pCi/g FRL
	Radium-228	1.8 pCi/g FRL
	Thorium-228	1.7 pCi/g FRL
	Thorium-232	1.5 pCi/g FRL
Secondary COCs		
Radiological COCs	Cesium-137	1.4 pCi/g FRL
	Thorium-230	280 pCi/g FRL
Metals	Aluminum	16,100 mg/kg BG[a]
	Arsenic	12 mg/kg FRL
	Beryllium	1.5 mg/kg FRL
	Lead	200 mg/kg BTV
	Manganese	1500 mg/kg BTV
	Molybdenum	10 mg/kg BTV
Polychlorinated biphenyl	Aroclor-1260	0.13 mg/kg FRL
Polynuclear aromatic hydrocarbons[b]	Benzo(a)anthracene	1 mg/kg BTV
	Benzo(a)pyrene	1 mg/kg BTV
	Benzo(a)fluoranthene	1 mg/kg BTV
	Benzo(g,h,i)perlyene	1 mg/kg BTV
	Dibenzo(a,h)anthracene	0.088 mg/kg BTV
	Indeno(1,2,3-cd)pyrene	1 mg/kg BTV

[a] As used in the development of the FRLs, aluminum defaults to the 95th percentile of background. The BTV for aluminum is 10,103 mg/kg. The 95th percentile of subsurface background is used to closer reflect residual soil.

[b] PAHs are certified to the BTVs. However, the identification of certification areas is based on soil contamination in excess of the FRLs [i.e., benzo(a)pyrene FRL is 2 mg/kg].

Fernald Environmental Management Project

Data Quality Objectives

Title: Site Soils In-situ Comparability Study

Number: SL-025

Revision: 1

Effective Date: 11/05/96

Contact Name: Steve Davis

UNCONTROLLED

Approval: William D. Kelley Date: 11-6-96
DQO Coordinator
William D. Kelley

Approval: Date: 11/06/96
Project Manager
Keith A. Nelson

Rev. #	0	1			
Effective:	10/17/96	11/05/96			

Data Quality Objectives
Site Soils In-situ
Comparability Study

1.0 Statement of Problem

The DQO team consists of a project lead, a field lead, a statistician, a lead radiological chemist, a geologist/site cell representative for WAC attainment issues, a sampling supervisor, a nondestructive assay supervisor, a data management lead, a gamma spectroscopy expert, and a representative from the DOE Environmental Measurements Lab.

The use of in-situ devices for measuring isotopic uranium, radium and thorium is desired in order to optimize time and resources during soil characterization. The Soils Remediation Project (SRP) requires a controlled study of the potential application for certification testing of in-situ analyses consisting of a combination of in-situ high purity germanium (HPGe) detectors, a mobile sodium iodide system (R-TRAK, and a field densitometer for information on soil density and percent moisture. The study needs to determine the accuracy and repeatability of the systems in actual field conditions. Additionally, soil type, soil temperature and vegetation information will be gathered. This study will determine if certification decisions at the Certification Unit (CU) level can be made that meet the sensitivity and precision requirements of the site; ultimately an assessment will be made if certification decisions are comparable when based on in-situ measurements compared to decisions based on laboratory analyses.

This study needs to complete field data collection and the statistical analysis in time for submission of the comparability study report to U.S. EPA by March 1997, and a certification report to U.S. EPA. by April 1997. The study of in-situ methodologies is necessary prior to submission of subsequent certification plans that incorporate the full use of these systems. Confidence with the in-situ methodologies is required to support technical justification for their use, resulting in acceptance and confidence by stakeholders and regulators.

2.0 Identify the Decision

The primary decision to be made from results of this study is whether the in-situ measurement systems can be used for certification on a CU by CU basis. The Study must be specific and detailed enough such that decisions can be made on the applicability of this technology to prospective future certification and/or classification studies on site soils for radiological analyses.

3.0 Inputs That Affect the Decision

The radiological constituents of concern at the FEMP are the primary radiological contaminants: isotopic uranium (from which both U_{-238} and U_{-total} will be reported), isotopic thorium, isotopic radium, as well as cesium-137. The maximum allowable detection capability of the in-situ instrumentation are the FRLs for the site soils. For practical purposes in this study, lower levels (see Table B-4) will be the detection limit goals in order to ensure detection capability at the site Waste Acceptance Criteria (WAC) for $uranium_{(total)}$ of 1030 μg/g. (See table B-2 for a list of contaminants of concern and corresponding action levels. See Table B-3 for a list of the total analyte list, which includes $U_{-234/235}$ for checking isotopic ratios, and K_{-40} for monitoring analysis efficiency).

The analytical media include soil, sediment, and organic material in the compositions typically encountered on the site.

The HPGe and sodium iodide (NaI) detectors were previously evaluated in studies performed in 1994(Soil Uranium Soils Demonstration Project) and 1995 (Appendix E of the Area I, Phase I Work Plan). Based on these studies, the following key factors have been identified as required to obtain accurate analyte concentrations for the in-situ measurement systems:

- Soil type
- Soil temperature
- Soil density
- Soil percent moisture
- environmental conditions impacting the instrumentation (rain, snow, temperature, vegetation)

4.0 The Boundaries of the Situation

The population parameters of concern in this study are all of the inputs that impact certification decisions that would be made if based on separate but parallel in-situ and laboratory data. These parameters include detection capability, data reproducability, linear range, and comparability with fixed-laboratory results.

The scale of decision making will be on the level of the certification unit (CU) as defined in the Area 1, Phase I work plan.

The action triggering radiological concentrations will be the limits listed in Table B-4. These define the minimum required sensitivity to allow certification decisions to be

made, regulatory criteria to be complied with, and public safety to be maximized.

The time period of this study is limited to the start of the Area 1, Phase I remediation project (Fall 1996) until the delivery of the certification report in early 1997.

5.0 Decision Rule

All data derived from this investigation will be used to support sampling and analysis protocols for the Soils Characterization And Excavation Program (SCEP). This information will assist SCEP in evaluating the applicability of in-situ methodologies for use during site characterization.

The goal for measurements from the field in-situ methodologies is to test the degree of comparability with the numerical averaging from fixed laboratory analyses, and achieve a detection level well below approximately 10 μg/g (ppm) total U. The site clean up level is 82ppm total U, with an As Low As Reasonably Achievable (ALARA) goal of 50ppm total U, and 20ppm total U in the former Process Area. If the field in-situ gamma unit do not correlate well with laboratory data then this in-situ methodology will be re-evaluated as to its usefulness for the project.

6.0 Limits on Decision Errors

An analytical false positive error for the in-situ gamma unit would be soil sample results that indicate higher than actual levels of radiological contaminants. This is a result that indicates a problem (therefore action) when there is no problem. The consequences of this type of error would be overestimating the levels of contaminants in the surface soils in the comparison study and possibly making a faulty decision as to whether this is an acceptable technology. This could also increase the amount of soil that will need to be excavated and disposed of.

An example of false positive errors from laboratory analysis would be a soil sample result that indicates a higher than actual level of contamination in the soil samples. This could result in evaluating the in-situ gamma unit as analyzing the presence of contaminants in soil below actual levels. This could result in eliminating an acceptable technology or overestimating the amount of soils requiring excavation.

A false negative error for the in-situ gamma units would result in underestimating the level of radiological contaminants in the soils, resulting in inadequate characterization of the soil. Inadequate characterization of the soil would result in inaccurate portrayal of the uranium envelope. This could result in additional risk to people exposed to the site after remediation is completed.

A false negative error from the laboratory analysis would be analytical results that indicate a lower than actual level of radiological contamination. This could result in elimination an acceptable technology and underestimate the amount of soils to

excavate. This could have impact on human risk by leaving more radiological constituents in the soil and thus increasing the risk above the acceptable level.

If measurement MDCs are well below the FRL, then non detect measurements will have little impact on the decisions made.

False negative errors are of more concern because of their potential adverse impact on human health.

Acceptable percent errors established by EPA are 10% false positives and 5% false negatives. Laboratory and field quality control measures shall be instituted to minimize errors. If sufficient valid data points are not obtained to meet project objectives, then samples collected and archived are available for analysis providing individual parameter hold times have not expired.

Errors in the sampling will be minimized through review of the sampling plan requirements with sampling technicians, providing on-site technical guidance by SCEP staff during the sampling operation, and the use of field quality control samples.

Errors in the laboratory analysis will be controlled through the use of QA/QC samples as per SCQ protocols. QA/QC samples will be analyzed for the identified radiological parameters and percent moisture. The moisture content of the soil samples is being obtained to assess the amount of water. Water can shield the gamma radiation and knowledge of this parameter may help increase understanding of field data variabilities.

7.0 Design for Obtaining Quality Data

7.1 Sample Collection

Data collection will be conducted in a minimum of ten selected areas having the dimensions of 10 by 10 meters (33 by 33 feet). The selection will be based on the level and type of contamination, accessability, and the ability to achieve the goals as stated above. Data collection will be divided into six different stages identified as:

- RTRAK Measurements
- HPGe Measurements
- Surface Moisture
- Density Gauge Measurements
- Physical Sampling
- Soil temperature readings

In-situ measurements inside each of the ten selected area will be performed by the RTRAK, HPGe, and surface moisture-density gauge. RTRAK measurements will be

conducted first followed by HPGe measurements. Surface moisture-density gauge measurements and physical sampling will be performed at the same time. All measurements and sampling will be completed within one day's time for each area. Coordinates of each sample location will be surveyed by Soil and Miscellaneous Media Projects (SMMP) personnel, using Geodimeter survey instrumentation in order for precision to be maintained.

HPGe measurements will be performed from both 30 cm (1 ft) and 1 m (3.3 ft) above a fixed point on ground surface. Immediately after in-situ measurements have been taken, 6 to 15 physical soil samples (for isotopic analysis) will be collected beginning at the same fixed point and radiating outward in a predetermined pattern. (This pattern design provides data that approximates the spherical crosssection of the HPGe detector readings.) Adjacent to each physical sample location, one or more surface moisture-density gauge measurement will be taken. Soil temperature will also be measured.

Each of the ten areas will be mowed and excessive debris removed by FEMP Site Personnel prior to the start of sampling and measurements.

7.2 QC Considerations

Laboratory analyses will be performed using the methodology and QC analyses specified for ASL B in the SCQ.

A rinsate blank of one of the casings will be collected and analysed prior to collection of the environmental samples, to ensure that these casings are not sources of contamination. If contamination is detected in this rinsate, the Project Manager in conjunction with applicable quality assurance analytical personnel will be responsible for determining the impacts on the project, and if necessary identifying and implementing an alternate container preparation or sampling technique that will insure data quality is not impacted. Field QC samples will also include field duplicates, collected with a frequency of one per Area (Areas will be listed in the PSP, and will define locations that are homogenous by soil matrix.).

7.3 Independent Assessment

Self-assessment and independent assessments of work processes and operations shall be undertaken to assure quality of performance. Self-assessment shall encompass technical and procedural requirements. Such self-assessment may be conducted at any point in the project.

Independent assessment shall be performed by the Fernald Environmental Management Project (FEMP) QA organization by conducting Surveillances. Surveillances shall be planned and documented in accordance with Section 12.3 of the SCQ.

7.4 Applicable Procedures

Sample collection under the PSP shall follow the requirements outlined within the following procedures:

ADM-02, Field Project Prerequisites
ASTM D 2922-91: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017-88: Standard Test Method for Water Content of Soil and Rock in place by Nuclear Methods (Shallow Depth)
EP-SMS-002, Field Quality Control Samples
EQT-22, Characterization of Gamma Sensitive Detectors
EQT-23, Operation of ADCAM Series Analyzers with Gamma Sensitive Detectors
EQT-30, Operation of the RTRAK Vehicle Sodium Iodide (NaI) Detection System
SMPL-01, Solids Sampling
PSP for Area 1 Phase 1, Remedial Action Work Plan for Comparability Study, Part B, Section 2.0

Data Quality Objective Summary
Site Soils
In-Situ Comparability Study

1A Task/Description: Comparability Sampling Analysis

1.B Project Phase: (Put an X in the appropriate selection.)

RI ☐ FS ☐ RD ☐ RA ☒ R,A ☐ OTHER

1.C. DQO No.: SL-025 DQO Reference No.: N/A

---

2. ☐ Media Characterization: (Put an X in the appropriate selection.)

Air ☐ Biological ☐ Groundwater ☐ Sediment ☐ Soil ☒

Waste ☐ Wastewater ☐ Surface water ☐ Other (specify) _____

---

3 Data Use with Analytical Support Level (A-E): (Put an X in the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization
A ☒ B ☒ C ☐ D E ☐

Risk Assessment
A ☐ B ☐ C ☐ D ☐ E ☐

Evaluation of Alternatives
A ☐ B ☐ C ☐ D ☐ E ☐

Engineering Design
A ☐ B ☐ C ☐ D ☐ E ☐

Monitoring during remediation activities
A ☐ B ☐ C ☐ D ☐ E ☐

Other
A ☐ B ☐ C ☐ D ☐ E ☐

4.A Drivers: Area 1 Phase 1 Remedial Action Work Plan (RAWP), Applicable or Relevant and Appropriate Requirements (ARARs) and Operable Unit 5 Record of Decision (ROD)

4.B Objective: Determine whether the in-situ methods used for radiological contamination are comparable with fixed laboratory analyses for providing accurate soils' data, and whether they are of sufficient accuracy and precision to be used for soil certification.

5. Site Information (Description):

The OU2 and OU5 RODs have identified areas at the FEMP that require remediation activities. The RODs specify that the soils in these areas will be comply with the FRLs. Certification will be necessary for areas of the site with soils that have been remediated to demonstrate that the residual soils do not contain contamination exceeding these levels. Use of in-situ testing would provide significant time and cost savings, if the resulting data is of sufficient quality and repeatability.

6 A. Data Types with appropriate Analytical Support Level Equipment Selection and SCQ Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the SCQ Section.)

1. pH	☐	2. Uranium	☐	3. BTX	☐
Temperature	☒*	Full Radiologic	☒**	TPH	☐
Specific Conductance	☐	Metals	☐	Oil/Grease	☐
Dissolved Oxygen	☐	Cyanide	☐		
Technetium-99		Silica	☐		
4. Cations	☐	5. VOA (specify)	☐	6. Other	☒***
Anions	☐	BNA	☐		
TOC	☐	Pesticides	☐		
TCLP	☐	PCB	☐		
CEC	☐				
COD	☐				

* soil and ambient air temperature at individual sample locations
** See Attached List
*** Density and % moisture

6 B. Equipment Selection and SCQ Reference:

	Equipment Selection	Refer to SCQ Section
ASL A	RTRAK, HPGe, Densitometer	SCQ Section: App B, Table 1

ASL B Per SCQ SCQ Section: App B, Table 1

ASL C _____ SCQ Section: _____

ASL D _____ SCQ Section: _____

ASL E _____ SCQ Section: _____

7.A. Sampling Methods: (Put an X in the appropriate selection.)

Biased ☐ Composite ☐ Environmental ☐ Grab ☒ Grid ☒

Intrusive ☒ Non-Intrusive ☐ Phased ☐ Source ☐

DQO Number: SL-025

7.B Sample Work Plan Reference: The DQO is being established prior to completion of the work plan.

Background samples: Area 1 Phase 1 Remedial Action Work Plan

7.C. Sample Collection Reference:

Sample Collection Reference: Per SCQ

---

8. Quality Control Samples: (Place an "X" in the appropriate selection box.)

8.A. Field Quality Control Samples:

Trip Blanks	☐	Container Blanks	☒ **
Field Blanks	☐ **	Duplicate Samples	☒
Equipment Rinsate Samples	☐ **	Split Samples	☐
Preservative Blanks	☐	Performance Evaluation Samples	☐

Other (specify) ** Rinsates of the casings will be analyzed for applicable analytes of concern to prequalify the casings as not containing contaminant levels that would impact the levels of concern. Rinsates will also be performed for cutting shoes where they are

utilized. Other field blanks and rinsates are not applicable to this type of sampling analysis.

8 B. Laboratory Quality Control Samples:

Method Blank	☒	Matrix Duplicate/Replicate	☒
Matrix Spike	☒	Surrogate Spikes	☐

Other (specify) _____

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

Sample density will be dependent upon the class of Certification Unit for an area. Proposed Certification Unit designation will be included in Project Specific Plans for each area sequentially undergoing certification.

TABLE B-1

AREA DESIGNATIONS

Area Designation	Contamination Level	Areas by Identification Number
Low	0 - 80 ppm Total Uranium	1, 8, 9
Medium	80 - 200 ppm Total Uranium	2, 4, 5, 6
High	> 200 ppm Total Uranium	3, 7
Heterogeneous	Varied	10

TABLE B-2
SUMMARY OF SITE SOIL CONSTITUENTS OF CONCERN

Analytical Suites	Site Soil Contaminants of Concern	Certification Level (FRL)
Primary COCS		
Gamma discernable radiological	Uranium-238	6.7 pCi/g FRL [1, 2]
	Uranium-Total	20 μg/g FRL [3]
	Radium-226	1.7 pCi/g FRL [4]
	Radium-228	1.8 pCi/g FRL [4]
	Thorium-228	1.7 pCi/g FRL [4]
	Thorium-230	280 pCi/g FRL [4]
	Thorium-232	1.5 pCi/g FRL [4]
	Cesium-137	1.4 pCi/g FRL [5]

1 Uranium-238 value is based on the OU5 Final ROD (1/31/96) FRL for uranium-total in the FEMP process area, assuming the natural distribution of uranium isotopes

2 OU5 Final ROD (1/31/1996) FRLs are listed: Minimum Detectable Activity (MDA) goals are 5.0 mg/kg

3 20 mg/Kg limit is the OU5 Final (ROD (1/31/1996) FRL for the process area. FRL is 82 μg/g for the site as a whole, with ALARA goal of 50μg/g

4 OU5 Final ROD (1/31/1996) FRLs are listed: MDA goals are 1.0 pCi/g

5 OU5 Final ROD (1/31/1996) FRL is listed:MDA goal is 0.5 pCi/g

TABLE B-3

IN-SITU COMPARABILITY STUDY: ANALYTE/SAMPLE COLLECTION LIST

ANALYTE	SAMPLE MATRIX	LAB	ASL	HOLDING TIME	METHOD/ CONTAINER
Uranium-234/235	Solid	On-Site	B	6 Months	Capped Liner
Uranium-238	Solid	On-Site	B	6 Months	
Radium-226	Solid	On-Site	B	6 Months	
Radium-228	Solid	On-Site	B	6 Months	
Thorium-228	Solid	On-Site	B	6 Months	
Thorium-230	Solid	On-Site	B	6 Months	
Thorium-232	Solid	On-Site	B	6 Months	
Cesium-137	Solid	On-Site	B	6 Months	
Potassium-40	Solid	On-Site	B	6 Months	

TABLE B-4
SUMMARY OF SITE SOIL CONSTITUENTS TARGET DETECTION LIMIT GOALS

Analytical Suites	Site Soil Contaminants of Concern	Target Detection Limit Goals
Primary COCS		
Gamma discernable radiological	Uranium-238	5.0 pCi/g [2]
	Uranium-Total	10 μg/g [1]
	Radium-226	0.5 pCi/g [2]
	Radium-228	0.5 pCi/g [2]
	Thorium-228	0.5 pCi/g [2]
	Thorium-230	50 pCi./g [2]
	Thorium-232	0.5 pCi/g [2]
	Cesium-137	0.5 pCi/g [2]

[1] U_{-total} value is based on 1/2 of the FRL for the process area. The instrumentation needs to also be able to resolve U_{-total} at the WAC limit of 1030 μg/g

[2] Detection levels are based on the expected detection capabilities for the HPGe detector system.

APPENDIX D

APPENDIX D

SLOAN'S CRAYFISH MANAGEMENT PLAN

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D.1.0 SLOAN'S CRAYFISH MANAGEMENT PLAN

D.1.1 Introduction

The purpose of this plan is to provide a management strategy for the state-threatened Sloan's crayfish *(Orconectes sloanii)* and its associated habitat at the Fernald Environmental Management Project (FEMP). The potential exists for impacts to the habitat and population to occur during the Area 1, Phase I soil excavation work within Operable Unit 5. Remedial work at the FEMP has the potential to result in increased sediment loading to Paddys Run in the area inhabited by the Sloan's crayfish. Therefore, the Department of Energy (DOE) has prepared a management plan to meet the intent of state and federal regulations governing the management of threatened and endangered species and to fulfill the DOE's role as a Natural Resource Trustee.

D.1.2 Background

The Sloan's crayfish has been listed as threatened in the state of Ohio. Populations of the Sloan's crayfish are known to reside only in southeastern Indiana and southwestern Ohio (St. John, 1993). The Sloan's crayfish resides in streams with constant flow and flat, rocky bottoms covered with broken or rounded stones. A decline in the species has been noted in streams that have been affected by urbanization, construction, and other forms of human stress. Crayfish breathe through gills; therefore, increases in sediment loading in streams they inhabit will decrease their chances for survival.

The species was discovered in the northern portion of Paddys Run at the FEMP (Figure D.1-1) during surveys conducted by Dr. F. Lee St. John in September 1993 and May 1994. The surveys for the crayfish were amongst several conducted at the site during that time frame. Remediation of the FEMP is being undertaken pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and will involve the excavation of large portions of the site and the construction of new treatment and disposal facilities. The Sloan's crayfish has been identified as a species that requires special consideration during the planning and implementation of remedial activities at the FEMP.

D.1.3 Management Objectives

The primary objective in managing the Sloan's crayfish population at the FEMP is to ensure that adequate habitat is available within Paddys Run for the continued existence of the population upon

completion of site remediation. This will be accomplished through preservation and/or postremedial restoration. In addition, efforts to protect the current population from degradation during remedial activities will also be employed to the extent practicable. As discussed in greater detail below, the combination of adequate controls to minimize sediment loading from the Area 1, Phase I work (as well as other remedial activities) coupled with the availability of a "refuge area" for the crayfish population upstream will minimize short-term degradation to the crayfish population. In addition, field monitoring will be initiated to identify potential impacts to the portions of Paddys Run containing the population. If it is determined that impacts to the stream may result in the long-term degradation of the population, then DOE will notify the appropriate agencies and relocate individual crayfish.

The objectives of this management plan are to undertake all measures practicable to protect the species within Paddys Run and to minimize stress to the species by relocating only if necessary. The DOE feels the most important aspect of the management plan is to ensure that an optimal habitat exists for the crayfish in the long-term (i.e., postremediation). This would be accomplished either through preserving and/or enhancing existing habitat or restoring habitat if the existing habitat is impacted during remediation. Future FEMP remedial activities may also involve excavation activities that will potentially impact the population. Therefore, this plan of action may be incorporated by reference into future work plans. The monitoring aspect of this management plan will be outlined in a support plan to the Integrated Environmental Monitoring Plan (IEMP) and will include the reporting of monitoring results to the appropriate agencies on a quarterly basis.

D.2.0 MANAGEMENT PLAN

There are three phases to the protection of the Sloan's crayfish and its associated habitat within Paddys Run. The first two phases are avoidance measures while the last phase is a mitigation effort. First, several controls will be installed to prevent excessive sedimentation into Paddys Run. Second, the area of Paddys Run upstream of the train trestle and the confluence of the northern drainage ditch will be preserved as a refuge for Sloan's crayfish to the maximum extent practicable (shown in Figure D.2-1). The third aspect of protection is the mitigation of appropriate habitat, if required, after remedial activities have been completed. All three phases of Sloan's crayfish protection are discussed in more detail below.

D.2.1 Sedimentation Controls

The primary source of surface water runoff from the FEMP to the Sloan's crayfish habitat in Paddys Run is from the westerly flowing drainage area located directly north of the railroad tracks on the northern side of the former production area. The confluence of this drainage area and Paddys Run is a National Pollutant Discharge Elimination System (NPDES) permitted storm water outfall (*4006) and is subject to semiannual monitoring under the terms and conditions of the current site NPDES permit (Ohio EPA Permit No. 1IO00004*ED). This ditch was also identified as a jurisdictional wetland during the 1993 delineation of the site.

Large scale earthmoving activities associated with the Operable Unit 1, Operable Unit 2, and Operable Unit 5 Remedial Actions are planned within several watershed basins in the northern and eastern portions of the site that ultimately drain to Paddys Run through the northern drainage ditch described above. Erosion control devices will conform to the requirements of the site NPDES permit, the FEMP Storm Water Pollution Prevention Plan (SWPPP, RM-0039), and various Applicable or Relevant And Appropriate Requirements (ARARs) identified in the Operable Unit 1, Operable Unit 2, and Operable Unit 5 RODs. Specifications for sedimentation and erosion control devices are being incorporated into the remedial design packages for these activities in an effort to avoid and/or minimize erosion and sedimentation to the northern drainage ditch and Paddys Run. As part of CERCLA Remedial Design packages for Operable Unit 1, Operable Unit 2, and Operable Unit 5, these erosion and sedimentation designs are subject to review and approval by the U.S. Environmental Protection Agency (U.S. EPA) and the Ohio Environmental Protection Agency (OEPA). Once established in the field, DOE will inspect these controls, at a minimum, on a weekly basis to ensure their effectiveness in accordance with the requirements of the SWPPP. Given that the extensive erosion and sedimentation controls described above will be established, adverse impacts to Sloan's crayfish habitat in Paddys Run will be avoided and minimized to the maximum extent practicable.

D.2.2 Refuge Preservation

The area of Paddys Run immediately north of the train trestle and the confluence of the northern drainage ditch to the FEMP property line will be preserved as a refuge for Sloan's crayfish to the maximum extent practicable (Figure D.2-1). Appropriate habitat exists in this area, as evidenced by several studies that have identified Sloan's crayfish upstream of the northern drainage ditch (St. John, 1993; Schneider, 1996). St. John, in his 1994 addendum report at the FEMP, concluded that Sloan's

crayfish repopulation within Paddys Run is governed by downstream migration rather than upstream migration or repopulation in situ.

The preservation of the upstream portion of Paddys Run is also the primary protection effort for the Indiana bat (*Myotis sodalis*), a federally-endangered species for which suitable habitat exists within the riparian areas north of the train trestle. This area will be considered a priority natural resource area, and a maximum effort will be made to preserve the stream and its associated habitat in its present state.

D.2.3 Restoration Commitment

Once remedial activities have been completed within the area of influence for Paddys Run, the stream will be restored to suitable Sloan's crayfish habitat, if necessary (Figure D.2-2). This stream restoration will take place in accordance with the sitewide natural resource restoration plan, as agreed to by the FEMP Natural Resource Trustees. It is expected the upstream refuge will act as the catalyst for the repopulation of impacted sections of Paddys Run, where pools and riffles will be reestablished.

D.3.0 FIELD MONITORING

Field monitoring will be conducted to determine the effectiveness of the sedimentation controls discussed above. Sedimentation controls will be inspected at least weekly in accordance with the FEMP SWPPP. In addition, visual observations will be used to monitor sediment loading in Paddys Run. DOE will conduct field observations within 24 hours of a storm event. If increased sediment loading is observed, daily monitoring will be initiated. If the increased loading continues for several days, DOE will implement the contingency plan to relocate individuals of Sloan's crayfish as described below.

The Sloan's crayfish population of Paddys Run will be surveyed every three years in order to monitor trends in the long-term status of the population. This information will not be used as an indicator of remedial impacts, but rather as an assistance in restoration planning.

D.4.0 CONTINGENCY PLAN

This contingency plan includes provisions for relocating individual Sloan's crayfish. Relocation will be dependant upon field observations of Paddys Run as discussed above. These relocation provisions

include the establishment of locations within Paddys Run, along with the frequency and methodology for relocation.

Relocation is an unproven technique that may result in harm to individuals. Problems associated with relocation include alteration of stream habitat from netting and species removal activity and loss of individuals from the stress of relocation. In addition, an otherwise healthy community could be impacted by the introduction of relocated species.

D.4.1 Relocation

The crayfish will be relocated further upstream within Paddys Run. Optimal habitat for the crayfish is a stream with constant current flowing over a rocky bottom, which occurs upstream of the train trestle in Paddys Run, within the refuge area illustrated in Figure D.2-1.

D.4.2 Frequency

Crayfish will be relocated as appropriate, up to a frequency of every two months, depending on stream conditions. If visual observations of the Paddys Run tributary indicates increased turbidity into Paddys Run for several consecutive days, then the crayfish will be relocated. If turbid tributary conditions persist two months after the initial relocation, the crayfish will be relocated again.

D.4.3 Methods

Crayfish will be obtained by seining Paddys Run with a minnow seine (1.2 x 1.8 meters; 0.64 centimeters mesh). Pools and riffles will be seined several times in an effort to capture as many individuals as possible. Upon capture, crayfish will be placed in a plastic container containing existing stream water and transported upstream for free release. The location selected for release will be predetermined based on the suitability of habitat.

D.5.0 REPORTING

The results of the monitoring activities described above will be reported to the U.S. EPA, OEPA and the Department of Interior (including the U.S. Fish and Wildlife Service) on a quarterly basis. Reporting will include observations of the sediment controls in place for the Area 1, Phase I work, observed impacts to the crayfish population resulting from site activities, and information available on

the status of the population. The report will include a copy of all field surveillance forms and a letter summarizing any findings for that reporting period. The first submittal of the report will occur on September 1, 1996 and will be submitted quarterly thereafter. Any issues requiring immediate attention (e.g., impacts that may require relocation of the species) will be conveyed to the agencies listed above as necessary. The reporting will be integrated with the quarterly reporting of other natural resource impacts which will be outlined in an independent plan supporting the IEMP.

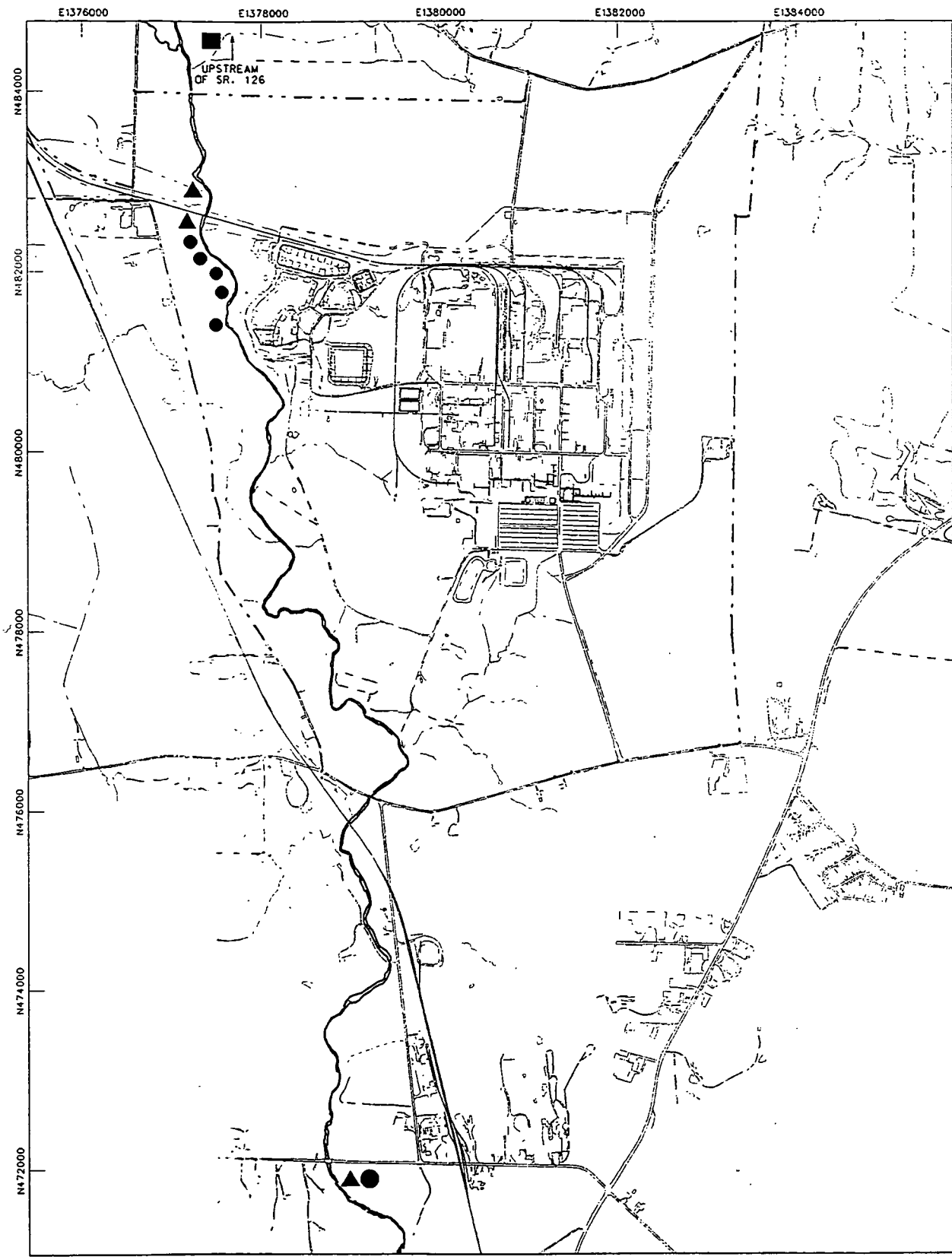
REFERENCES

Schneider, T. Sloan's Crayfish Populations in the Northern Portion of Paddys Run, personal communication, 1996.

St. John, F. L. Report on the Sloan's Crayfish (*Orconectes sloanii* Bundy) at the Fernald Environmental Management Project, 1993.

St. John, F.L., Addendum to the Report on the Status of the Sloan's Crayfish, *Orconectes sloanii* (Bundy, 1876) at the Fernald Environmental Management Project, 1994.

FILE NAME /res3016/crayfish1.dgn 8x11 cr05 6-25-96 GES STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

- FEMP BOUNDARY
- ▲ SLOAN'S CRAYFISH POPULATIONS IN 1993
- ● SLOAN'S CRAYFISH POPULATIONS IN 1994
- ■ SLOAN'S CRAYFISH POPULATIONS IN 1995

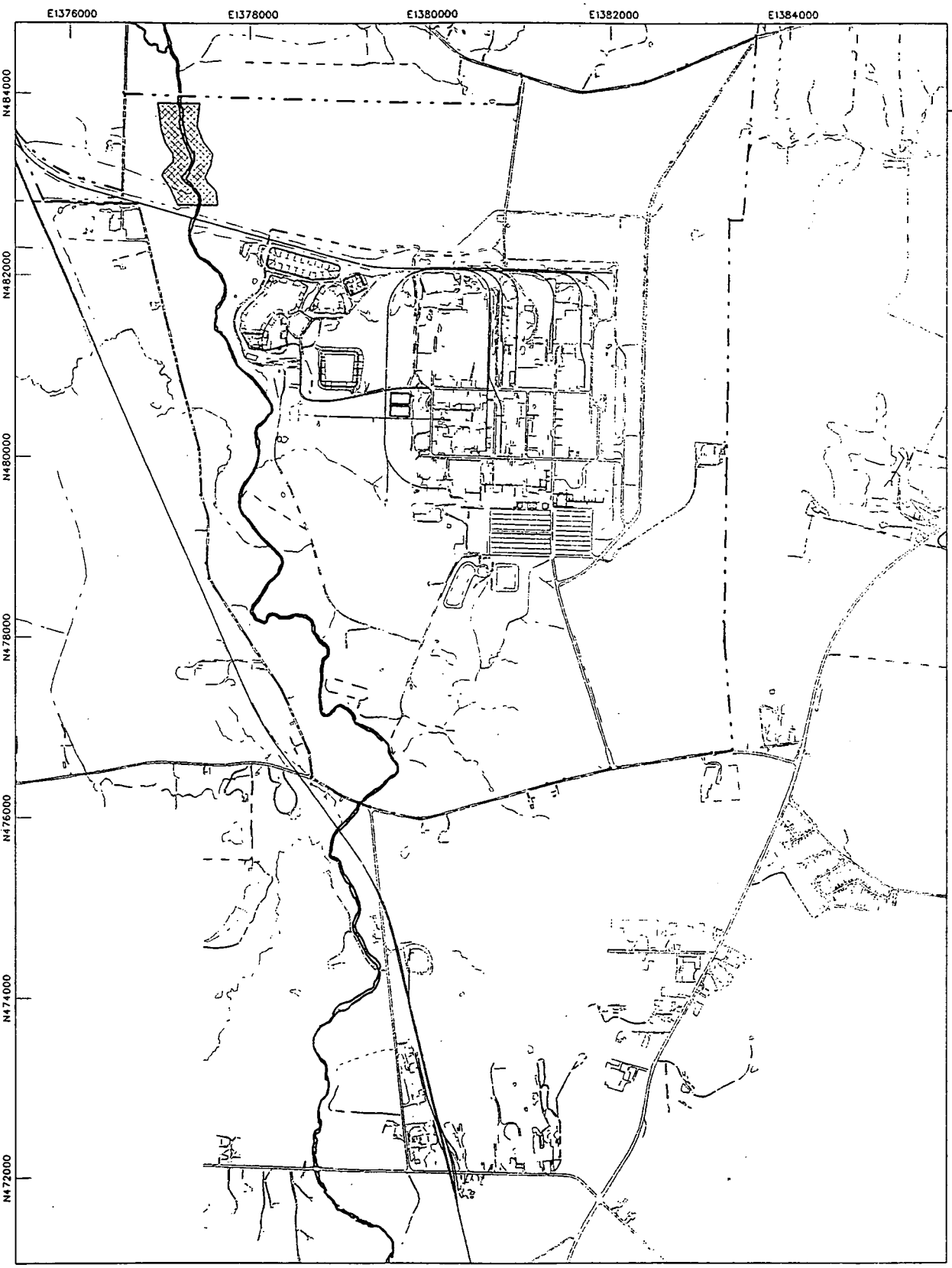
SCALE

1500 750 0 1500 FEET

DRAFT

FIGURE D.1-1. RECENT SURVEY RESULTS FOR SLOAN'S CRAYFISH

FILE NAME /res3016/crayfish2.dgn 8x11 cru5 6-25-96 GES STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

— · · — FEMP BOUNDARY

REFUGE AREA FOR SLOAN'S CRAYFISH

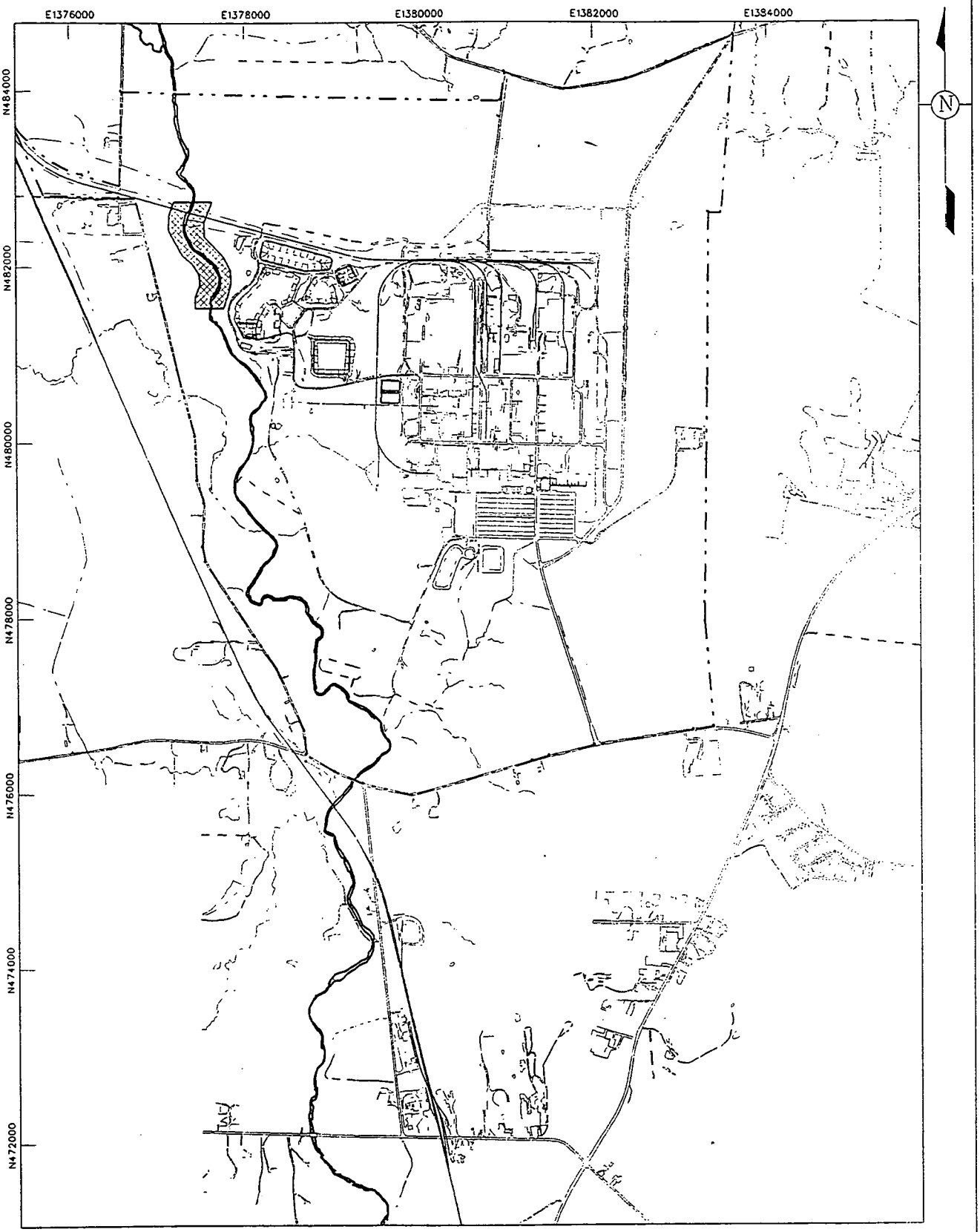
SCALE

1500 750 0 1500 FEET

DRAFT

FIGURE D.2-1. REFUGE AREA FOR SLOAN'S CRAYFISH

FILE NAME /res3016/crayfish3.dgn 8x11 cru5 6-25-96 CES STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

FEMP BOUNDARY

AREA OF INFLUENCE FOR PADDY'S RUN

SCALE

1500 750 0 1500 FEET

DRAFT

FIGURE D.2-2. AREA OF INFLUENCE FOR PADDY'S RUN

APPENDIX E
SPATIAL DISTRIBUTION OF SAMPLES RELATIVE TO FINAL REMEDIATION LEVELS, WASTE ACCEPTANCE CRITERIA, AND BENCHMARK THRESHOLD VALUES

Appendix E.

E-1 Sitewide Location of Samples in Excess of FRL; Total Uranium
E-2 Sitewide Location of Samples in Excess of FRL; Thorium-228
E-3 Sitewide Location of Samples in Excess of FRL; Thorium-232
E-4 Sitewide Location of Samples in Excess of FRL; Radium-226
E-5 Sitewide Location of Samples in Excess of FRL; Radium-228
E-6 Sitewide Location of Samples in Excess of FRL; Cesium-137
E-7 Sitewide Location of Samples in Excess of FRL; Lead-210
E-8 Sitewide Location of Samples in Excess of FRL; Neptunium-237
E-9 Sitewide Location of Samples in Excess of FRL; Plutonium-238
E-10 Sitewide Location of Samples in Excess of FRL; Strontium-90
E-11 Sitewide Location of Samples in Excess of FRL; Technetium-99
E-12 Sitewide Location of Samples in Excess of FRL; Thorium-230
E-13 Sitewide Location of Samples in Excess of FRL; Arsenic
E-14 Sitewide Location of Samples in Excess of FRL; Beryllium
E-15 Sitewide Location of Samples in Excess or Below the FRL and BTV; Lead
E-16 Sitewide Location of Samples in Excess or Below the FRL and BTV; Manganese
E-17 Sitewide Location of Samples in Excess of FRL; Aroclor-1260
E-18 Sitewide Location of Samples in Excess of FRL; of Aroclor-1254
E-19 Sitewide Location of Samples in Excess of FRL; Carbozole
E-20 Sitewide Location of Samples in Excess of FRL; Dieldrin
E-21 Sitewide Location of Samples in Excess or Below the FRL and BTV; Benzo(a)anthracene
E-22 Sitewide Location of Samples in Excess or Below the FRL and BTV; Benzo(b)flouranthene
E-23 Sitewide Location of Samples in Excess or Below the FRL and BTV; Benzo(a)pyrene
E-24 Sitewide Location of Samples in Excess or Below the FRL and BTV; Dibenzo(a,h)anthracene
E-25 Sitewide Location of Samples in Excess of FRL; Indeno(1,2,3-cd)pyrene
E-26 Sitewide Location of Samples in Excess of FRL; 1,1-Dichloroethene
E-27 Sitewide Location of Samples in Excess of FRL; Tetrachlorethene
E-28 Sitewide Location of Samples in Excess of FRL; Trichloroethene
E-29 Sitewide Location of Samples in Excess of FRL; Heptachlorodibenzo-p-dioxin
E-30 Sitewide Location of Samples in Excess of FRL; Octachlorodibenzo-p-dioxin
E-31 Sitewide Location of Samples in Excess of WAC; Total Uranium
E-32 Sitewide Location of Samples in Excess of WAC; Technetium-99
E-33 Sitewide Location of Samples in Excess of WAC; Trichloroethene
E-34 Sitewide Location of Samples in Excess of WAC; Tetrachlorothene
E-35 Sitewide Location of Samples in Excess of WAC; Bromodichloroethane
E-36 Sitewide Location of Samples in Excess of WAC; Ether
E-37 Sitewide Location of Samples in Excess of WAC; Alpha-Chlordane
E-38 Sitewide Location of Samples in Excess of WAC; 4-Nitroaniline
E-39 Sitewide Location of Samples in Excess of WAC; Vinyl Chloride
E-40a Sitewide Location of Samples in Excess of BTVs; Aluminum
E-40b Sitewide location of Samples in Excess of 95th Percentile of Surface Soil Background: Aluminum
E-40c Sitewide location of Samples in Excess of 95th Percentile of Sub-Surface Soil Background: Aluminum
E-41 Sitewide Location of Samples in Excess of BTVs; Antimony
E-42 Sitewide Location of Samples in Excess of BTVs; Benzo(g,h,i)perylene
E-43 Sitewide Location of Samples in Excess of BTVs; Benzo(k)fluoranthene
E-44 Sitewide Location of Samples in Excess of BTVs; Cadmium
E-45 Sitewide Location of Samples in Excess of BTVs; Chrysene
E-46 Sitewide Location of Samples in Excess of BTVs; Molybdenum
E-47 Sitewide Location of Samples in Excess of BTVs; Silver
E-48 Sitewide Location of Samples in Excess of BTVs; Zinc

FIGURE E-1. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL; TOTAL URANIUM.

SRD10 DGN MAP HOR OPTH SL83.054.DGN 11-13-96 STATE PLANAR COORDINATE SYSTEM 1983

000302

514

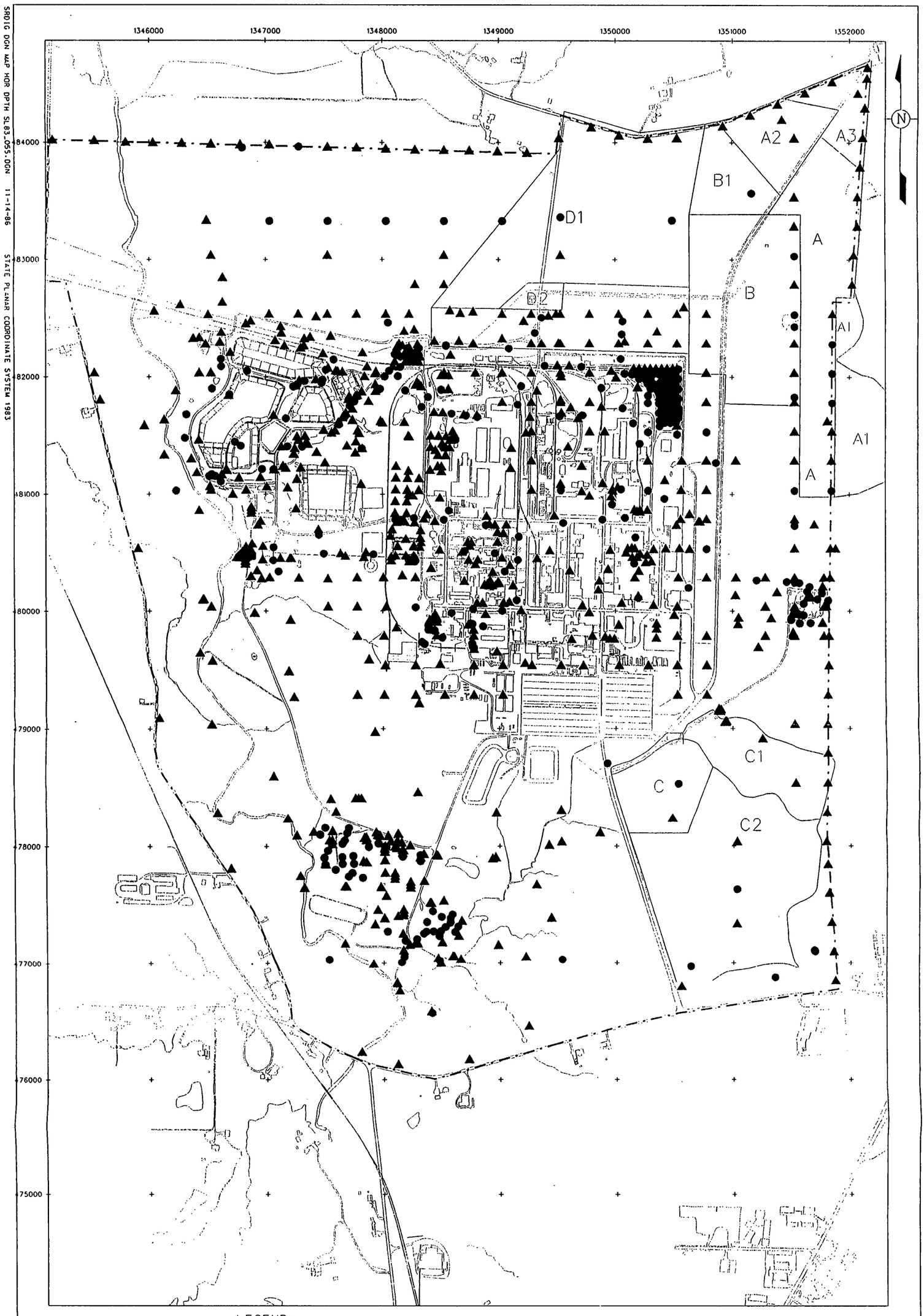


FIGURE E-2. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL; THORIUM-228.

SRDIG DGN MAP HOR DPTH SL83_055.DGN 11-14-86 STATE PLANAR COORDINATE SYSTEM 1983

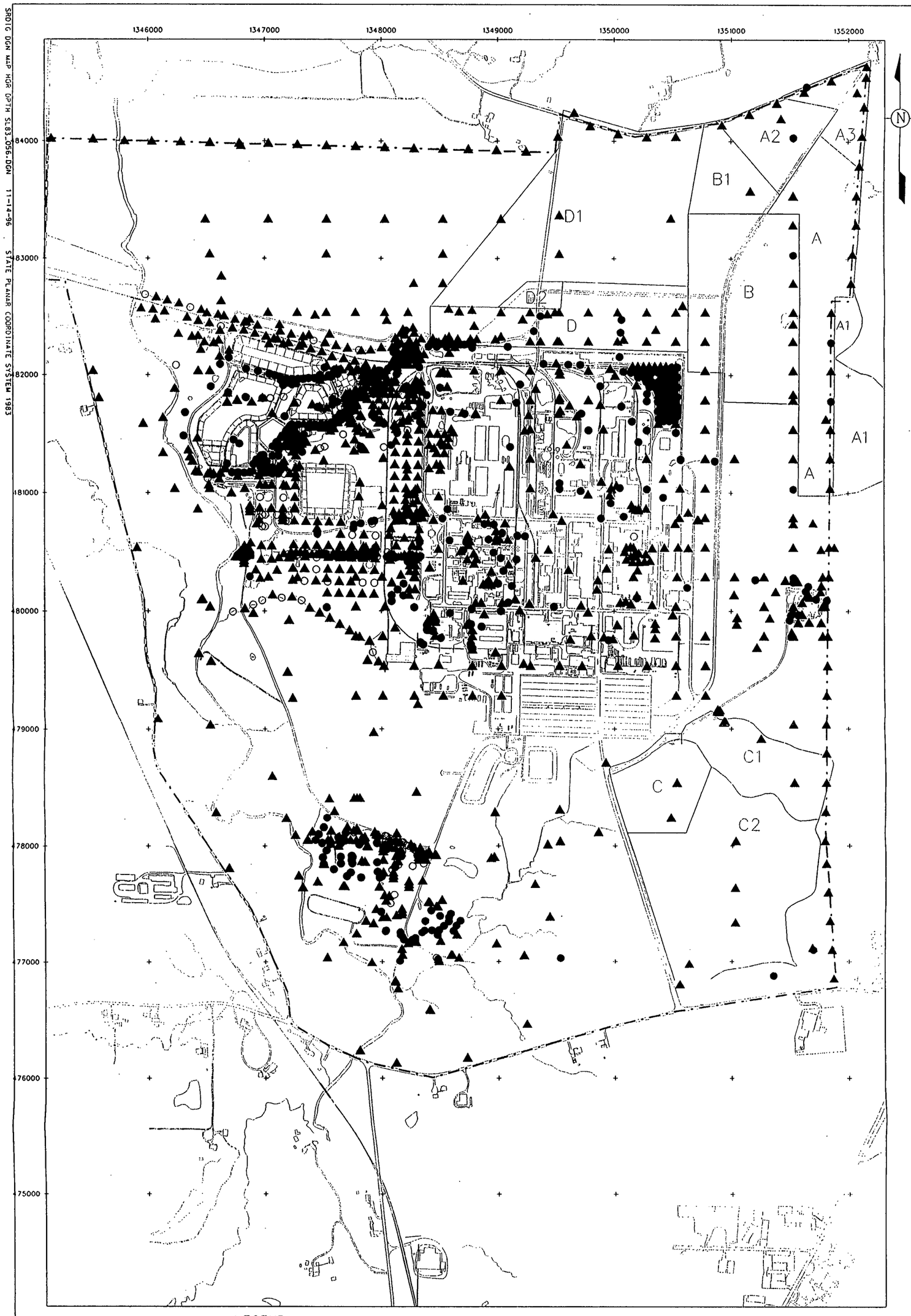
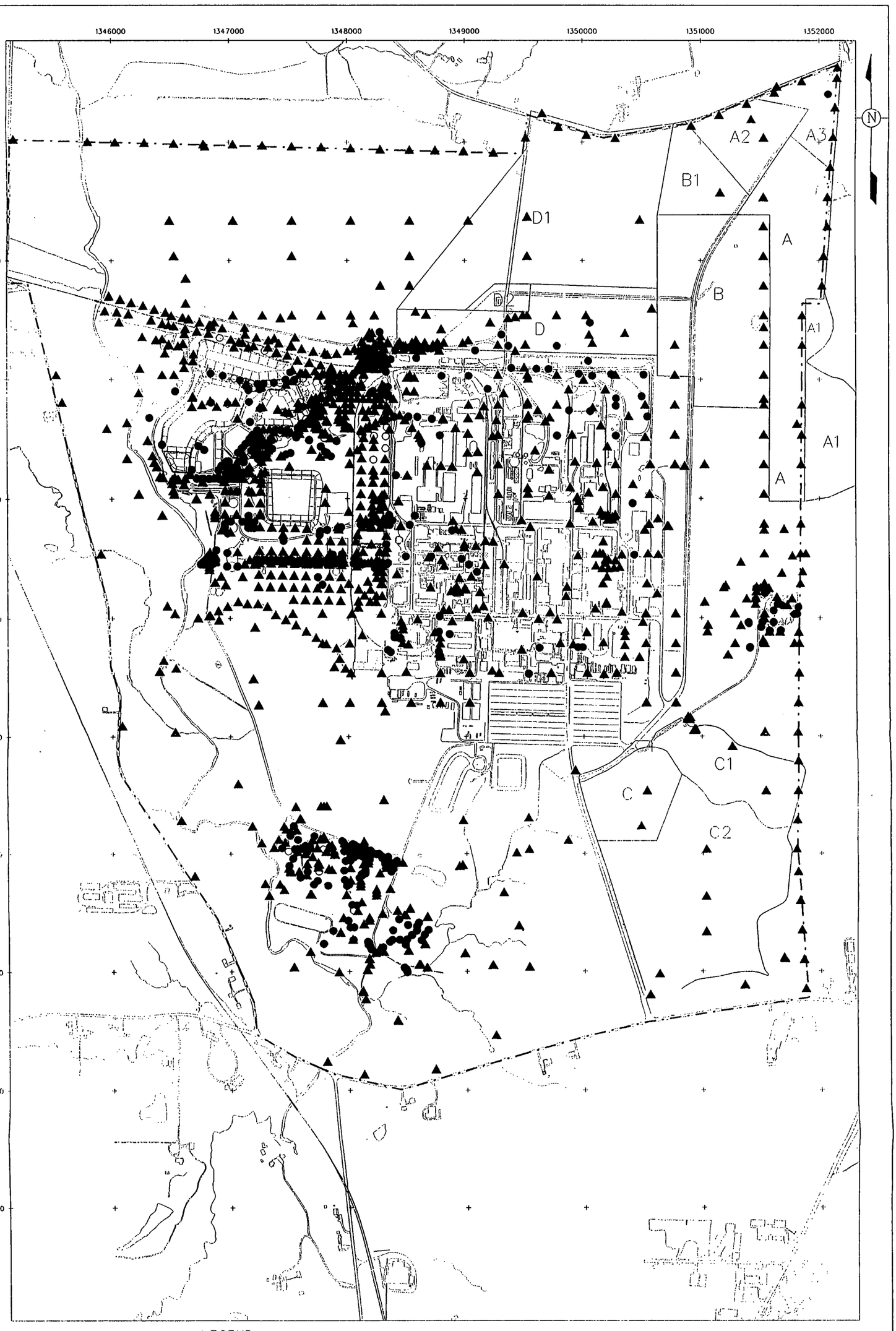


FIGURE E-3. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL; THORIUM-232.

SRDIG DGN MAP HGR OPTH SL83_056.DGN 11-14-96 STATE PLANAR COORDINATE SYSTEM 1983

000304

514



LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL; DETECTED
- ○ EXCEEDS FRL; NON DETECTED
- ▲ BELOW FRL; DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-4. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL; RADIUM-226.

SRDTG DGN MAP HOR DPTH SL83_057.DGN 11-14-96 STATE PLANAR COORDINATE SYSTEM 1983

000305

514

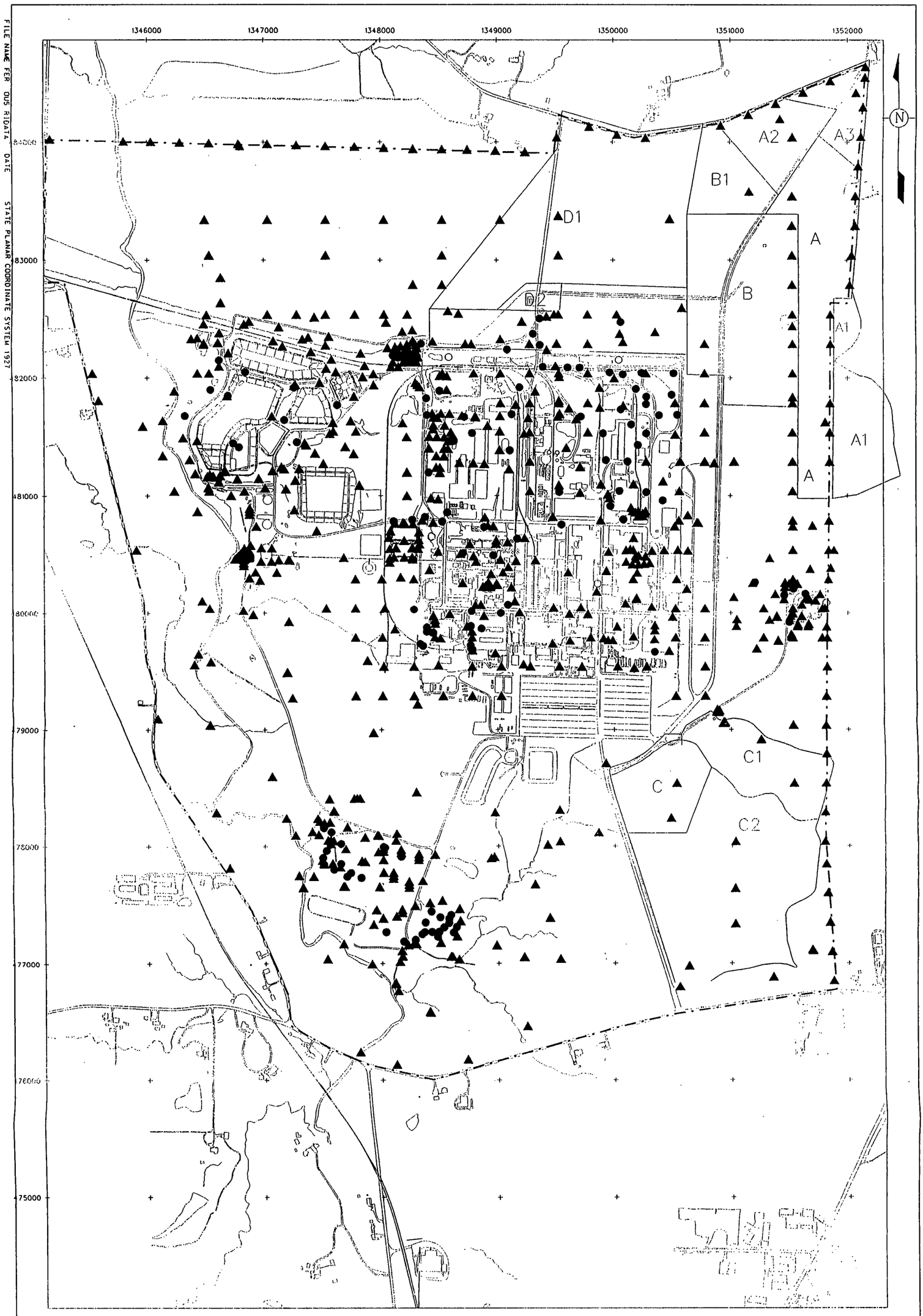


FIGURE E-5. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL; RADIUM-228.

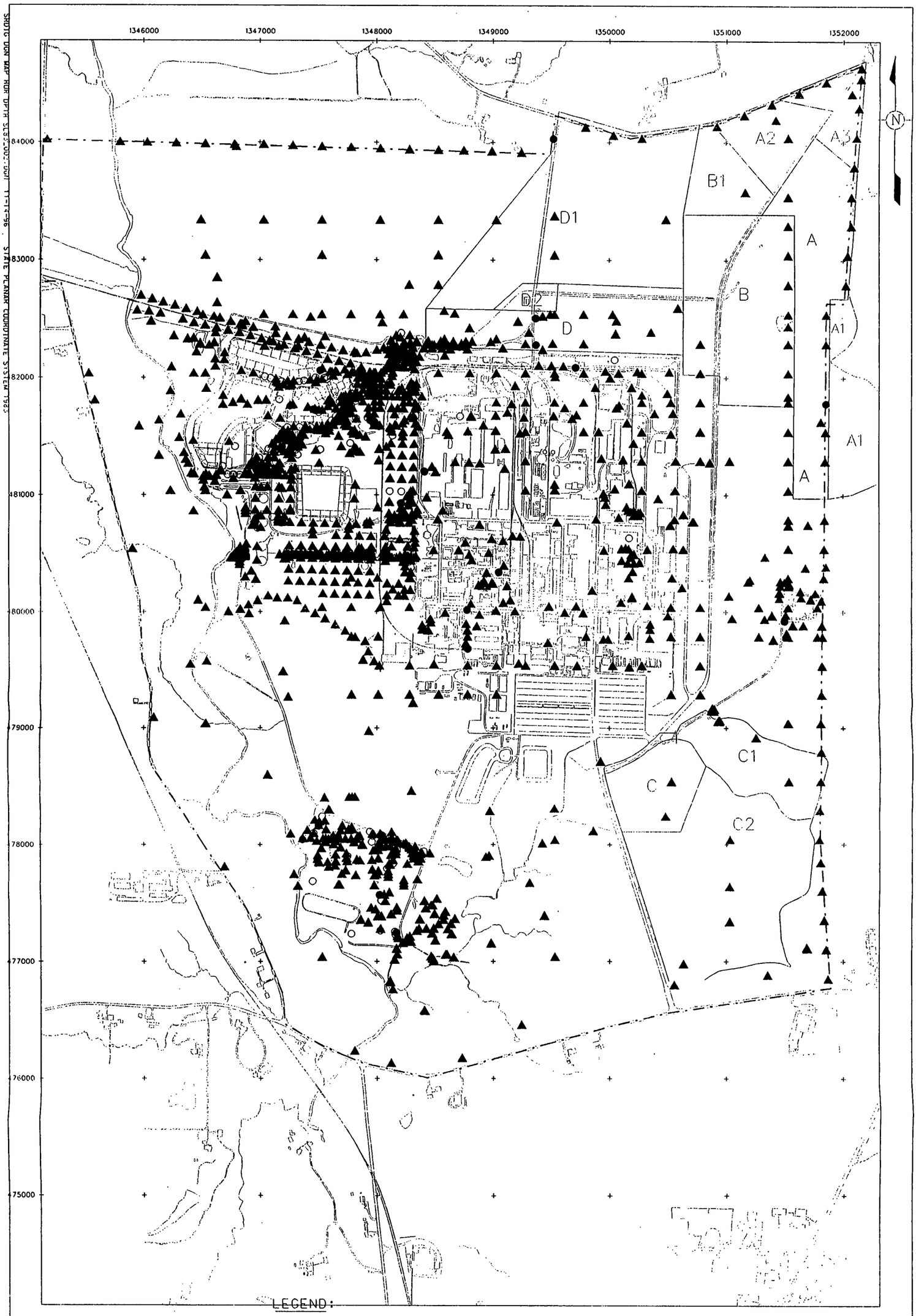
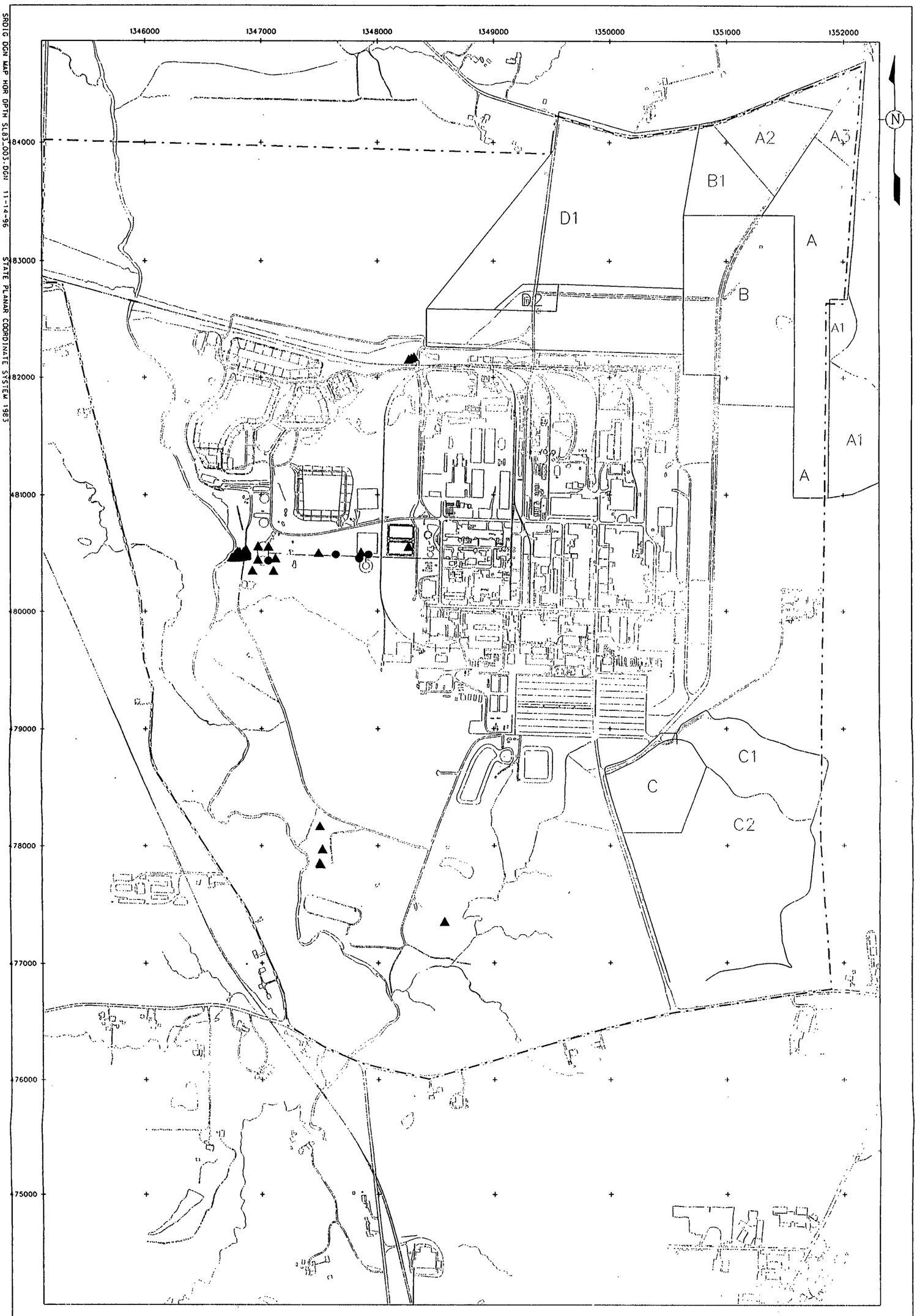


FIGURE E-6. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: CESIUM-137.



LEGEND:

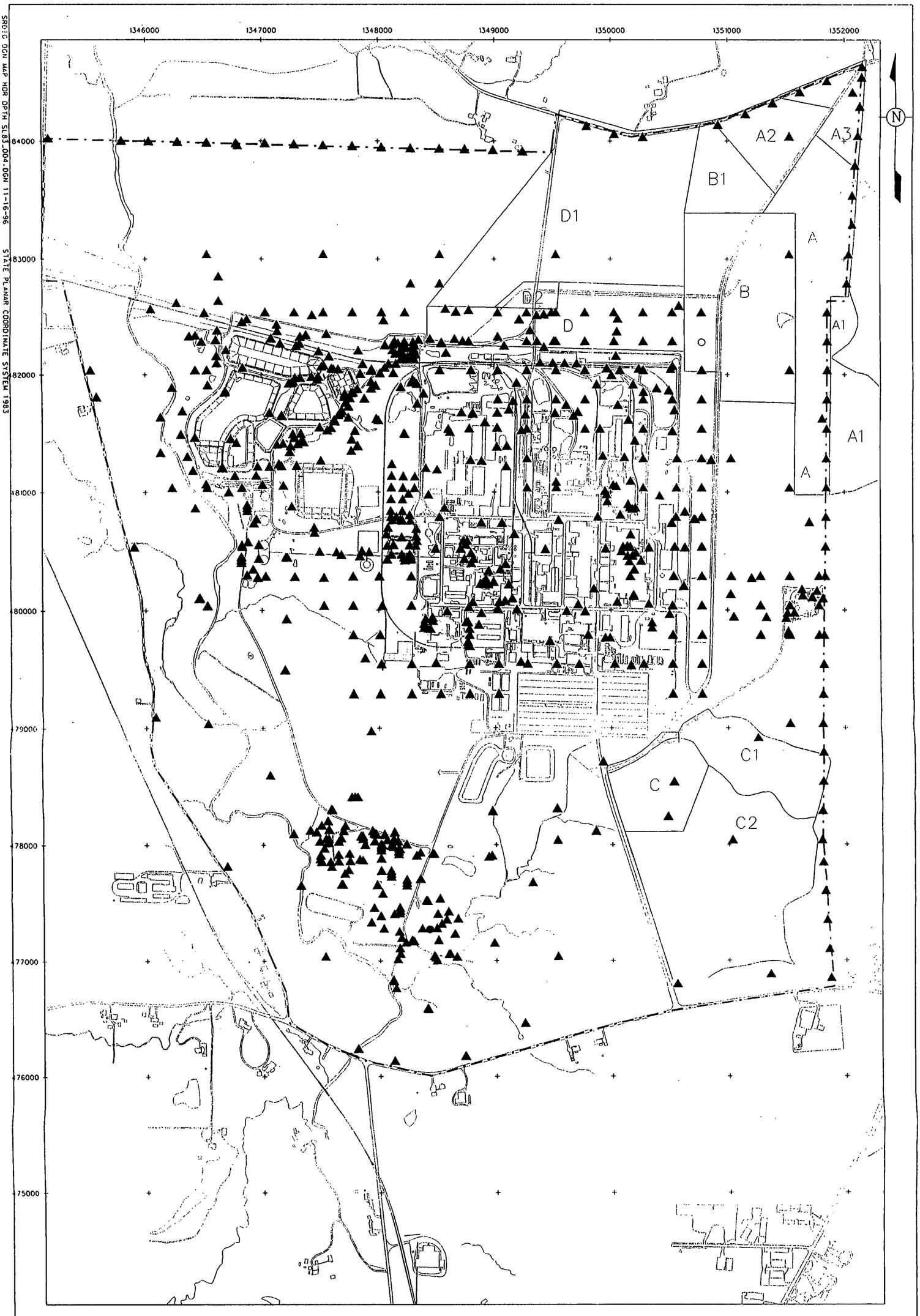
FEMP BOUNDARY
EXCEEDS FRL: DETECTED
EXCEEDS FRL: NON DETECTED
BELOW FRL: DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

DRAFT

FIGURE E-7. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: LEAD-210.

SRD1G DGN MAP HOR OPTH SL83_003.DGN 11-14-96 STATE PLANAR COORDINATE SYSTEM 1983



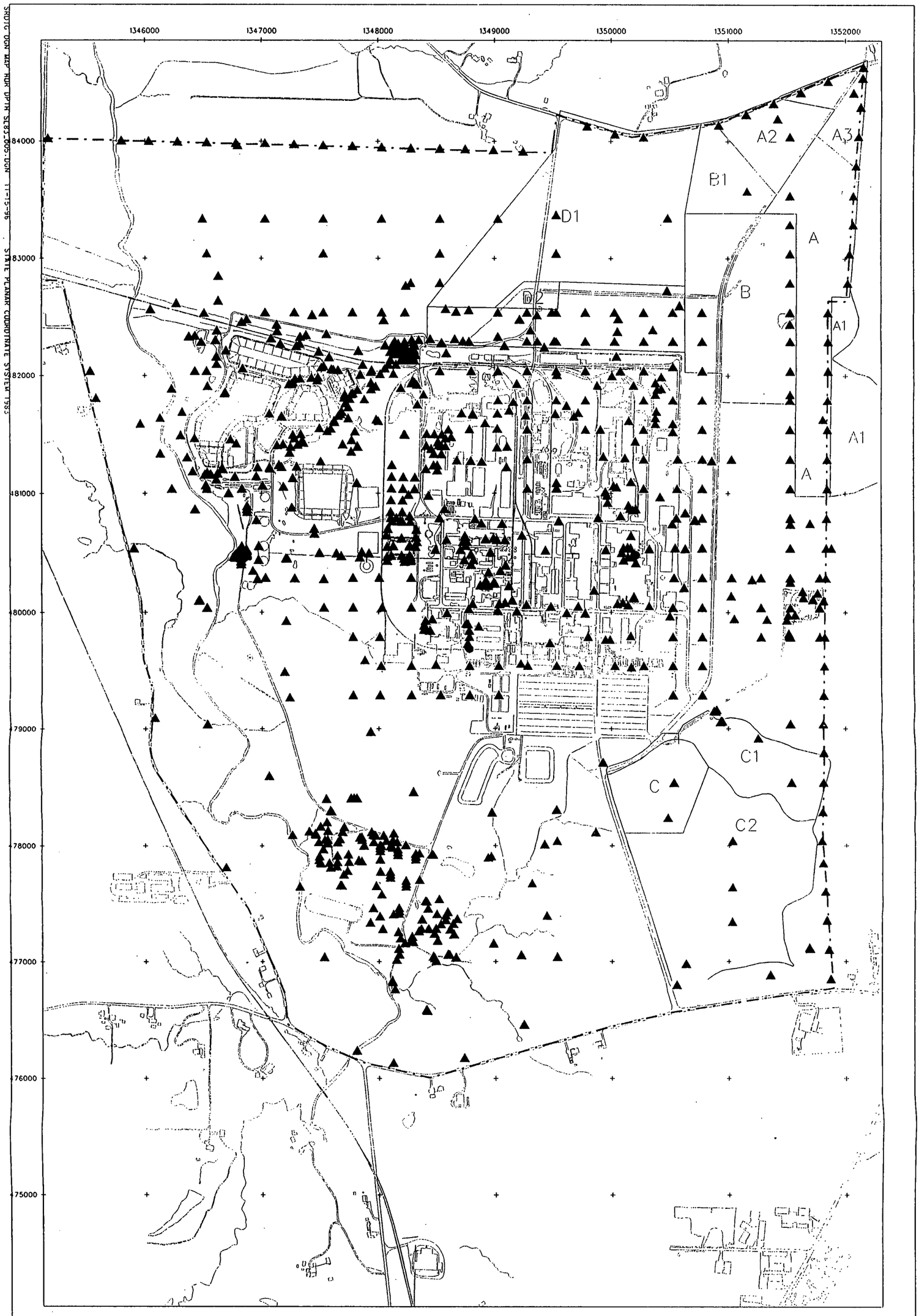
LEGEND:

FEMP BOUNDARY
EXCEEDS FRL; DETECTED
EXCEEDS FRL; NON DETECTED
BELOW FRL; DETECT AND NON DETECTED

SCALE
800 400 0 801 OFEET

DRAFT

FIGURE E-8. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: NEPTUNIUM-237



LEGEND:

FEMP BOUNDARY
EXCEEDS FRL; DETECTED
EXCEEDS FRL; NON DETECTED
BELOW FRL; DETECT AND NON DETECTED

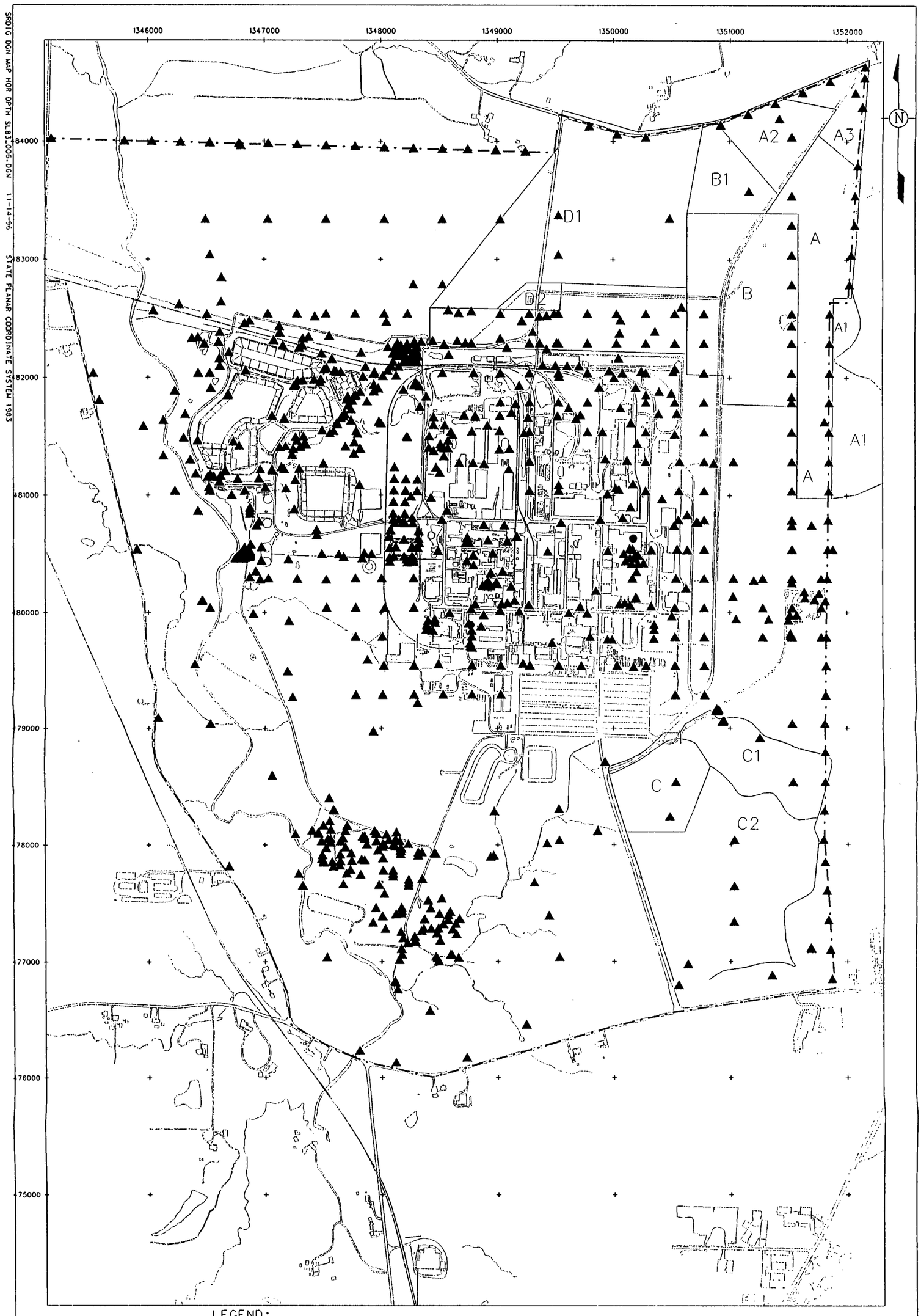
SCALE
800 400 0 800 FEET

DRAFT

FIGURE E-9. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: PLUTONIUM-238

514

000340



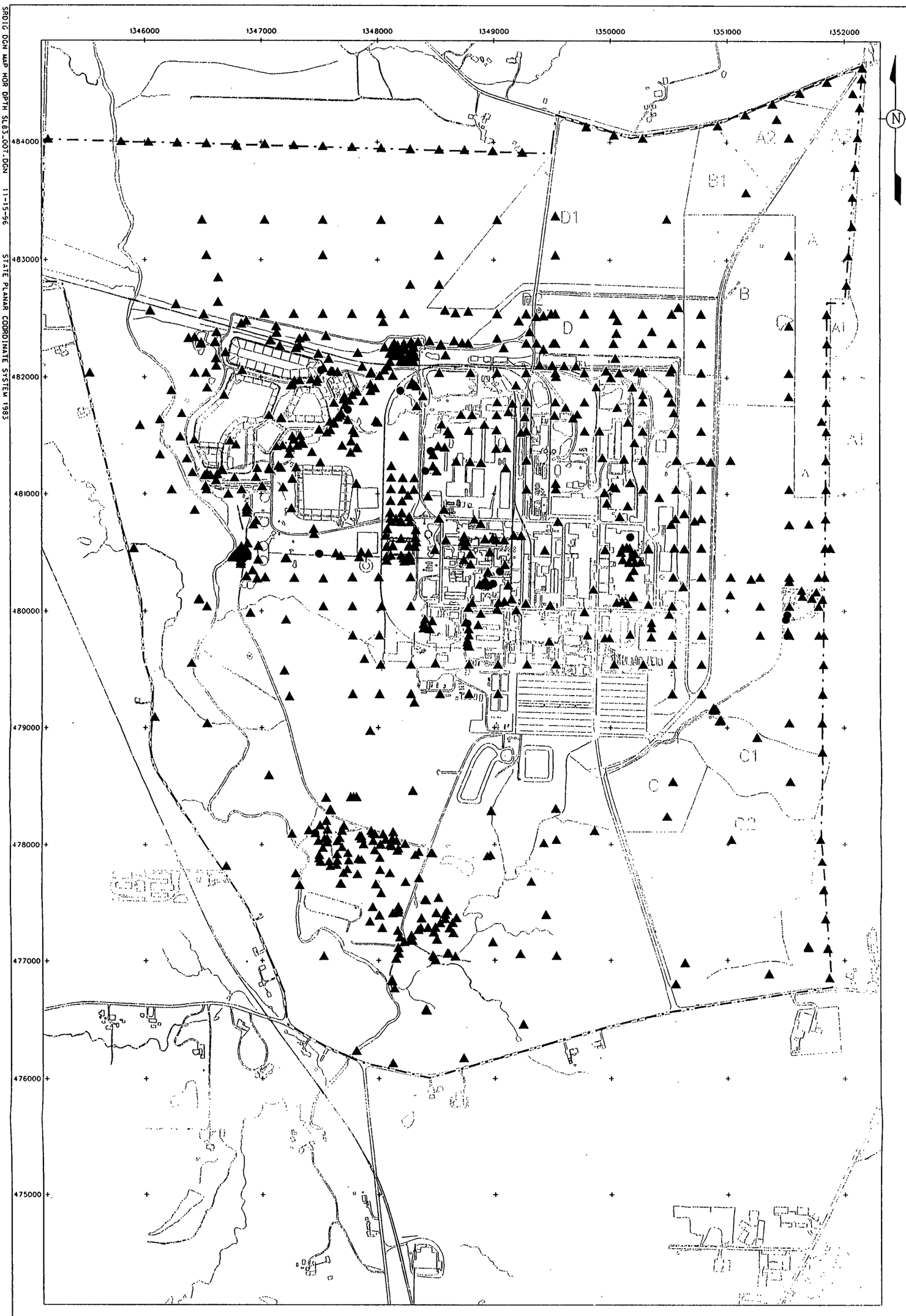
LEGEND:

FEMP BOUNDARY
EXCEEDS FRL; DETECTED
EXCEEDS FRL; NON DETECTED
BELOW FRL; DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

DRAFT

FIGURE E-10. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: STRONTIUM-90.



LEGEND:

FEMP BOUNDARY
EXCEEDS FRL; DETECTED
EXCEEDS FRL; NON DETECTED
BELOW FRL; DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

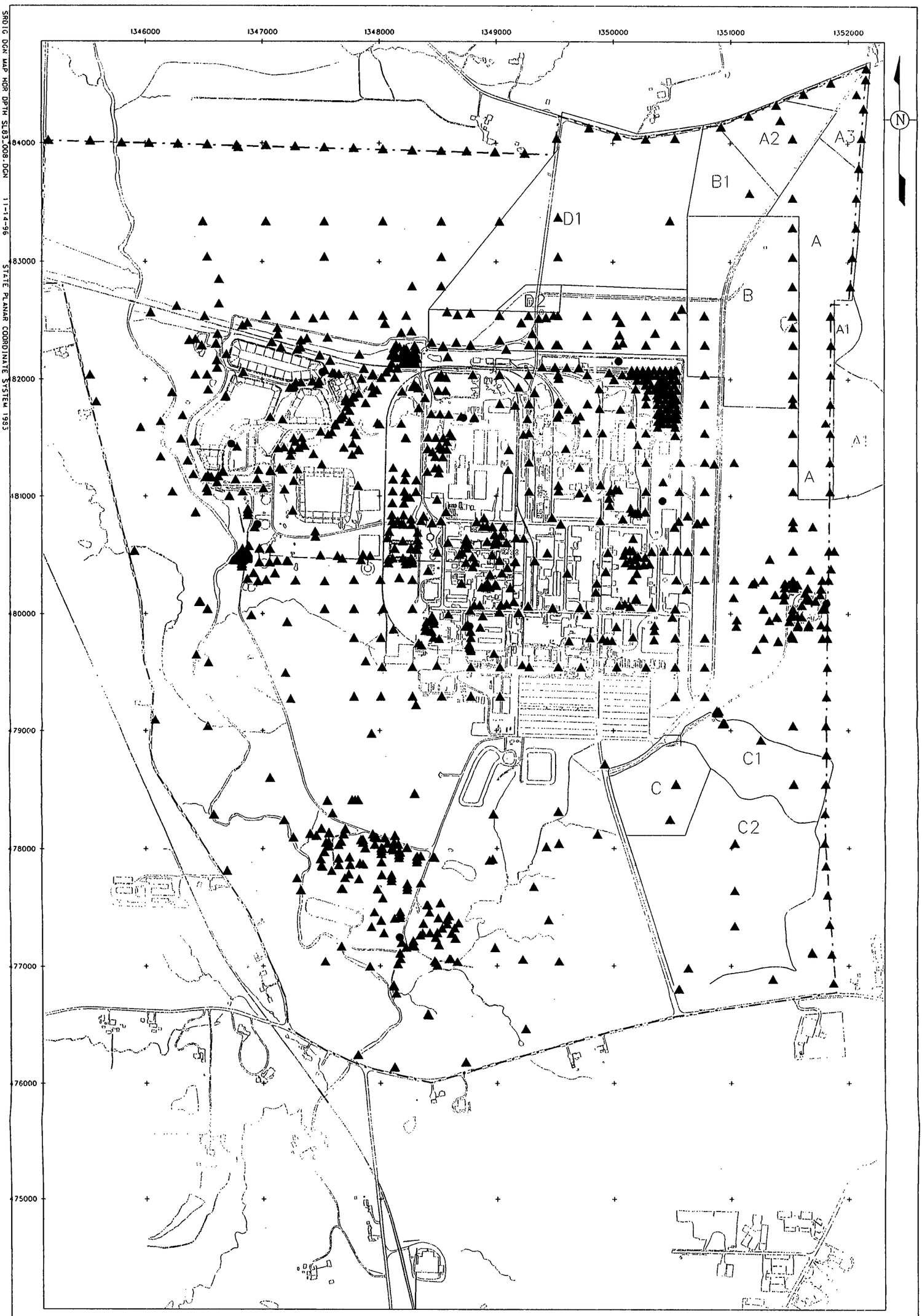
DRAFT

FIGURE E-11. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: TECHNETIUM-99.

SBDIC DGN MAP HOR DPTH SL83_007.DGN 11-15-96 STATE PLANAR COORDINATE SYSTEM 1983

000342

514



LEGEND:

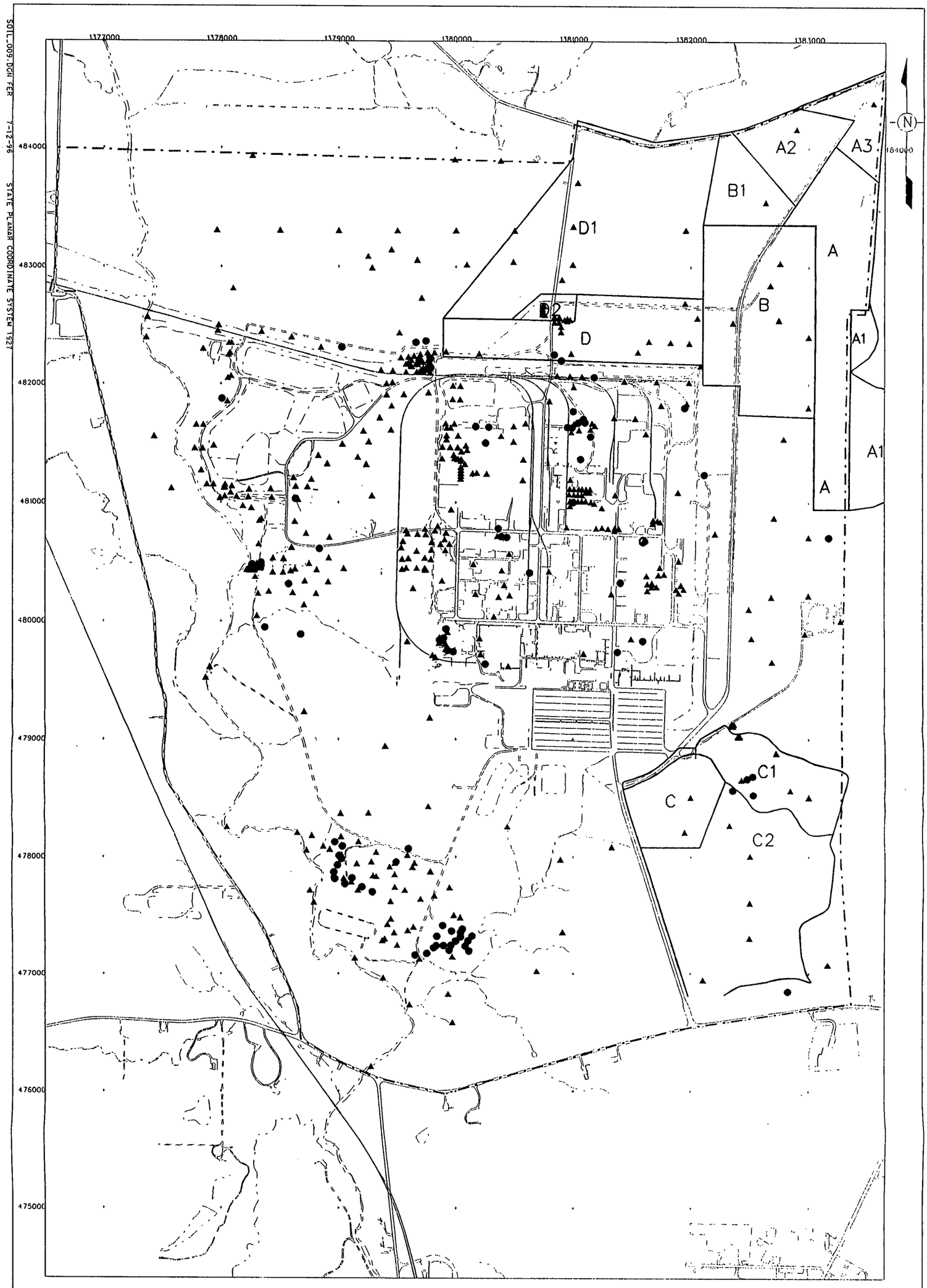
FEMP BOUNDARY
EXCEEDS FRL; DETECTED
EXCEEDS FRL; NON DETECTED
BELOW FRL; DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

DRAFT

FIGURE E-12. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: THORIUM-230

SR01G DGN MAP HOR DPTH SL83_008.DGN 11-14-96 STATE PLANAR COORDINATE SYSTEM 1983



LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL; DETECTED
- ○ EXCEEDS FRL; NON DETECTED
- ▲ BELOW FRL; DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-13. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: ARSENIC.

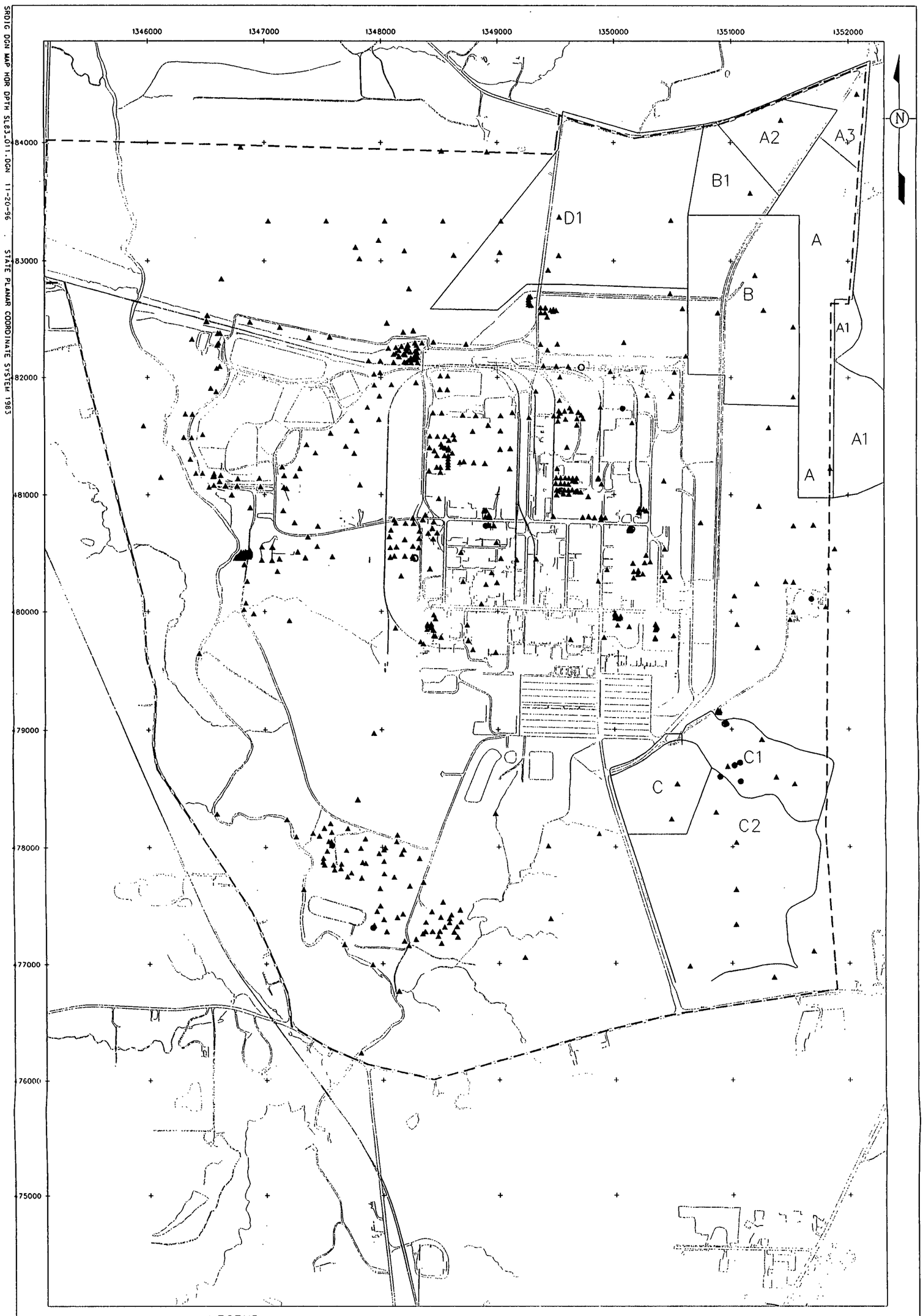
LEGEND:

FEMP BOUNDARY
EXCEEDS FRL; DETECTED
EXCEEDS FRL; NON DETECTED
BELOW FRL; DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

DRAFT

FIGURE E-14. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: BERYLLIUM



LEGEND:

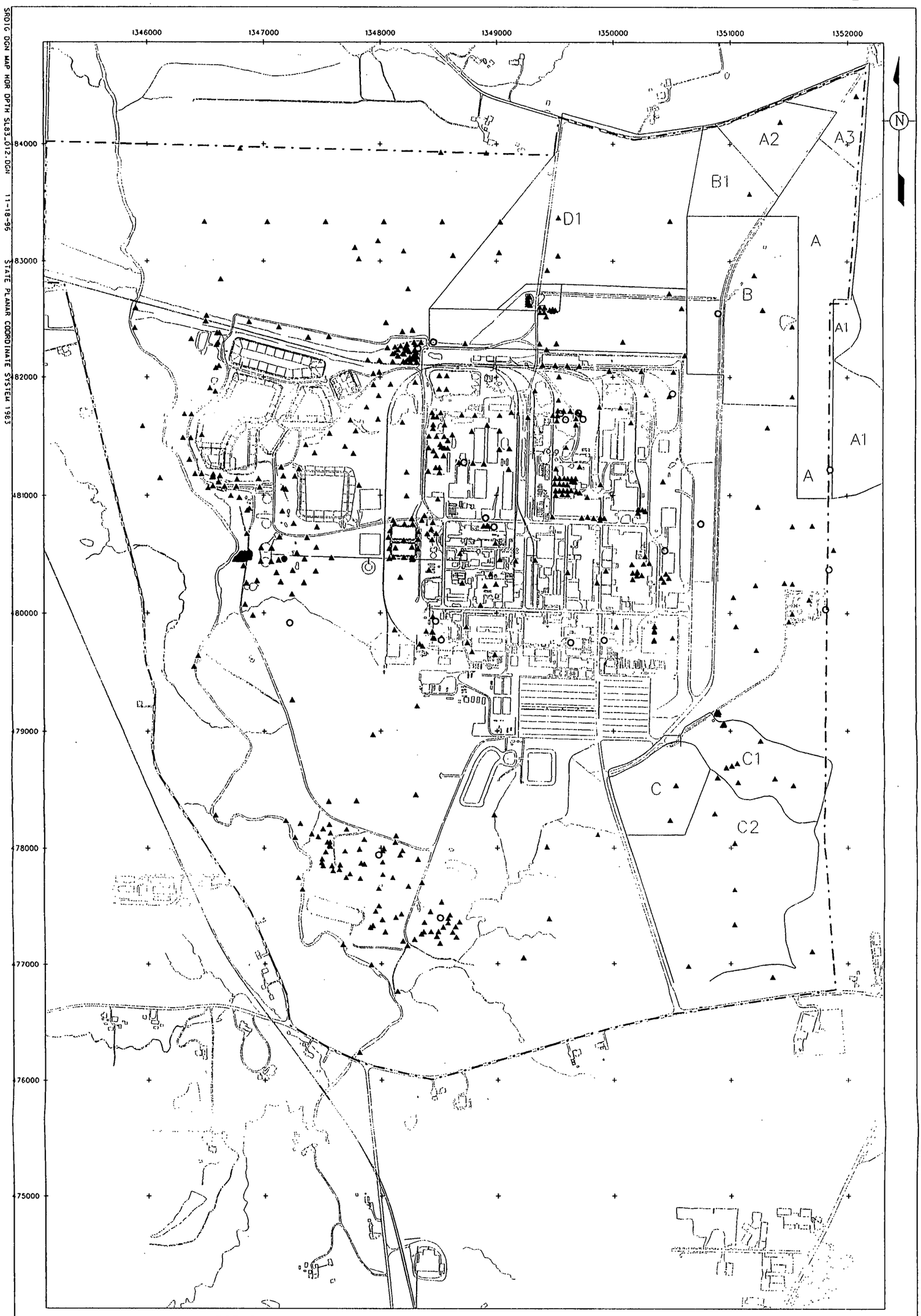
- FEMP BOUNDARY
- EXCEEDS FRL: DETECTED
- EXCEEDS FRL: NON DETECTED
- BETWEEN BTV AND FRL: DETECTED
- BETWEEN BTV AND FRL: NON DETECTED
- BELOW BTV: DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-15. SITEWIDE LOCATION OF SAMPLES IN EXCESS OR BELOW THE FRL AND BTV: LEAD.



LEGEND:

- FEMP BOUNDARY
- EXCEEDS FRL: DETECTED
- EXCEEDS FRL: NON DETECTED
- BETWEEN BTV AND FRL: DETECTED
- BETWEEN BTV AND FRL: NON DETECTED
- BELOW BTV: DETECT AND NON DETECTED

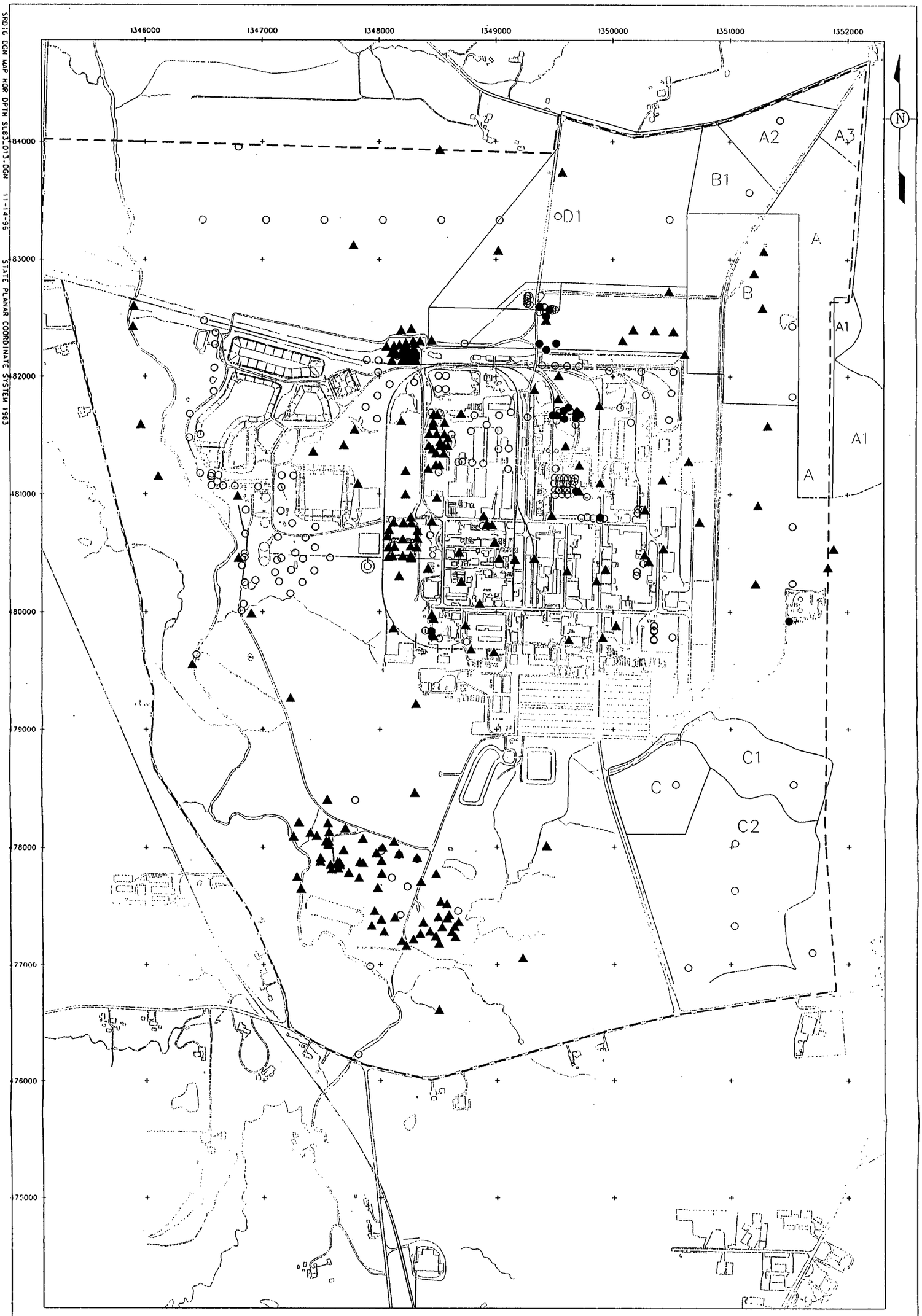
SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-16. SITEWIDE LOCATION OF SAMPLES IN EXCESS OR BELOW THE FRL AND BTV: MANGANESE

SRDIG DGN MAP HOR DPTH SL83_012.DGN 11-18-96 STATE PLANAR COORDINATE SYSTEM 1983



LEGEND:

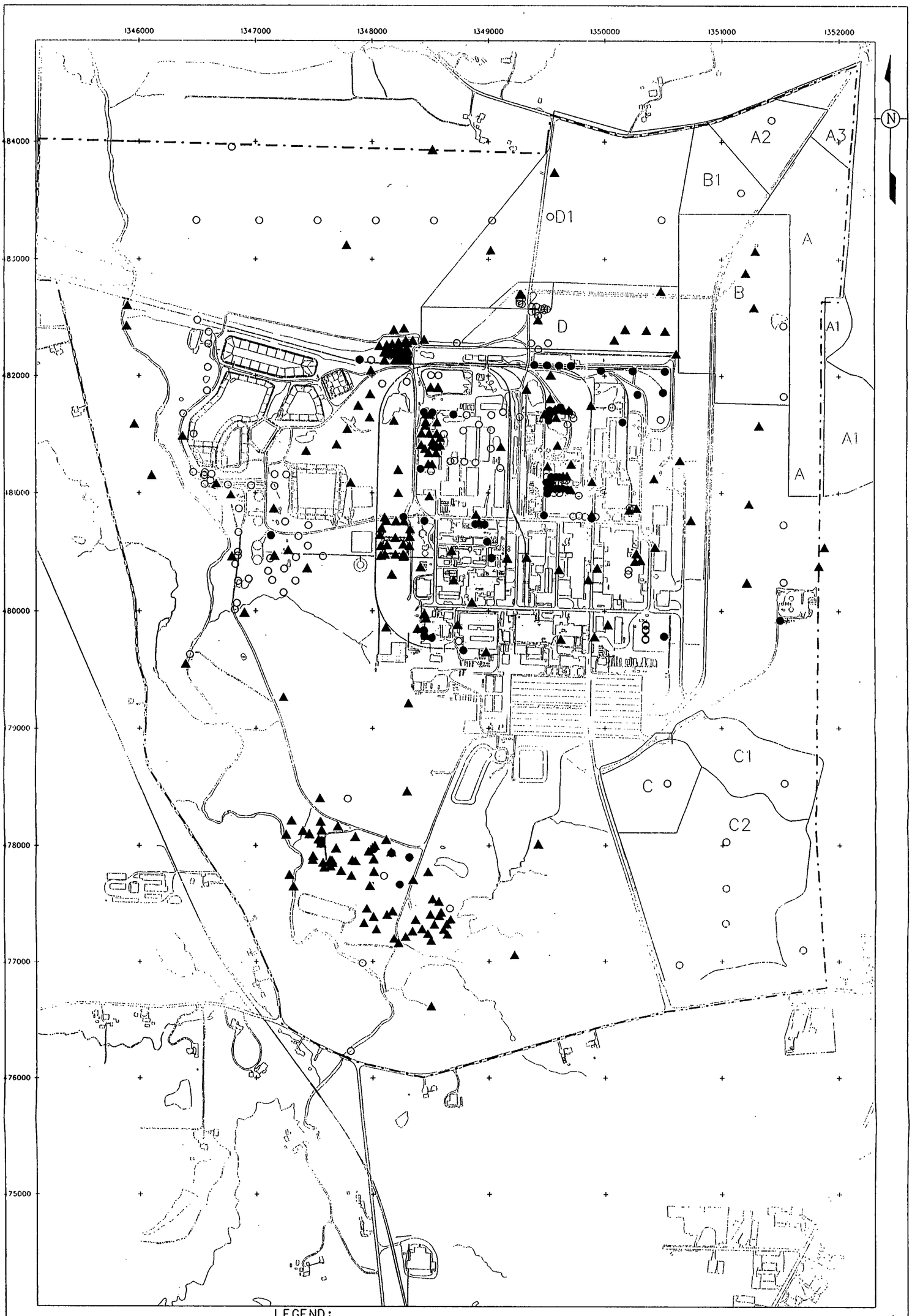
- FEMP BOUNDARY
- ● EXCEEDS FRL; DETECTED
- ○ EXCEEDS FRL; NON DETECTED
- ▲ BELOW FRL; DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-17. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: AROCLOR-1260.



LEGEND:

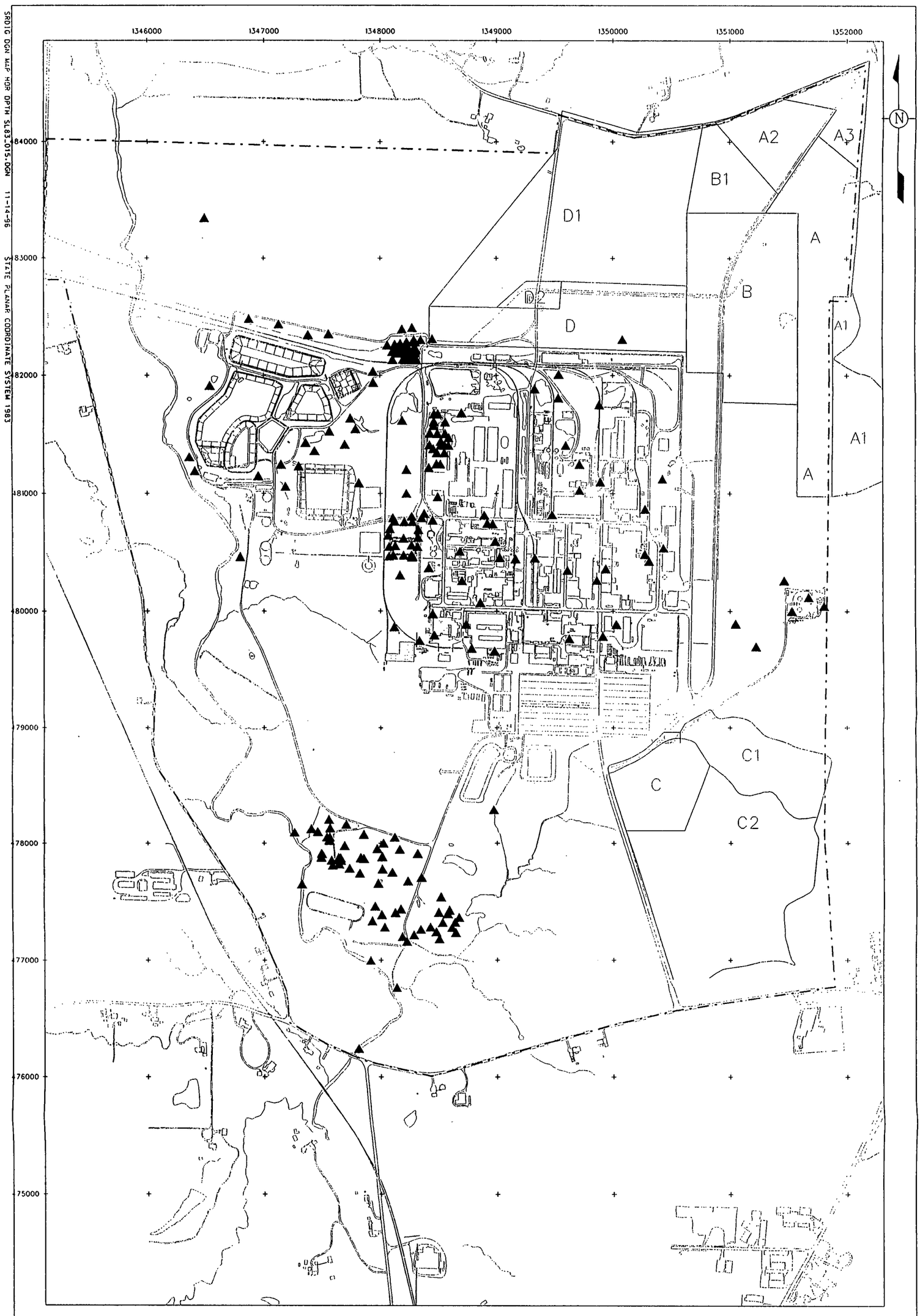
FEMP BOUNDARY
EXCEEDS FRL; DETECTED
EXCEEDS FRL; NON DETECTED
BELOW FRL; DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

DRAFT

FIGURE E-18. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: AROCLOR-1254.

SRD1G DGN MEP NOR OPTH SL83_014.DGN 11-14-96 STATE PLANAR COORDINATE SYSTEM 1983



LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL; DETECTED
- ○ EXCEEDS FRL; NON DETECTED
- ▲ BELOW FRL; DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-19. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: CARBAZOLE.

SRDIG DGN MAP MOR DPTH SL83_015.DGN 11-14-96 STATE PLANAR COORDINATE SYSTEM 1983

000320

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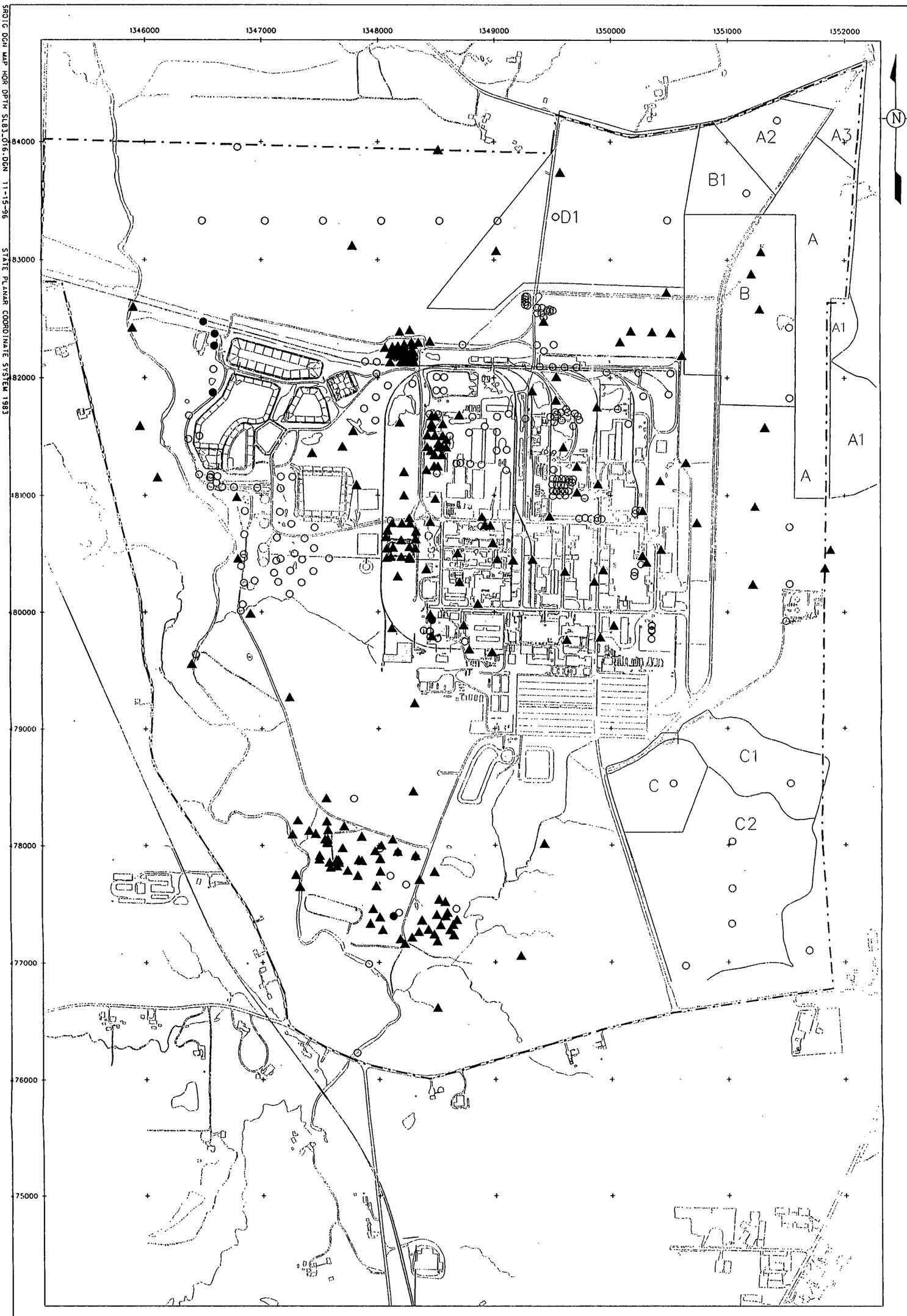


LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL: DETECTED
- ○ EXCEEDS FRL: NON DETECTED
- ▲ BELOW FRL: DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

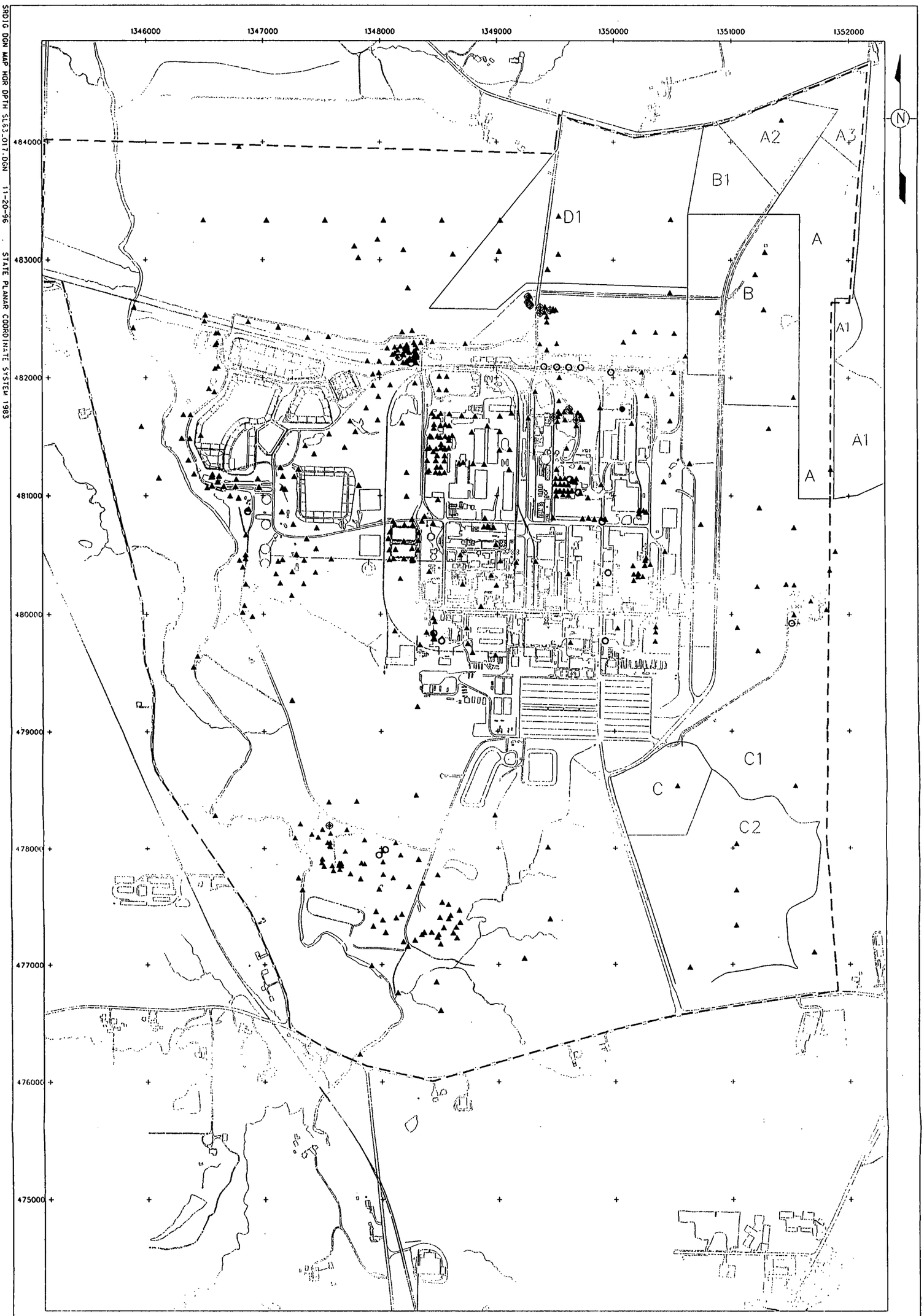
DRAFT

FIGURE E-20. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: DIELDRIN.

SR01C DGN MAP HOR OPTH S183_016.DGN 11-15-96 STATE PLANAR COORDINATE SYSTEM 1983

000321

514



LEGEND:

- FEMP BOUNDARY
- EXCEEDS FRL; DETECTED
- EXCEEDS FRL; NON DETECTED
- BETWEEN BTV AND FRL; DETECTED
- BETWEEN BTV AND FRL; NON DETECTED
- BELOW BTV; DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-21. SITEWIDE LOCATION OF SAMPLES IN EXCESS OR BELOW THE FRL AND BTV: BENZO(A)ANTHRACENE

SRD1G DGN MAP HOR DPTH SL63_017.DGN 11-20-96 STATE PLANAR COORDINATE SYSTEM 1983

000322

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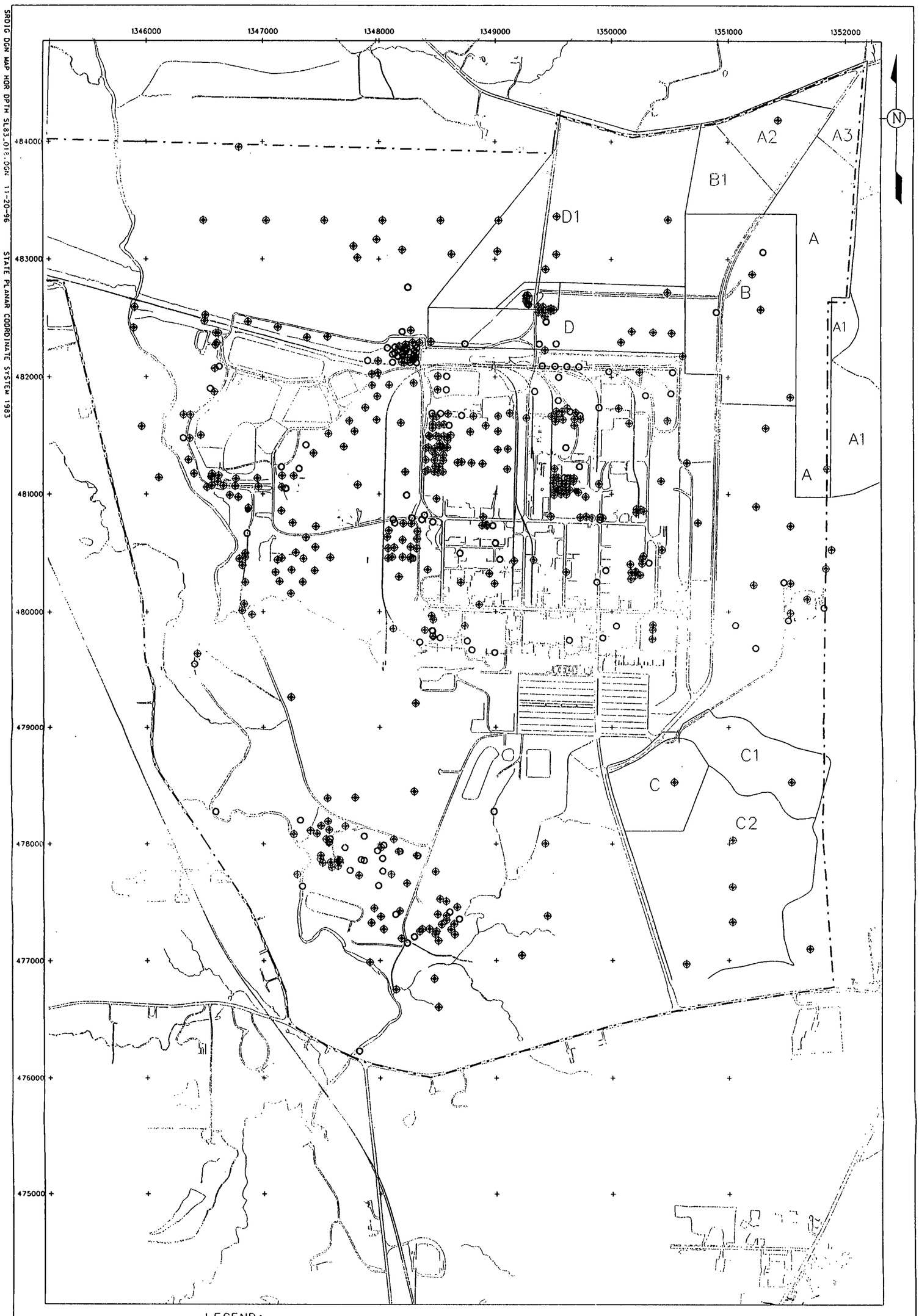
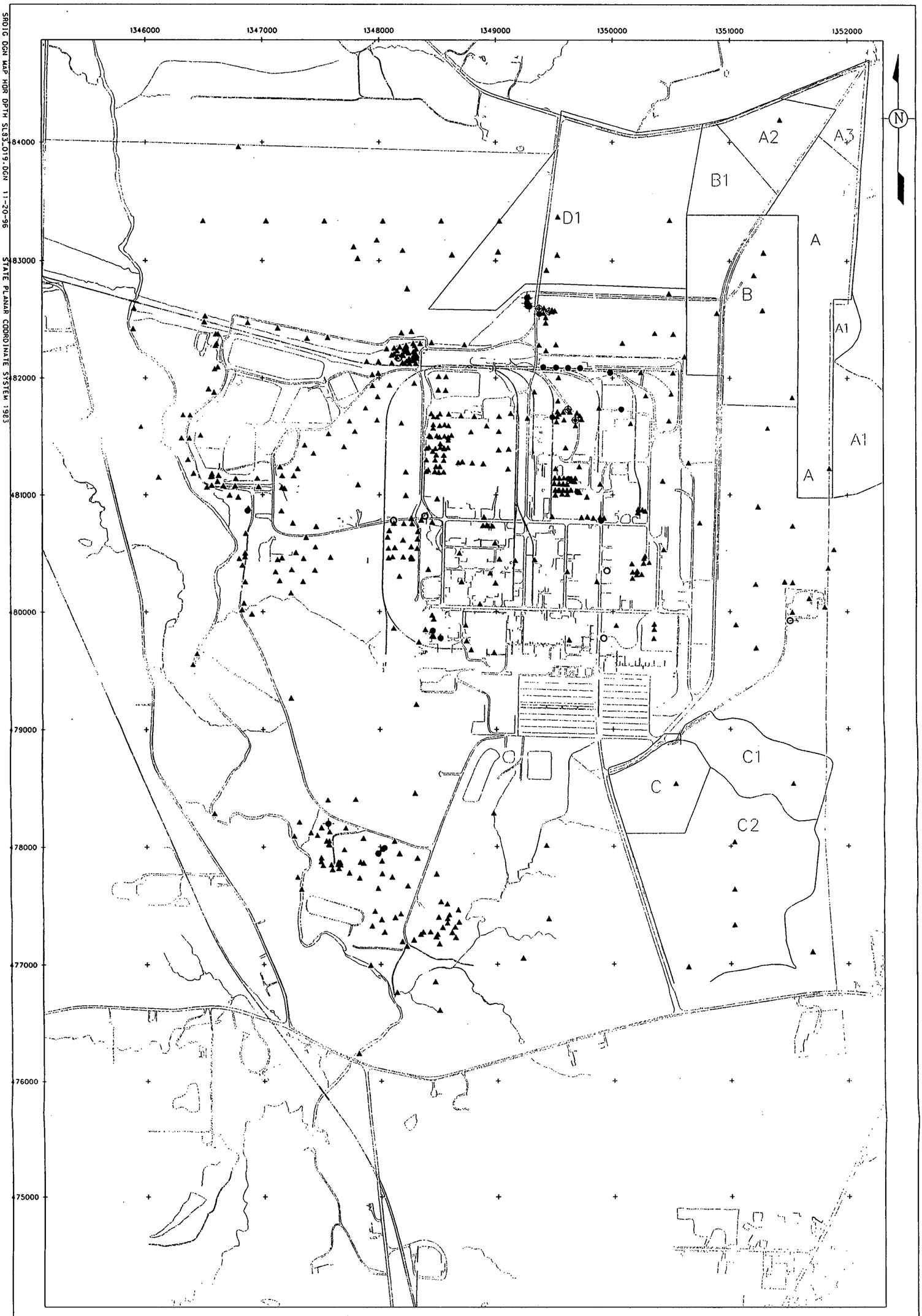


FIGURE E-22. SITEWIDE LOCATION OF SAMPLES IN EXCESS OR BELOW THE FRL AND BTV: BENZO(B)FLUORANTHENE.



LEGEND:

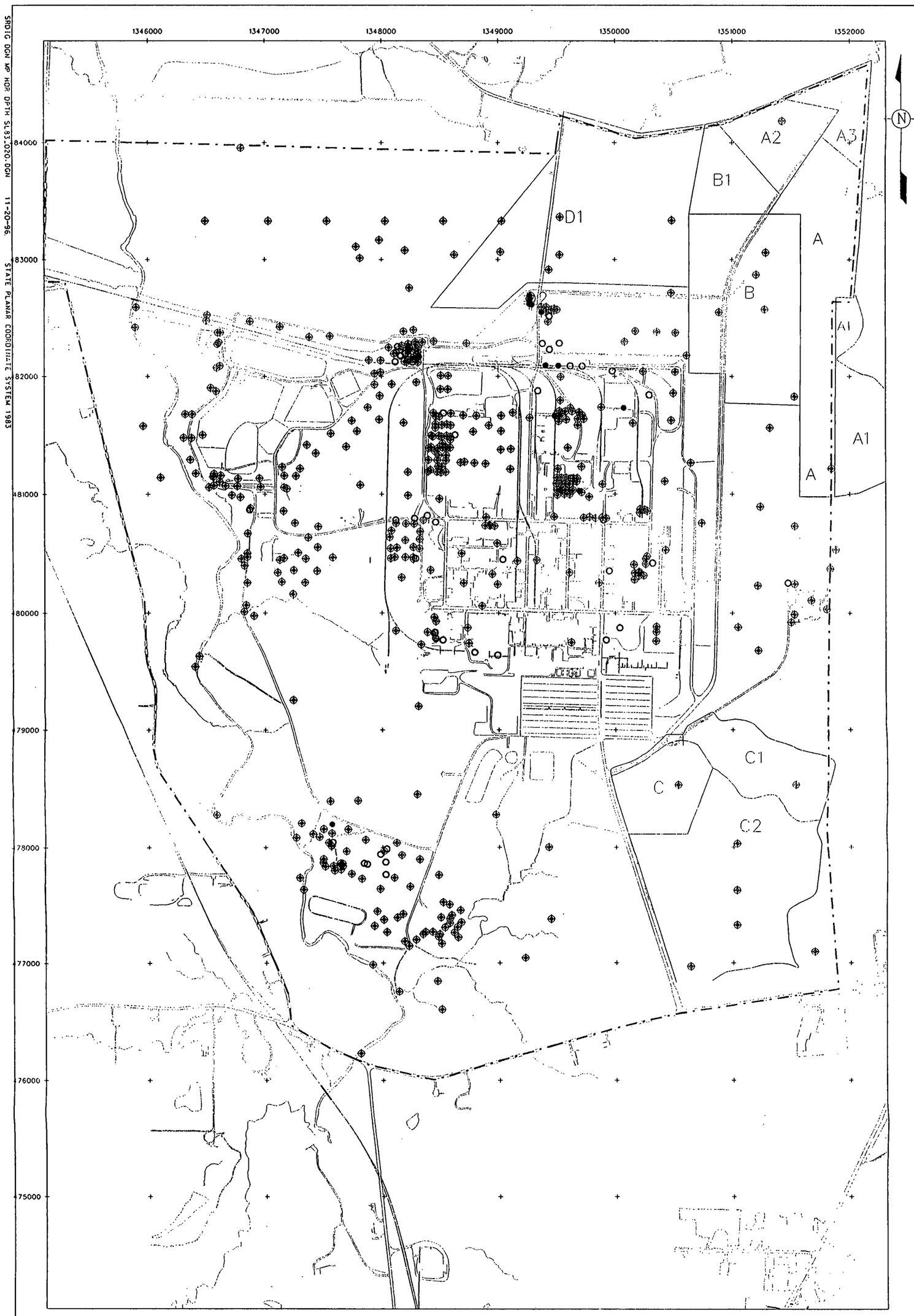
- FEMP BOUNDARY
- EXCEEDS FRL; DETECTED
- EXCEEDS FRL; NON DETECTED
- BETWEEN BTV AND FRL; DETECTED
- BETWEEN BTV AND FRL; NON DETECTED
- BELOW BTV; DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-23. SITEWIDE LOCATION OF SAMPLES IN EXCESS OR BELOW THE FRL AND BTV: BENZO(A)PYRENE.



LEGEND:

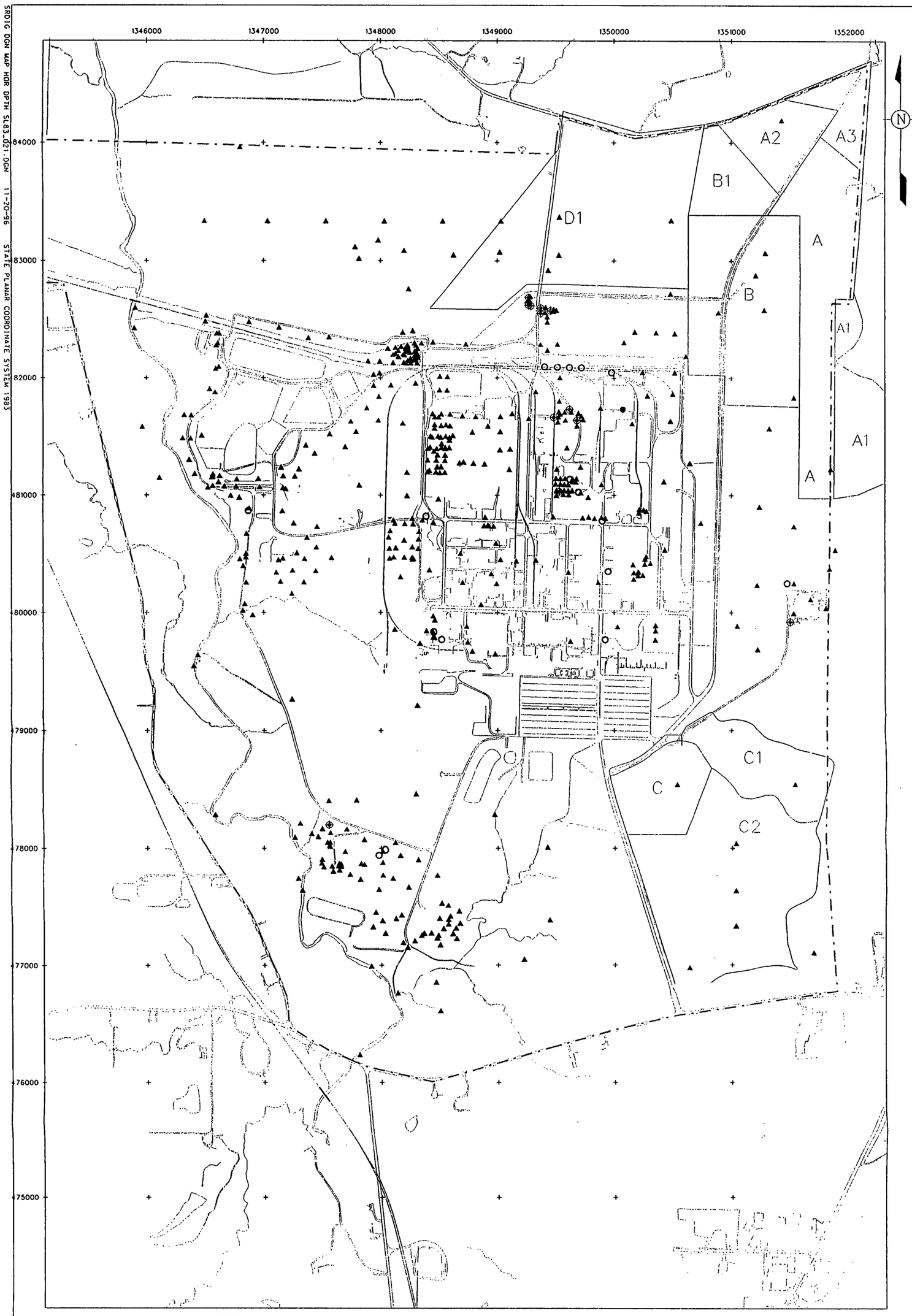
- FEMP BOUNDARY
- ● EXCEEDS FRL; DETECTED
- ✦ EXCEEDS FRL; NON DETECTED
- ○ BETWEEN BTV AND FRL; DETECTED
- ⊕ BETWEEN BTV AND FRL; NON DETECTED
- ▲ BELOW BTV; DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-24. SITEWIDE LOCATION OF SAMPLES IN EXCESS OR BELOW THE FRL AND BTV: DIBENZO(A,H)ANTHRACENE.



LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL; DETECTED
- ✦ EXCEEDS FRL; NON DETECTED
- ○ BETWEEN BTV AND FRL; DETECTED
- ⊕ BETWEEN BTV AND FRL; NON DETECTED
- ▲ BELOW BTV; DETECT AND NON DETECTED

SCALE

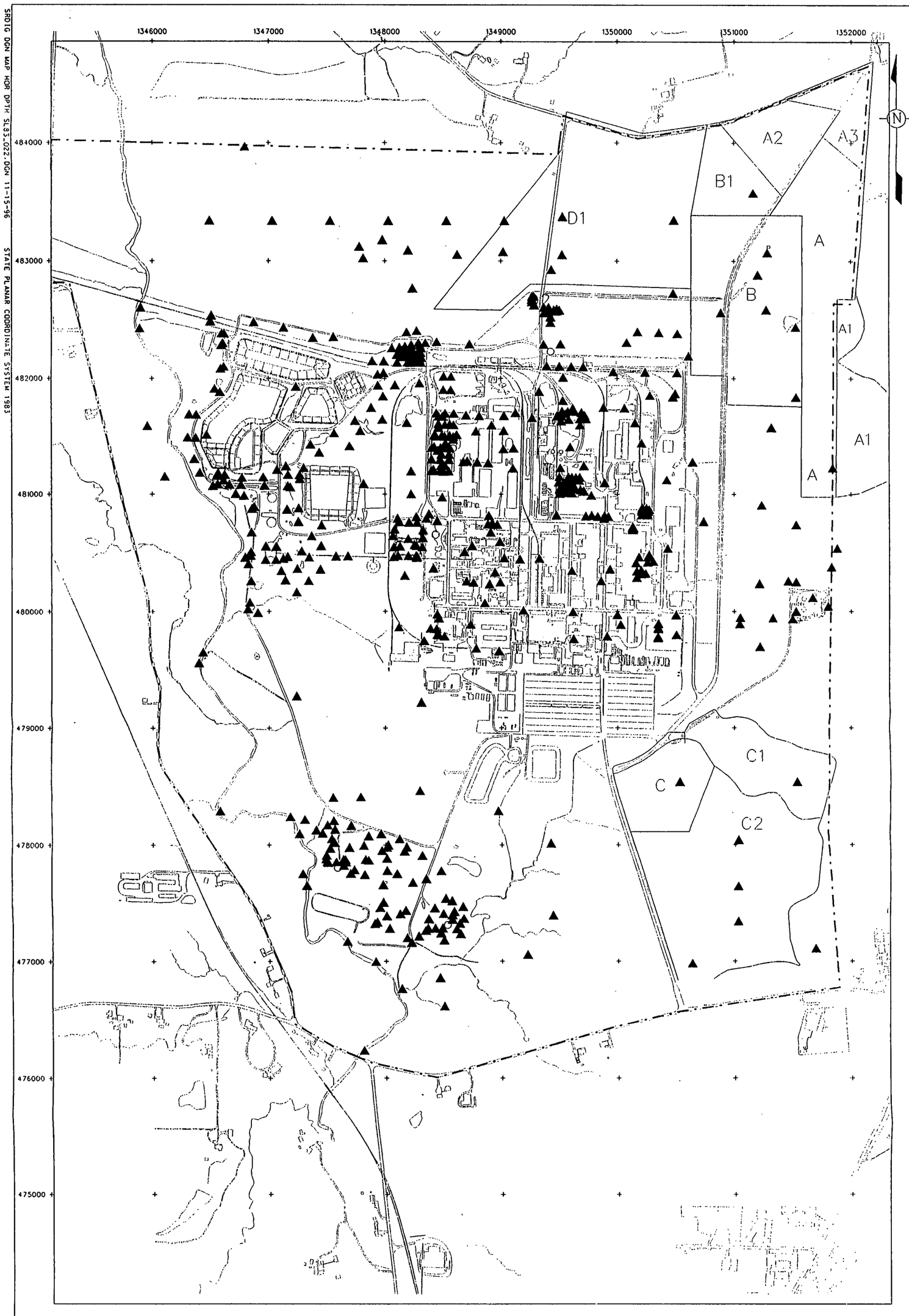
800 400 0 800 FEET

DRAFT

FIGURE E-25. SITEWIDE LOCATION OF SAMPLES IN EXCESS OR BELOW THE FRL AND BTV: INDENO(1,2,3-CD)PYRENE.

000326

514



LEGEND:

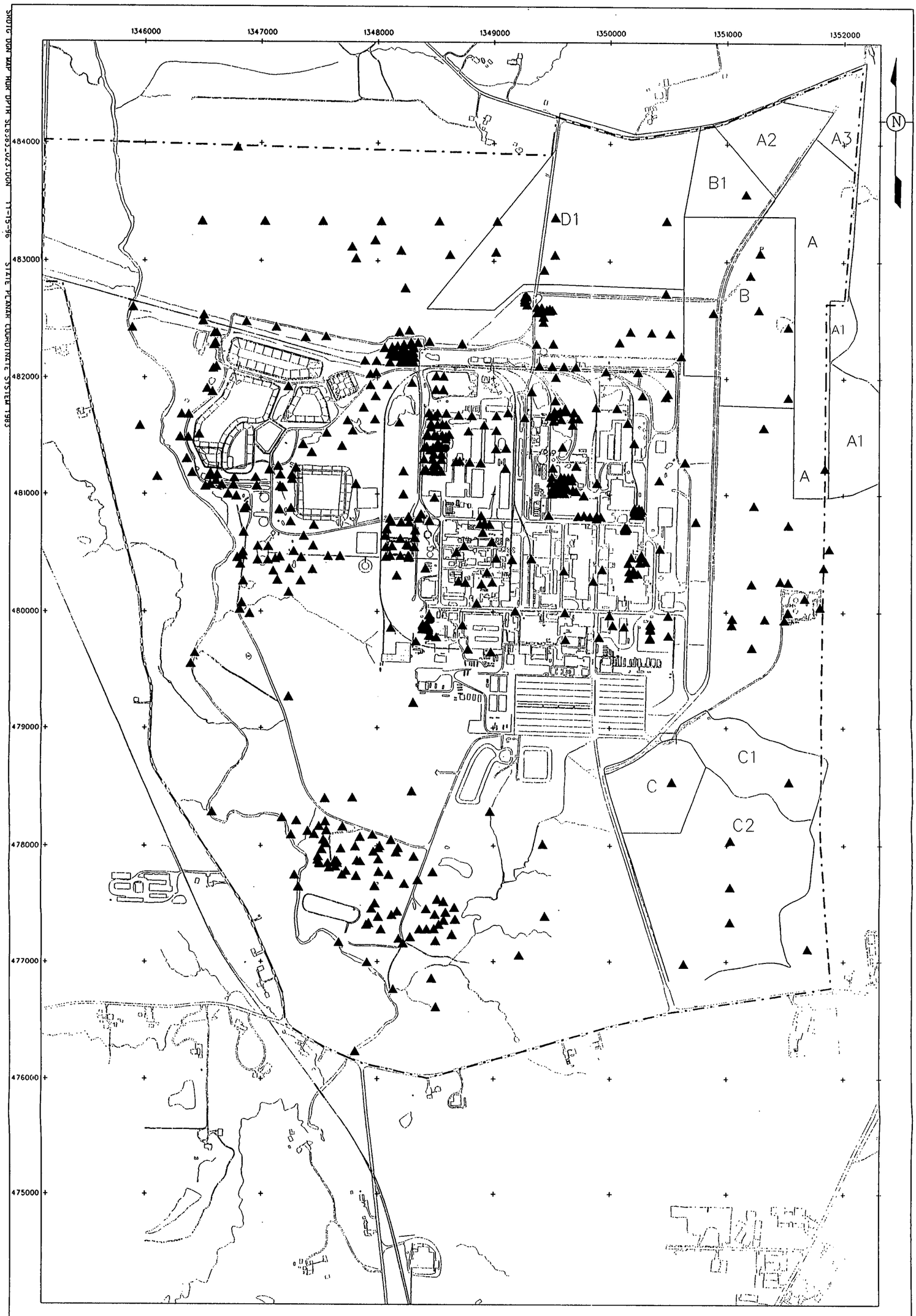
- FEMP BOUNDARY
- ● EXCEEDS FRL: DETECTED
- ○ EXCEEDS FRL: NON DETECTED
- ▲ BELOW FRL: DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-26. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: 1,1-DICHLOROETHENE.



LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL; DETECTED
- ○ EXCEEDS FRL; NON DETECTED
- ▲ BELOW FRL; DETECT AND NON DETECTED

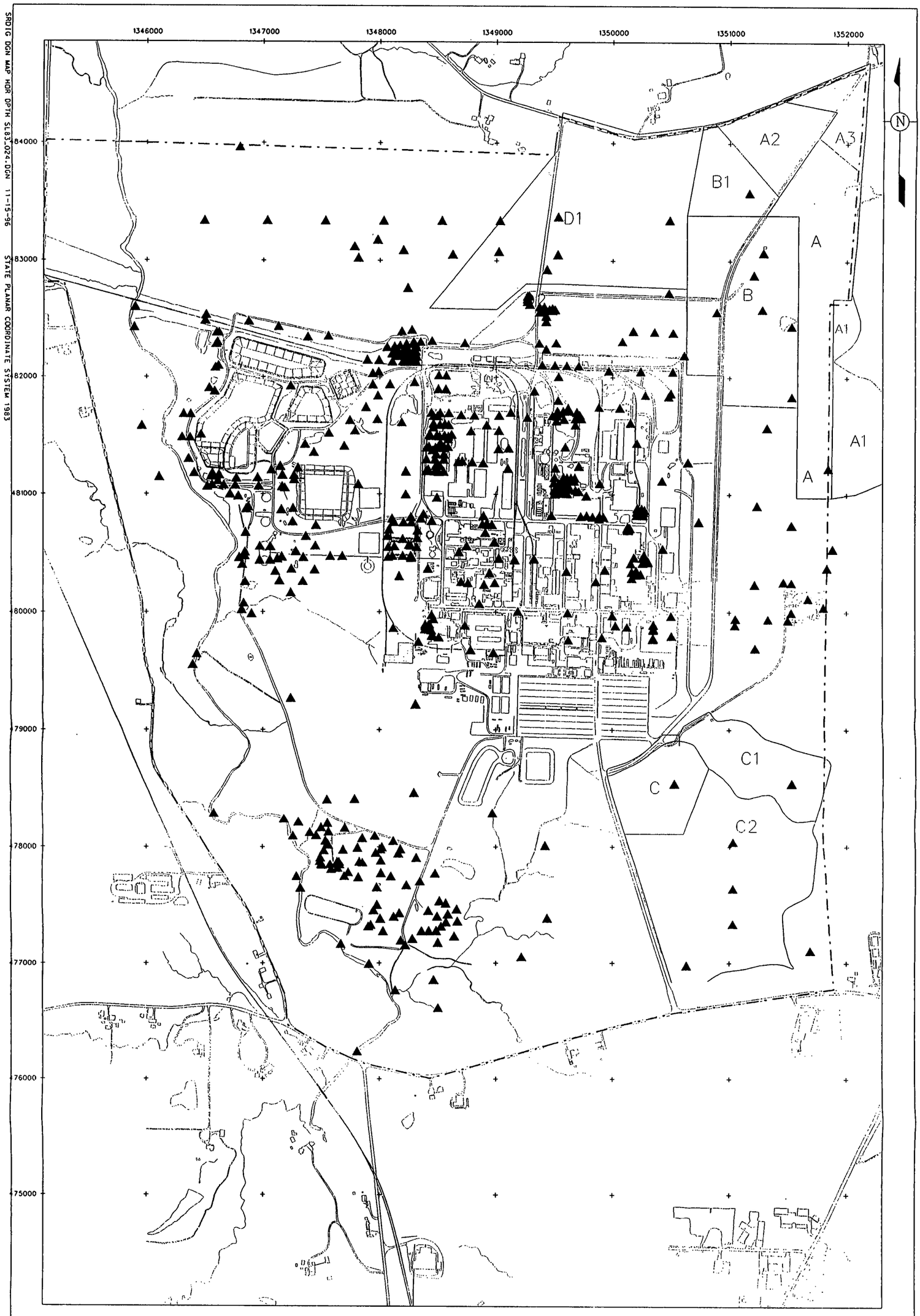
SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-27. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: TETRACHLOROETHENE

SHOTG DGN MAP MDR DPTH SL3823-2023.DGN 11-15-96 STATE PLANAR COORDINATE SYSTEM 1983



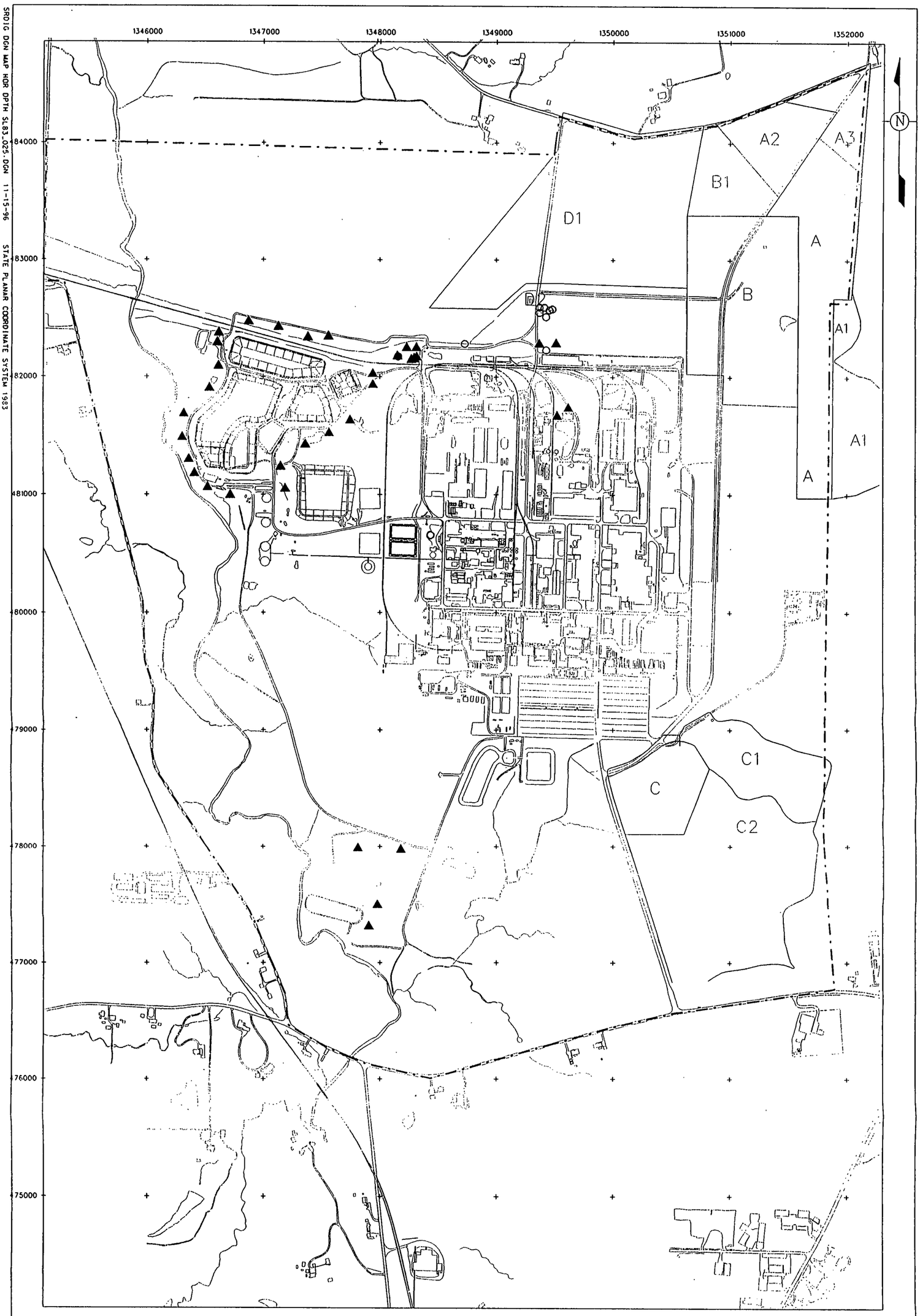
LEGEND:

FEMP BOUNDARY
EXCEEDS FRL: DETECTED
EXCEEDS FRL: NON DETECTED
BELOW FRL: DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

DRAFT

FIGURE E-28. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: TRICHLOROETHENE.



LEGEND:

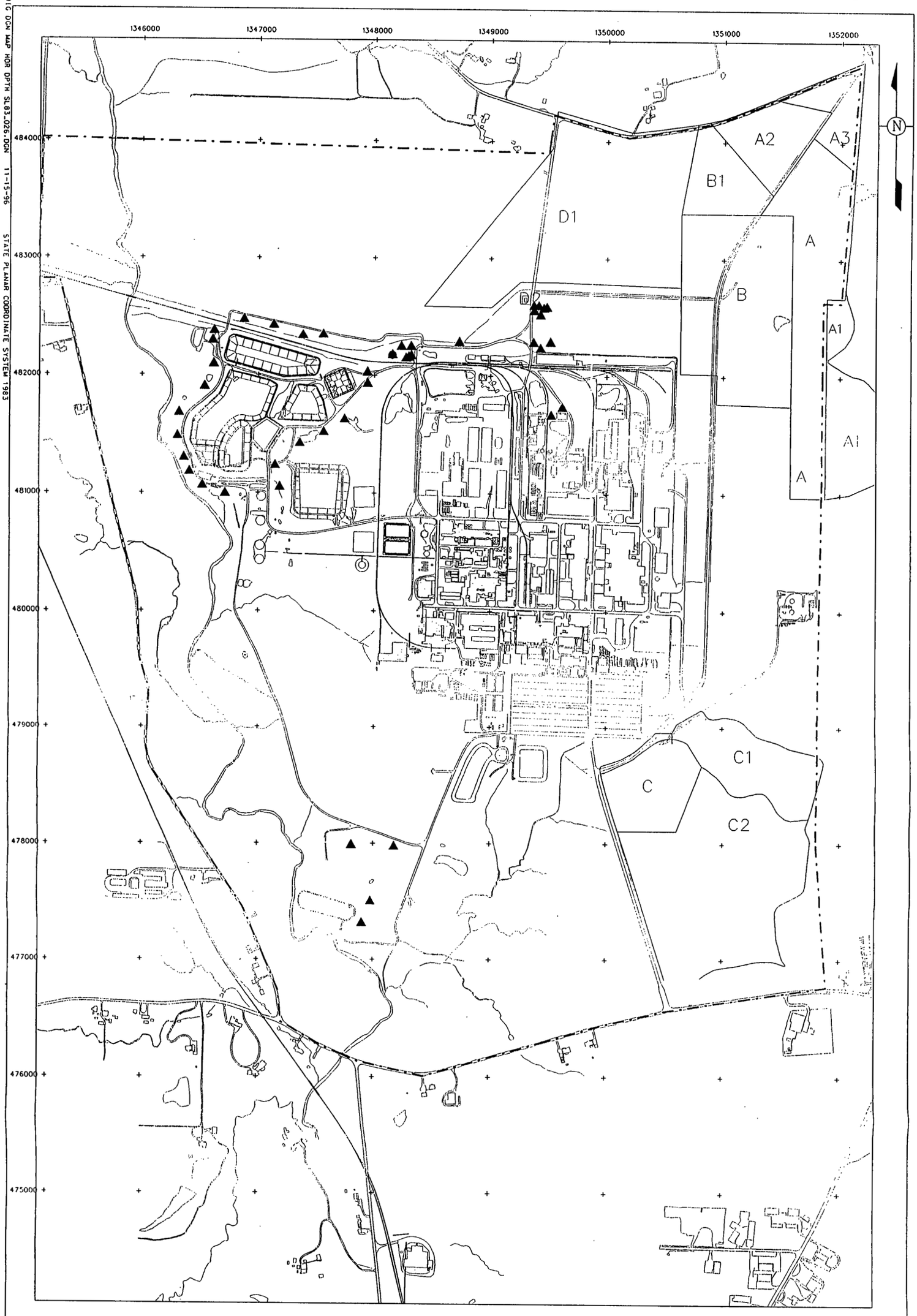
FEMP BOUNDARY
EXCEEDS FRL: DETECTED
EXCEEDS FRL: NON DETECTED
BELOW FRL: DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

DRAFT

SRDIG DGN MAP HOR OPTH SL83.025.DGN 11-15-96 STATE PLANAR COORDINATE SYSTEM 1983

FIGURE E-29. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: HEPTACHLORODIBENZO-P-DIOXINS



LEGEND:

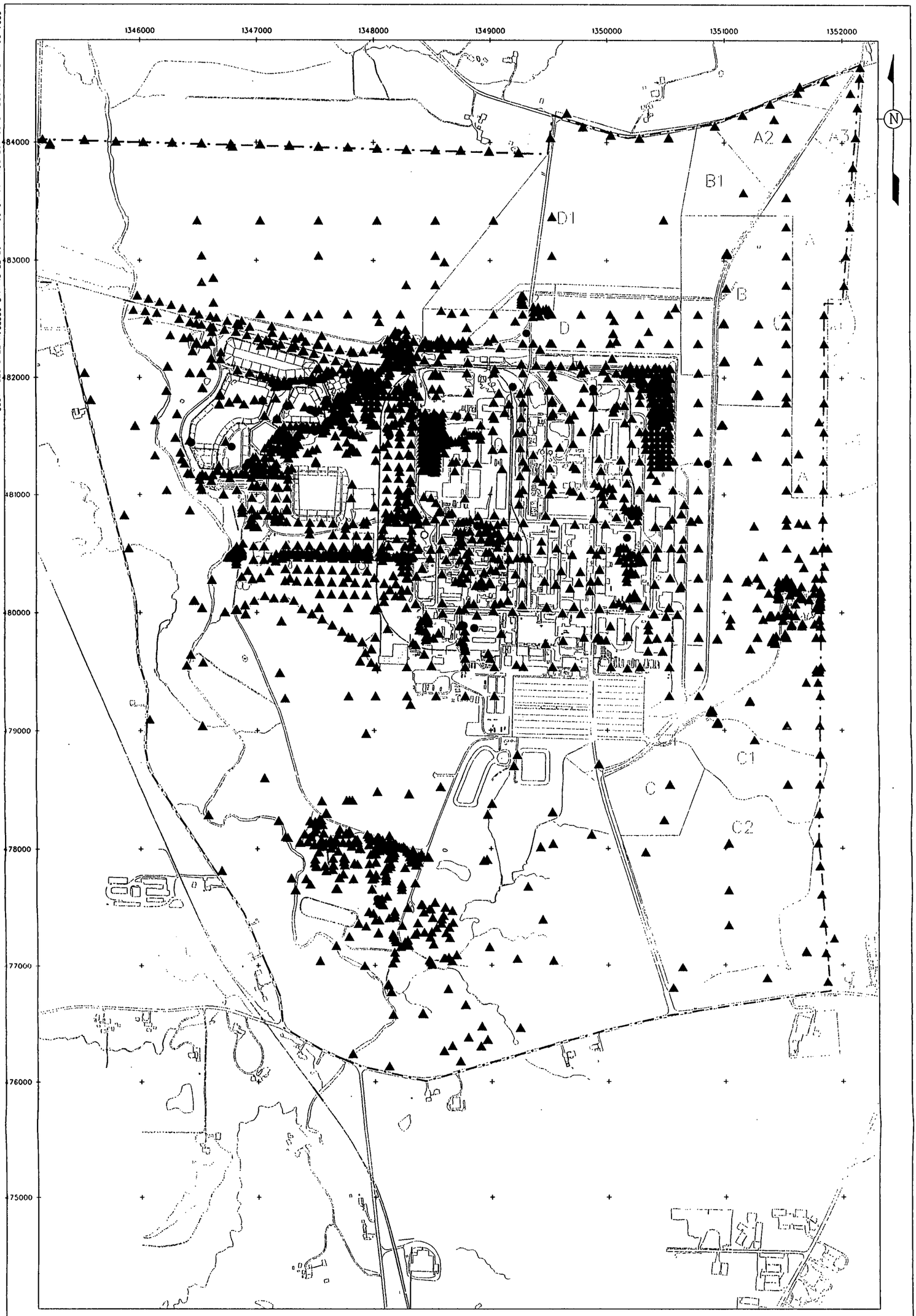
- FEMP BOUNDARY
- ● EXCEEDS FRL: DETECTED
- ○ EXCEEDS FRL: NON DETECTED
- ▲ BELOW FRL: DETECT AND NON DETECTED

DRAFT

SCALE

800 400 0 800 FEET

FIGURE E-30. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF FRL: OCTACHLORODIBENZO-P-DIOXIN.



LEGEND:

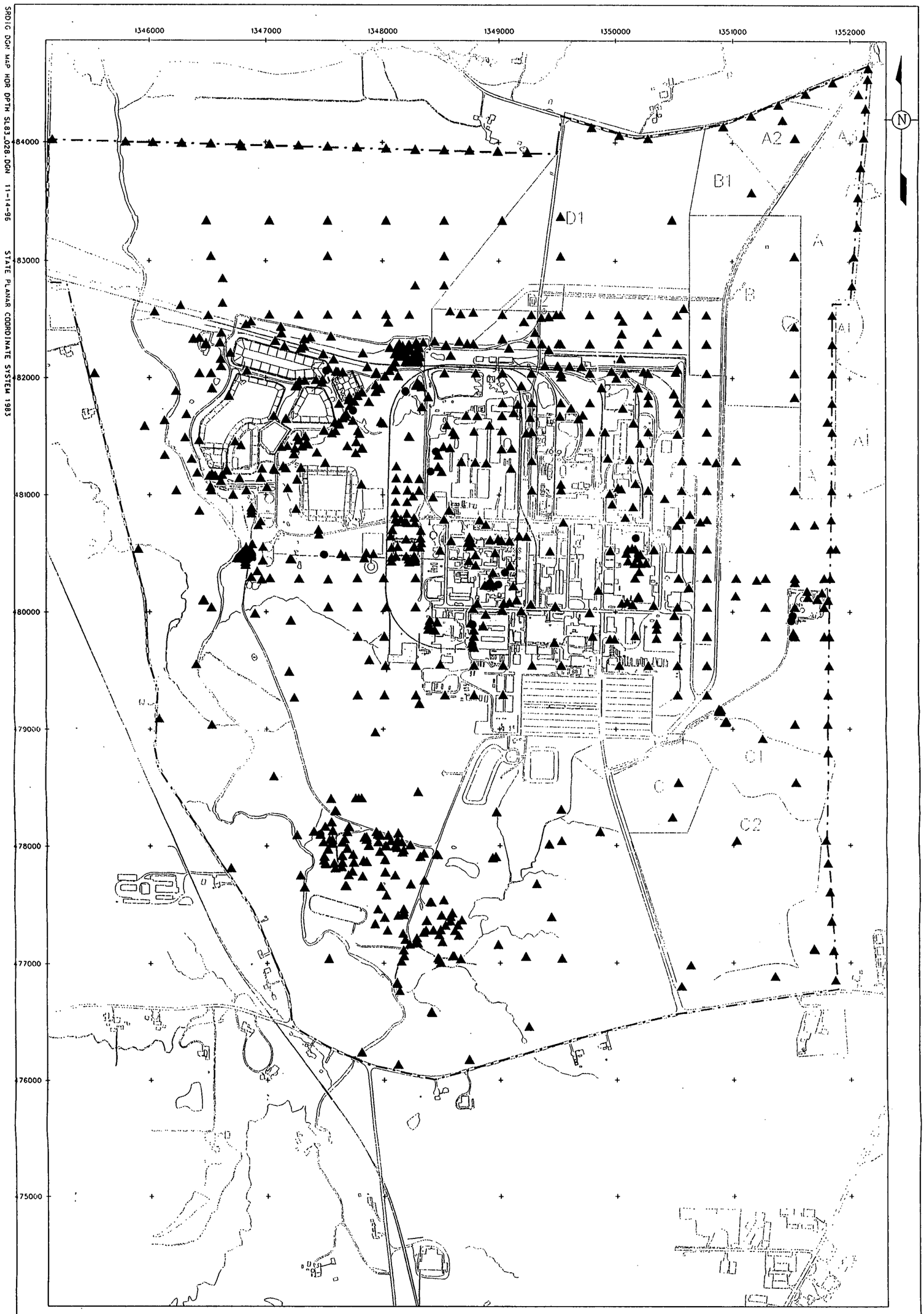
- FEMP BOUNDARY
- ● EXCEEDS WAC; DETECTED
- ○ EXCEEDS WAC; NON DETECTED
- ▲ BELOW WAC; DETECT AND NON DETECTED

SCALE

10 5 0 10 FEET

DRAFT

FIGURE E-31. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF WAC: TOTAL URANIUM.



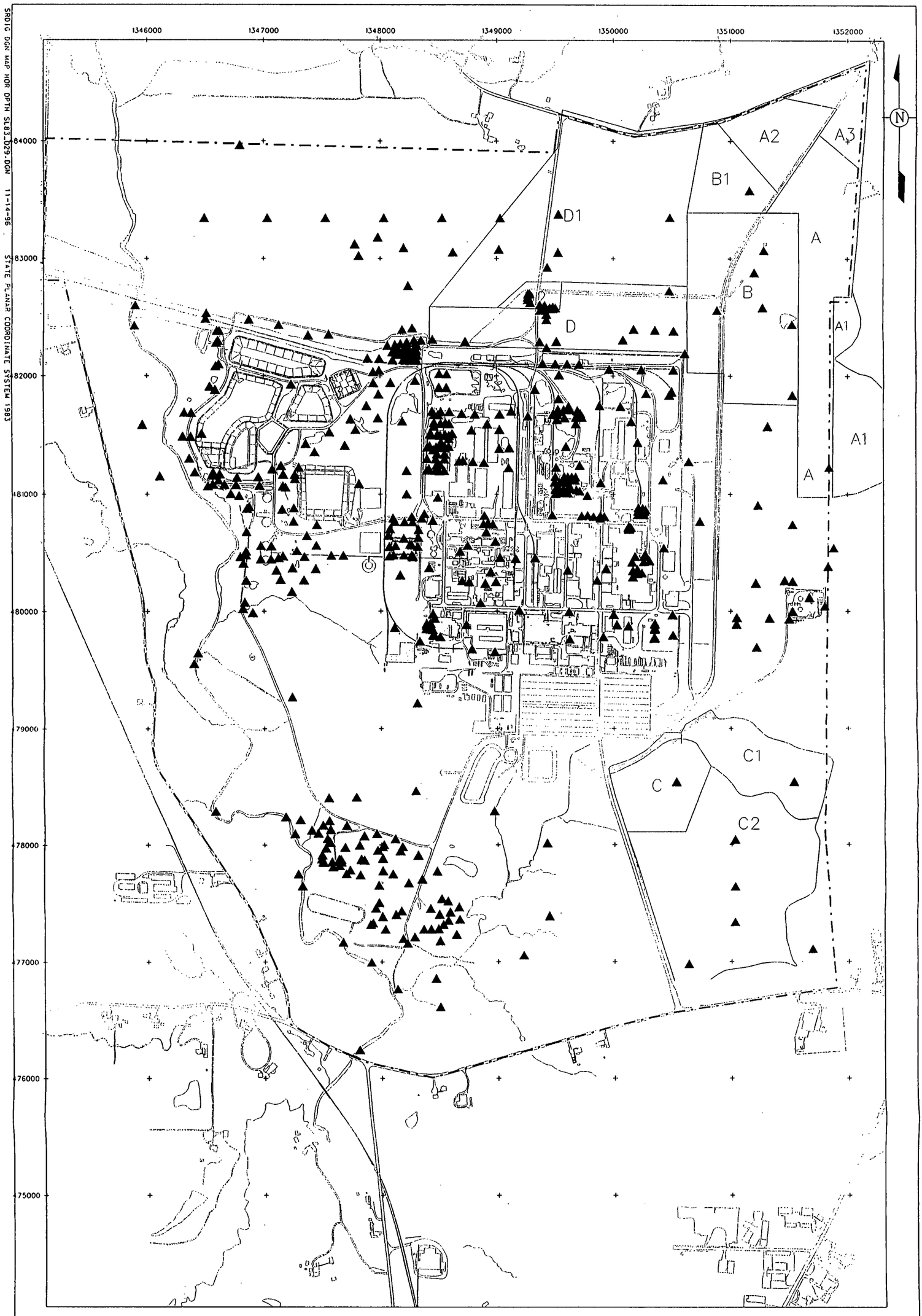
LEGEND:

FEMP BOUNDARY
EXCEEDS WAC: DETECTED
EXCEEDS WAC: NON DETECTED
BELOW WAC: DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

DRAFT

FIGURE E-32. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF WAC: TECHNETIUM-99.



LEGEND:

FEMP BOUNDARY
EXCEEDS WAC: DETECTED
EXCEEDS WAC: NON DETECTED
BELOW WAC: DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

DRAFT

FIGURE E-33. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF WAC: TRICHLOROETHENE.

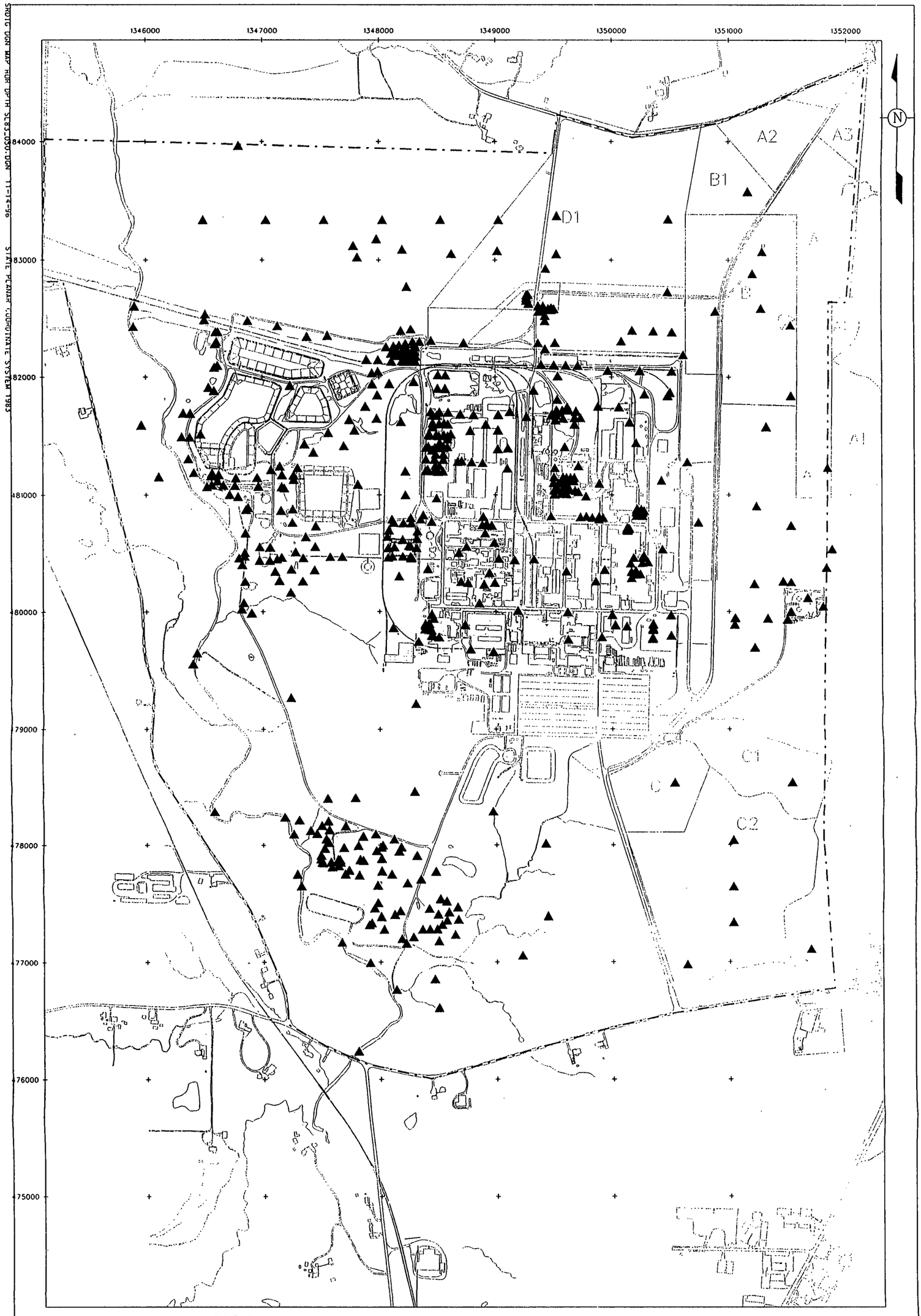


FIGURE E-34. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF WAC: TETRACHLOROETHENE.

LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS WAC: DETECTED
- ○ EXCEEDS WAC; NON DETECTED
- ▲ BELOW WAC: DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-35. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF WAC: BROMODICHLOROMETHANE.

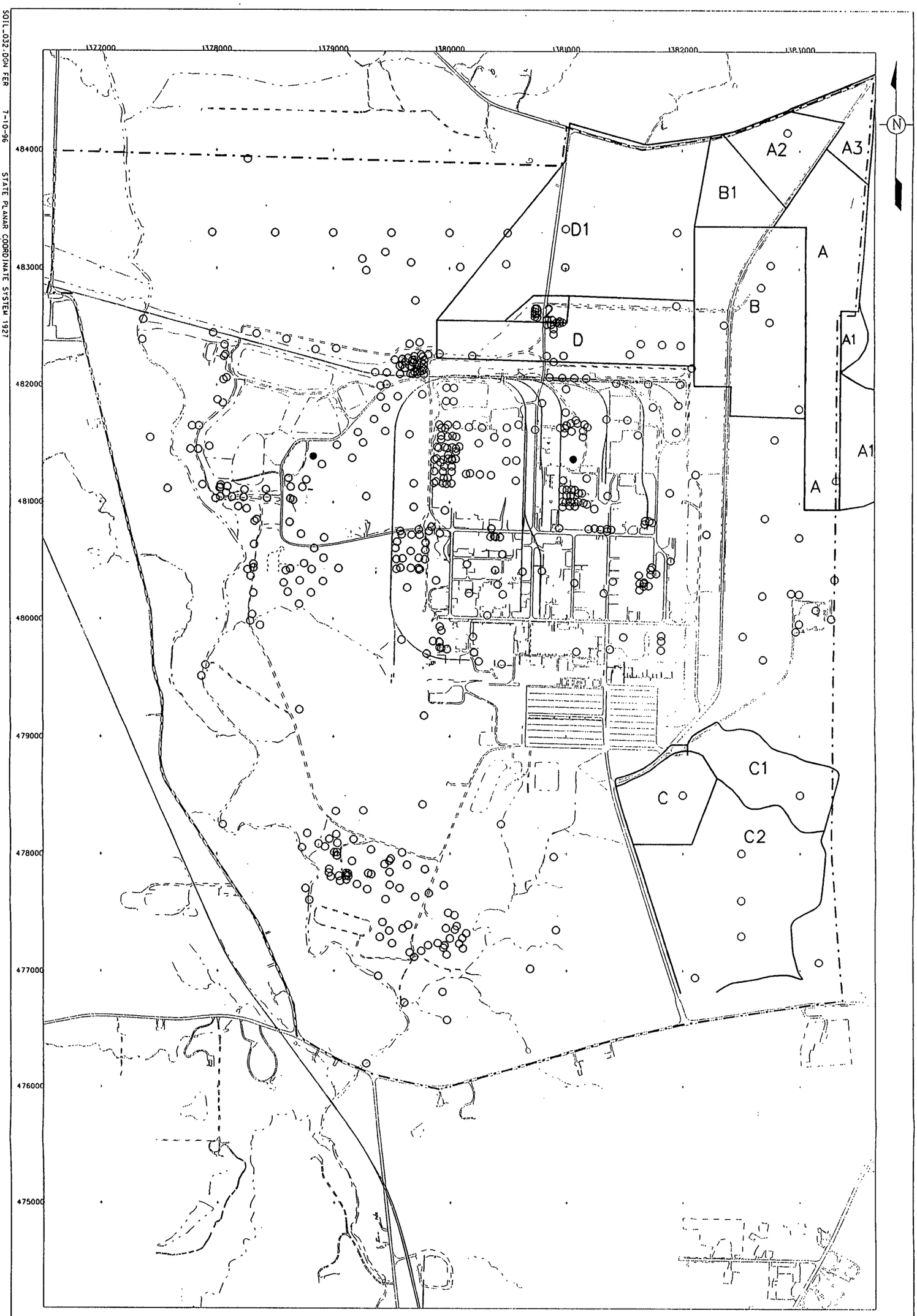


FIGURE E-36. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF WAC: BIS(2-CHLOROISOPROPYL) ETHER.

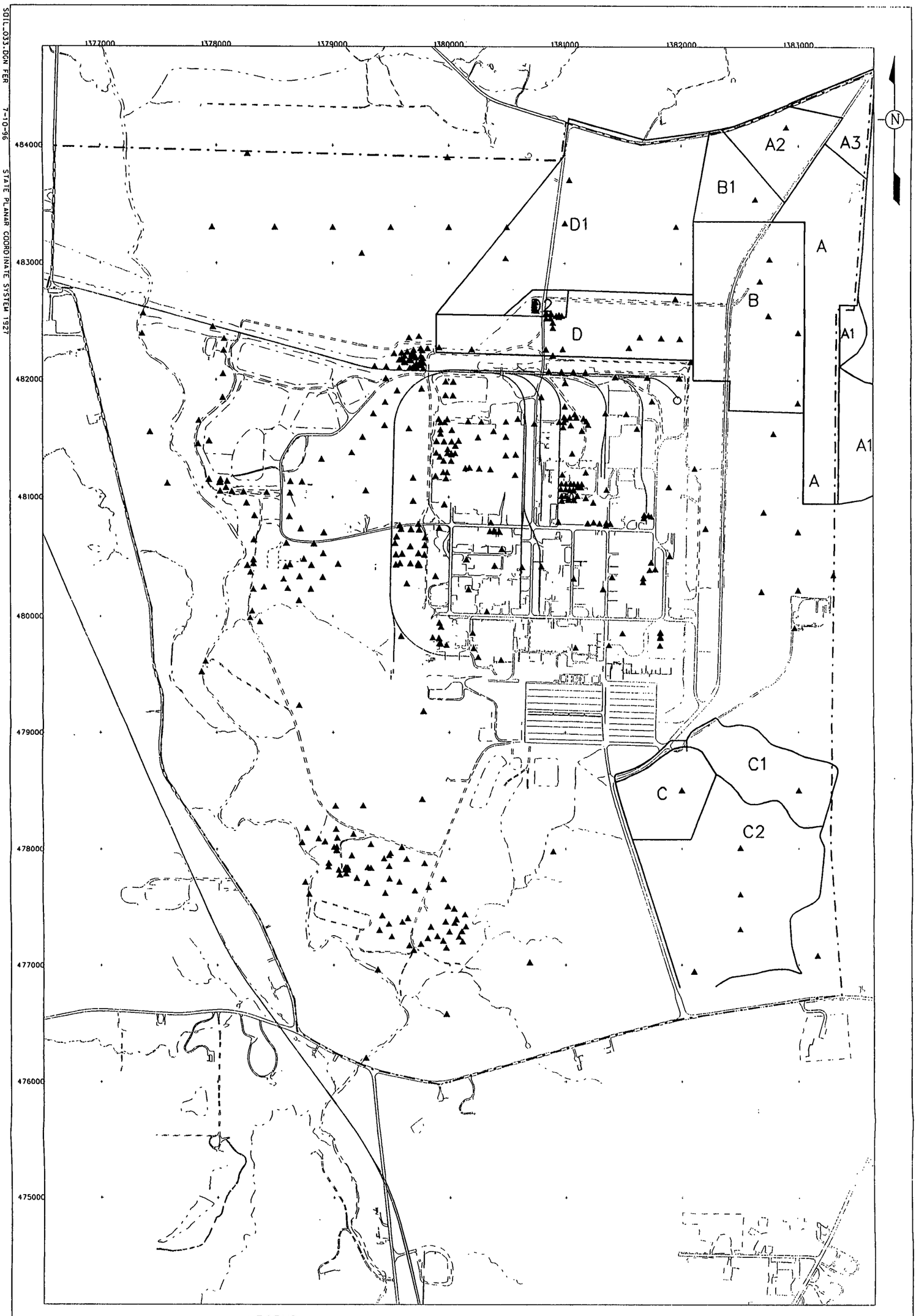


FIGURE E-37. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF WAC: ALPHA-CHLORDANE.

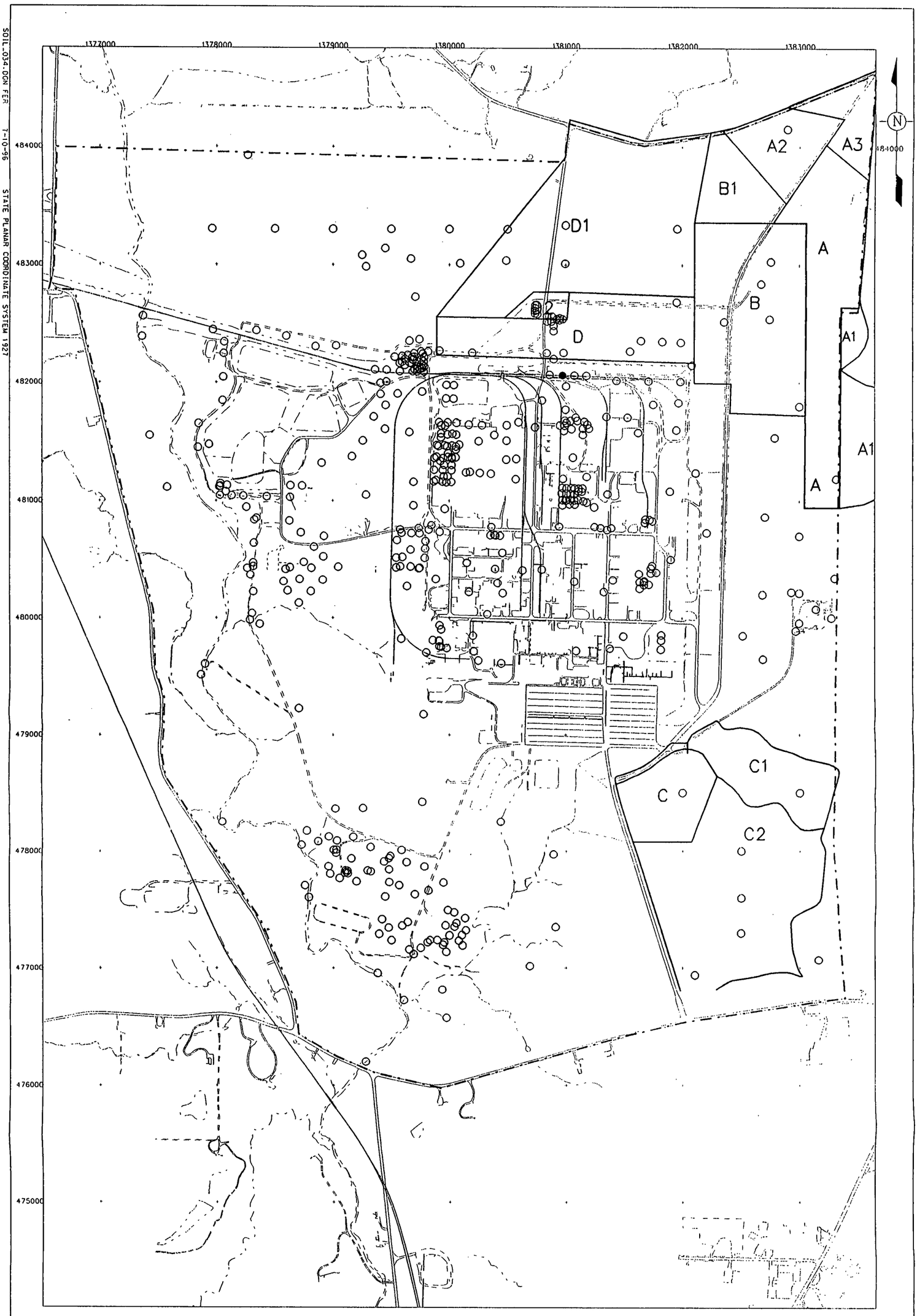
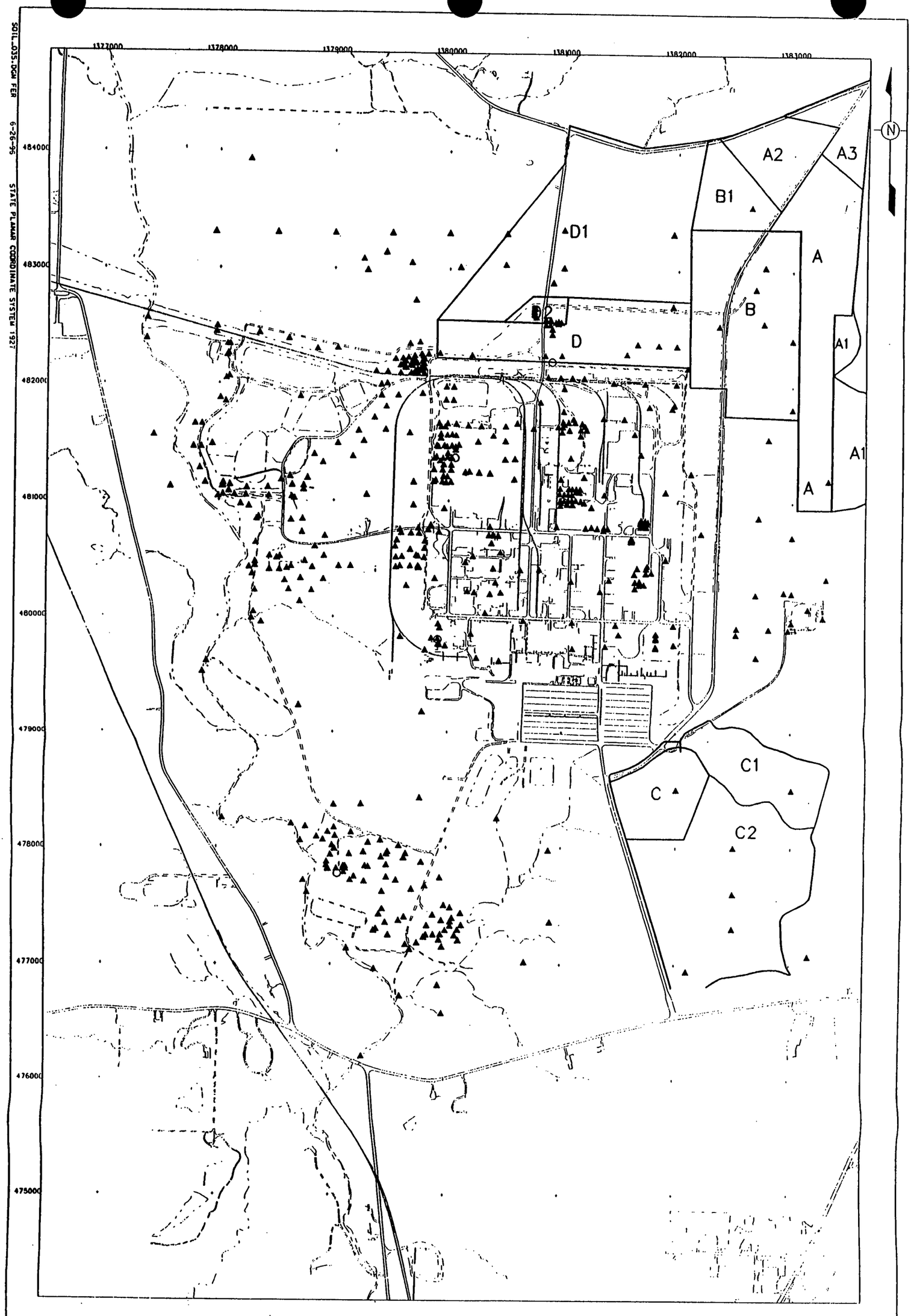


FIGURE E-38. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF WAC: 4-NITROANILINE.



LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS WAC: DETECTED
- ○ EXCEEDS WAC: NON DETECTED
- ▲ BELOW WAC: DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-39. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF WAC: VINYL CHLORIDE.

FIGURE E-40.A. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF BTV: ALUMINUM.

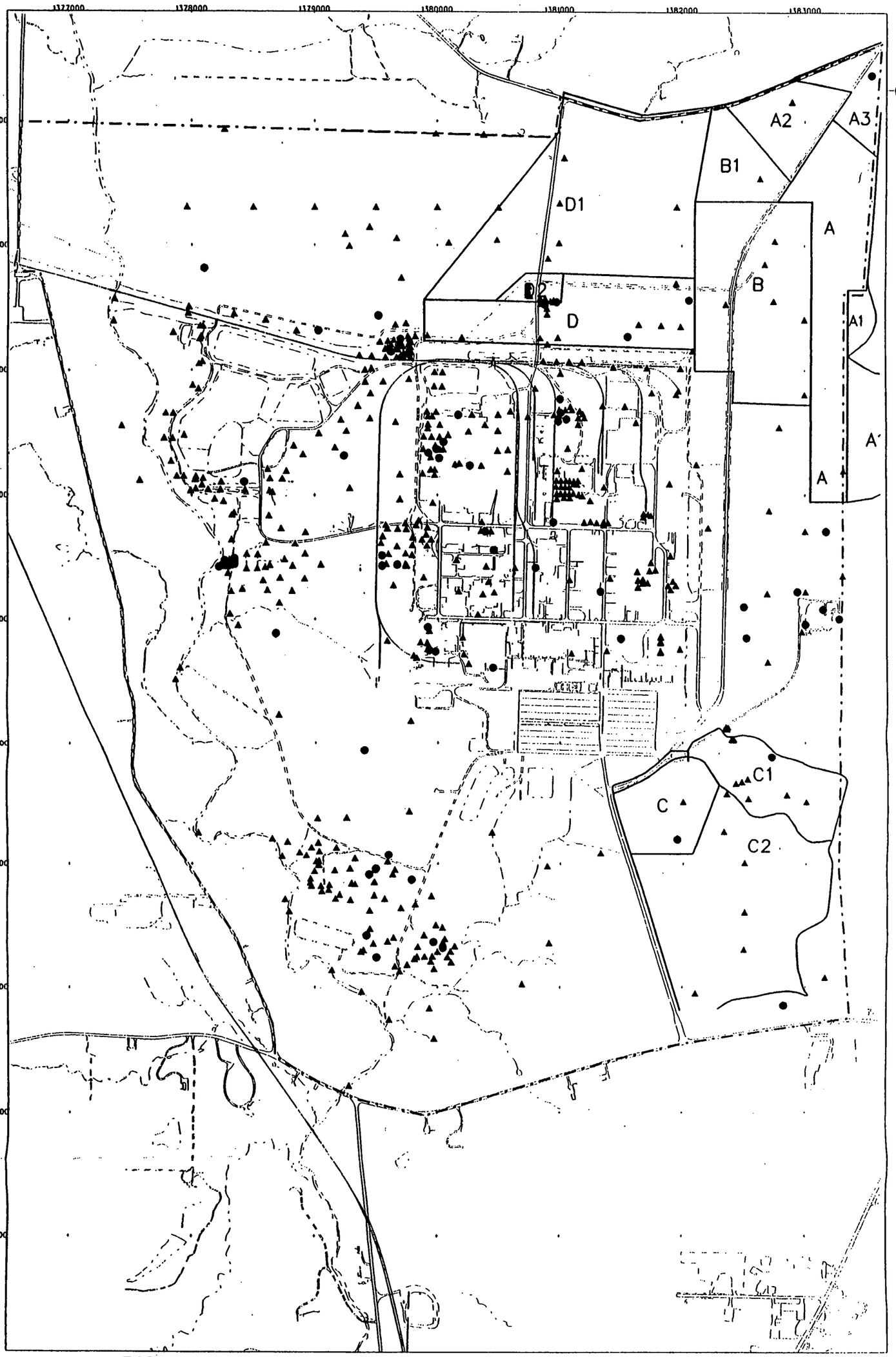
LEGEND:

FEMP BOUNDARY
EXCEEDS BTV: DETECTED
EXCEEDS BTV: NON DETECTED
BELOW BTV: DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

DRAFT

FIGURE E-40-B. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF 95th PERCENTILE OF SURFACE SOIL BACKGROUND: ALUMINUM.



LEGEND:

FEMP BOUNDARY

● EXCEEDS BTV; DETECTED

○ EXCEEDS BTV; NON DETECTED

▲ BELOW BTV; DETECT AND NON DETECTED

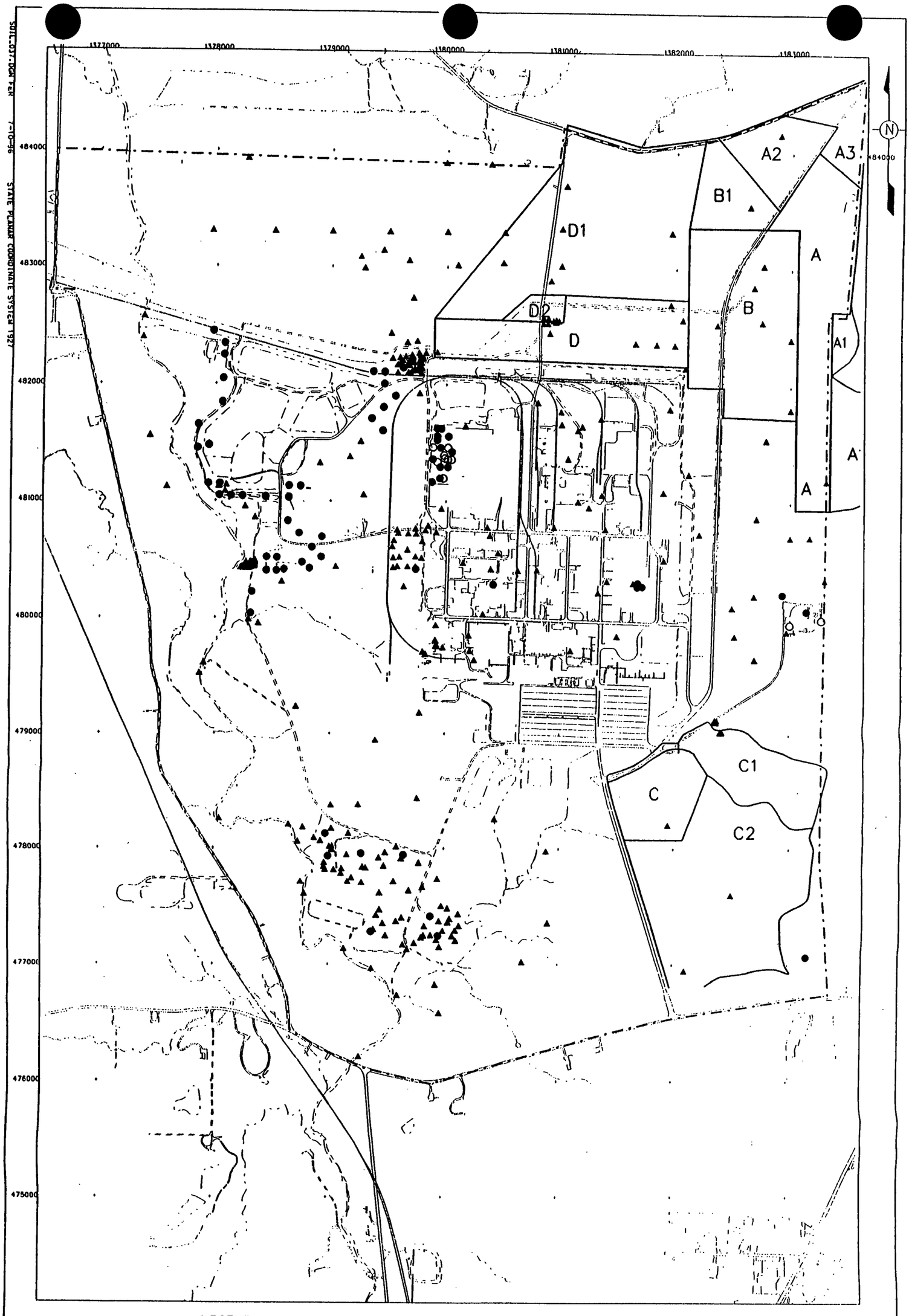
SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-40-C. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF 95th PERCENTILE OF SUB SURF SOIL BACKGROUND; ALUMINUM.

SOIL_049.DGN FER 7-9-96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS BTV: DETECTED
- ○ EXCEEDS BTV: NON DETECTED
- ▲ BELOW BTV: DETECT AND NON DETECTED

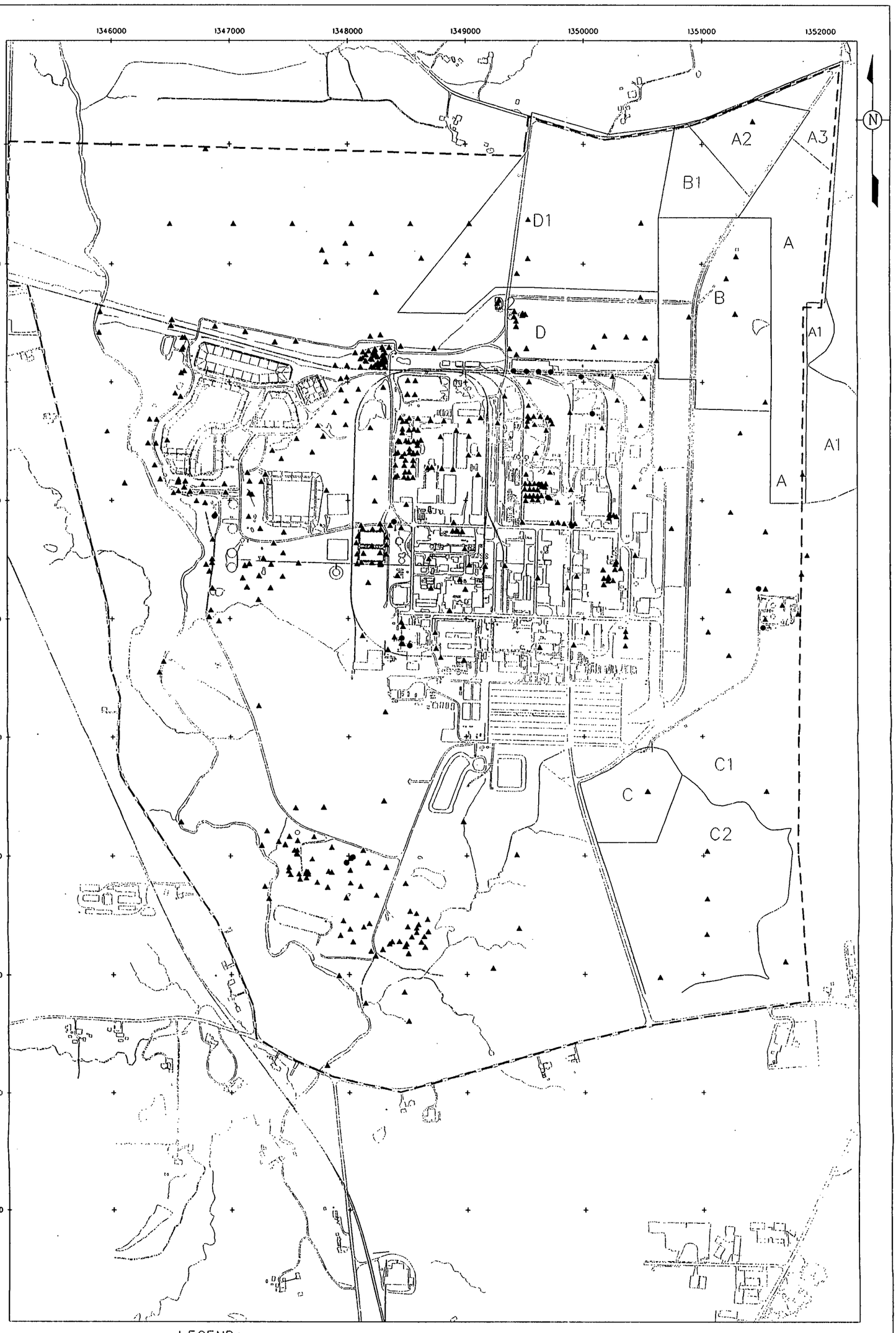
SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-41. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF BTV: ANTIMONY.

SOIL.037.DGN FER 7-10-96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

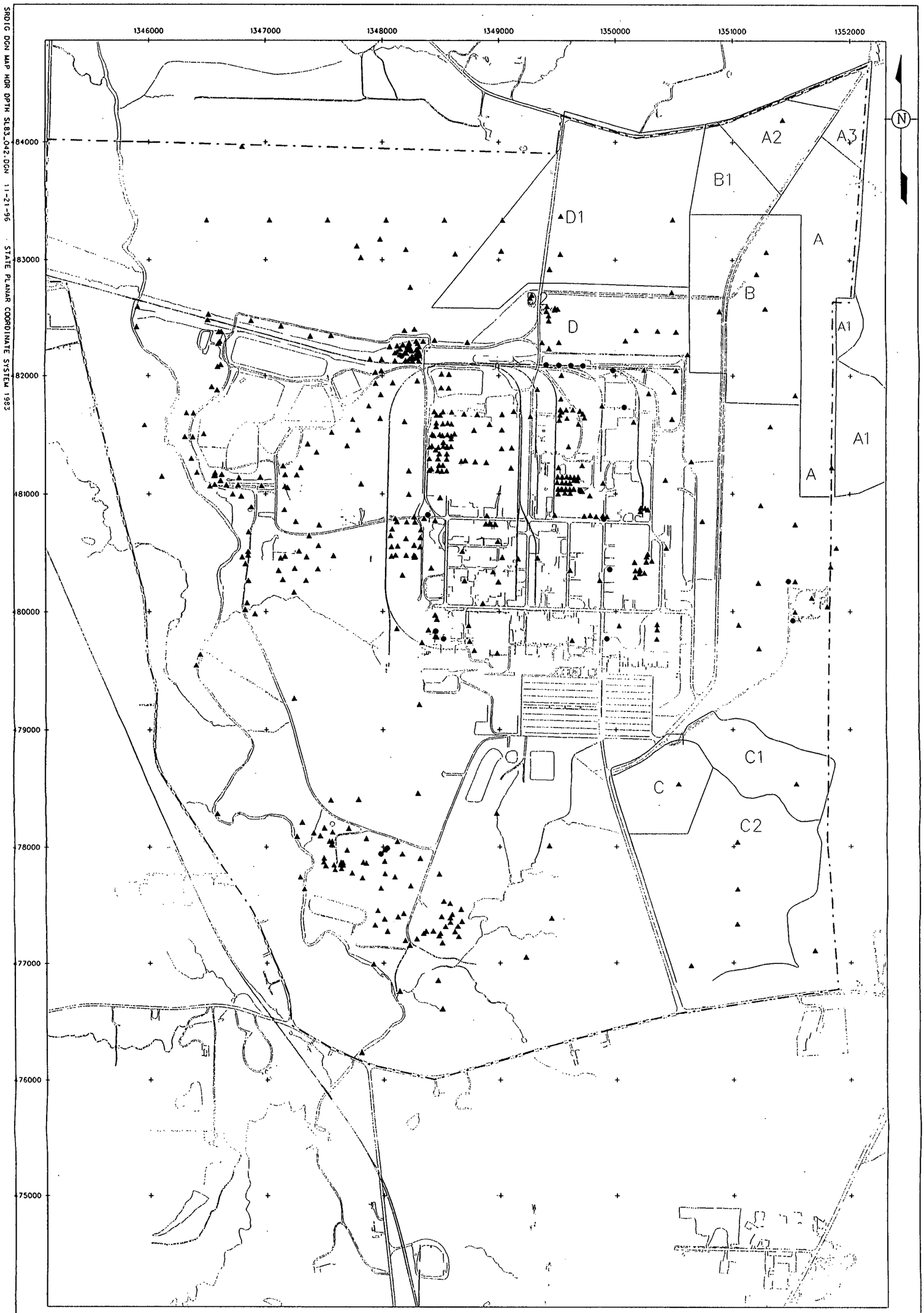
FEMP BOUNDARY
EXCEEDS BTV: DETECTED
EXCEEDS BTV: NON DETECTED
BELOW BTV: DETECT AND NON DETECTED

SCALE
300 100 0 300 FEET

DRAFT

FIGURE E-42. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF BTV: BENZO(G,H,I)PERYLENE.

SROGN DG MAP HOR DPTH SL83-041.DGN 11-21-96 STATE PLANAR COORDINATE SYSTEM 1983



LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS BTV; DETECTED
- ○ EXCEEDS BTV; NON DETECTED
- ▲ BELOW BTV; DETECT AND NON DETECTED

SCALE

800 400 0 800 FEET

DRAFT

FIGURE E-43. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF BTV: BENZO(K)FLUORANTHENE.

SRDIG DGN MAP HOR DPTH SL83_042.DGN 11-21-96 STATE PLANAR COORDINATE SYSTEM 1983

LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS BTV; DETECTED
- ☆ EXCEEDS BTV; NON DETECTED
- ▲ BELOW BTV; DETECT AND NON DETECTED

SCALE
800 400 0 800 FEET

DRAFT

FIGURE E-44. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF BTV: CADMIUM.

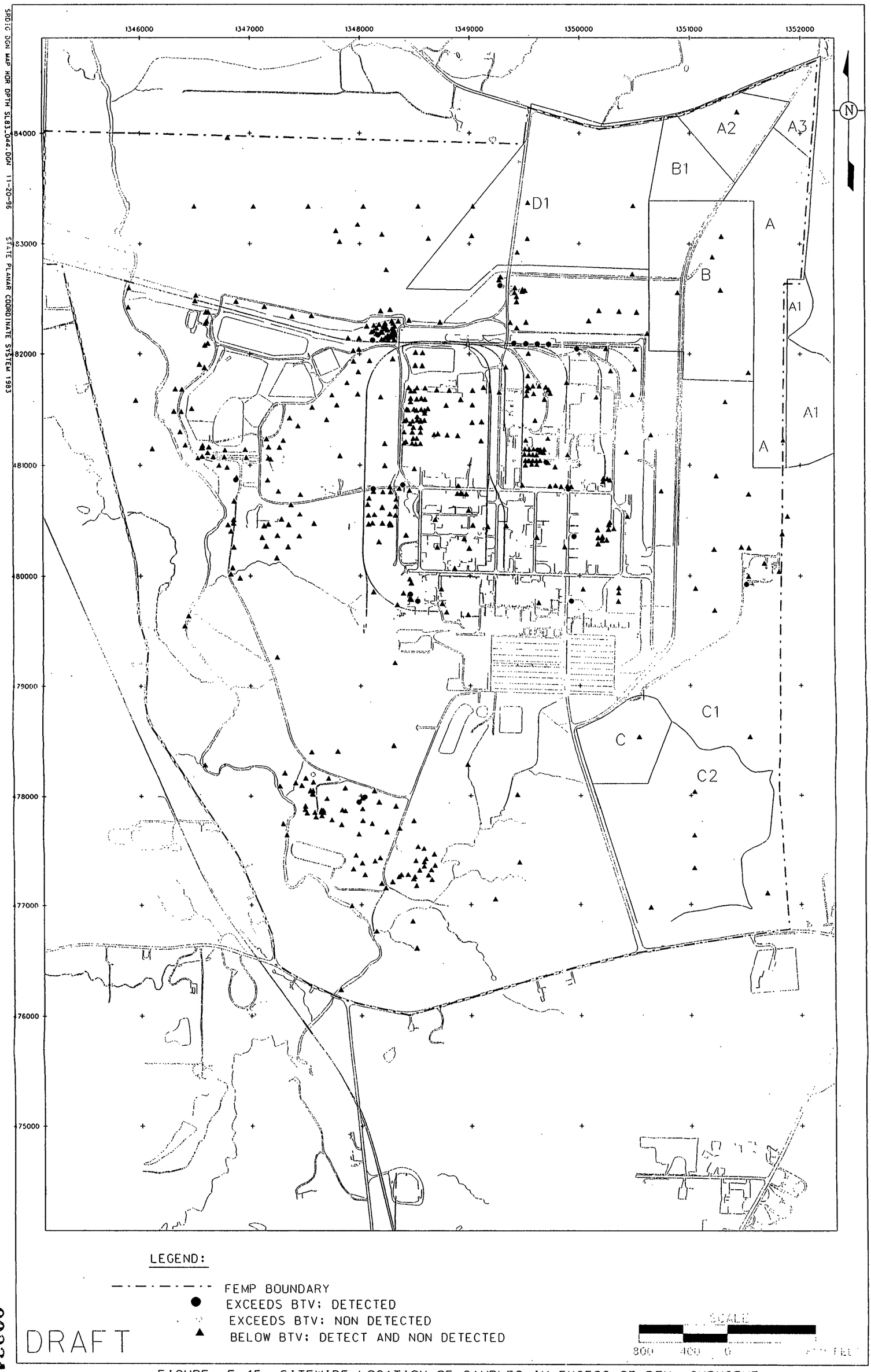
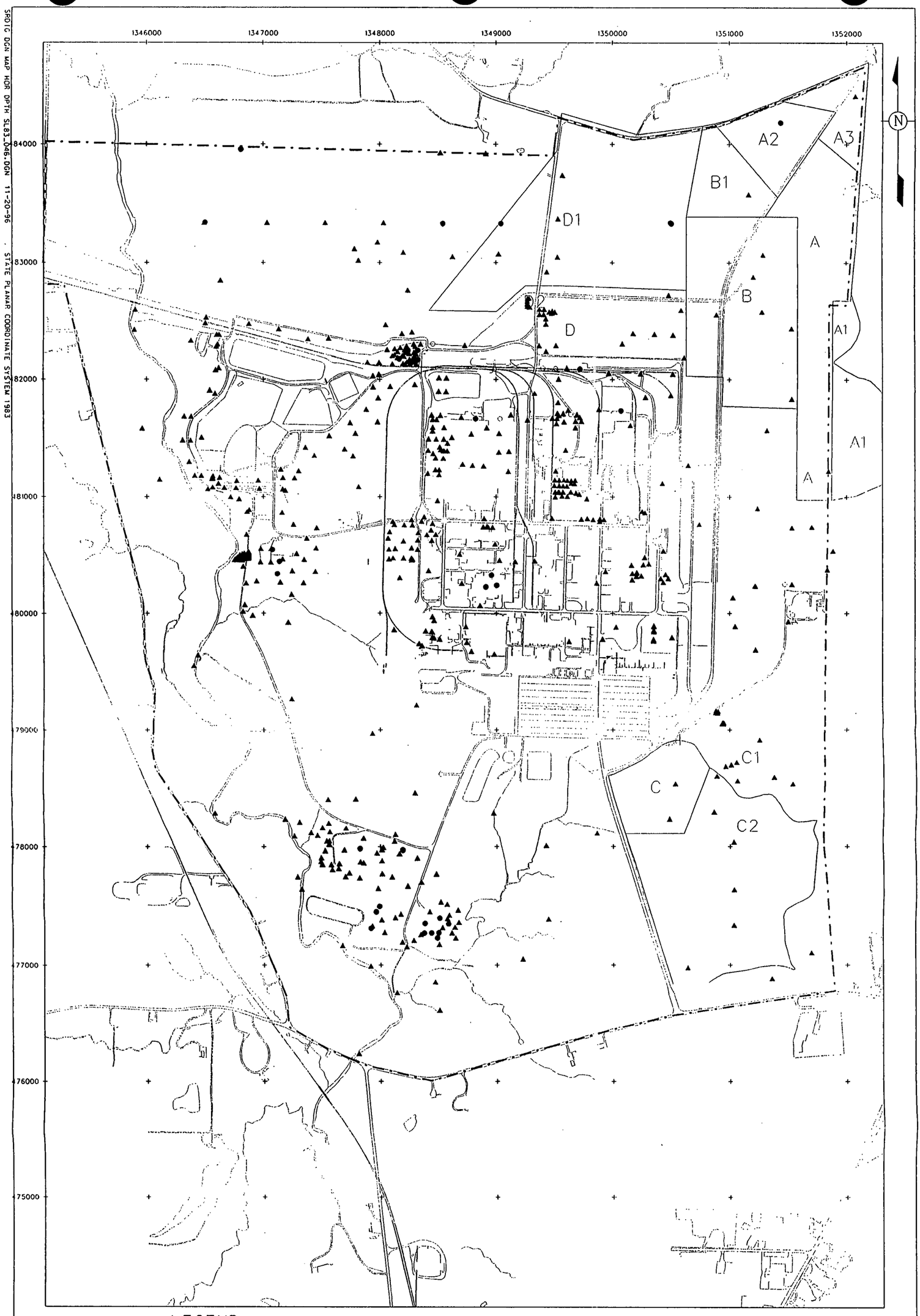


FIGURE E-45. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF BTV: CHRYSENE.



LEGEND:

FEMP BOUNDARY

● EXCEEDS BTV; DETECTED

EXCEEDS BTV; NON DETECTED

▲ BELOW BTV; DETECT AND NON DETECTED

DRAFT

FIGURE E-46. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF BTV: MOLYBDENUM.

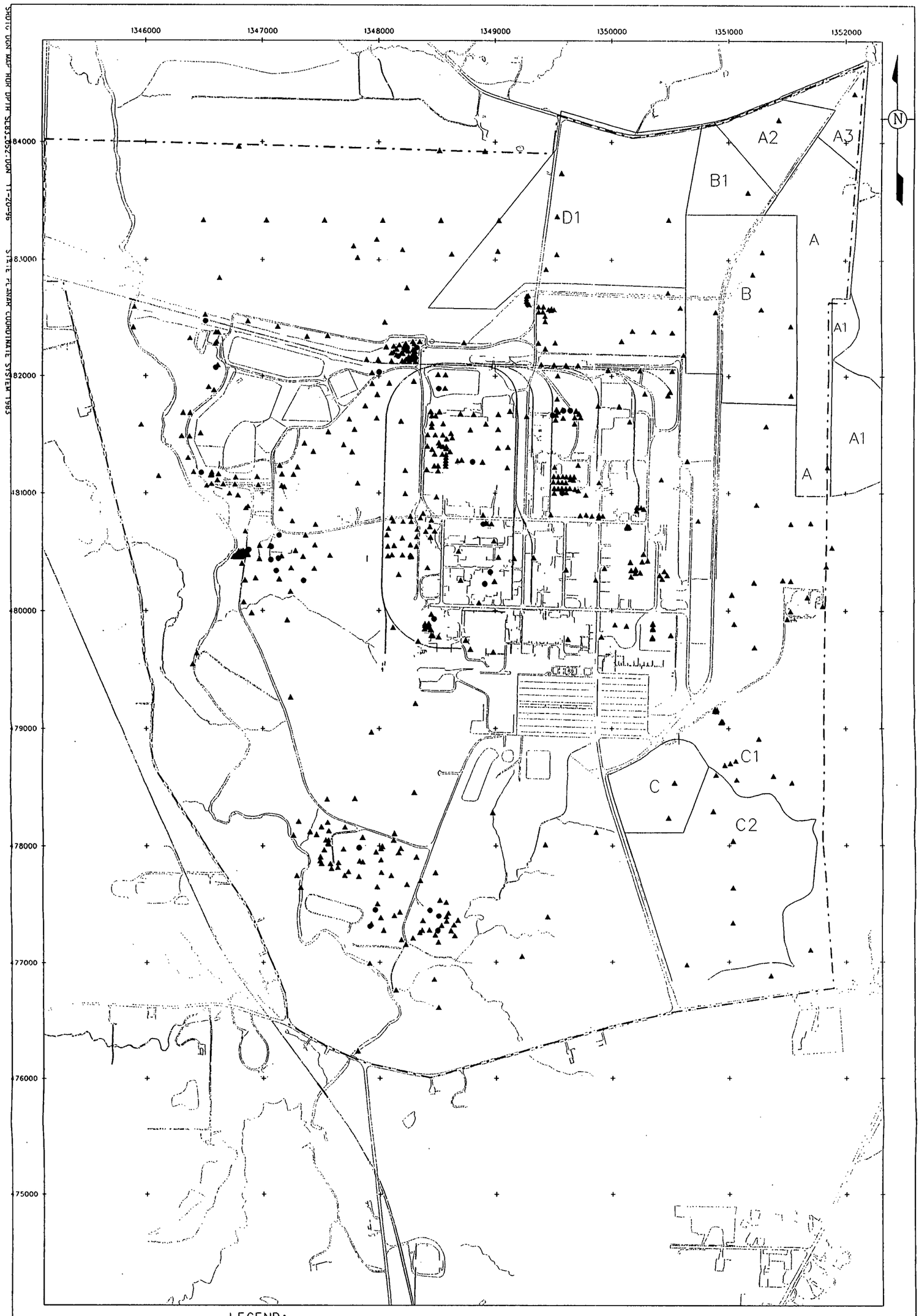


FIGURE E-47. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF BTV; SILVER.

FIGURE E-48. SITEWIDE LOCATION OF SAMPLES IN EXCESS OF BTVs: ZINC.

SRDIG DGN MAP HOR DPTH SL83_053.dgn 11-20-96 STATE PLANAR COORDINATE SYSTEM 1983

APPENDIX F
REAL-TIME TEST RESULTS

TABLE OF CONTENTS

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F.1.0 REAL-TIME TEST RESULTS

F.1.1 Measurements of Gamma-Emitting Radionuclides in Surface Soil

The measurement of gamma-emitting radionuclides in the field using, a variety of scintillation and solid state detectors, has been well established for over four decades. In the last two decades, the performance of high-resolution germanium (Ge) detectors has been highly developed (ICRU 1994).

The Fernald Environmental Management Project (FEMP) is engaged in applying several technologies to the remediation of the site in accordance with final remediation levels (FRLs) stipulated in the Operable Unit 5 Record of Decision approved by the U.S. Environmental Protection Agency (EPA). The main radiological constituent of concern at the FEMP is uranium; however, there are other radioactive species such as thorium-232, thorium-228, radium-226 and radium-228 which also have FRLs. In situ gamma-ray spectroscopy (IGS) is looked upon as a rapid, relatively inexpensive method to accurately determine concentrations of these radioactivities in surface soil at the FEMP site.

The measurement of uranium in surface soil at the FEMP with high resolution Ge detectors has been reported in detail (Miller et al. 1994). This study was extended in August 1995 to demonstrate the applicability of IGS to FEMP soil remediation requirements. All work was performed in accordance with the Project-Specific Plan for Demonstration of the In Situ Gamma Spectroscopy Unit (DOE 1995).

Nine sampling areas (Figure F-1) were chosen (based on Operable Unit 5 RI results to provide a range of uranium concentrations) at which to test the technology; Area 7 was not sampled due to weather concerns. The sampling areas were overlayed by a 33- by 33-foot grid composed of 20 individual cells. The IGS unit measured the total uranium, radium-226, radium-228, thorium-228 and thorium-232 activities of the sampling area six consecutive times.

Six replicate measurements were taken to provide accuracy and reproducibility of the data. At locations IGS-01, IGS-04 and IGS-05, three of the measurements were taken on one day followed by the collection of one soil sample for moisture content analysis. The remaining three measurements were taken the following day.

Following the measurements, surface soil samples were collected from 0 to 4 inches at the middle of each of the 20 cells; see Table F-1 for the sampling points. The soil samples were analyzed for moisture content and for total uranium by colormetric and gamma spectroscopy methods. Samples were analyzed for uranium-234/235, uranium-236, uranium-238, radium-226, radium-228, thorium-228 and thorium-232. Additionally, the three samples collected following the three replicate measurements were analyzed for moisture content. A duplicate and a field blank were prepared and analyzed at each location. This sampling effort met analytical support levels (ASL) B requirements.

The IGS measurements were taken using a high-performance germanium (HPGe) system consisting of an 83 percent relative efficient, n-type, HPGe gamma-ray detector coupled to a portable 16000 channel pulse-height analyzer interfaced with a laptop computer. The system was placed on a tripod that positioned the detector one meter above the ground. At the direction of site personnel, six 900-second measurements were made at each of eight locations. Spectral data were processed using environmental gamma-ray analysis software. An independent measurement with a μR meter was made at each site and the results were recorded on the field worksheet.

The tripod was constructed of aluminum to minimize the shielding effects on the detector and was designed to support all of the hardware required for the measurements so that only the ends of the legs would touch the ground. (Some of the areas measured were known to contain removable contamination.)

Before deployment, the HPGe detector had been characterized and a response file reflecting a homogeneous distribution had been prepared to use with the analysis software. A homogeneous distribution assumption was made to lend a conservative posture to the results. Detector characterization is the process by which a detector's response as a function of energy and angle is determined. The detector used had been characterized by two independent methods. The results agreed to within 3 percent at all energies within the range 30 to 3000 kiloelectron volts (keV).

Spectral information was collected in 8000 of the 16000 data channels of the pulse-height analyzer. The gain of the analyzer was adjusted so that the 8000 channels covered an energy range of 0 to 3000 keV. The pulse-height analyzer included a digital stabilizer that was employed for all of the measurements.

A summary of the results is presented in Table F-2. The analysis software routinely provides information about naturally occurring radionuclides and cesium-137. The uranium-238 concentration was based on the 63, 93, and 1001 keV gamma rays from thorium-234 and protactinium-234m. The radium-228 concentration was based on the 90, 129, 209, 270, 328, 338, 409, 463, 794, 836, 911, 965, and 969 keV gamma rays from actinium-228. The thorium-228 concentration was based on the 75, 87, 239, and 300 keV gamma rays from lead-212. The thorium-232 concentration was based on the 239 keV from lead-212, the 511 keV and 583 keV from thallium-208, and the 911 keV from actinium-228 gamma rays. Total uranium was determined by doubling the uranium-238 concentration (to account for the uranium-234) and adding the uranium-235 concentration value.

The uranium-235 concentration was determined by unfolding the 186 keV photopeak. Uranium-235 emits a 185.7 keV gamma-ray and radium-226 emits an 186.1 keV gamma ray. The two gamma rays appear as one in the energy spectrum because the detector does not have sufficient resolution. The analysis software estimates the radium-226 concentration based on 352 keV from lead-214 and on 609 and 1120 keV from bismuth-214. Once determined, the radium-226 contribution to the 186 keV photopeak can be removed and the residue attributed to uranium-235. This method typically works well for environmental measurements where radium-226 is in or near equilibrium with lead-214 and bismuth-214. The analysis software provides detailed diagnostics that can be used to gauge the effectiveness of the unfolding. Because the radium-228 concentrations generally agree within 10 percent of the thorium-228 concentrations, it can be stated that equilibrium for the thorium-232 chain exists at the locations sampled.

A typical output from the spectrum analysis is presented in Table F-3. There is a similar output for each measurement. The "nuclide summary" gives the estimates for the radionuclide of interest in units of picocuries per gram (pCi/g) as well as microcuries per square meter (μCi/m^2) with an estimate of error based on counting statistics. The activity of potassium-40 and cesium-137 provide useful information on the credibility of the measured radioactivities because of the sources of these nuclides. Another useful number is reported in the "Exposure (μR/hr)" column. This number is the gamma or exposure rate in air and is well known for uranium, thorium, and other nuclides. Comparisons of the exposure calculated with either theoretical values or measured values using a pressurized ion chamber could reveal a number of inconsistent IGS results.

Averages of all IGS and FEMP laboratory results are assembled in Table F-4. The IGS results for total uranium have been corrected for average moisture content because laboratory measurements are reported on dried samples.

These data demonstrate an acceptable level of performance by the IGS unit. Location 8 data are not reported because of errors in soil sampling. Location 7 was not measured during this demonstration.

Figures F-2 through F-11 graphically compare the laboratory results to the IGS results, which are presented numerically in Table F-4. Each figure shows a linear line fitted to the data using least squares means. The figures also show the 95 percent confidence bounds of the linear fit. The laboratory measurements (y axis) represent the average from each sampling location. The error bounds on the laboratory values represent one standard error of the mean. The in situ measurements represent an average value; thus no estimate of the standard error is available for the IGS measurements.

Figure F-2 compares the laboratory BrPEDAP results (the standard method used by the laboratory) with IGS results. The comparison shows that in the region of interest (50 ppm of uranium), the IGS measurements are about 20 percent higher than those from the laboratory. Figure F-3 compares X-ray fluorescence (XRF) and IGS results and, although there is a positive correlation, the variance is unacceptably large. The comparison of XRF and laboratory gamma results is shown in Figure F-4 and again shows an unacceptably large variance.

Figures F-5 through F-7 compare laboratory gamma and IGS results for uranium- 238, uranium-235 and total uranium. These figures demonstrate good comparability, particularly in the region of interest (the FRL) for uranium.

The comparison of laboratory gamma and IGS results for thorium-232 is shown in Figure F-8. Comparability is acceptable for the region of interest near the FRL. Similarly acceptable results are shown in Figure F-9 for radium-226 and Figure F-10 for cesium-137.

Figure F-11 compares the results of the two methods for potassium-40, although this radionuclide is not a constituent of concern. However, its natural occurrence provides a good automatic check for instrument gain and response. The figure shows that in FEMP soil, potassiumn-40 is in the range of

14 to 18 pCi/g in undisturbed soil, thus providing a good "internal" standard for any gamma spectroscopy.

Laboratory measurements are not without uncertainty. Calibration of the laboratory spectrometers without appropriate standards can result in bias and error. Sample heterogeneity can result in errors because relatively small samples (aliquots g) are analyzed. Counting statistics must be evaluated. Conventional chemical analysis can also be in error due to such factors as incomplete or variable dissolution of the sample, sample losses, and/or low recovery.

F.2.0 FEASIBILITY STUDY OF THE DYNAMIC SENSOR PACKAGE FOR URANIUM MEASUREMENTS

At the FEMP, an action level of 50 [milligrams per kilogram (mg/kg) or parts per million (ppm)] for total uranium (or approximately 17 pCi/g of uranium-238) has been established for soil. The radiological character of surface media can be determined by measuring the gamma rays present. This measurement can be performed while the sensor package is stationary or moving parallel to a surface. Sensors typically deployed to make these measurements are sodium iodide (NaI) and HPGe gamma-ray detectors. High quality dynamic measurements (as opposed to static measurements) have been routinely made by the DOE's Remote Sensing Laboratory using NaI detectors. Recently, a number of in situ measurements were made at the FEMP using both NaI and HPGe gamma-ray detectors. In addition to the in situ measurements, soil samples were collected. These measurements and samples were taken by FERMCO to determine the NaI's sensitivity to uranium and thorium in site soil. This information was required to verify the feasibility of measuring uranium to the FRLwith NaI detectors using a mobile platform and to optimize sampling strategies for the dynamic sensor package (DSP) mobile platform. The DSP enables rapid scanning of surface media and provides information about the horizontal distribution of contaminants identifying "hot spots," as defined by DOE Order 5400.5.

Initial results are presented in Table F-5; laboratory results are reported in terms of dry soil and HPGe and NaI measurements are reported as measured with soil moisture present. The values should be corrected for the water content to enable direct comparison. The errors reported are counting errors only.

Analysis of the HPGe data showed the thorium-232 decay chain exhibited secular equilibrium.

The NaI data were collected using a single 4- by 4-inch detector. The minimum detectable activity (MDA) for this detector to uranium-238 in 120 seconds is defined as:

$$MDA=(3*(2*B)1/2/T)*CF$$

where:

B = total background counts (cts)
T = count time in seconds (s)
CF = conversion factor to convert counts per seconds to concentration (pCi/g/cps)

for uranium-238:

B = 1391 cts
T = 120 s
CF = 5.4 pCi/g/cps

then:

MDA = 7.1 pCi/g.

If the count time is reduced by a factor of 4, then the MDA is increased by a factor of 2.

The first action level in terms of uranium-238 concentration is approximately 17 pCi/g averaged over 100 square meters (m^2). DOE Order 5400.5 defines limits for hot spots as the action level multiplied by a factor of (100/A)1/2 where A is the area of the hot spot. The maximum area allowed for a hot spot is 25 m^2. Using the maximum area for a hot spot yields a multiplying factor of 2 or an action level of approximately 35 pCi/g for uranium-238 when averaged over 25 m^2.

The single 4- by 4-inch NaI data used in the above calculation would have an estimated MDA of 28.4 pCi/g with a 7.5 second acquisition time. The field of view for the DSP when used in a static mode is approximately 4- by 2.7 meters. To measure 25 m^2 in 7.5 seconds, the DSP would travel at 0.83 meters per second or almost 2 miles per hour. At 0.83 m/s, the DSP would measure 100 m^2 in 30 seconds. The above 4- by 4-inch detector has MDA of 14.2 pCi/g with a 30 second count time.

An array of four 4- by 4-inch NaI detectors should have the following MDA to uranium-238:

$$MDA=(3*(2*B)1/2/T)*CF$$

for uranium-238:

B=1391 cts
T=30 s
CF=1.4 pCi/g/cps

then:
MDA=7.4 pCi/g.

The above array should have an estimated MDA of 29.6 pCi/g with a 1.9 second acquisition time. Using the field of view for the DSP given above, the DSP could travel at 3.3 m/s or approximately 7.3 miles per hour. At 3.3 m/s, the DSP would measure 100 m^2 in less than 8 seconds. The above 4- by 4-inch detector array has an estimated MDA of 14.8 pCi/g with a 7.5 second count time. Based on these estimates, the DSP system employing four 4- by 4-inch NaI detectors should easily meet the measurement requirements for uranium-238.

A single 4- by 4-inch NaI has a MDA for thorium-232 in 120 seconds of:

MDA=(3*(2*B)1/2/T)*CF

for thorium-232:

B=27 cts
T=120 s
CF=0.34 pCi/g/cps

then:
MDA=0.06 pCi/g

for T=30 s:
MDA=0.12 pCi/g

for T=7.5 s
MDA=0.25 pCi/g

for T=1.9 s
MDA=0.5 pCi/g.

Estimated MDAs for the DSP to thorium-232 are approximately a factor of 2 lower for the same count times when compared to the single detector.

TABLE F-1
SOIL SAMPLING POINTS

↑	IGS-01 A	IGS-01 B	IGS-01 C	IGS-01 D	IGS-01 E
33	IGS-01 F	IGS-01 G	IGS-01 H	IGS-01 I	IGS-01 J
feet	IGS-01 K	IGS-01 L	IGS-01 M	IGS-01 N	IGS-01 O
↓	IGS-01 P	IGS-01 Q	IGS-01 R	IGS-01 S	IGS-01 T

← 33 feet →

Note: Grid is not to scale

TABLE F-2
FERNALD IN SITU GAMMA-RAY SPECTROMETRY DEMONSTRATION AUGUST 1995

Run No.	Date	Acquire Time	Time (s)	Sampling Location	Total U (pCi/g)	K-40 (pCi/g)	Error (%)	U-238	Error (%)	Ra-226	Error (%)	U-235	Error (%)	Th-232	Error (%)	Ra-228	Error (%)	Th-228	Error (%)	Cs-137	Error (%)
1	8/15/95	9:33	900	IGS-01	26.26	10.50	1.7	12.80	4.5	1.14	2.1	0.66	5.4	0.91	2.7	0.93	3.5	0.89	4.7	0.49	3.4
2	8/15/95	9:54	900	IGS-01	27.41	9.86	1.8	13.40	4.3	0.98	2.4	0.61	5.7	0.92	2.6	0.90	3.7	0.93	4.4	0.49	3.3
3	8/15/95	10:23	900	IGS-01	26.65	10.00	1.7	13.00	4.4	0.91	2.5	0.65	5.5	0.92	2.6	0.95	3.4	0.89	4.7	0.47	3.4
13	8/16/95	6:43	900	IGS-01	25.43	9.75	1.8	12.40	4.6	1.19	2.0	0.63	5.5	0.92	2.6	0.99	3.3	0.87	4.8	0.47	3.4
14	8/16/95	7:01	900	IGS-01	26.63	10.10	1.8	13.00	4.4	1.11	2.2	0.63	5.6	0.92	2.7	0.98	3.4	0.90	4.7	0.50	3.2
15	8/16/95	7:19	900	IGS-01	26.79	9.99	1.8	13.10	4.4	1.19	2.1	0.59	5.9	0.91	2.7	0.96	3.5	0.93	4.5	0.47	3.5
4	8/15/65	11:12	900	IGS-02	42.49	10.20	1.7	20.70	3.2	0.80	2.9	1.09	3.9	0.90	2.8	0.90	3.6	0.85	5.3	0.45	3.5
5	8/15/95	11:33	900	IGS-02	43.67	10.20	1.7	21.30	3.1	0.79	2.9	1.07	3.9	0.91	2.8	0.90	3.6	0.92	4.9	0.46	3.4
6	8/15/95	11:52	900	IGS-02	41.62	10.20	1.7	20.30	3.2	0.79	2.8	1.02	4.1	0.99	2.6	0.96	3.5	0.95	4.7	0.41	3.8
7	8/15/95	12:11	900	IGS-02	43.39	9.85	1.8	21.20	3.1	0.77	2.9	0.99	4.3	0.93	2.7	0.92	3.6	0.95	4.7	0.46	3.4
8	8/15/95	12:30	900	IGS-02	42.23	10.00	1.7	20.60	3.2	0.76	2.9	1.03	4.1	0.88	2.8	0.89	3.7	0.83	5.3	0.45	3.6
9	8/15/95	12:49	900	IGS-02	43.69	10.30	1.7	21.30	3.1	0.75	2.9	1.09	3.9	0.86	2.9	0.87	3.8	0.94	4.7	0.44	3.6
16	8/16/95	7:55	900	IGS-03	57.79	9.23	1.8	28.20	2.2	1.30	1.9	1.39	2.8	0.95	2.5	0.97	3.5	0.95	4.2	0.34	4.3
17	8/16/95	8:13	900	IGS-03	55.65	9.02	1.9	27.10	2.3	1.30	1.9	1.45	2.7	0.88	2.7	0.95	3.5	0.87	4.7	0.37	4.1
18	8/16/95	8:34	900	IGS-03	57.64	8.96	1.9	28.10	2.2	1.27	1.9	1.44	2.8	0.92	2.6	0.95	3.4	0.96	4.2	0.34	4.4
19	8/16/95	8:55	900	IGS-03	56.44	9.02	1.8	27.50	2.3	1.27	1.9	1.44	2.8	0.87	2.7	0.87	3.6	0.85	4.8	0.34	4.2

TABLE F-2
(CONT'D)

Run No.	Date	Time	Acquire Time (s)	Sampling Location	Total U (pCi/g)	K-40 (pCi/g)	Error (%)	U-238	Error (%)	Ra-226	Error (%)	U-235	Error (%)	Th-232	Error (%)	Ra-228	Error (%)	Th-228	Error (%)	Cs-137	Error (%)
20	8/16/95	9:11	900	IGS-03	60.08	8.95	1.9	29.30	2.1	1.23	2.0	1.48	2.7	0.90	2.7	0.96	3.4	0.86	4.8	0.37	4.1
21	8/16/95	9:30	900	IGS-03	56.59	8.98	1.8	27.60	2.3	1.21	2.0	1.39	2.8	0.92	2.6	0.96	3.4	0.91	4.5	0.36	4.1
10	8/15/95	15:52	900	IGS-04	53.29	10.20	1.9	26.00	3.2	1.68	2.2	1.29	4.6	7.94	0.7	8.90	1.0	7.29	1.2	0.34	6.5
11	8/15/95	16:20	900	IGS-04	56.12	10.20	1.9	27.40	3.0	1.64	2.2	1.32	4.5	7.92	0.7	8.48	0.9	7.50	1.2	0.27	8.1
12	8/15/95	16:37	900	IGS-04	56.05	10.60	1.9	27.40	3.0	1.62	2.3	1.25	4.8	8.07	0.7	8.51	0.9	7.63	1.2	0.30	7.2
22	8/16/95	10:15	900	IGS-04	56.4	10.40	1.9	27.60	3.1	2.06	1.9	1.20	5.0	8.34	0.7	9.01	0.9	7.71	1.2	0.29	7.7
23	8/16/95	10:33	900	IGS-04	51.40	10.50	1.9	25.10	3.4	2.03	1.9	1.20	5.0	8.19	0.7	8.91	0.9	7.38	1.3	0.29	7.8
24	8/16/95	10:53	900	IGS-04	49.83	10.20	1.9	24.30	3.5	2.00	1.9	1.23	4.9	8.25	0.7	8.93	0.9	7.60	1.2	0.29	7.8
25	8/16/95	14:30	900	IGS-05	207.37	11.00	1.8	101.00	1.4	3.48	1.3	5.37	1.9	3.35	1.5	3.30	1.9	3.00	3.3	0.48	5.0
26	8/16/95	14:53	900	IGS-05	215.46	11.20	1.7	105.00	1.4	3.47	1.3	5.46	1.8	3.31	1.5	3.36	1.9	2.99	3.3	0.48	5.0
27	8/16/95	15:14	900	IGS-05	215.34	11.60	1.7	105.00	1.4	3.48	1.3	5.34	1.9	3.28	1.5	3.28	1.9	3.05	3.3	0.45	5.2
31	8/17/95	7:02	900	IGS-05	205.26	11.10	1.8	100.00	1.4	4.13	1.2	5.26	1.8	3.14	1.6	3.18	1.9	2.77	3.5	0.48	4.9
32	8/17/95	7:23	900	IGS-05	209.24	10.90	1.8	102.00	1.4	4.11	1.2	5.24	1.8	3.15	1.5	3.22	1.9	2.85	3.3	0.45	5.2
33	8/17/95	7:43	900	IGS-05	205.21	11.30	1.8	100.00	1.4	4.16	1.1	5.21	1.8	3.13	1.6	3.22	1.9	2.75	3.5	0.46	5.1
28	8/16/95	16:27	900	IGS-06	10.02	7.27	2.1	4.93	16.0	1.09	2.3	0.16	19.9	0.65	3.8	0.68	4.6	0.52	9.2	0.09	12.8
29	8/16/95	16:46	900	IGS-06	8.19	7.09	2.1	3.97	16.5	1.03	2.4	0.25	14.8	0.60	4.0	0.65	4.8	0.52	9.2	0.06	19.1
30	8/16/95	17:04	900	IGS-06	7.64	6.74	2.2	3.74	17.6	1.08	2.3	0.16	20.0	0.62	4.0	0.65	4.8	0.60	8.1	0.09	12.3
34	8/17/95	8:29	900	IGS-06	7.93	7.01	2.1	3.91	22.3	1.57	1.8	0.11	22.1	0.58	4.1	0.63	4.9	0.54	8.9	0.08	13.8

TABLE F-2
(CONT'D)

Run No.	Date	Time	Acquire Time (s)	Sampling Location	Total U (pCi/g)	K-40 (pCi/g)	Error (%)	U-238	Error (%)	Ra-226	Error (%)	U-235	Error (%)	Th-232	Error (%)	Ra-228	Error (%)	Th-228	Error (%)	Cs-137	Error (%)
35	8/17/95	8:47	900	IGS-06	7.53	6.94	2.1	3.71	16.7	1.62	1.7	0.11	22.4	0.59	4.1	0.63	5.1	0.56	8.6	0.07	17.4
36	8/17/95	9:04	900	IGS-0	7.43	7.09	2.1	3.65	23.0	1.53	1.8	0.13	20.7	0.57	4.3	0.59	5.2	0.59	8.2	0.06	17.8
43	8/17/95	15:44	900	IGS-08	28.31	10.90	1.7	14.00	5.3	0.68	3.4	0.31	13.6	0.67	3.6	0.68	4.7	0.65	7.6	0.04	26.2
44	8/17/95	16:04	900	IGS-08	28.12	11.00	1.7	13.90	5.4	0.67	3.4	0.32	13.1	0.67	3.7	0.69	4.6	0.65	7.5	0.05	20.8
45	8/17/95	16:23	900	IGS-08	29.08	11.10	1.7	14.40	5.1	0.75	3.1	0.28	14.8	0.65	3.9	0.70	4.6	0.64	7.7	0.06	20.6
46	8/17/95	16:43	900	IGS-08	25.92	10.90	1.7	12.80	5.8	0.71	3.3	0.32	13.1	0.66	3.8	0.64	4.9	0.62	7.9	0.05	22.4
47	8/17/95	17:01	900	IGS-08	28.47	10.60	1.7	14.10	5.2	0.73	3.2	0.27	15.2	0.66	3.7	0.66	4.8	0.59	8.4	0.04	30.1
48	8/17/95	17:18	900	IGS-08	26.93	10.60	1.7	13.30	5.5	0.72	3.2	0.33	12.6	0.67	3.7	0.68	4.7	0.65	7.5	0.05	24.9
37	8/17/95	9:44	900	IGS-09	9.94	11.30	1.6	4.97	21.1	1.71	2.2	0.00		0.86	4.3	0.87	4.6	0.81	17.9	0.10	16.8
38	8/17/95	10:19	900	IGS-09	10.05	11.30	1.6	4.83	22.4	1.70	2.1	0.39	33.2	0.90	4.1	0.90	4.4	0.82	17.7	0.09	18.4
39	8/17/95	10:54	900	IGS-09	8.36	11.40	1.7	3.83	28.1	1.55	2.3	0.70	21.0	0.89	4.2	0.85	4.6	0.78	18.6	0.10	16.4
40	8/17/95	11:32	900	IGS-09	10.61	11.10	1.7	5.07	20.9	1.44	2.4	0.47	29.5	0.83	4.4	0.82	4.8	0.67	21.7	0.11	15.1
41	8/17/95	12:05	900	IGS-09	7.94	11.00	1.7	3.97	26.0	1.38	2.5	0.00		0.86	4.2	0.84	4.6	0.91	16.1	0.13	13.5
42	8/17/95	12:45	900	IGS-09	10.01	11.10	1.7	4.76	21.8	1.45	2.4	0.49	28.3	0.84	4.3	0.87	4.5	0.65	22.0	0.12	14.4

TABLE F-3
SAMPLE OUTPUT FROM SPECTRUM ANALYSIS
IGS-01, 08/15/95, RUN NO. 1

Energy (keV)	Resolution FWHM (keV)	Live Time (s)	Real Time (s)	Quad Value	Gain (keV/ch)	Offset (keV)	Height (cm)
1460.5	2.56	900	933	0.232E-07	0.376	0.407	100

Nuclide Summary

Isotope	Activity pCi/g	Activity μCi/m^2	Error %
K-40	10.5	0.157E+06	1.7
U-238	12.8	0.193+06	4.5
Ra-226	1.14	0.171E+05	2.1
U-235	0.660	0.989E+04	5.4
Th-232	0.909	0.136E+05	2.7
Cs-137	0.491	0.737E+04	3.4

Energy (keV)	Net Count	Background Count	Error (%)	Isotope	Photo-peak	Activity (pCi/g)	Activity (μCi/m^2)	Exposure (μR/hr)
17.7	693.5	1490.5	9.0	Pa-231	18.5	0.11E+03	0.16E+07	0.00
				Pu-238	17.1	39.0	0.58E+06	
23.8	732.5	2952.5	11.0	Sn-113	24.0	8.6	0.13E+06	0.00
				In-115	24.2	1.8	0.27E+05	
				Sn-113	24.2	4.6	0.69E+05	
27.0	217.1	3209.9	38.0	Am-241	26.3	18.0	0.27E+06	0.00
				Th-231	26.6	2.4	0.36E+05	
				Sn-113	27.3	4.1	0.62E+05	
				Pa-231	27.4	4.9	0.73E+05	
				Sn-113	27.9	22.0	0.32E+06	
46.2	509.3	11734.7	30.0	a	a	a	a	0.43E-02
63.2	1811.0	16164.0	10.0	Th-234	63.2	15.0	0.23E+06	0.20E-01
				U-238	63.2	15.0	0.23E+06	

TABLE F-3
(CONT'D)

Energy (keV)	Net Count	Background Count	Error (%)	Isotope	Photo-peak	Activity (pCi/g)	Activity (μCi/m^2)	Exposure (μR/hr)
74.5	557.2	15919.8	32.0	Am-243	74.7	0.25	0.38E+04	0.78E-02
				Pb-212	74.8	1.7	0.26E+05	
				U-235	74.9	0.17E+05	0.25E+09	
				Px-82	75.0	0.17	0.25E+04	
76.8	832.7	15483.3	21.0	Lu-174	76.5	3.0	0.45E+05	0.12E-01
				Pu-241	77.0	0.10E+07	0.15E+11	
				Pb-212	77.1	1.4	0.21E+05	
				Bi-209	77.1	0.24	0.37E+04	
				Pu-239	77.6	0.57E+05	0.85E+09	
84.2	400.3	13853.7	42.0	Th-231	84.2	14.0	0.21E+06	0.64E-02
				U-235	84.2	2.2	0.33E+05	
				Px-82	84.7	0.33	0.49E+04	
				Hg-203	84.9	17.0	0.26E+06	
87.2	446.9	13293.1	37.0	Eu-155	86.5	0.38	0.57E+04	0.74E-02
				Am-243	86.8	36.0	0.54E+06	
				Th-234	87.0	0.17E+04	0.25E+08	
				Ac-225	87.0	42.0	0.62E+06	
				Pb-212	87.2	1.9	0.29E+05	
				Cd-109	88.0	3.2	0.48E+05	
92.2	2880.8	12469.2	6.0	Th-234	92.6	14.0	0.21E+06	0.50E-01
				U-238	92.6	14.0	0.21E+06	
98.2	388.5	10863.5	38.0	Pa-234	98.4	96.0	0.14E+07	0.71E-02
				Pu-238	98.4	0.65E+05	0.97E+09	
				Pu-239	98.4	0.16E+04	0.24E+08	
				Pu-241	98.4	0.20E+04	0.30E+08	
				Am-243	98.5	0.10E+04	0.16E+08	
				Cm-244	98.9	0.62E+04	0.93E+08	
				Am-241	99.0	0.47E+03	0.71E+07	
143.6	304.1	5936.9	36.0	Fe-59	142.7	5.8	0.87E+05	0.76E-02
				Th-230	143.6	0.13e+03	0.20E+07	
				U-235	143.8	0.61	0.92E+04	
				Pu-239	144.2	0.20E+05	0.31E+09	

TABLE F-3
(CONT'D)

Energy (keV)	Net Count	Background Count	Error (%)	Isotope	Photo-peak	Activity (pCi/g)	Activity (μCi/m^2)	Exposure (μR/hr)
163.6	259.1	4724.9	38.0	Ba-140	162.7	0.61	0.91E+04	0.78E-02
				I-235	163.4	1.1	0.17E+05	
				Am-241	164.6	0.83E+05	0.12E+10	
185.5	1984.8	4550.2	5.0	U-235	185.7	0.32	0.48E+04	0.71E-01
				U-238	186.1	6.7	0.10E+06	
				U-235	185.7	0.74	0.11E+05	
				U-238	186.1	12.0	0.18E+06	
191.4	283.4	4011.6	32.0	Am-241	191.9	0.26E+06	0.39E+10	0.11E-01
				Fe-59	192.2	2.1	0.31E+05	
209.1	366.2	3457.8	23.0	Am-241	208.0	0.10E+05	0.15E+09	0.15E-01
				Ac-228	209.4	1.7	0.25E+05	
238.4	1710.5	2909.5	5.0	Pb-212	238.6	0.84	0.13E+05	0.86E-01
				Th-232	238.6	0.80	0.12E+05	
241.5	380.5	2784.5	20.0	U-235	240.9	0.12E+03	0.17E+07	0.18E-01
				Pb-214	241.9	1.1	0.16E+05	
270.0	233.8	1993.2	28.0	Ac-228	270.3	1.3	0.20E+05	0.14E-01
				U-232	270.5	0.14E+04	0.21E+08	
				Th-227	270.6	0.63E+03	0.95E+07	
				Th-227	270.7	0.16E+03	0.24E+07	
				Np-240	270.8	0.56	0.84E+04	
277.5	221.2	1873.8	28.0	Tl-208	277.4	0.71	0.11E+05	0.14E-01
				Np-239	277.6	0.33	0.50E+04	
294.9	964.5	1590.5	7.0	Pb-214	295.2	1.1	0.17E+05	0.65E-01
				Eu-152	296.0	53.0	0.80E+06	
300.1	258.6	1501.4	22.0	Th-227	299.9	2.6	0.39E+05	0.18E-01
				U-235	299.9	2.9	0.43E+05	
				Pb-212	300.1	1.7	0.25E+05	
				Pa-231	300.1	2.5	0.37E+05	
				Am-241	300.1	0.10E+07	0.15E+11	
327.9	211.1	1285.9	25.0	Ac-228	328.0	1.4	0.21E+05	0.16E-01
				La-140	328.8	0.24	0.36E+04	

TABLE F-3
(CONT'D)

Energy (keV)	Net Count	Background Count	Error (%)	Isotope	Photo-peak	Activity (pCi/g)	Activity (μCi/m^2)	Exposure (μR/hr)
338.1	499.5	1232.5	11.0	Ac-228	338.4	1.1	0.16E+05	0.40E-01
				U-235	338.6	4.1	0.61E+05	
351.7	1754.0	1284.0	4.0	Ra-226	351.9	1.2	0.17E+05	0.15
				Pb-214	352.0	1.1	0.17E+05	
				Co-57	352.2	0.13E+05	0.19E+09	
462.7	189.4	749.6	22.0	Pa-228	463.0	0.36	0.54E+04	0.24E-01
				Ac-228	463.0	1.0	0.15E+05	
				Sb-125	463.4	0.44	0.66E+04	
477.0	170.2	707.8	23.0	Pb-211	478.0	0.34E+03	0.50E+07	0.22E-01
510.4	539.4	675.6	8.0	I-133	510.4	9.2	0.14E+06	0.77E-01
				Tl-208	510.8	0.60	0.90E+04	
				Na-22	511.0	0.77E-01	0.12E+04	
				Zn-65	511.0	4.9	0.73E+05	
				Y-88	511.0	35.0	0.52E+06	
583.0	1094.1	564.9	4.0	Tl-208	583.1	0.34	0.51E+04	0.19
				Th-232	583.1	0.97	0.15E+05	
609.0	1946.5	548.5	3.0	Xe-135	608.6	20.0	0.30E+06	0.35
				Bi-214	609.3	1.1	0.17E+05	
				Ra-226	609.3	1.2	0.18E+05	
661.3	1502.6	526.4	3.0	Cs-137	661.6	0.49	0.74E+04	0.30
				Am-241	662.4	0.12E+06	0.18E+10	
727.1	268.5	394.5	12.0	Ac-228	727.0	94.0	0.14E+07	0.61E-01
				Bi-212	727.0	0.64	0.95E+04	
				U-239	727.5	0.31E+04	0.46E+08	
				Bi-214	727.8	0.48E+03	0.71E+07	
				Pu-239	727.9	0.62E+08	0.94E+12	
767.3	278.1	436.9	12.0	Pu-238	766.4	0.33E+06	0.49E+10	0.67E-01
				Pa-234	766.6	38.0	0.57E+06	
				Pa-234	766.6	38.0	0.57E+06	
				Rh-102	766.8	0.23	0.34E+04	
				Am-241	766.9	0.15E+07	0.23E+11	
				Bi-214	768.4	1.6	0.24E+05	

TABLE F-3
(CONT'D)

Energy (keV)	Net Count	Background Count	Error (%)	Isotope	Photo-peak	Activity (pCi/g)	Activity (μCi/m^2)	Exposure (μR/hr)
773.3	69.0	399.0	43.0	Ac-228	772.1	1.2	0.18E+05	0.17E-01
				I-132	772.7	0.26E-01	0.39E+03	
				Th-227	773.0	0.15E+05	0.22E+09	
				Ac-228	773.5	22.0	0.33E+06	
785.8	122.8	344.2	23.0	Bi-212	785.4	1.7	0.26E+05	0.30E-01
				Pa-234	786.3	0.10E+03	0.15E+07	
				Pu-238	786.3	0.98E+06	0.15E+11	
794.4	175.3	318.7	16.0	Pa-228	794.7	2.5	0.37E+05	0.44E-01
				Ac-228	794.8	1.0	0.15E+05	
				Tl-210	795.0	0.49E-01	0.74E+03	
				Cs-134	795.8	0.58E-01	0.87E+03	
805.7	101.8	303.2	26.0	Pu-238	805.4	0.21E+08	0.31E+12	0.26E-01
				Bi-214	806.2	23.0	0.35E+06	
860.2	209.5	346.5	14.0	Tl-208	860.4	0.48	0.73E+04	0.57E-01
911.0	842.0	284.0	4.0	Ac-228	911.1	0.97	0.14E+05	0.25
				Th-232	911.1	0.97	0.14E+05	
934.0	131.7	268.3	20.0	Bi-214	934.1	1.2	0.18E+05	0.40E-01
964.1	88.7	444.3	35.0	Eu-152	964.0	0.18	0.26E+04	0.28E-01
				Ac-228	964.6	0.47	0.71E+04	
				Pa-228	964.6	0.26	0.38E+04	
968.6	424.3	371.7	8.0	Ac-228	968.9	0.82	0.12E+05	0.13
1000.9	292.0	269.0	10.0	Pa-234	1001.0	10.0	0.15E+06	0.96E-01
				Pa-234	1001.0	10.0	0.15E+06	
				U-238	1001.0	10.0	0.15E+06	
				Pu-238	1001.1	0.65E+07	0.98E+11	
1120.2	554.7	286.3	6.0	Bi-214	1120.4	0.96	0.14E+05	0.21
				Ra-226	1120.4	0.96	0.14E+05	
1154.4	79.9	275.1	31.0	Bi-214	1155.2	1.4	0.21E+05	0.31E-01
1238.0	262.4	271.6	11.0	I-133	1237.5	5.0	0.75E+05	0.11
				Bi-214	1238.1	1.3	0.20E+05	
1280.9	94.2	174.8	22.0	Bi-214	1281.0	1.9	0.29E+05	0.41E-01
1377.2	166.9	127.1	12.0	Bi-214	1377.7	1.3	0.19E+05	0.80E-01

TABLE F-3
(CONT'D)

Energy (keV)	Net Count	Background Count	Error (%)	Isotope	Photo-peak	Activity (pCi/g)	Activity (μCi/m^2)	Exposure (μR/hr)
1408.0	121.2	127.8	16.0	Bi-214	1408.0	1.5	0.23E+05	0.60E-01
				Eu-152	1408.0	0.18	0.27E+04	
				A-28l	1408.8	3.1	0.47E+05	
1460.7	3761.7	132.3	2.0	K-40	1460.8	11.0	0.16E+06	1.9
1508.9	106.8	93.2	16.0	Bi-214	1509.2	1.5	0.23E+05	0.57E-01
				Pa-234	1510.5	0.37E+03	0.55E+07	
1587.9	131.8	109.2	14.0	a	a	a	a	0.75E-01
1620.3	79.9	67.1	18.0	Bi-212	1620.6	0.92	0.14E+05	0.47E-01
1629.7	49.9	77.1	29.0	Ac-228	1630.4	0.81	0.12E+05	0.29E-01
1660.9	75.0	45.0	17.0	Bi-214	1661.3	2.1	0.31E+05	0.45E-01
1729.4	105.0	55.0	14.0	Bi-214	1729.6	1.1	0.17E+05	0.66E-01
1764.4	538.4	64.6	5.0	Bi-214	1764.0	1.0	0.15E+05	0.35
				Pa-234	1765.4	0.28E+04	0.43E+08	
1846.4	61.6	44.4	20.0	Bi-214	1847.4	0.94	0.14E+05	0.42E-01
2103.1	137.5	49.5	11.0	Tl-208	2103.5	0.46	0.69E+04	0.11
2118.5	51.7	42.3	23.0	Bi-214	2118.5	1.4	0.22E+05	0.42E-01
2203.9	181.2	52.8	9.0	Bi-214	2204.1	1.2	0.19E+05	0.16
2447.1	80.7	16.3	13.0	Bi-214	2447.7	1.8	0.27E+05	0.79E-01
2614.6	1003.4	18.6	3.0	Tl-208	2614.6	0.36	0.54E+04	1.1

Sum of estimated external exposure rate: 7.10 μR/Hr

[a]No isotope identified

TABLE F-4
SUMMARY OF MEASUREMENTS

Sampling Area	Method	Parameter	N	Average Moisture	Average (pCi/g) (Dry)	Average (mg/kg[a]) (Dry)
IGS-01	In situ	Cs-137	6.0	22.9	0.6	
IGS-01	Gamma	Cs-137	20.0	22.9	0.7	
IGS-01	In situ	K-40	6.0	22.9	13.0	
IGS-01	Gamma	K-40	20.0	22.9	16.7	
IGS-01	Gamma	Ra-226	6.0	22.9	1.4	
IGS-01	Gamma	Ra-226	20.0	22.9	1.2	
IGS-01	In situ	Ra-228	6.0	22.9	1.2	
IGS-01	In situ	Th-228	6.0	22.9	1.2	
IGS-01	In situ	Th-232	6.0	22.9	1.2	
IGS-01	Gamma	Th-232	20.0	22.9	1.5	
IGS-01	In situ	U-235	6.0	22.9	0.8	
IGS-01	Gamma	U-235	20.0	22.9	1.0	
IGS-01	In situ	U-238	6.0	22.9	16.8	
IGS-01	Gamma	U-238	20.0	22.9	18.0	
IGS-01	Alpha	Uranium, total	1.0	25.2	35.3	53.0
IGS-01	BrPEDAP	Uranium, total	20.0	22.9	29.9	44.8
IGS-01	In situ	Uranium, total	6.0	22.9	34.4	51.6
IGS-01	XRF	Uranium, total	20.0	22.9	53.1	79.6
IGS-01	Gamma	Uranium, total	20.0	22.9	29.2	43.8
IGS-02	In situ	Cs-137	6.0	19.7	0.6	
IGS-02	Gamma	Cs-137	20.0	19.6	0.6	
IGS-02	In situ	K-40	6.0	19.7	12.6	
IGS-02	Gamma	K-40	20.0	19.6	17.8	
IGS-02	Gamma	Ra-226	20.0	19.6	1.5	
IGS-02	In situ	Ra-226	6.0	19.7	1.0	
IGS-02	In situ	Ra-228	6.0	19.7	1.1	
IGS-02	In situ	Th-228	6.0	19.7	1.1	
IGS-02	In situ	Th-232	6.0	19.7	1.1	
IGS-02	Gamma	Th-232	20.0	19.6	1.5	

TABLE F-4
(CONT'D)

Sampling Area	Method	Parameter	N	Average Moisture	Average (pCi/g) (Dry)	Average (mg/kg[a]) (Dry)
IGS-02	In situ	U-235	6.0	19.7	1.3	
IGS-02	Gamma	U-235	20.0	19.6	1.4	
IGS-02	In situ	U-238	6.0	19.7	26.0	
IGS-02	Gamma	U-238	20.0	19.6	24.6	
IGS-02	Alpha	Uranium, total	3.0	18.5	36.4	54.7
IGS-02	BrPEDAP	Uranium, total	20.0	19.7	43.6	65.4
IGS-02	In situ	Uranium, total	6.0	19.7	53.4	80.1
IGS-02	XRF	Uranium, total	20.0	19.7	66.2	99.3
IGS-02	Gamma	Uranium, total	20.0	19.7	45.6	68.4
IGS-03	In situ	Cs-137	6.0	21.7	0.5	
IGS-03	Gamma	Cs-137	20.0	21.7	0.6	
IGS-03	In situ	K-40	6.0	21.7	11.5	
IGS-03	Gamma	K-40	20.0	21.7	16.5	
IGS-03	Gamma	Ra-226	20.0	21.7	1.5	
IGS-03	In situ	Ra-226	6.0	21.7	1.6	
IGS-03	In situ	Ra-228	6.0	21.7	1.2	
IGS-03	In situ	Th-228	6.0	21.7	1.2	
IGS-03	In situ	Th-232	6.0	21.7	1.2	
IGS-03	Gamma	Th-232	20.0	21.7	1.8	
IGS-03	In situ	U-235	6.0	21.7	1.8	
IGS-03	Gamma	U-235	20.0	21.7	2.5	
IGS-03	In situ	U-238	6.0	21.7	35.7	
IGS-03	Gamma	U-238	20.0	21.7	43.3	
IGS-03	Alpha	Uranium, total	1.0	21.2	65.3	98.0
IGS-03	BrPEDAP	Uranium, total	20.0	21.7	74.3	112
IGS-03	In situ	Uranium, total	6.0	21.7	73.2	110
IGS-03	XRF	Uranium, total	20.0	21.7	102	152
IGS-03	Gamma	Uranium, total	20.0	21.7	74.7	112
IGS-04	In situ	Cs-137	6.0	13.9	0.3	
IGS-04	Gamma	Cs-137	20.0	13.9	0.5	

TABLE F-4
(CONT'D)

Sampling Area	Method	Parameter	N	Average Moisture	Average (pCi/g) (Dry)	Average (mg/kg[a]) (Dry)
IGS-04	In situ	K-40	6.0	13.9	12.0	
IGS-04	Gamma	K-40	20.0	13.8	16.0	
IGS-04	In situ	Ra-226	6.0	13.9	2.1	
IGS-04	Gamma	Ra-226	20.0	13.9	2.2	
IGS-04	In situ	Ra-228	6.0	13.9	10.2	
IGS-04	In situ	Th-228	6.0	13.9	8.7	
IGS-04	In situ	Th-232	6.0	13.9	9.4	
IGS-04	Gamma	Th-232	20.0	13.9	17.9	
IGS-04	In situ	U-235	6.0	13.9	1.5	
IGS-04	Gamma	U-235	20.0	13.9	1.6	
IGS-04	In situ	U-238	6.0	13.9	30.6	
IGS-04	Gamma	U-238	20.0	13.9	32.7	
IGS-04	Alpha	Uranium, total	2.0	9.1	28.7	43.0
IGS-04	BrPEDAP	Uranium, total	20.0	13.9	48.1	72.1
IGS-04	Dissolution Bromo	Uranium, total	20.0		48.3	72.5
IGS-04	In situ	Uranium, total	6.0	13.9	62.6	93.9
IGS-04	XRF	Uranium, total	20.0	13.9	54.3	81.5
IGS-04	Gamma	Uranium, total	20.0	13.9	60.9	91.4
IGS-05	In situ	Cs-137	6.0	18.2	0.6	
IGS-05	Gamma	Cs-137	20.0	18.2	0.6	
IGS-05	In situ	K-40	6.0	18.2	13.7	
IGS-05	Gamma	K-40	20.0	18.2	20.0	
IGS-05	In situ	Ra-226	6.0	18.2	4.7	
IGS-05	Gamma	Ra-226	20.0	18.2	8.6	
IGS-05	In situ	Ra-228	6.0	18.2	4.0	
IGS-05	In situ	Th-228	6.0	18.2	3.6	
IGS-05	In situ	Th-232	6.0	18.2	3.9	
IGS-05	Gamma	Th-232	20.0	18.2	11.1	
IGS-05	In situ	U-235	6.0	18.2	6.5	
IGS-05	Gamma	U-235	20.0	18.2	6.1	

TABLE F-4
(CONT'D)

Sampling Area	Method	Parameter	N	Average Moisture	Average (pCi/g) (Dry)	Average (mg/kg[a]) (Dry)
IGS-05	In situ	U-238	6.0	18.2	124.9	
IGS-05	Gamma	U-238	20.0	18.2	107.9	
IGS-05	Alpha	Uranium, total	2.0	21.0	292	438
IGS-05	BrPEDAP	Uranium, total	20.0	18.2	198	298
IGS-05	In situ	Uranium, total	6.0	18.2	256	385
IGS-05	XRF	Uranium, total	20.0	18.1	229	344
IGS-05	Gamma	Uranium, total	20.0	18.2	194	219
IGS-06	In situ	Cs-137	6.0	9.7	0.1	
IGS-06	Gamma	Cs-137	20.0	9.6	0.3	
IGS-06	In situ	K-40	6.0	9.7	7.8	
IGS-06	Gamma	K-40	20.0	9.6	10.9	
IGS-06	In situ	Ra-226	6.0	9.7	1.5	
IGS-06	Gamma	Ra-226	20.0	9.6	1.1	
IGS-06	In situ	Ra-228	6.0	9.7	0.7	
IGS-06	In situ	Th-228	6.0	9.7	0.6	
IGS-06	In situ	Th-232	6.0	9.7	0.7	
IGS-06	Gamma	Th-232	20.0	9.6	0.9	
IGS-06	In situ	U-235	6.0	9.7	0.2	
IGS-06	Gamma	U-235	20.0	9.6	0.3	
IGS-06	In situ	U-238	6.0	9.7	4.4	
IGS-06	Gamma	U-238	20.0	9.7	3.1	
IGS-06	Alpha	Uranium, total	4.0	11.1	4.6	6.7
IGS-06	BrPEDAP	Uranium, total	20.0	9.7	5.2	7.8
IGS-06	In situ	Uranium, total	6.0	9.7	9.0	13.5
IGS-06	XRF	Uranium, total	20.0	9.6	8.6	12.9
IGS-06	Gamma	Uranium, total	20.0	9.7	4.3	6.5
IGS-09	In situ	Cs-137	6.0	16.9	0.2	
IGS-09	Gamma	Cs-137	20.0	16.9	0.2	
IGS-09	In situ	K-40	6.0	16.9	13.5	
IGS-09	Gamma	K-40	20.0	16.9	17.3	

TABLE F-4 (CONT'D)

Sampling Area	Method	Parameter	N	Average Moisture	Average (pCi/g) (Dry)	Average (mg/kg[a]) (Dry)
IGS-09	In situ	Ra-226	6.0	16.9	1.9	
IGS-09	Gamma	Ra-226	20.0	16.9	1.6	
IGS-09	In situ	Ra-228	6.0	16.9	1.0	
IGS-09	In situ	Th-228	6.0	16.9	0.9	
IGS-09	In situ	Th-232	6.0	16.9	1.0	
IGS-09	Gamma	Th-232	20.0	16.9	1.3	
IGS-09	In situ	U-235	6.0	16.9	0.4	
IGS-09	Gamma	U-235	20.0	16.9	0.4	
IGS-09	In situ	U-238	6.0	16.9	5.5	
IGS-09	Gamma	U-238	20.0	16.9	4.8	
IGS-09	Alpha	Uranium, total	3.0	17.1	8.4	12.7
IGS-09	BrPEDAP	Uranium, total	20.0	16.9	6.2	9.3
IGS-09	In situ	Uranium, total	6.0	16.9	11.4	17.1
IGS-09	XRF	Uranium, total	20.0	16.9	15.3	22.9
IGS-09	Gamma	Uranium, total	20.0	16.9	8.4	12.6

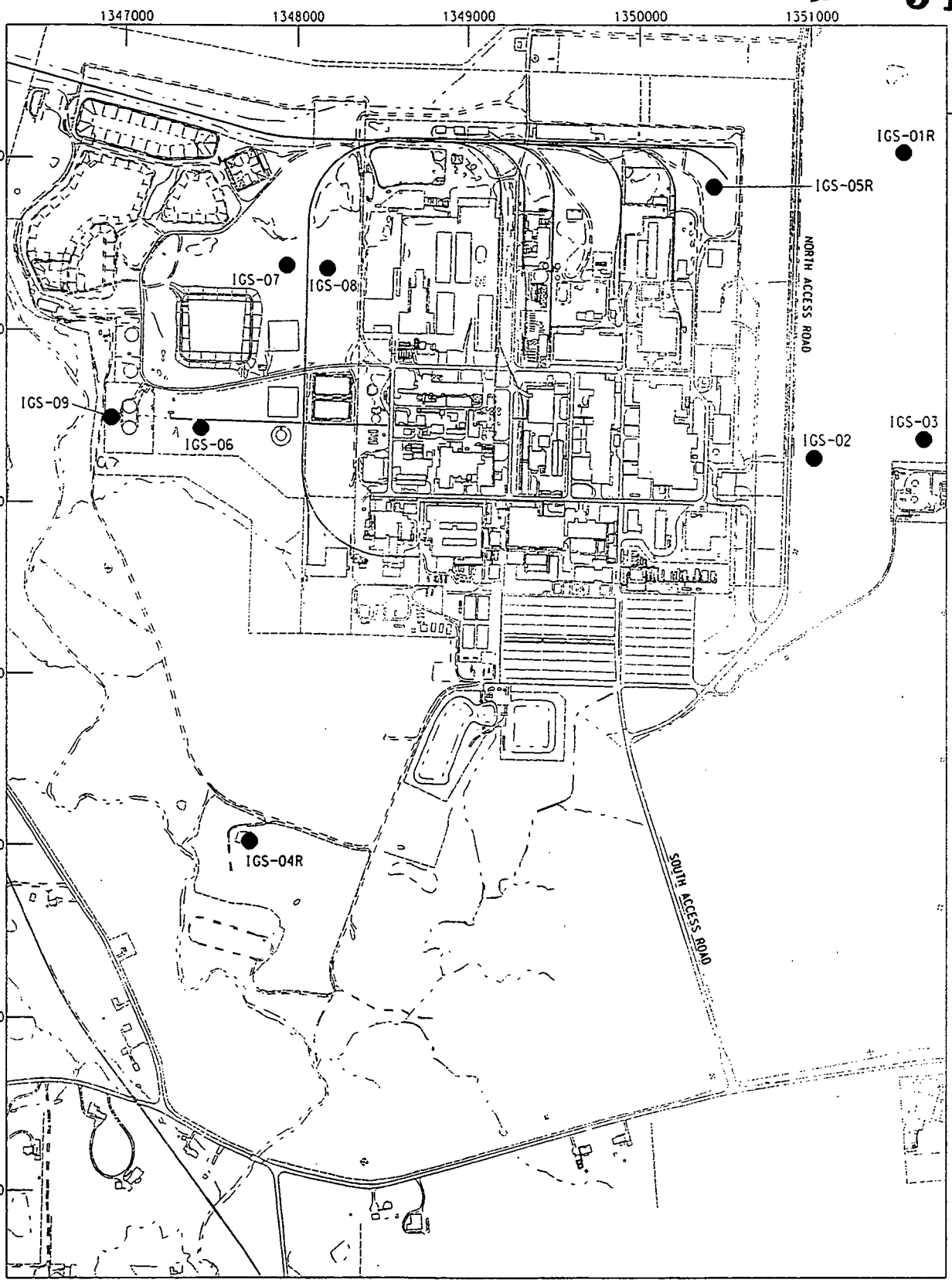
[a] Only applies to uranium, total

TABLE F-5
INITIAL RADIOLOGICAL RESULTS FROM GAMMA RAY MEASUREMENTS

	Uranium-238						Thorium-232					
	HPGe[a]		NaI[a]		Lab[b]		HPGe		NaI		Lab	
Sampling Location	pCi/g	Error[c]	pCi/g	Error[c]	pCi/g	Error[c]	pCi/g	Error[c]	pCi/g	Error[c]	pCi/g	Error[c]
IGS-01	12.9	0.6	15.9	2.3	18.1	0.7	0.92	0.02	1.0	0.06	1.5	0.06
IGS-02	20.9	0.6	23.0	2.5	24.7	1.6	0.91	0.02	0.9	0.06	1.5	0.04
IGS-03	28.0	0.6	25.8	2.6	43.3	1.3	0.91	0.02	1.0	0.06	1.8	0.16

[a]High performance germanium detectors; measured with soil moisture present
[b]Sodium iodide detectors; reported in terms of dry soil
[c]Counting errors only

FILE NAME:/rs2693/gamma.dgn OUS DATE3-20-96 GES 8x11 STATE PLANAR COORDINATE SYSTEM 1983



LEGEND:

IGS-04R ● SAMPLING AREA

R= 2 SETS OF MEASUREMENTS TAKEN OVER 48 HOURS.

SCALE

850 425 0 850FEET

DRAFT

FIGURE F-1. SAMPLING LOCATIONS FOR GAMMA-RAY SPECTROSCOPY

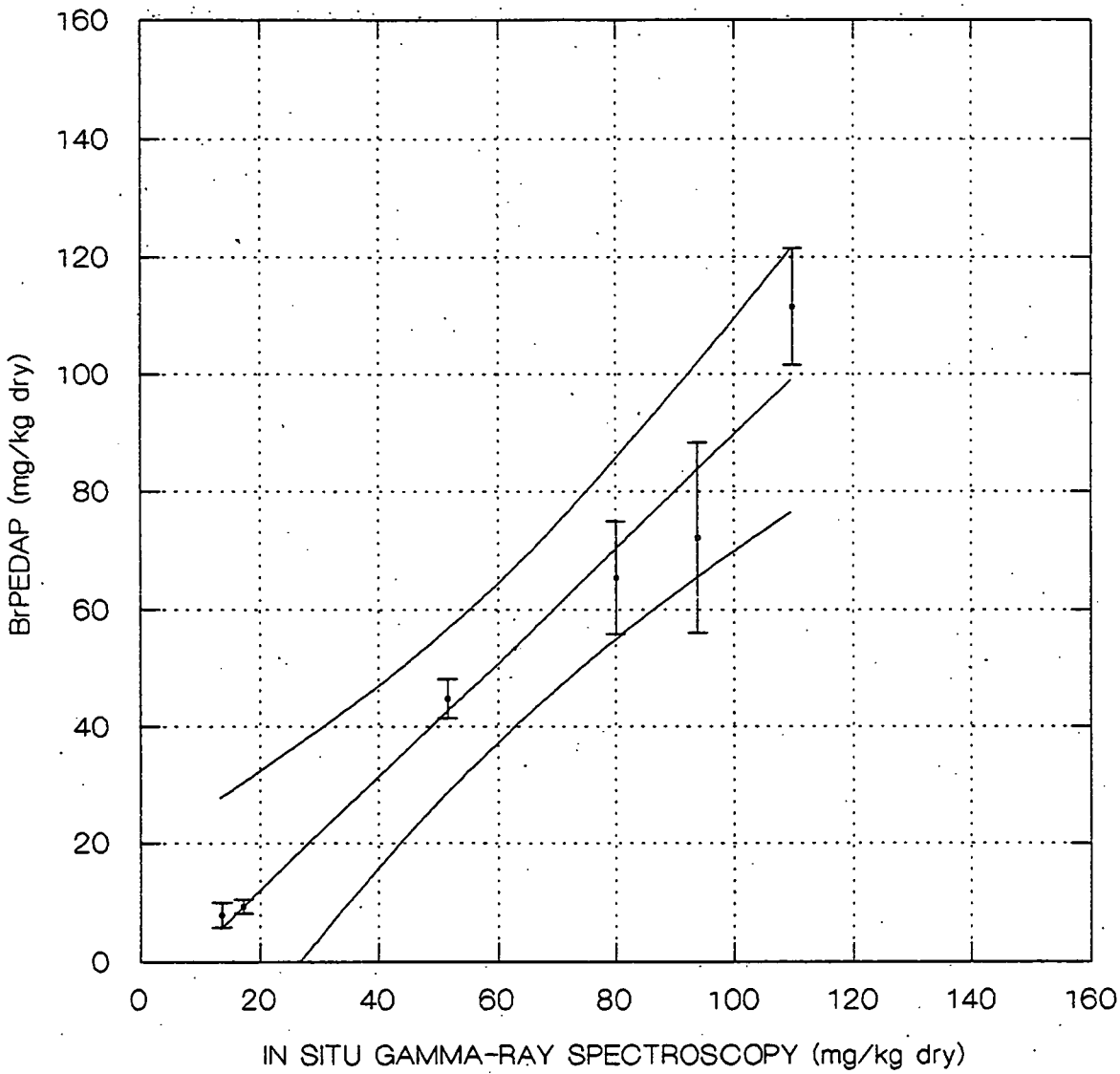


FIGURE F-2. COMPARISON OF IN SITU GAMMA-RAY SPECTROSCOPY AND BrPEDAP RESULTS FOR TOTAL URANIUM

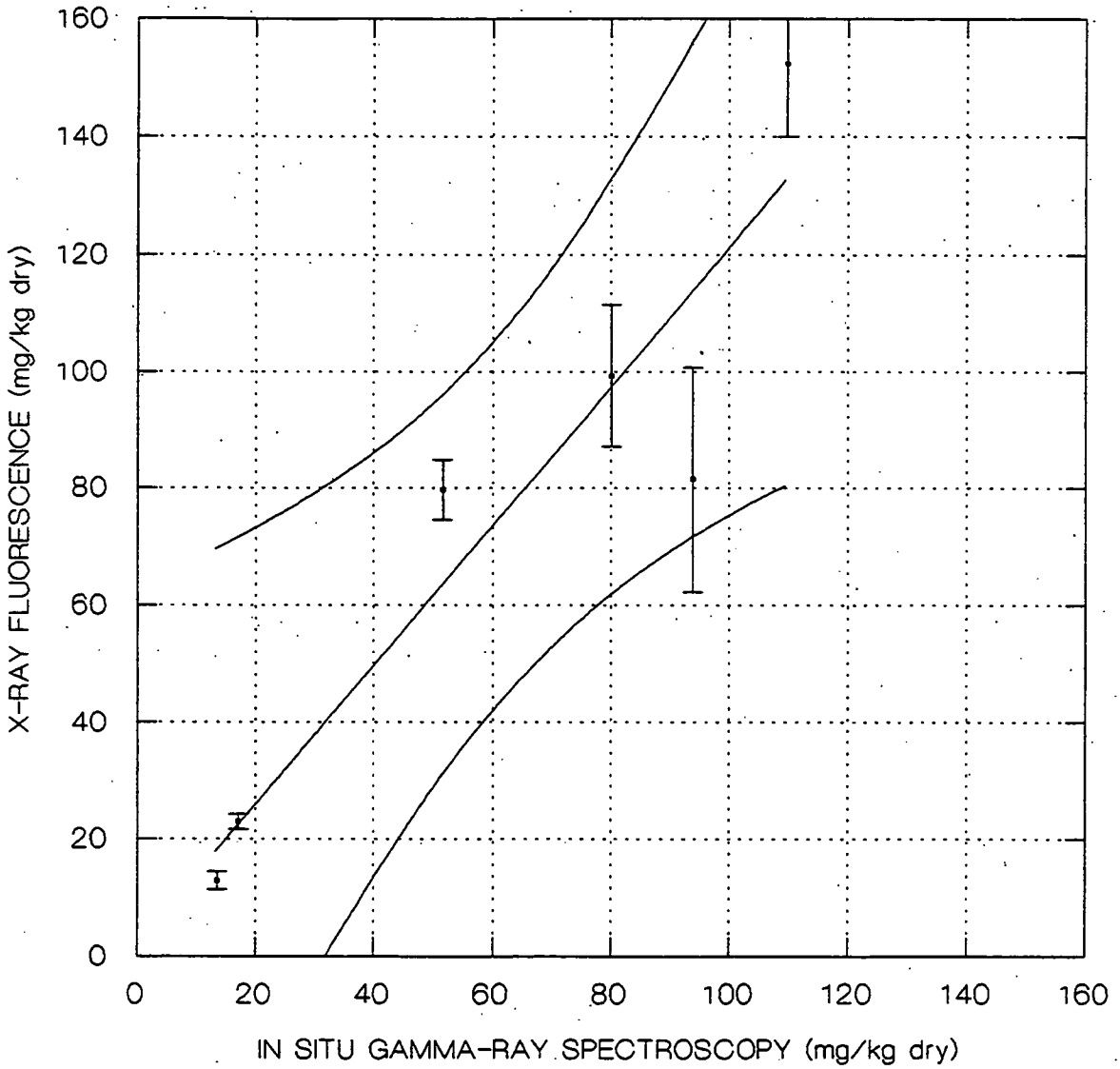


FIGURE F-3. COMPARISON OF IN SITU GAMMA-RAY SPECTROSCOPY AND X-RAY FLUORESCENCE RESULTS FOR TOTAL URANIUM

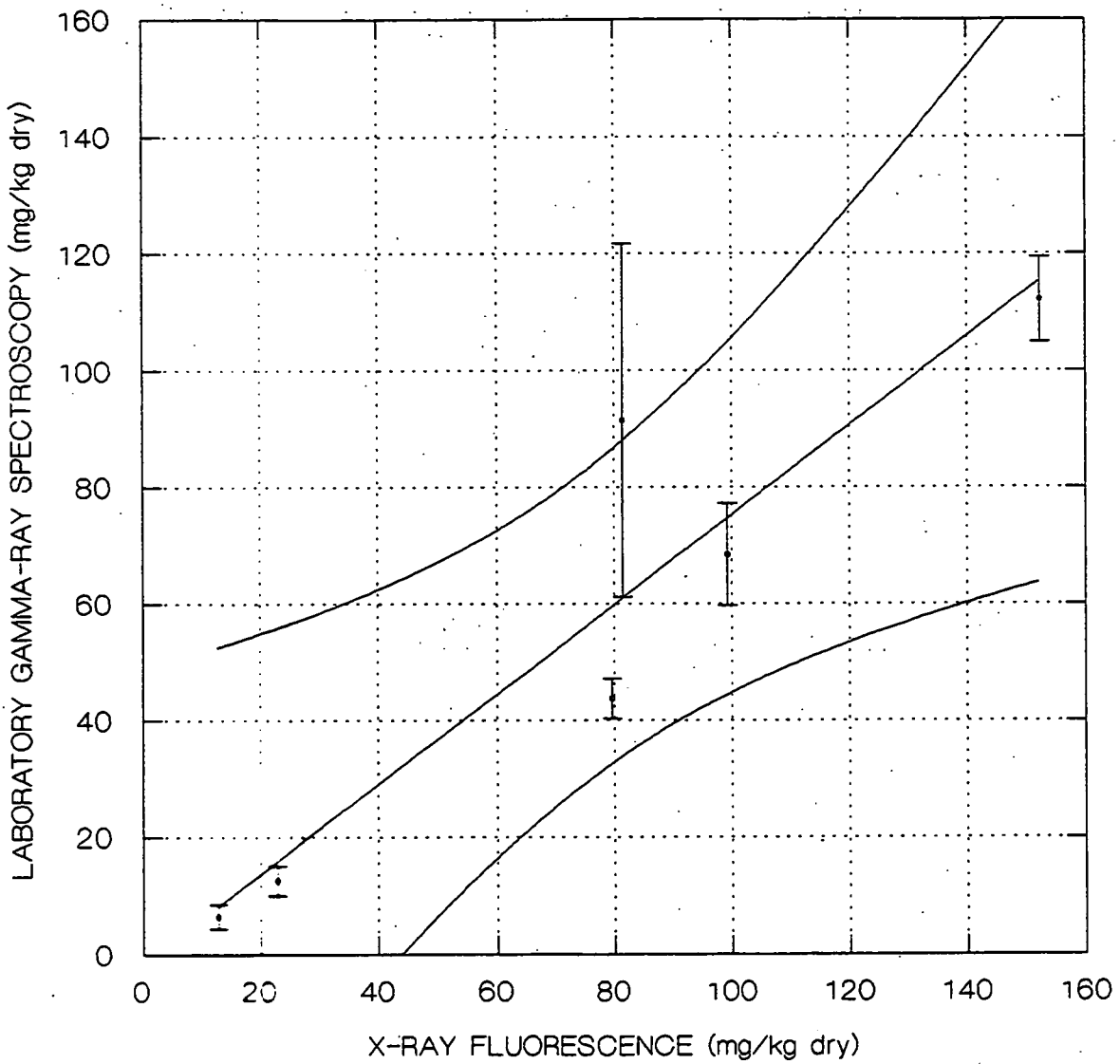


FIGURE F-4. COMPARISON OF X-RAY FLUORESCENCE AND LABORATORY GAMMA-RAY SPECTROSCOPY RESULTS FOR TOTAL URANIUM

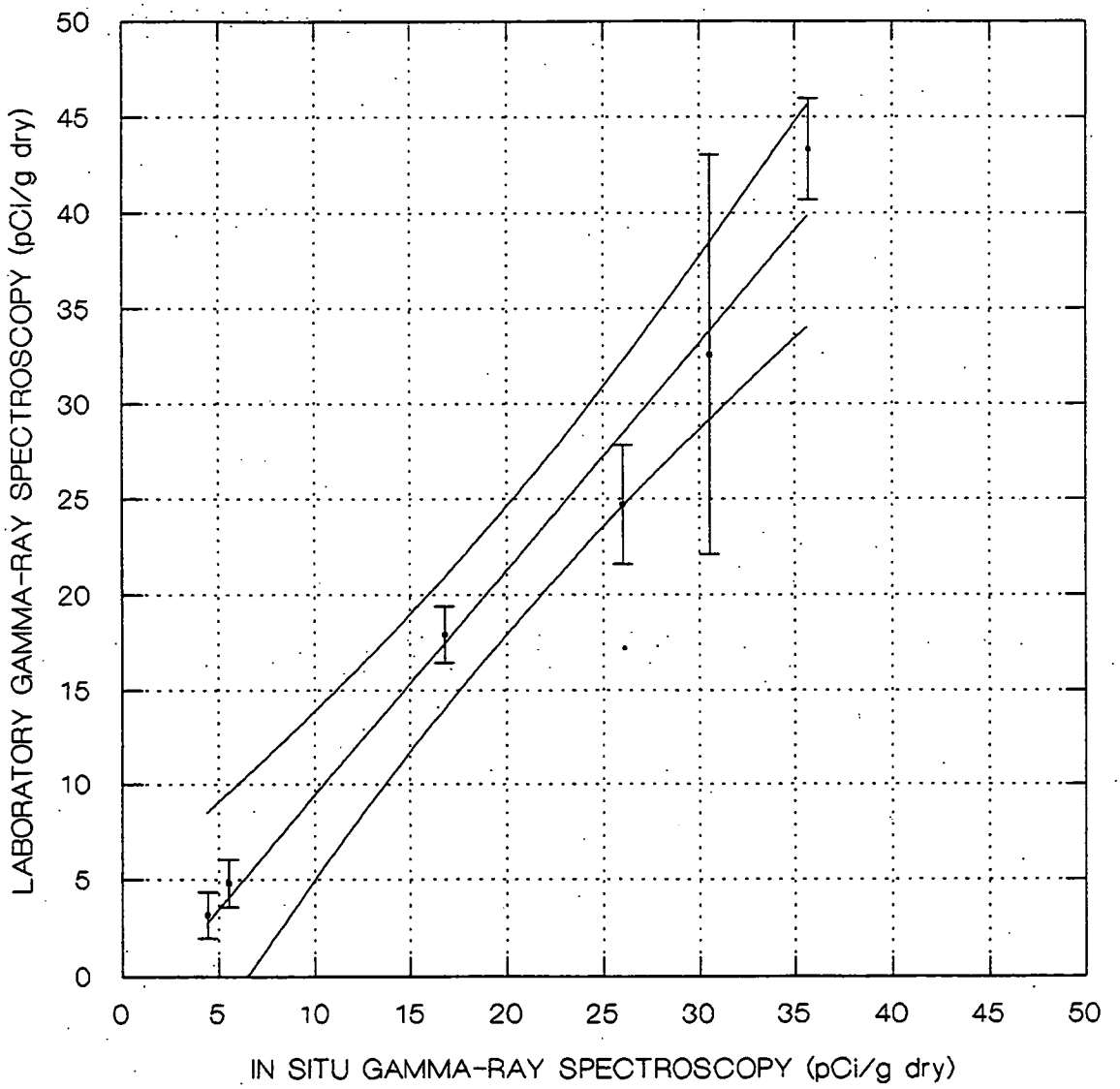


FIGURE F-5. COMPARISON OF IN SITU AND LABORATORY GAMMA-RAY SPECTROSCOPY RESULTS FOR URANIUM-238

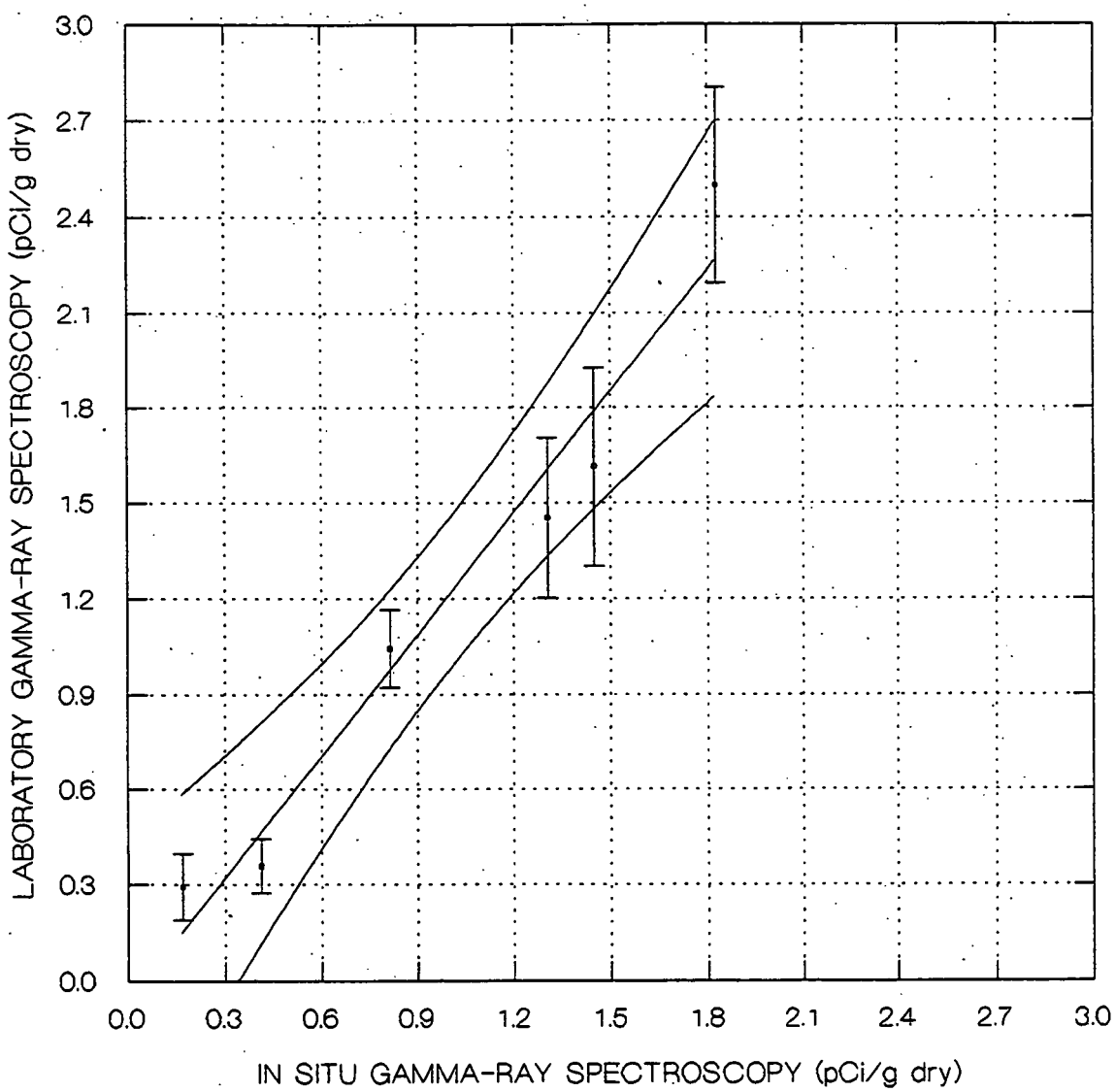


FIGURE F-6. COMPARISON OF IN SITU AND LABORATORY GAMMA-RAY SPECTROSCOPY RESULTS FOR URANIUM-235

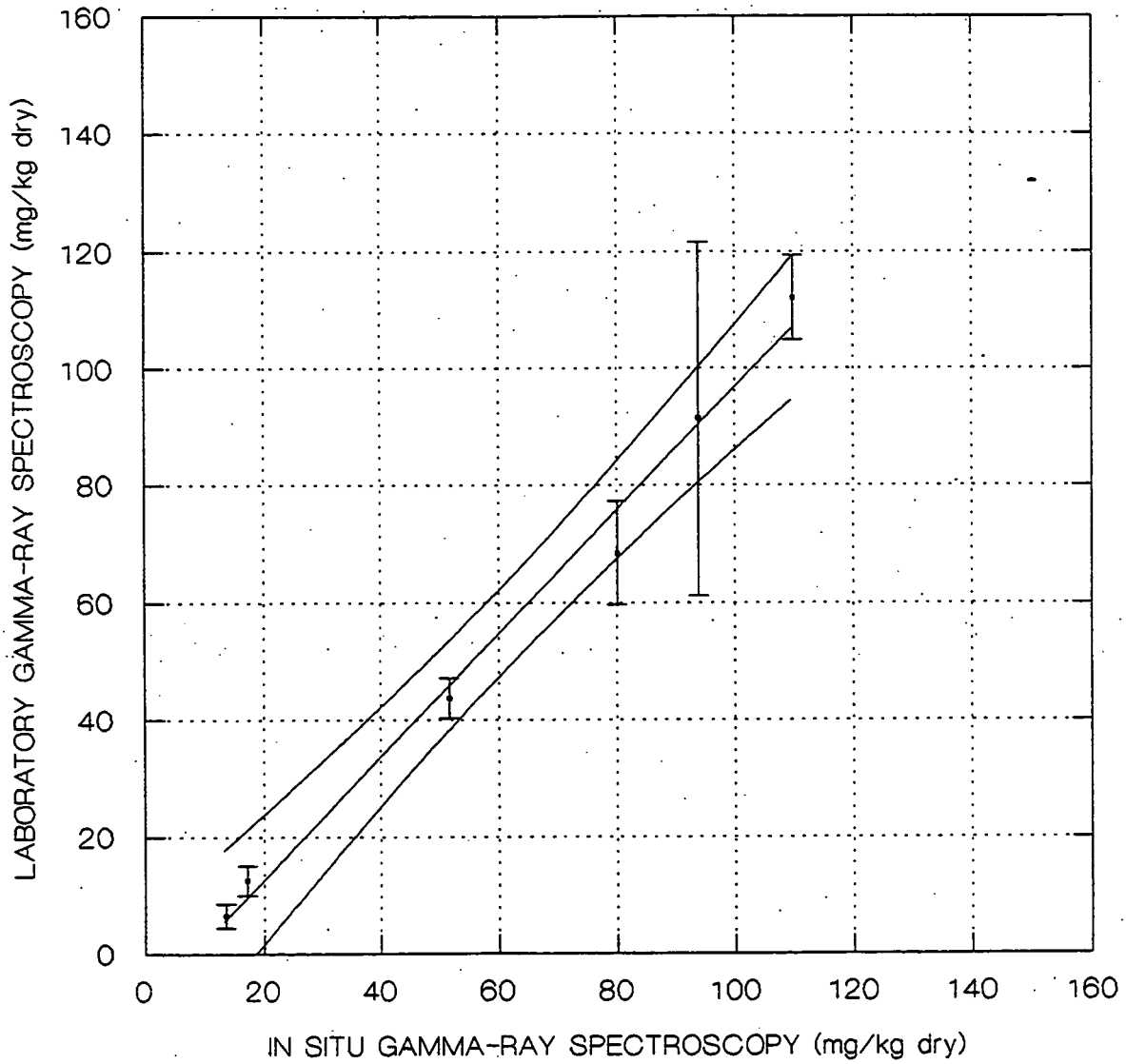


FIGURE F-7. COMPARISON OF IN SITU AND LABORATORY GAMMA-RAY SPECTROSCOPY RESULTS FOR TOTAL URANIUM

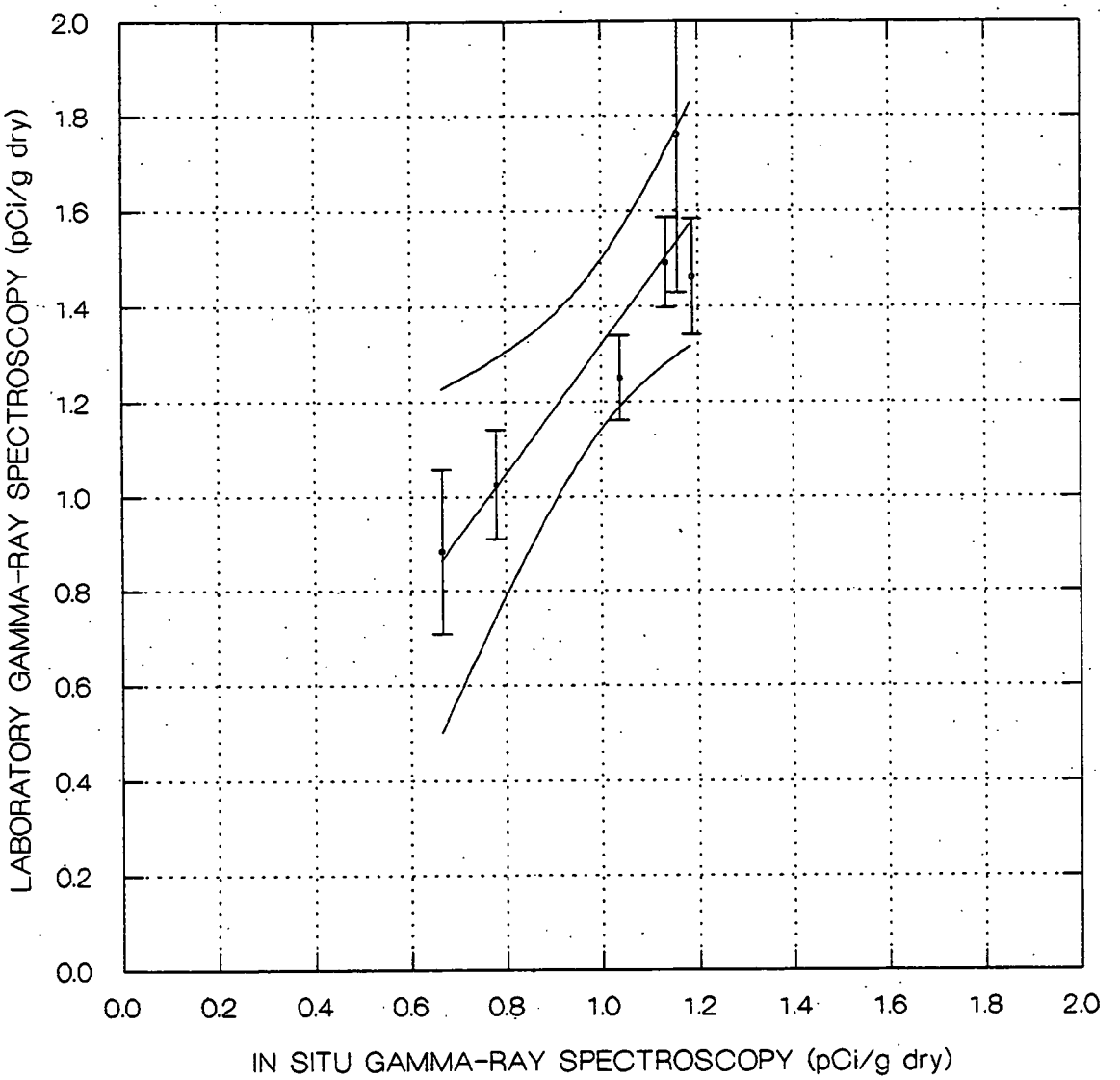


FIGURE F-8. COMPARISON OF IN SITU AND LABORATORY GAMMA-RAY SPECTROSCOPY RESULTS FOR THORIUM-232

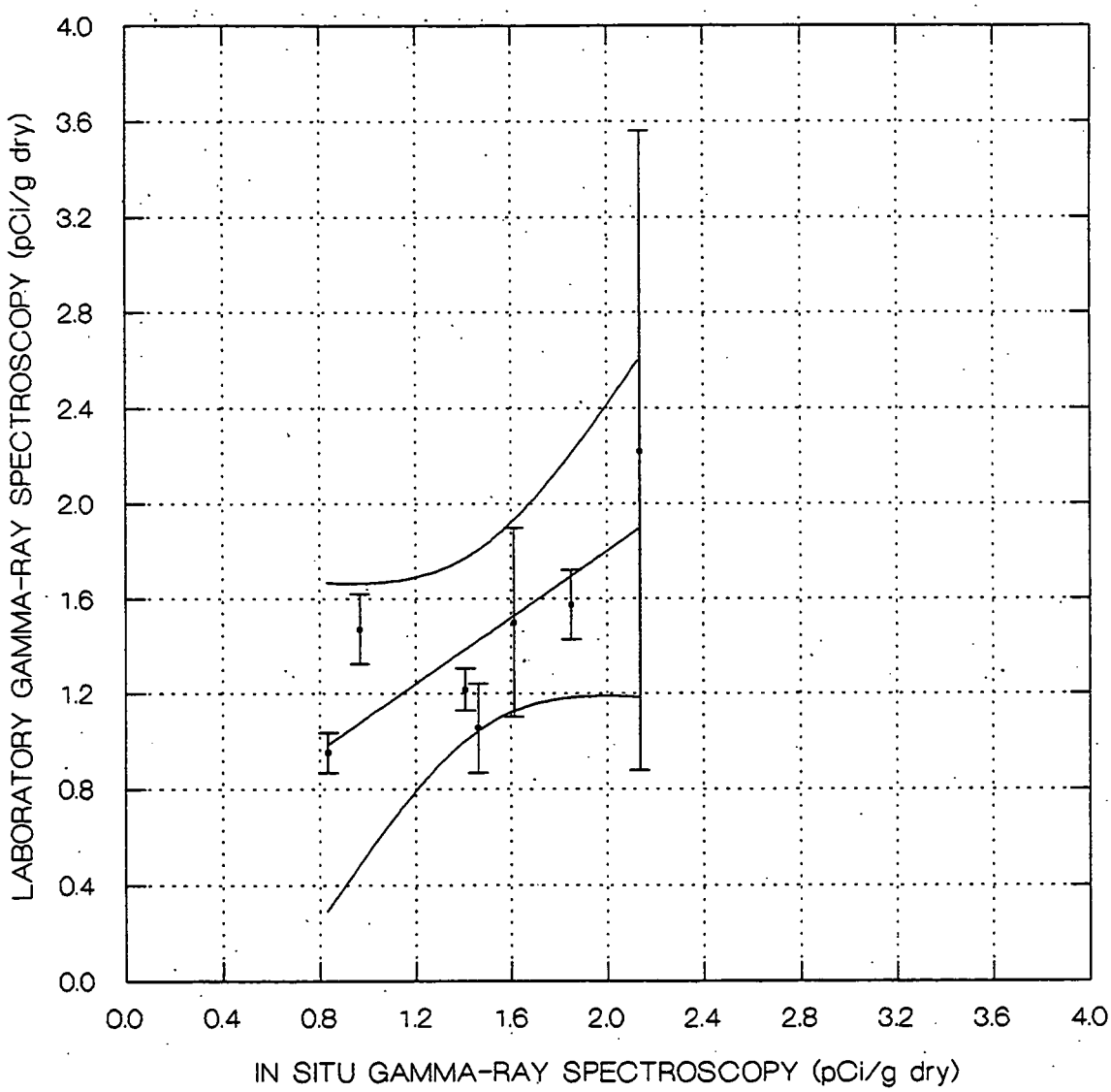


FIGURE F-9. COMPARISON OF IN SITU AND LABORATORY GAMMA-RAY SPECTROSCOPY RESULTS FOR RADIUM-226

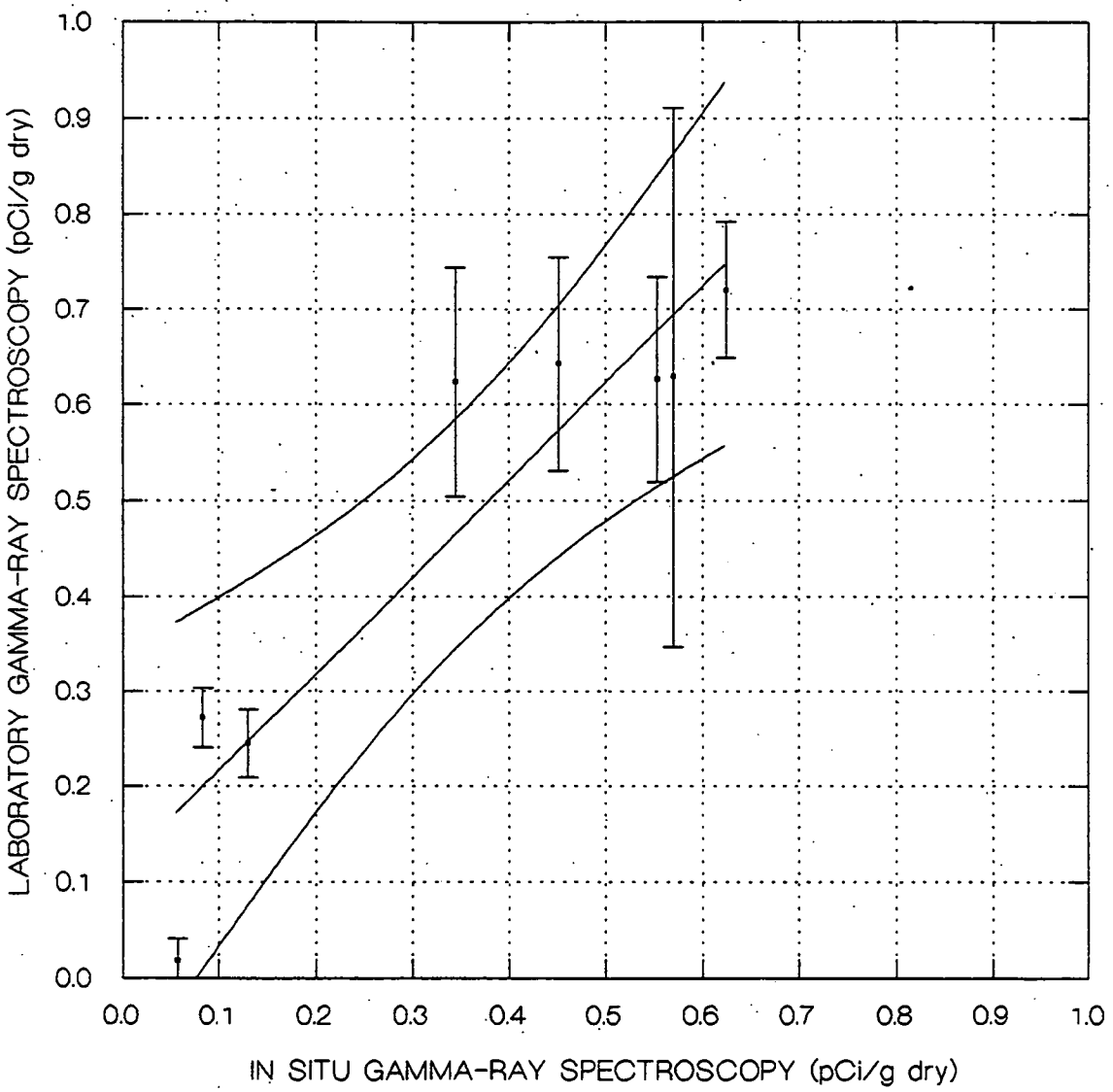


FIGURE F-10. COMPARISON OF IN SITU AND LABORATORY GAMMA-RAY SPECTROSCOPY RESULTS FOR CESIUM-137

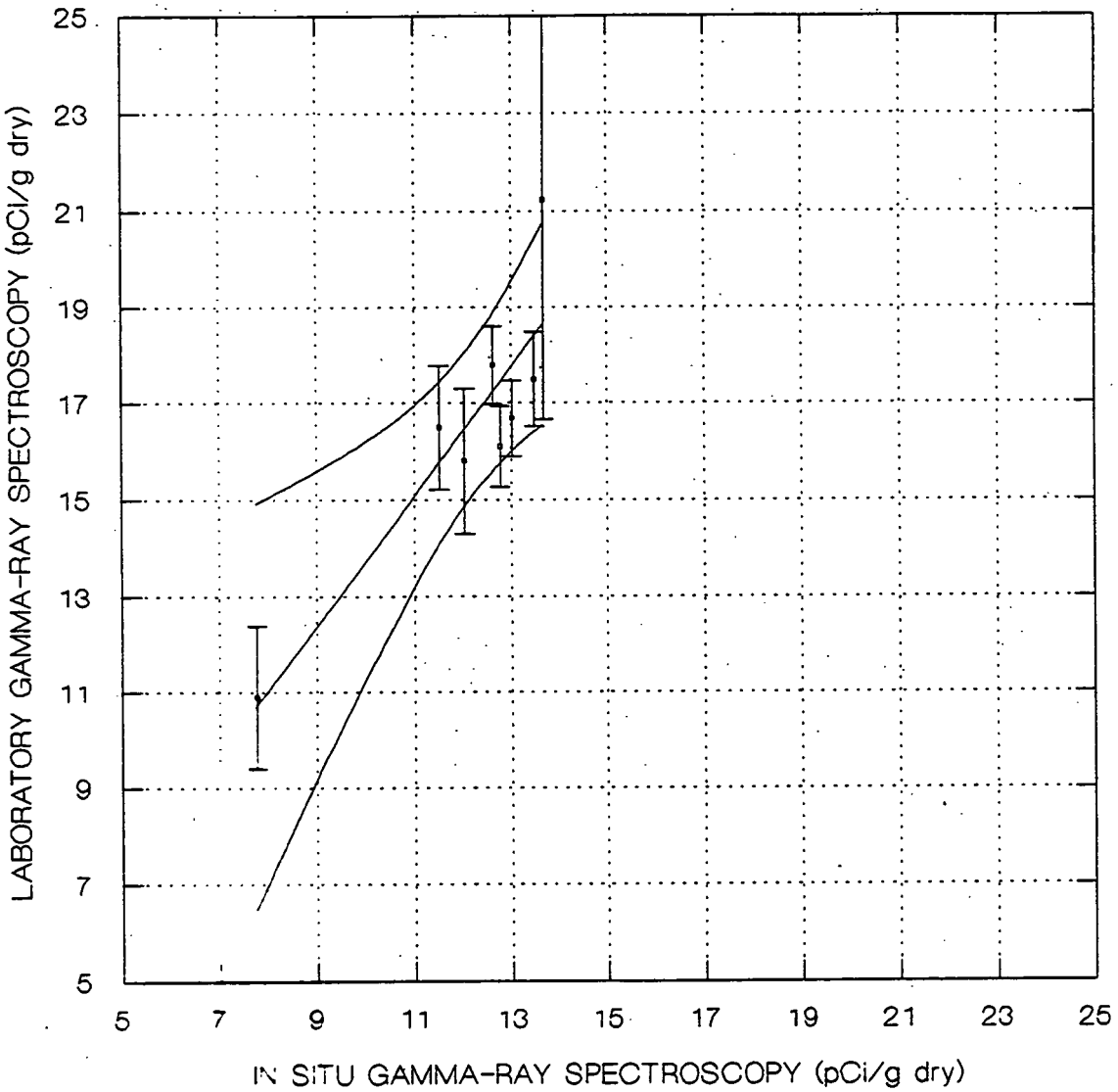


FIGURE F-11. COMPARISON OF IN SITU AND LABORATORY GAMMA-RAY SPECTROSCOPY RESULTS FOR POTASSIUM-40

APPENDIX G
DRAIN TILES

DRAIN TILES

Appendix G provides detailed information related to the removal of drain tiles from the Area 1, Phase I remediation area. Figure G-1 shows the known drain tiles within Area 1, Phase I, as well as the locations from which soil samples were collected from within the drain tiles. These samples were taken at locations where the tiles were exposed to the surface through openings in the ground (eroded pathways leading to the tiles). These clay tile pipes (CTPs) are believed to have been installed approximately 50-60 years ago. Over this period of time, farming activities, such as plowing, etc., and frost action have caused breaks in the tiles. Through the process of erosion, surface water infiltrated through the soil into the breaks in the drain tiles and eroded various openings to the surface. Table G-1 lists the total uranium analytical laboratory results for sediment removed from the drain tiles. None of the analytical results exceed the final remediation level (FRL) for uranium. Only two locations meet or exceed As Low As Reasonably Achievable (ALARA) limits of 50 parts per million (CTP 9 and CTP 11); however, drain tiles at these locations were removed during remediation activities.

Figure G-2 shows the section of known drain tile removed from the Area 1, Phase I east remediation area. Drain tiles were removed from areas meeting three criteria:

- The tiles are within the Area 1, Phase I remediation area (see Figure A-1).
- The tiles are not located within the footprint of the On-Site Disposal Facility (OSDF). Drain tiles within the footprint of the OSDF (CTP-13-16, Figure G-1) will not be removed during Area 1, Phase I remediation activities; these activities will be addressed during construction of the OSDF.
- The tiles are adjacent to or near the site of the OSDF and/or have drainage patterns that would potentially act as pathways to or from the OSDF.

The two sections of drain tiles removed during Area 1, Phase I east soil remediation activities were removed due to their proximity to the OSDF site (CTP 7-11, and CTP-12, Figure G-1, and G-2).

All drain tiles known or discovered during Area 1, Phase I activities will be removed except for those in the northeast drainage swale. The DOE considers it inadvisable to remove the drain tiles in the north east corner of the site adjacent to the property line (CTP 1-6, Figure G-1) because of:

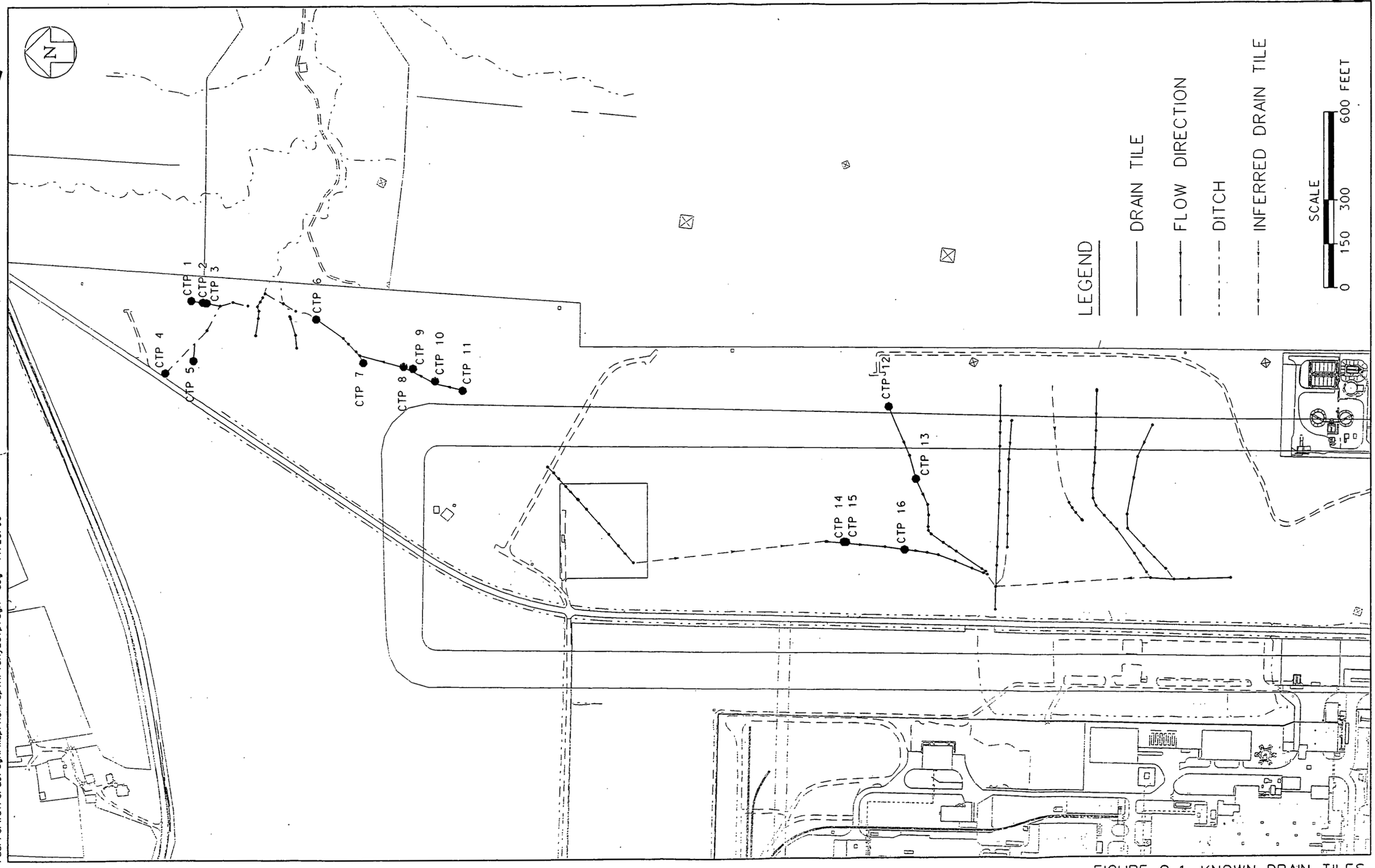
- The desire of the neighboring property owner not to change the overall drainage pattern adjacent to his property

- The low level of contamination in the area

Tiles towards the southern end (Figure G-2) that are outside the OSDF footprint will be addressed during Area 1, Phase II remediation activities. (OEPA Comment #14)

TABLE G-1
TOTAL URANIUM DATA FROM SEDIMENT IN THE EAST FIELD DRAINAGE TILES

CTP #	Parameter	Value	Units	Northing	Easting
CTP 1	Uranium	46	ppm	483959	1352018
CTP 2	Uranium	45	ppm	483920	1352012
CTP 3	Uranium	37	ppm	483907	1352010
CTP 4	Uranium	28	ppm	483049	1351770
CTP 5	Uranium	44	ppm	483952	1351812
CTP 6	Uranium	19	ppm	483534	1351954
CTP 7	Uranium	47	ppm	483374	1351804
CTP 8	Uranium	45	ppm	483236	1351791
CTP 9	Uranium	57	ppm	483204	1351784
CTP 10	Uranium	32	ppm	483128	1351741
CTP 11	Uranium	50	ppm	483034	1351708
CTP 12	Uranium	23	ppm	481580	1351645
CTP 13	Uranium	44	ppm	481488	1351396
CTP 14	Uranium	34	ppm	481736	1351181
CTP 15	Uranium	24	ppm	481728	1351180
CTP 16	Uranium	30	ppm	481527	1351153



/usr/erhal/oru5/dgn/map/hor/dpth/tony_ctp.dgn deg 11/26/96

FIGURE G-1. KNOWN DRAIN TILES

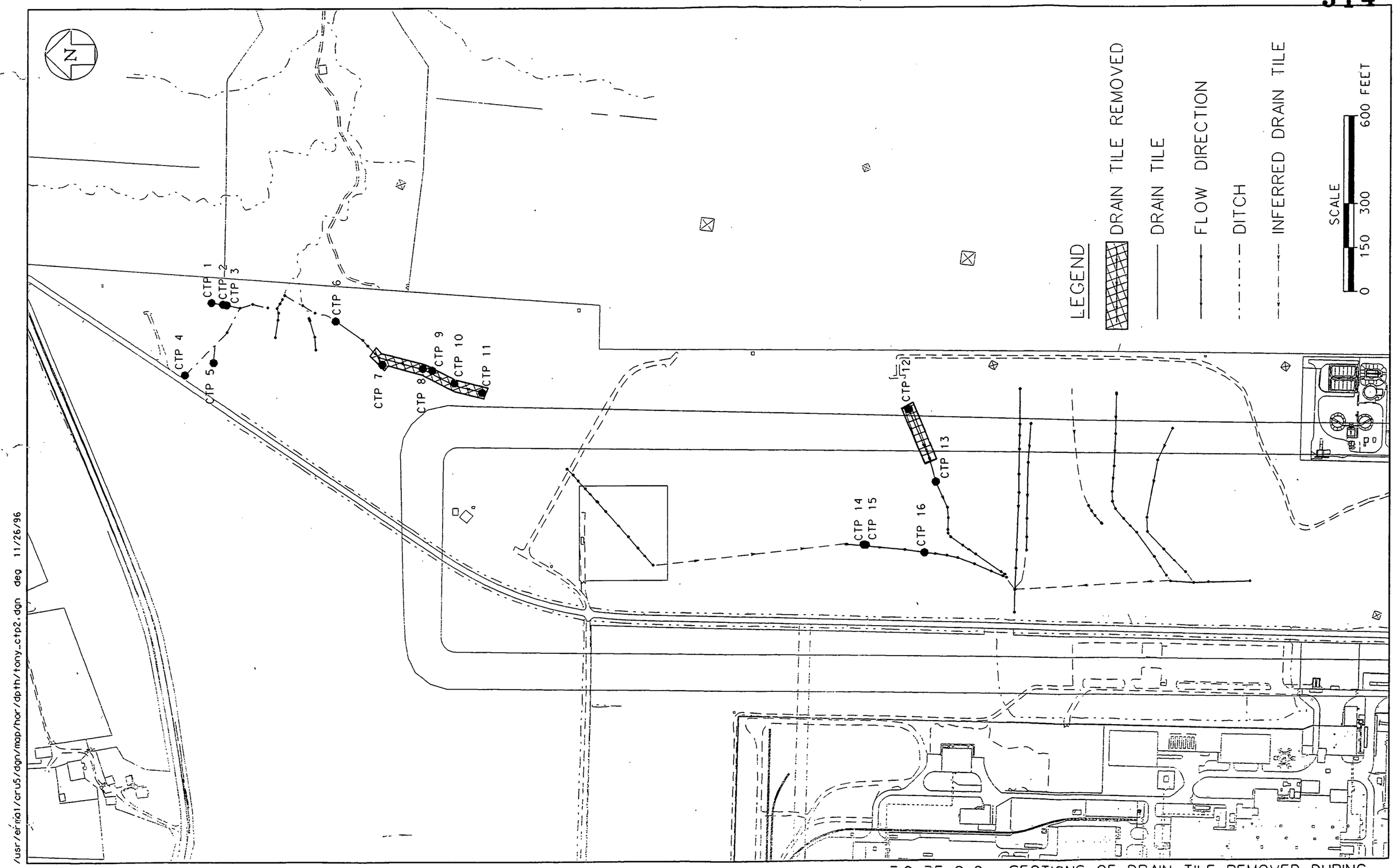


FIGURE G-2. SECTIONS OF DRAIN TILE REMOVED DURING AREA 1/PHASE I (EAST) REMEDIATION ACTIVITIES