NOTICE

All drawings located at the end of the document.

2F100

ER/WM&I DDT

000064434

Source/Driver (Name & Number from ISP, IAG milestone, Mgmt Action, Corres Control, etc)

Closure #· (Outgoing Correspondence Control #, if applicable)

Due Date

Annette Primrose
Originator Name

R S Luker
QA Approval

J E Law
A M Tyson
Contractor Manager(s)

Ann Sieben
Kaiser-Hill Program Manager(s)

Document Classification Review Waiver Per Classification office

T G Hedahl
Kaiser-Hill Director

Document Subject KH00003NS1A

Final Trenches and Mound Site Characterization Report – AMT-063-96

September 27, 1996 96-RM-ER-0173-KH

Discussion and/or Comments

Enclosed are seven copies of the Final Trenches and Mound Site Characterization Report Please transmit five copies to DOE, RFFO This document has been reviewed by Kaiser-Hill and comments have been incorporated

RMRS recommends that this document be updated when the RFCA action levels for radionuclides and metals have been determined If you have any questions, please contact John Law at extension 4842 or Annette Primrose at extension 4385

ALP slm

cc

M C Broussard	-	w/o Attach
C S Evans	-	w/o Attach
J E Law	-	w/o Attach
L J Peterson-Wright	-	w/o Attach
A L Primrose	-	w/o Attach
A M Tyson	-	w/o Attach
RMRS Records	-	w/Attach

Enclosures
As Stated

OCT 1996 RECEIVED RECORDS CENTER

ADMIN RECORD

ER/WM & I DDT 7/95

I113-A-~~00041~~

000041

Date

John J Rampe
Program Liaison Division
DOE, RFFO

FINAL TRENCHES AND MOUND SITE CHARACTERIZATION REPORT - XXX-XXX-96

Enclosed are five copies of the Final Trenches and Mound Site Characterization Report Kaiser-Hill recommends that this document be updated when the RFCA action levels for radionuclides and metals have been determined

If you have any questions, please contact me at extension 9886

Ann Sieben
Title

AS slm

Enclosures
As Stated

cc

L A	Archuleta	-	RMRS	-	Bldg T893B
J E	Law	-	RMRS	-	Bldg T893A
A L	Primrose	-	RMRS	-	Bldg T893A
G H	Setlock	-	Kaiser-Hill	-	Bldg T130C
A M	Tyson	-	RMRS	-	Bldg T893B

2

RF/ER-96-0044.UN

Trenches and Mound Site Characterization Report

Draft

Rocky Mountain Remediation Services, L.L.C.

September 1996

3

TABLE OF CONTENTS

EXECUTIVE SUMMARY		ES-1
1 0	INTRODUCTION	1-1
1 1	PURPOSE OF REPORT	1-2
1 2	ORGANIZATION OF REPORT	1-2
1 3	REMEDIAL ACTIONS	1-3
2 0	WORK PLAN METHODOLOGY	2-1
2 1	HISTORICAL INFORMATION	2-1
2 2	AERIAL PHOTOGRAPHS	2-1
2 3	SITE VISITS	2-1
2 4	GEOPHYSICAL SURVEYS	2-2
2 5	SOIL GAS SURVEYS	2-3
2 6	SUBSURFACE MATERIAL SAMPLING	2-3
3 0	RESULTS	3-1
3 1	TRENCH T-1 (IHSS 108)	3-3
3 2	RYAN'S PIT (IHSS 109)	3-9
3 3	TRENCH T-4 (IHSS 111 1)	3-17
3 4	TRENCH T-5 (IHSS 111 2)	3-25
3 5	TRENCH T-6 (IHSS 111 3)	3-29
3 6	TRENCH T-7 (IHSS 111 4)	3-33
3 7	TRENCH T-8 (IHSS 111 5)	3-39
3 8	TRENCH T-9 (IHSS 111 6)	3-45
3 9	TRENCH T-10 (IHSS 111 7)	3-51
3 10	TRENCH T-11 (IHSS 111 8)	3-57
3 11	TRENCH T-12 (PAC NE-1412)	3-63
3 12	TRENCH T-13 (PAC NE 1413)	3-69

3 13	MOUND SITE (IHSS 113)	3-75
4 0	CONCLUSIONS	4-1
4 1	AREAS REQUIRING REMEDIAL ACTION	4-1
4 2	AREAS REQUIRING PRE-REMEDIAL INVESTIGATION	4-1
4 3	AREAS NOT REQUIRING REMEDIAL ACTION	4-2
5 0	REFERENCES	5-1

FIGURES

1-1 Location Map of Trenches and Mound Site

Trench T-1

3 1-1 Location Map of Trench T-1
3 1-2 Soil Gas Survey Results for Trench T-1
3 1-3 Location of Wells and Boreholes at Trench T-1

Trench T-2

3 2-1 Location Map of Trench T-2
3 2-2 Soil Gas Survey Results for Trench T-2
3 2-3 Location of Wells and Boreholes at Trench T-2

Trench T-4

3 3-1 Location Map of Trench T-4
3 3-2 Soil Gas Survey Results for Trench T-4
3 3-3 Location of Wells and Boreholes at Trench T-4

Trench T-5

3 4-1 Location Map of Trench T-5
3 4-2 Soil Gas Survey Results for Trench T-5
3 4-3 Location of Wells and Boreholes at Trench T-5

Trench T-6

3 5-1 Location Map of Trench T-6
3 5-2 Soil Gas Survey Results for Trench T-6
3 5-3 Location of Wells and Boreholes at Trench T-6

Trench T-7

3 6-1 Location Map of Trench T-7
3 6-2 Soil Gas Survey Results for Trench T-7
3 6-3 Location of Wells and Boreholes at Trench T-7

Trench T-8

3 7-1 Location of Map of Trench T-8
3 7-2 Soil Gas Survey Results for Trench T-7
3 7-3 Location of Wells and Boreholes at Trench T-8

Trench T-9

3 8-1 Location Map of Trench T-9

3 8-2 Soil Gas Survey Results for Trench T-9
3 8-3 Location of Wells and Boreholes at Trench T-9

Trench T-10

3 9-1 Location Map of Trench T-10
3 9-2 Soil Gas Survey Results for Trench T-10
3 9-3 Location of Wells and Boreholes at Trench T-10

Trench T-11

3 10-1 Location map of Trench T-11
3 10-2 Soil Gas Survey Results for Trench T-11
3 10-3 Location of Wells and Boreholes at Trench T-11

Trench T-12

3 11-1 Location Map of Trench T-12
3 11-2 Soil Gas Survey Results for Trench T-12
3 11-3 Location of Wells and Boreholes at Trench T-12

Trench T-13

3 12-1 Location Map of Trench T-13
3 12-2 Soil Gas Survey Results for Trench T-13
3 12-3 Location of Wells and Boreholes at Trench T-13

Mound Site

3 13-1 Location Map of Mound Site
3 13-2 Soil Gas Survey Results for Mound Site
3 13-3 Location of Wells and Boreholes at Mound Site

7

TABLES

1-1 Characterization Sites

Trench T-1

3 1-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels
3 1-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 1-3 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 1-4 Subsurface Soil Radionuclide Concentrations Exceeding PPRGs
3 1-5 Groundwater Organic Compounds Exceeding RFCA Tier II Action Levels
3 1-6 Groundwater Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 1-7 Groundwater Metal Concentrations Exceeding RFCA Tier II Action Levels
3 1-8 Groundwater Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 1-9 Groundwater Radionuclide Concentrations Exceeding RFCA Tier II Action Levels
3 1-10 Summary Information for Trench T-1

Trench T-2

3 2-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels
3 2-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 2-3 Subsurface Soil Metal Concentrations Exceeding PPRGs
3 2-4 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 2-5 Subsurface Soil Radionuclide Concentrations Exceeding PPRGs
3 2-6 Groundwater Organic Compounds Exceeding RFCA Tier II Action Levels
3 2-7 Groundwater Organic Compounds Exceeding RFCA Tier I Action Levels
3 2-8 Groundwater Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 2-9 Groundwater Metal Concentrations Exceeding RFCA Tier II Action Levels
3 2-10 Groundwater Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 2-11 Groundwater Radionuclide Concentrations Exceeding RFCA Tier II Action Levels
3 2-12 Summary Information for Trench T-2

Trench T-4

3 3-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels
3 3-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 3-3 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 3-4 Subsurface Soil Radionuclide Concentrations Exceeding PPRGs
3 3-5 Groundwater Organic Compounds Exceeding RFCA Tier II Action Levels
3 3-6 Groundwater Organic Compounds Exceeding RFCA Tier I Action Levels
3 3-7 Groundwater Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 3-8 Groundwater Metal Concentrations Exceeding RFCA Tier II Action Levels
3 3-9 Groundwater Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 3-10 Groundwater Radionuclide Concentrations Exceeding RFCA Tier II Action Levels
3 3-11 Summary Information for Trench T-4

Trench T-5

3 4-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

3 4-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 4-3 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 4-4 Subsurface Soil Radionuclide Concentrations Exceeding PPRGs
3 4-5 Groundwater Radionuclide Concentrations Exceeding RFCA Tier II Action Levels
3 4-6 Summary Information for Trench T-5

Trench T-6

3 5-1 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 5-2 Subsurface Soil Radionuclide Concentrations Exceeding PPRGs
3 5-3 Summary Information for Trench T-6

Trench T-7

3 6-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels
3 6-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 6-3 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 6-4 Subsurface Soil Radionuclide Concentrations Exceeding PPRGs
3 6-5 Groundwater Organic Compounds Exceeding RFCA Tier II Action Levels
3 6-6 Summary Information for Trench T-7

Trench T-8

3 7-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels
3 7-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 7-3 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 7-4 Subsurface Soil Radionuclide Concentrations Exceeding PPRGs
3 7-5 Groundwater Organic Compounds Exceeding RFCA Tier II Action Levels
3 7-6 Summary Information for Trench T-8

Trench T-9

3 8-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels
3 8-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 8-3 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 8-4 Groundwater Radionuclide Concentrations Exceeding RFCA Tier II Action Levels
3 8-5 Summary Information for Trench T-9

Trench T-10

3 9-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels
3 9-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 9-3 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 9-4 Summary Information for Trench T-10

Trench T-11

3 10-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels
3 10-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values

3 10-3 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 10-4 Subsurface Soil Radionuclide Concentrations Exceeding PPRGs
3 10-5 Groundwater Organic Compounds Exceeding RFCA Tier II Action Levels
3 10-6 Groundwater Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 10-7 Groundwater Metal Concentrations Exceeding RFCA Tier II Action Levels
3 10-8 Groundwater Radionuclide Concentrations Exceeding RFCA Tier II Action Levels
3 10-9 Summary Information for Trench T-11

Trench T-12

3 11-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels
3 11-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 11-3 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 11-4 Subsurface Soil Radionuclide Concentrations Exceeding PPRGs
3 11-5 Groundwater Organic Compounds Exceeding RFCA Tier II Action Levels
3 11-6 Groundwater Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 11-7 Groundwater Metal Concentrations Exceeding RFCA Tier II Action Levels
3 11-8 Groundwater Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 11-9 Groundwater Radionuclide Concentrations Exceeding RFCA Tier II Action Levels
3 11-10 Summary Information for Trench T-12

Trench T-13

3 12-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels
3 12-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 12-3 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 12-4 Groundwater Organic Compounds Exceeding RFCA Tier II Action Levels
3 12-5 Groundwater Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 12-6 Groundwater Metal Concentrations Exceeding RFCA Tier II Action Levels
3 12-7 Groundwater Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 12-8 Groundwater Radionuclide Concentrations Exceeding RFCA Tier II Action Levels
3 12-9 Summary Information for Trench T-13

Mound Site

3 13 1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels
3 13 2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 13 3 Subsurface Soil Radionuclide Concentrations Exceeding $UTL_{99/99}$ Values
3 13 4 Subsurface Soil Radionuclide Concentrations Exceeding PPRGs
3 13 5 Groundwater Organic Compounds Exceeding RFCA Tier I Action Levels
3 13 6 Groundwater Organic Compounds Exceeding RFCA Tier II Action Levels
3 13 7 Groundwater Metal Concentrations Exceeding $UTL_{99/99}$ Values
3 13 8 Groundwater Metal Concentrations Exceeding RFCA Tier II Action Levels
3 13 9 Groundwater Radionuclide Concentrations Exceeding RFCA Tier II Action Levels
3 13 10 Summary Information for Mound Site

10

EXHIBITS

Trench T-1

3 1 A Trench T-1 Historical Release Report Information
3 1 B Trench T-1 EM-31 Surveys
3 1 C Trench T-1 EM-61 Surveys
3 1 D Trench T-1 Ground Penetrating Radar Surveys

Trench T-2

3 2 A Trench T-2 Historical Release Report Information
3 2 B Trench T-2 EM-31 Surveys
3 2 C Trench T-2 EM-61 Surveys
3 2 D Trench T-2 Borehole Logs

Trench T-4

3 3 A Trench T-4 Historical Release Report Information
3 3 B Trench T-4 EM-31 Surveys
3 3 C Trench T-4 EM-61 Surveys
3 3 D Trench T-4 Ground Penetrating Radar Surveys
3 3 E Trench T-4 Borehole Logs

Trench T-5

3 4 A Trench T-5 Historical Release Report Information
3 4 B Trench T-5 EM-31 Surveys
3 4 C Trench T-5 Ground Penetrating Radar Surveys
3 4 D Trench T-5 Borehole Logs

Trench T-6

3 5 A Trench T-6 Historical Release Report Information
3 5 B Trench T-6 EM-31 Surveys
3 5 C Trench T-6 EM-61 Surveys
3 5 D Trench T-6 Ground Penetrating Radar Surveys
3 5 E Trench T-6 Borehole Logs

Trench T-7

3 6 A Trench T-7 Historical Release Report Information
3 6 B Trench T-7 EM-31 Surveys
3 6 C Trench T-7 EM-61 Surveys
3 6 D Trench T-7 Ground Penetrating Radar Surveys
3 6 E Trench T-7 Borehole Logs

Trench T-8

3 7 A Trench T-8 Historical Release Report Information
3 7 B Trench T-8 EM-31 Surveys
3 7 C Trench T-8 Ground Penetrating Radar Surveys
3 7 D Trench T-8 Borehole Logs

Trench T-9

3 8 A Trench T-9 Historical Release Report Information
3 8 B Trench T-9 EM-31 Surveys
3 8 C Trench T-9 EM-61 Surveys
3 8 D Trench T-9 Ground Penetrating Radar Surveys
3 8 E Trench T-9 Borehole Logs

Trench T-10

3 9 A Trench T-10 Historical Release Report Information
3 9 B Trench T-10 EM-31 Surveys
3 9 C Trench T-10 EM-61 Surveys
3 9 D Trench T-10 Ground Penetrating Radar Surveys
3 9 E Trench T-10 Borehole Logs

Trench T-11

3 10 A Trench T-11 Historical Release Report Information
3 10 B Trench T-11 EM-31 Surveys
3 10 C Trench T-11 Borehole Logs

Trench T-12

3 11 A Trench T-12 Historical Release Report Information
3 11 B Trench T-12 EM-31 Surveys
3 11 C Trench T-12 Ground Penetrating Radar Surveys
3 11 D Trench T-12 Borehole Logs

Trench T-13

3 12 A Trench T-13 Historical Release Report Information
3 12 B Trench T-13 EM-31 Surveys
3 12 C Trench T-13 EM-61 Surveys
3 12 D Trench T-13 Borehole Logs

Mound Site

3 13 A Mound Site Historical Release Report Information
3 13 B Mound Site Borehole Logs

12

EXECUTIVE SUMMARY

This draft Trenches and Mound Site Characterization Report summarizes the results from the Trenches and Mound Site characterization performed in 1995 The objectives of the characterization efforts were to identify the dimensions and boundaries of the trenches, delineate areas of high concentration of volatile organic compounds in the trenches and the Mound Site, and provide other data necessary to support accelerated removal actions or remediation of the sources of contamination at these locations

This characterization report focuses on the Northeast and Southeast Trenches Areas and Mound Site Specifically, the following sites were investigated, Trench T-4 (Individual Hazardous Substance Site [IHSS] 111 1), Trench T-10 (IHSS 111 7), Trench T-11 (IHSS 111 8), Trench T-13 (PAC NE-1413), Trench T-5 (IHSS 111 2), Trench T-6, (IHSS 111 3), Tech T-7 (IHSS 111 4), Trench T-8 (IHSS 111 5), Trench T-9 (IHSS 111 6), Trench T-12 (PACE NE 1412), Mound Site (IHSS 113), Trench T-1 (IHSS 108), and Trench T-2, call Ryan's Pit (IHSS 109)

Data from the Trenches and Mound site characterization were combined with data from previous investigations The data were compared against background concentrations, Preliminary Programmatic Remediation Goals (PPRGs), and the Rocky Flats Cleanup Agreement (RFCA) Action Levels The comparisons indicate that Ryan's Pit, Trench T-4, Trench T-3 and the Mound Site require remedial action Trench T-1 requires further investigation Trenches T-5, T-6, T-7, T-8, T-9, T-10, T-11, T-12 and T-13 do not require remediation

13

1.0 INTRODUCTION

This report summarizes results of the field work performed in the summer of 1995 under the Trenches and Mound Site Characterization Work Plan Data were collected to determine which sites required remedial action, and the estimated extent of necessary remedial actions The work was planned based on the results of previous investigations including those performed for the Operable Unit 2 (OU2) Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) Report (DOE, 1995)

The investigation performed as part of the RFI/RI was intended to locate contaminated areas, but was not intended to characterize these sufficiently for the purpose of planning remedial actions For example, while at least one borehole was drilled into each trench, drilling through the trenches was excluded because of the uncertainties in the trench contents, and in whether the area beneath the trenches was contaminated Drilling through the trenches could potentially have created pathways for contaminants to migrate downward into uncontaminated areas After the areas were characterized and contamination identified, follow-on investigations were to be implemented to delineate the contaminated areas and to plan remedial actions

The OU 2 Phase II RFI/RI investigation concluded that several sites required additional information to determine the extent of the contaminant source, or whether sources were present that required remedial action The areas requiring additional investigation were addressed as part of the 1995 Trenches and Mound Characterization project Specifically, the following sites were investigated (see Table 1-1) and are also presented in Figure 1-1

Table 1-1 Characterization Sites

Area	IHSS
Northeast Trenches North of the East Access Road	Trench T-4 (IHSS 111 1), Trench T-10 (IHSS 111 7), Trench T-11 (IHSS 111 8), and Trench T-13 (PAC NE-1413)
Southeast Trenches South of the East Access Road	Trench T-5 (IHSS 111 2), Trench T-6 (IHSS 111 3), Trench T-7 (IHSS 111 4), Trench T-8 (IHSS 111 5), Trench T-9 (IHSS 111 6), and Trench T-12 (PAC NE-1412)
Mound Site Area	Mound Site (IHSS 113), and Trench T-1 (IHSS 108)
903 Pad Lip Area	Trench T-2, called Ryan's Pit (IHSS 109)

This investigation did not include Trench T-3 (IHSS 110) because it was previously characterized as part of the OU 2 Subsurface IM/IRA project In addition, samples were not taken from within

Trench T-1 due to the potentially hazardous conditions associated with suspected pyrophoric uranium within this trench

The preliminary results of this field investigation for Ryan's Pit (IHSS 109) indicated, but did not absolutely confirm, the presence of a volatile organic source Additional data were required prior to the initiation of the accelerated action for this IHSS The additional data collected as part of the accelerated action at Ryan's Pit is not reported here However, a source was found, excavated and treated A summary of the project can be found in the Completion Report for the Remediation of IHSS 109, Ryan's (RMRS, 1996)

1.1 PURPOSE OF REPORT

The objectives of the characterization project were to identify the dimensions and boundaries of the trenches, to delineate areas of high concentrations of volatile organic compounds (VOCs), and to provide sufficient data to support accelerated source removals or other remedial actions at these locations

The field investigation (EG&G, 1995a) utilized an observational approach where the results of each investigative phase were used to determine the next steps This entailed compiling available historical information, developing and implementing non-intrusive investigations, followed by the development and implementation of intrusive investigations The results for each area investigated are summarized in a stand-alone section While this approach results in redundant reporting, each section can be used independently of the others

1 2 ORGANIZATION OF REPORT

The Characterization Report is divided into four sections as follows

- Section 1, Introduction, discusses the purpose and organization of the report

- Section 2, Work Plan Methodology, describes the characterization methodology employed

- Section 3, Summary of individual investigations, provides approximate dimensions of the sites and the nature and extent of contamination in subsurface soils and groundwater This section also contains supporting information including, Historical Release Report information, EM-31 and EM-61 surveys, GPR surveys and borehole geological logs

15

- Section 4, Conclusions, presents a brief summary of the findings of the report to support the early action program

- Section 4, References, presents references cited in the report

1.3 REMEDIAL ACTIONS

Several accelerated removal actions have been implemented since the Trenches and Mound Site investigation began These accelerated actions utilized data presented in this report The accelerated actions are

- Ryan's Pit in 1995,

- Trench T-3 in 1996, and

- Trench T-4 in 1996

As of this date, the Ryan's Pit Accelerated action has been completed except for the final disposition of the soils, excavation of Trench T-3 has been completed, soils have been treated and are being returned to the trench, and Trench T-4 excavation has been completed

2.0 WORK PLAN METHODOLOGY

Sections 2 1 through 2 4 describe the implementation of the Trenches and Mound Site Characterization Work Plan (EG&G, 1995a) Previous investigations are summarized in the OU 2 Phase II RFI/RI Report (EG&G, 1995b) and focused on locating and characterizing contaminated areas in OU-2 These investigations did not provide the data necessary to determine dimensions and boundaries of the trenches, or areas of high concentration of contaminants in the trenches or Mound Site

The program utilized several methodologies to meet project objectives historical data were compiled to identify potential contaminants, trench location and size, aerial photographs were examined to identify disturbed areas, verify trench dimension and determine times of operation, a visual survey was conducted to identify features on the ground and to lay out a geophysical sampling grid, two electromagnetic surveys were conducted to delineate magnetic anomalies and to delineate trench boundaries, Ground Penetrating Radar (GPR) surveys were conducted to better determine trench depth and extent, soil gas surveys were conducted to identify and delineate volatile organic contaminant plumes, and subsurface soil sampling was conducted to verify soil gas survey results and to better define metal and radionuclide contamination present at the sites

2.1 HISTORICAL INFORMATION

To provide information regarding the disposal practices at the Trenches and Mound Site, pertinent sections from the Historical Release Report and other historical documents were reviewed In addition, several long-term Rocky Flats Plant employees were interviewed

2.2 AERIAL PHOTOGRAPHS

Aerial photographs dating from 1954 through 1972 were examined to ascertain the time period of operation at the sites, approximate the length and width of the sites, identify any staging areas, and gather information which might confirm the contents of the trenches and Mound Site

2 3 SITE VISIT

A visual survey of the trenches and Mound Site was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general area of the disposal sites Soil disturbances such as mounding and subsidence were identified and recent

geologic characterization information was used to delineate between Rocky Flats Alluvium and soil disturbance caused by construction related activities Evidence of fill material deposits was also noted In addition to the geologic characteristics of the area, changes in vegetation were used in the identification of the more recently disturbed soil and revegetated fill material Upon completion of the visual survey, pin flags were laid out to establish geophysical grids

2.4 GEOPHYSICAL SURVEYS

Electromagnetic (EM) methods provide a means of measuring the electrical conductivity of subsurface materials EM-31 and EM-61 surveys were run at most of the sites to aid in determining the lateral and vertical extent of trench materials, the presence and distribution of buried metallic objects, and the presence of any conductive plumes

2.4.1 EM-31

EM data was collected with a Geonics EM-31 Terrain Conductivity Meter (EM-31) When using the EM-31, the depth of investigation is dependent on the instrument mode of operation The horizontal dipole mode (coils are vertical coplanar) has a penetration depth of approximately 8 feet and the vertical dipole mode (coils are horizontal coplanar) has an approximate penetration depth 16 feet

Both the quadrature phase component and the inphase component of the inducted magnetic field were measured The quadrature phase is linearly related to the ground conductivity and therefore directly responsive to geologic variations The inphase component measures the ratio of the inducted magnetic field to the primary field and as a result is more responsive to the presence of metallic objects than the quadrature phase

EM data was collected in a grid pattern over each trench with a station spacing of 5 feet The station spacing was chosen to allow potential resolution of trench edges A significantly larger station spacing would make the interpretation of trench edges more ambiguous

2.4 2 EM-61

Based on the EM-31 results, further definition of those areas which potentially contained metallic debris was accomplished using a Geonics EM-61 The EM-61 was used to more accurately define lateral limits of buried metallic debris

EM-61 measures different magnetic frequency ranges than the EM-31 survey The EM-61 survey is not as distorted by water, grain size variation within the sediment Noise from overhead power lines is minimized Therefore, the areas which contain metallic debris are better defined EM-61 will identify metallic debris from the surface to below the bottom of the trench

2.4.3 Ground Penetrating Radar (GPR)

GPR involves transmitting a relatively high-frequency electromagnetic pulse and recording the travel time of the reflected electromagnetic energy Reflections occur whenever the dielectric constant of the materials changes The graphical representation of the compiled travel times is an approximation of the interfaces one would see in a cross section through the survey area

The effectiveness of GPR at a given site is directly proportional to the dielectric properties of the medium through which the signal is transmitted Properties of the medium can affect penetration depths as the EM pulses lose energy in the form of heat when transmitted through electrically conductive material Conductive material such as clay can reduce GPR penetration depths and, in some cases, render GPR ineffective Saturated soils and rainy conditions can also render GPR ineffective

2.5 SOIL GAS SURVEYS

A soil gas survey was conducted on a grid over each trench to identify areas of high volatile organic compounds (VOC) concentrations The soil gas survey was performed at 20 foot intervals along two lines running parallel to the major axis of each trench Soil gas samples were collected at two depths at each sampling locations, generally at 5 feet and at 10 feet below ground surface (bgs) Soil gas samples were collected and analyzed with a photoionization detector (PID) and/or a flame ionization detector (FID) Samples were collected at approximately 30 percent of the grid locations for confirmation laboratory analysis using the modified Method 8010 (EPA, 1986)

2.6 SUBSURFACE MATERIAL SAMPLING

Based on the soil gas survey results, areas with elevated VOC concentrations were evaluated along with historical borehole data to determine how many subsurface samples were needed and where to collect them If the VOC high concentration area defined by the soil gas survey was less than 20 feet in diameter, then two boreholes were drilled and sampled If the VOC high concentration area defined by the soil gas survey was greater than 20 feet in diameter, then three boreholes were drilled and sampled

20

3.0 RESULTS

The following sections summarize the data collected during the Trenches and Mound Site characterization activities Data collected during the characterization activities has been compiled with historical data and compared against background Upper Tolerance Levels $(UTL)_{99/99}$ Levels, Rocky Flats Cleanup Agreement (RFCA) Action Levels, and Preliminary Program Remediation Goals (PPRGs) to support the accelerated action program

Action levels for Volatile Organic Compounds (VOCs) are based on maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act Tier I action levels were developed to identify potential cleanup targets in areas where VOC contamination of groundwater exceeds 100 times the MCL Tier II action levels were developed to protect surface water quality from contaminated groundwater Soil action levels were developed based on the leaching potential of each compound

3.1 TRENCH T-1 (IHSS 108)

Trench T-1 was investigated using the following methodologies

- Historical data were compiled using the Historical Release Report and supplemented with employee interviews to identify potential contaminants, trench location, and size
- Aerial photographs were examined to identify disturbed areas, verify trench dimensions, and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- Two electromagnetic (EM) surveys were conducted to locate buried conductive and/or metallic objects and define trench boundaries
- Ground Penetrating Radar (GPR) surveys were conducted to better determine trench dimensions
- Soil gas surveys were conducted to identify and delineate contaminant plumes

As shown in Figure 3 1-1, Trench T-1 is located approximately 100 feet south of the southeast corner of the Protected Area (PA) fence The trench dimensions are approximately 200 feet long, 15 feet wide, and 5 feet deep The trench was reportedly used for disposal from 1954 to 1962 for 125 drums containing approximately 25,000 kg of depleted uranium chips and hydraulic oil Some of the drums contained metal turnings, still bottoms (residue from a distillation process), cemented cyanide waste, and copper alloy The pertinent section of the Historical Release Report (HRR) is presented as Exhibit 3 1 A (PAC Reference Number 900-108)

Although the general location of Trench T-1 was known, the exact location of the trench had not been physically identified prior to the Trenches Area and Mound Site Characterization Program of 1995 Aerial photographs dating from 1954 through 1972 were examined to ascertain the period of operation, approximate the length and width, identify staging areas, and gather information which might confirm the contents of the trench (Colorado Aerial Photo Service, 1993) Photographs from 1962 and 1963 show this site, approximately 20 feet wide by 200 feet long, with dark staining and disturbed soil The location and dimensions of this staining and soil disturbance are consistent with information from the HRR

3 1 1 Geology

Surficial deposits in the area of Trench T-1 consist of poorly consolidated Rocky Flats Alluvium overlying the Arapahoe and Laramie Formations to a depth of approximately 18 feet Artificial fill deposits correspond with the area identified as Trench T-1 The top of bedrock in the area is approximately 18 feet below ground surface (bgs) Bedrock lithology generally consists of

claystone, however, channel of the Arapahoe Formation Number 1 Sandstone is present beneath the southwest portion of the trench and this formation is approximately 40 feet thick in the area of Trench T-1 (EG&G, 1995c) The hydrograph from monitoring well 12091 located south of Trench T-1 indicates that groundwater fluctuates between 7 to 19 feet bgs

3.1.2 Site Visual Survey and Geophysical Surveys

After aerial photographs were examined, a visual survey of the Trench T-1 area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general area of Trench T-1 Soil disturbances such as mounding and subsidence were identified and used together with recent geologic characterization information to delineate between Rocky Flats Alluvium and soil disturbances caused by construction related activities Evidence of fill deposits also were noted In addition to the geologic characteristics of the area, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material The area did not show any evidence of surficial water or seeps

Upon completion of the visual survey, a geophysical grid was laid out using pin flags The grid was 65 feet wide (north-south) by 275 feet long (east-west) with flags placed at five foot increments

EM-31 Survey

After establishing the geophysical grid, the EM-31 survey was performed The data collected from the horizontal dipole mode survey indicate anomalies in the top eight feet of alluvium Both the vertical and horizontal dipole modes of the EM-31 survey indicate the same anomalies The anomalies vary in size from 10-24 feet wide and indicate that Trench T-1 is approximately 200 feet long This interpretation agrees with the HRR and aerial photographs These anomalies strongly support the presence of buried metallic objects and/or other conductive solid or liquid materials in the trench The EM-31 survey did not indicate a conductive contaminant plume Results of the EM-31 survey are presented in Exhibit 3 1 B

EM-61 Survey

To further define the physical characteristics of the grid area, an EM-61 survey was also performed The EM-61 survey identified the same anomalies shown by the EM-31 survey These anomalies represent the areas within the trench most likely to contain buried metallic objects The buried drums noted in the HRR are most likely located in the west end of the trench with fewer drums or other

metallic debris located in the east end of the trench Results of the EM-61 survey are presented in Exhibit 3 1 C

Ground Penetrating Radar

GPR was used in conjunction with the EM-31 and EM-61 surveys to better determine the extent of Trench T-1 The north-south surveys indicated the trench width varies from 10 to 24 feet wide The east-west survey indicated that the trench is six feet deep except for 60 feet of the eastern end of the trench where it is 10 feet deep and appears to contain dense materials This area corresponds with an anomaly in the EM-31 and EM-61 surveys The GPR survey results are presented in Exhibit 3 1 D

3.1.3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995, the vadose zone in the Trench T-1 area was highly saturated The increased soil moisture content tended to attenuate soil gas readings, making sample collection difficult However, 32 samples were collected and analyzed for total volatile organic content using field instrumentation To verify field soil gas readings of total VOCs, 19 samples were collected and sent to an onsite laboratory for general chemistry analysis using Method 8010 (EPA, 1986)

Based on the trench boundaries as determined by geophysical surveys, locations for soil gas sampling were spotted every 10 feet around the trench Soil gas sampling was not performed inside of the Trench T-1 boundaries because of the suspected presence of pyrophoric uranium Soil gas samples were collected at depths of five and nine feet bgs If a sample had a field measurement above 100 ppm on the field instrumentation, the field crew stepped off 10 feet from that location and collected an additional sample This procedure was repeated until readings less than 100 ppm were obtained This methodology was employed to determine the extent of the VOC contaminant plume outside of the trench boundaries

The soil gas survey results indicate the presence of a possible VOC source within the trench At five feet bgs the maximum concentration of total VOCs (600 ppm) was detected at location SG2T01005 (ten feet north of the trench boundary) The maximum concentration for total VOCs (1726 ppm) at the nine foot bgs was detected at location SB2T01009A Soil gas survey results are presented in as Figure 3 1-2

24

3.1.4 Subsurface Soil Sampling

Subsurface soil sampling from the Trench T-1 area was the final step of the characterization activities The planned methodology was to drill angled boreholes (at approximately 60 degrees) beneath the bottom of the trench to detect contamination that may have migrated downward This method would prevent penetration of the trench bottom possibly creating a contamination migration pathway This approach would also prevent the possibility of allowing oxygen to enter the trench and creating a reaction with the uranium However, due to the amount and size of cobbles encountered during the angle drilling phase of the characterization, the collection of subsurface samples was not possible The program was subsequently canceled

Previous characterization of the subsurface soils in the vicinity of Trench T-1 took place during the OU 2 Phase II Resource Conservation and Recovery photographs (RCRA) Field Investigation (RFI)/Remedial Investigation (RI) Program The data from two boreholes, BH3487 located in the trench, and BH3587 located approximately 30 feet east and 15 feet south of the southeast corner of the trench, indicate elevated levels of metals and radionuclides Figure 3 1-3 identifies the locations of boreholes and wells that characterize the Trench T-1 area

Organic Compounds

There were no detected concentrations of organic compounds exceeding the Rocky Flats Cleanup Agreement (RFCA) Subsurface Soil Action Levels or the Preliminary Program Remediation Goals (PPRGs) for subsurface soils, construction worker scenario as presented in Table 3 1-1

Metals

Calcium (range 89,300-116,000 mg/kg), and cadmium (range 2 0-3 3 mg/kg) concentrations exceeded the background Upper Tolerance Limit ($UTL_{99/99}$) as shown in Table 3 1-2) There were no metals detected at concentrations greater than the PPRGs for subsurface soils, construction worker scenario

Radionuclides

Americium-241 (range 0 04-0 60 pCi/g), cesium-137 (range 0 40-1 5 pCi/g), and plutonium 239/240 (range 0 06-1 5 pCi/g) activities exceeded the background $UTL_{99/99}$ as presented in Table 3 1-3 As presented in Table 3 1-4, radium-226 (0 50 pCi/g) and radium-228 (range 1 3-1 6 pCi/g) activities exceed the PPRGs for subsurface soils, construction worker scenario

3.1.5 Groundwater

There are five wells located near Trench T-1 Well 00893 is located within the trench Wells 01891 and 12091 are located approximately five feet south of the southeast corner of the trench and wells 02387 and 0436 are located approximately 15 feet south of the middle of the southern boundary of the trench Elevated concentrations of metals, radionuclides, and one organic compound were observed

Organic Compounds

Concentrations of methylene chloride (range 7-16 µg/L) from wells surrounding Trench T-1 exceeded the RFCA Tier II Groundwater Action Level as shown in Table 3 1-5 There were no detected concentrations of organic compounds greater than the RFCA Tier I Groundwater Action Levels or the PPRGs for surface water, open-space receptor

Metals

Concentrations of dissolved barium (range 172-240 µg/L), total barium (range 331-404 µg/L), dissolved chromium (range 13 9-14 6 µg/L), total lead (range 19 2-23 5 µg/L), dissolved manganese (range 311-553 µg/L), total potassium (range 5,010-8,680 µg/L) exceeded the background $UTL_{99/99}$ as presented in Table 3 1-6 Dissolved antimony (range 12-40 µg/L), total antimony (22 6 µg/L), dissolved manganese (range 311-552 µg/L), and total manganese (range 191-530 µg/L) concentrations exceeded the RFCA Tier II Groundwater Action Levels as shown in Table 3 1-7 There were no detected concentrations of metals greater than the RFCA Tier I Groundwater Action Levels or the PPRGs for surface water, open-space receptor

Radionuclides

The total americium-241 (1 09 pCi/L), total cesium-137 (1 15 pCi/L), dissolved strontium-89/90 (1 568 pCi/L) and total plutonium-239,240 (0 13 pCi/L) activities exceeded the background $UTL_{99/99}$ values as shown in Table 3 1-8 Dissolved gross alpha (range 7 12-9 96 pCi/L), dissolved gross beta, (range 5 6-33 0 pCi/L), total americium-241 (1 09 pCi/L), total cesium-137 (1 15 pCi/L), and total plutonium-239/240 (0 13 pCi/L), dissolved uranium-233/234 (range 2 5-4 8 pCi/L), dissolved uranium-238 (range 1 8-4 3 pCi/L), and dissolved strontium-89/90 (1 57 pCi/L) activities exceeded the RFCA Tier II Groundwater Action Levels (see Table 3 1 9) There were no detected activities of radionuclides greater than the RFCA Tier I Groundwater Action Levels or the PPRGs for surface water, open-space receptor

20

3.1.6 Summary

Results of the geophysical surveys indicate that Trench T-1 is approximately 10 to 17 feet wide, 6 to 10 feet deep, and 200 feet long which corresponds to an approximate volume of 444 to 1,260 cubic yards (cy) of buried material

The EM-31 and EM-61 surveys indicate two separate areas potentially containing buried metallic objects The large anomaly on the east end of the trench is the most likely location for the buried drums referred to in the HRR The smaller anomaly on the west end of the trench is potentially more buried drums or metallic debris GPR confirms the presence of dense materials in the vicinity of the east side of the trench

Due to the low permeability of the soil and the saturated conditions the soil gas survey was not conclusive as to the extent of VOC contamination in the trench and surrounding area The EM-31 survey did not indicate the presence of a conductive plume

There were no organic compounds detected in the subsurface soils surrounding Trench T-1 which exceed the RFCA subsurface soil action levels None of the concentrations of metals detected in the surrounding subsurface soils exceeded the PPRGs for subsurface soils, construction worker scenario Three metals were detected at concentrations greater than the background $UTL_{99/99}$ and three radionuclides were detected with activities greater than the background $UTL_{99/99}$ In addition, radium-226 and radium-228 were detected with activities greater than the PPRGs for subsurface soils, construction worker scenario However, the background $UTL_{99/99}$ activities for radium-226 and radium-228 exceed the PPRGs for subsurface soil, construction worker scenario

None of the concentrations of detected organic compounds or metals nor the activities of the detected radionuclides in the groundwater exceed the PPRGs for surface water, open-space receptor or the RFCA Tier I Groundwater Action Levels Methylene chloride concentrations, five metal concentrations, and eight radionuclide activities exceed the RFCA Tier II Groundwater Action Levels

Trench T-1 summary information is presented in Table 3 1-10 Without samples collected from within the trench, the type and extent of contamination within the trench cannot be confirmed The potential for exposure of pyrophoric materials in uncontrolled circumstances indicates the need for a removal action Remedial action for this site is indicated and additional characterization activities will need to be performed to develop the appropriate response action

Table 3 1-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
[redacted]										

LABORATORY QUALIFIERS
J = Positively identified below sample quantitation limit result is estimated

NOTES
RFCA Action Levels for Benzoic Acid and 2-Butanone have not been determined

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted but was estimated

Table 3.1-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND UTL $_{99/99}$
Trench T 1	893	BH00093JE		7/8/93	Calcium	89300	2 4		V	53250
Trench T 1	BH3487	BH3487815D		7/29/87	Aluminum	70600			N	45110
Trench T 1	BH3487	BH34870815	8 14 7	7/29/87	Cadmium	3 1			N	1 33
Trench T 1	BH3487	BH348708CL	6 6-8	7/29/87	Cadmium	2			N	1 33
Trench T 1	BH3487	BH348715WS		7/29/87	Cadmium	2			N	1 33
Trench T 1	BH3487	BH348718CT	17 18	7/29/87	Cadmium	2 1			N	1 33
Trench T 1	BH3487	BH348721BR	21 22 1	7/29/87	Cadmium	1 4			N	1 33
Trench T 1	BH3487	BH3487815D	8 14 7	7/29/87	Cadmium	3 1			N	1 33
Trench T 1	BH3487	BH34870008	0-8	7/29/87	Calcium	116000			N	53250
Trench T 1	BH3587	BH35871215	12 15	7/28/87	Cadmium	2 2			N	1 33
Trench T 1	BH3587	BH358715CT	14 1 15 4	7/28/87	Cadmium	2 6			N	1 33
Trench T 1	BH3587	BH358718BR	18 4-19 45	7/28/87	Cadmium	3 3			N	1 33
Trench T 1	BH3587	BH35870012	0-12 3	7/27/87	Calcium	77900			N	53250
Trench T 1	BH3587	BH35870012D	0-12 3	7/27/87	Calcium	93900			N	53250

LABORATORY QUALIFIER

VALIDATION CODES
N = Will not be validated
V = Valid result

Table 3.1-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND UTL 99/99
Trench T 1	893	BH00093JE		7/8/93	Americium-241	0 04	0 008	0 018	V	0 022
Trench T-1	893	BH00093JE		7/8/93	Plutonium-239,240	0 19	0 001	0 032	V	0 025
Trench T 1	893	BH00097JE		7/9/93	Radium-226	0 5	0 36	0 25	V	1 42
Trench T-1	893	BH00098JE		7/9/93	Radium-228	1 3	0 57	0 46	Y	2 33
Trench T-1	893	BH00097JE		7/9/93	Radium-228	1 6	0 71	0 54	Y	2 33
Trench T 1	BH3487	BH348715WS		7/29/87	Cesium-137	0 4		1 1	N	0 129
Trench T-1	BH3487	BH348718CT	17-18	7/29/87	Cesium-137	0 4		1 1	N	0 129
Trench T 1	BH3487	BH348721BR	21-22 1	7/29/87	Cesium-137	0 4		1 6	N	0 129
Trench T-1	BH3487	BH34870008	0-8	7/29/87	Cesium-137	0 8		1 5	N	0 129
Trench T 1	BH3487	BH3487815D	8-14 7	7/29/87	Cesium-137	1		1 7	N	0 129
Trench T-1	BH3487	BH348708CL	6 6-8	7/29/87	Cesium-137	1 1		1 1	N	0 129
Trench T-1	BH3487	BH34870815	8-14 7	7/29/87	Cesium-137	1 5		1 1	N	0 129
Trench T 1	BH3487	BH348718CT	17-18	7/29/87	Plutonium-239,240	0 06		0 18		0 025
Trench T-1	BH3487	BH348718CT	17-18	7/29/87	Plutonium-239,240	0 06		0 18		0 025
Trench T-1	BH3487	BH3487815D	8-14 7	7/29/87	Plutonium-239 240	0 09		0 2		0 025
Trench T-1	BH3487	BH3487815D	8-14 7	7/29/87	Plutonium-239,240	0 09		0 2		0 025
Trench T-1	BH3587	BH35870012D	0-12 3	7/27/87	Americium-241	0 3		0 13	N	0 022
Trench T 1	BH3587	BH35870012	0-12 3	7/27/87	Americium-241	0 4		0 19	N	0 022
Trench T-1	BH3587	BH358718BR	18 4-19 45	7/28/87	Americium-241	0 03		0 08	N	0 022
Trench T-1	BH3587	BH358718BR	18 4-19 45	7/28/87	Americium-241	0 03		0 08	N	0 022
Trench T-1	BH3587	BH358715CT	14 1-15 4	7/28/87	Americium-241	0 06		0 06	N	0 022
Trench T-1	BH3587	BH35870012D	0-12 3	7/27/87	Cesium-137	0 6		1 6	N	0 129
Trench T-1	BH3587	BH35870012	0-12 3	7/27/87	Cesium-137	1		1 3	N	0 129
Trench T-1	BH3587	BH358715CT	14 1-15 4	7/28/87	Cesium-137	0 6		1 1	N	0 129
Trench T-1	BH3587	BH35871215	12-15	7/28/87	Cesium-137	0 9		1 5	N	0 129
Trench T-1	BH3587	BH35870012	0-12 3	7/27/87	Plutonium-239,240	1 5		0 2		0 025
Trench T-1	BH3587	BH35870012D	0-12 3	7/27/87	Plutonium-239,240	1 5		0 2		0 025
Trench T-1	BH3587	BH35871215	12-15	7/28/87	Plutonium-239 240	0 06		0 13		0 025

VALIDATION CODES
V = Valid result
N = Will not be validated
Y = Analytical results in validation process

Table 3.1-4 Subsurface Soil Radionuclide Activities Exceeding PPRGs

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	PPRG (pCi/g)
Trench T-1	893	BH00097JE		7/9/93	Radium-226	0 5	0 36	0 25	V	0 494
Trench T-1	893	BH00098JE		7/9/93	Radium-228	1 3	0 57	0 46	Y	1 01
Trench T-1	893	BH00097JE		7/9/93	Radium-228	1 6	0 71	0 54	Y	1 01

VALIDATION CODES
V = Valid result
Y = Analytical results in validation process

Table 3.1-5 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T-1	1891	GW02872IT	5/13/92	Methylene Chloride	0 007	0 00001		0 005	
Trench T-1	12091	GW02116IT	12/19/91	Methylene Chloride	0 01	0 00001		0 005	A
Trench T-1	12091	GW02876IT	5/13/92	Methylene Chloride	0 016	0 00001	B	0 005	

LABORATORY QUALIFIERS
B = Indicates chemical was in both the sample and associated method blank

VALIDATION CODES
A = Result accepted with qualifications

Table 3.1-6 Groundwater Dissolved Metal Concentrations Exceeding $UTL_{99/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (μ g/L)	DETECTION LIMIT (μ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T-1	1891	GW02178IT	12/23/91	Banum	172	200	B	V	171 2
Trench T-1	1891	GW02509IT	2/27/92	Banum	196	200	BE	JA	171 2
Trench T-1	1891	GW02872IT	5/13/92	Banum	191	200	B	V	171 2
Trench T-1	1891	GW03284IT	7/29/92	Banum	202	200		V	171 2
Trench T-1	1891	GW00254WC	3/3/93	Banum	222	17		V	171 2
Trench T-1	1891	GW00686WC	5/3/93	Banum	237	17		V	171 2
Trench T-1	1891	GW01213WC	8/24/93	Banum	227	200		V	171 2
Trench T-1	1891	GW01628WC	12/2/93	Banum	240	200		V	171 2
Trench T-1	1891	GW00254GA	2/17/94	Banum	226	200		V	171 2
Trench T-1	1891	GW00759GA	5/11/94	Banum	218	200		V	171 2
Trench T-1	1891	GW01754GA	11/11/94	Banum	214	1		V	171 2
Trench T-1	1891	GW02310GA	3/27/95	Banum	214	0 6		V	171 2
Trench T-1	1891	GW02178IT	12/23/91	Chromium	14 6	10		JA	13 51
Trench T-1	1891	GW01281GA	8/25/94	Manganese	553	15		V	263
Trench T-1	12091	GW02116IT	12/19/91	Chromium	13 9	10		JA	13 51
Trench T-1	12091	GW02116IT	12/19/91	Manganese	311	15		V	263

LABORATORY QUALIFIER
B = Detected concentration was less than the contract required detection limit and above the instrument detection limit
E = Reported value is estimated due to interference

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result

Table 3 1-6 Groundwater Total Metal Concentrations Exceeding $UTL_{99/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (μ g/L)	DETECTION LIMIT (μ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T-1	1891	GW02509IT	2/27/92	Banum	331	200	E	V	296
Trench T-1	1891	GW02872IT	5/13/92	Banum	345	200		V	296
Trench T-1	1891	GW03284IT	7/29/92	Banum	404	200		V	296
Trench T-1	1891	GW03284IT	7/29/92	Lead	19 2	3		V	18 4
Trench T-1	1891	GW02178IT	12/23/91	Potassium	5010	5000	E	JA	4980
Trench T-1	1891	GW02509IT	2/27/92	Potassium	5280	5000		V	4980
Trench T-1	1891	GW02872IT	5/13/92	Potassium	5350	5000	E	JA	4980
Trench T-1	1891	GW03284IT	7/29/92	Potassium	5850	5000		V	4980
Trench T-1	12091	GW02876IT	5/13/92	Banum	370	200		V	296
Trench T-1	12091	GW02876IT	5/13/92	Lead	23 5	3		V	18 4
Trench T-1	12091	GW02116IT	12/19/91	Potassium	8210	5000	E	JA	4980
Trench T-1	12091	GW02876IT	5/13/92	Potassium	8680	5000	E	JA	4980
Trench T-1	12091	GW03290IT	7/29/92	Potassium	6030	5000		V	4980

LABORATORY QUALIFIER
E = Reported value is estimated due to interference

VALIDATION CODES
JA = Result accepted, but was estimated
V = Valid result

Table 3.1-7 Groundwater Dissolved Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (μ g/L)	DETECTION LIMIT (μ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (μ g/L)
Trench T-1	1891	GW01281GA	8/25/94	Manganese	553	15		V	183
Trench T-1	12091	GW02514IT	2/27/92	Antimony	12	60	B	V	6
Trench T-1	12091	GW00625GA	4/27/94	Antimony	40	34	B	V	6
Trench T-1	12091	GW01429GA	9/12/94	Antimony	13	13	B	V	6
Trench T-1	12091	GW02116IT	12/19/91	Manganese	311	15		V	183

LABORATORY QUALIFIER
B = Detected concentration was less than contract required detection limit and above instrument detection limit

VALIDATION CODES
V = Valid result

Table 3.1-7 Groundwater Total Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (µ g/L)
Trench T-1	1891	GW03284IT	7/29/92	Antimony	22 6	60	B	V	6
Trench T-1	1891	GW02178IT	12/23/91	Manganese	304	15		V	183
Trench T-1	1891	GW02509IT	2/27/92	Manganese	237	15		V	183
Trench T-1	1891	GW02872IT	5/13/92	Manganese	191	15		V	183
Trench T-1	1891	GW03284IT	7/29/92	Manganese	291	15		V	183
Trench T-1	12091	GW02116IT	12/19/91	Manganese	530	15		V	183
Trench T-1	12091	GW02514IT	2/27/92	Manganese	244	15		V	183
Trench T-1	12091	GW02876IT	5/13/92	Manganese	408	15		V	183
Trench T-1	12091	GW03290IT	7/29/92	Manganese	245	15		V	183

LABORATORY QUALIFIER
B = Detected concentration was less than contract required detection limit and above instrument detection limit

VALIDATION CODES
V = Valid result

Table 3.1-8 Groundwater Dissolved Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T-1	12091	GW02514IT	2/27/92	Strontium-89,90	1 568	0 4	0 941	JA	1 164

VALIDATION CODES
JA = Result accepted but was estimated

Table 3.1-8 Groundwater Total Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T-1	12091	GW02514IT	2/27/92	Americium-241	1 09	0	0 136	A	0 04
Trench T-1	12091	GW02876IT	5/13/92	Cesium-137	1 15	0 74	0 544	A	1 03
Trench T-1	12091	GW02514IT	2/27/92	Plutonium-239,240	0 13	0 006	0 028	A	0 06

VALIDATION CODES
A = Result accepted with qualifications

Table 3.1-9 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T-1	1891	GW02509IT	2/27/92	Gross Alpha	7 165	1 5	3 02	A	7
Trench T-1	1891	GW00254WC	3/3/93	Gross Alpha	7 125	1 4198	2 49	V	7
Trench T-1	1891	GW01281GA	8/25/94	Gross Alpha	9 9592	4 8641	4 4705	V	7
Trench T-1	1891	GW02178IT	12/23/91	Gross Beta	7 555	3 4	2 38	A	5
Trench T-1	1891	GW02509IT	2/27/92	Gross Beta	15 36	2 6	2 73	A	5
Trench T-1	1891	GW03284IT	7/29/92	Gross Beta	5 6	2 8	2	V	5
Trench T-1	1891	GW00254WC	3/3/93	Gross Beta	5 811	3 6308	2 62	V	5
Trench T-1	1891	GW00686WC	5/3/93	Gross Beta	33	2 8	3 1	A	5
Trench T-1	1891	GW01281GA	8/25/94	Gross Beta	18 8738	4 4238	3 736	V	5
Trench T-1	1891	GW02178IT	12/23/91	Uranium-233,234	4 826	0	1 34	V	1 07
Trench T-1	1891	GW02509IT	2/27/92	Uranium-233,234	4 356	0 086	0 998	V	1 07
Trench T-1	1891	GW00254WC	3/3/93	Uranium-233,234	3 859	0 2611	1 09	A	1 07
Trench T-1	1891	GW00686WC	5/3/93	Uranium-233,234	4 9	0 085	1	A	1 07
Trench T-1	1891	GW01628WC	12/2/93	Uranium-233,234	3 5	0 33	0 9	Y	1 07
Trench T-1	1891	GW00254GA	2/17/94	Uranium-233,234	3 8	0 084	0 67	V	1 07
Trench T-1	1891	GW00759GA	5/11/94	Uranium-233,234	3 4	0 25	0 94	V	1 07
Trench T-1	1891	GW01281GA	8/25/94	Uranium-233 234	4 8187	0 1958	0 8982	Y	1 07
Trench T-1	1891	GW01754GA	11/11/94	Uranium-233,234	4 3	0 28	1 2	Y	1 07
Trench T-1	1891	GW02310GA	3/27/95	Uranium-233,234	3 3	0 32	0 87	V	1 07
Trench T-1	1891	GW02178IT	12/23/91	Uranium-238	3 215	0	1 05	V	0 768
Trench T-1	1891	GW02509IT	2/27/92	Uranium-238	2 841	0	0 765	V	0 768
Trench T-1	1891	GW00254WC	3/3/93	Uranium-238	2 434	0 2428	0 829	A	0 768
Trench T-1	1891	GW00686WC	5/3/93	Uranium-238	2 7	0 055	0 73	A	0 768
Trench T-1	1891	GW01628WC	12/2/93	Uranium-238	2 1	0 33	0 68	Y	0 768
Trench T-1	1891	GW00254GA	2/17/94	Uranium-238	2 2	0 084	0 43	A	0 768
Trench T-1	1891	GW00759GA	5/11/94	Uranium-238	2 4	0 2	0 76	V	0 768
Trench T-1	1891	GW01281GA	8/25/94	Uranium-238	2 2762	0 1082	0 6018	Y	0 768
Trench T-1	1891	GW01754GA	11/11/94	Uranium-238	2 5	0 25	0 82	Y	0 768
Trench T-1	1891	GW02310GA	3/27/95	Uranium-238	1 8	0 3	0 61	V	0 768
Trench T-1	12091	GW02514IT	2/27/92	Gross Alpha	8 983	0 85	2 78	A	7
Trench T-1	12091	GW03290IT	7/29/92	Gross Alpha	7 5	0 54	0 95	V	7
Trench T-1	12091	GW02116IT	12/19/91	Gross Beta	9 364	4	1 83		5
Trench T-1	12091	GW02514IT	2/27/92	Gross Beta	8 157	2 7	2 18	A	5
Trench T-1	12091	GW03290IT	7/29/92	Gross Beta	6 6	2 7	2	V	5
Trench T-1	12091	GW03822IT	11/10/92	Gross Beta	6 8	4 93	3 31	V	5
Trench T-1	12091	GW00690WC	4/29/93	Gross Beta	7 7	2 5	2	A	5
Trench T-1	12091	GW02514IT	2/27/92	Strontium-89,90	1 568	0 4	0 941	JA	0 852
Trench T-1	12091	GW02116IT	12/19/91	Uranium-233,234	5 452	0 6	1 31		1 07
Trench T-1	12091	GW02514IT	2/27/92	Uranium-233,234	5 643	0	1 35	A	1 07

Table 3.1-9 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T-1	12091	GW02876IT	5/13/92	Uranium-233,234	4 549	0	1 13	A	1 07
Trench T-1	12091	GW03290IT	7/29/92	Uranium-233,234	4 2	0 056	0 5	A	1 07
Trench T-1	12091	GW03822IT	11/10/92	Uranium-233,234	3 9	0 1417	0 784	A	1 07
Trench T-1	12091	GW00257WC	3/3/93	Uranium-233,234	3 652	0 3141	1 09	A	1 07
Trench T-1	12091	GW00690WC	4/29/93	Uranium-233,234	3 4	0 048	0 99	A	1 07
Trench T-1	12091	GW01498WC	11/10/93	Uranium-233,234	4 4011	0 1907	0 945	Y	1 07
Trench T-1	12091	GW00365GA	3/7/94	Uranium-233,234	2 8	0 15	0 77	V	1 07
Trench T-1	12091	GW00625GA	4/27/94	Uranium-233,234	4 3	0 155	0 823	V	1 07
Trench T-1	12091	GW01429GA	9/12/94	Uranium-233,234	3 7	0 18	1 1	Y	1 07
Trench T-1	12091	GW01761GA	11/15/94	Uranium-233,234	2 9172	0 1809	0 644	Y	1 07
Trench T-1	12091	GW02638GA	5/31/95	Uranium-233,234	2 5	0 42	0 77	Y	1 07
Trench T-1	12091	GW02116IT	12/19/91	Uranium-238	4 337	0 6	1 14		0 768
Trench T-1	12091	GW02514IT	2/27/92	Uranium-238	3 691	0 119	1 04	A	0 768
Trench T-1	12091	GW02876IT	5/13/92	Uranium-238	3 282	0 187	0 928	A	0 768
Trench T-1	12091	GW03290IT	7/29/92	Uranium-238	3	0 018	0 41	A	0 768
Trench T-1	12091	GW03822IT	11/10/92	Uranium-238	2 9	0 1297	0 6632	JA	0 768
Trench T-1	12091	GW00257WC	3/3/93	Uranium-238	2 699	0 2628	0 913	A	0 768
Trench T-1	12091	GW00690WC	4/29/93	Uranium-238	2	0 13	0 74	A	0 768
Trench T-1	12091	GW01498WC	11/10/93	Uranium-238	2 7004	0 1907	0 7207	Y	0 768
Trench T-1	12091	GW00365GA	3/7/94	Uranium-238	1 8	0 095	0 58	V	0 768
Trench T-1	12091	GW00625GA	4/27/94	Uranium-238	2 5919	0 1458	0 6328	V	0 768
Trench T-1	12091	GW01429GA	9/12/94	Uranium-238	2 8	0 26	0 9	Y	0 768
Trench T-1	12091	GW01761GA	11/15/94	Uranium-238	1 9068	0 1922	0 5218	Y	0 768
Trench T-1	12091	GW02638GA	5/31/95	Uranium-238	2 3	0 34	0 74	Y	0 768

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted but was estimated
V = Valid result
Y = Analytical results in validation process

Table 3.1-9 Groundwater Total Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL (pCi/L)
Trench T-1	12091	GW02514IT	2/27/92	Americium-241	1 09	0	0 136	A	

VALIDATION CODES
A = Result accepted with qualifications

TABLE 3.1-10 TRENCH T-1 SUMMARY INFORMATION

CONTAMINANTS		
Media Subsurface Soils		
Greater than $UTL_{99/99}$	Greater than RFCA Standards	Greater than PPRGs
Aluminum Calcium Cadmium		
Americium-241 Cesium-137 Plutonium-239/240		Radium-226 Radium-228

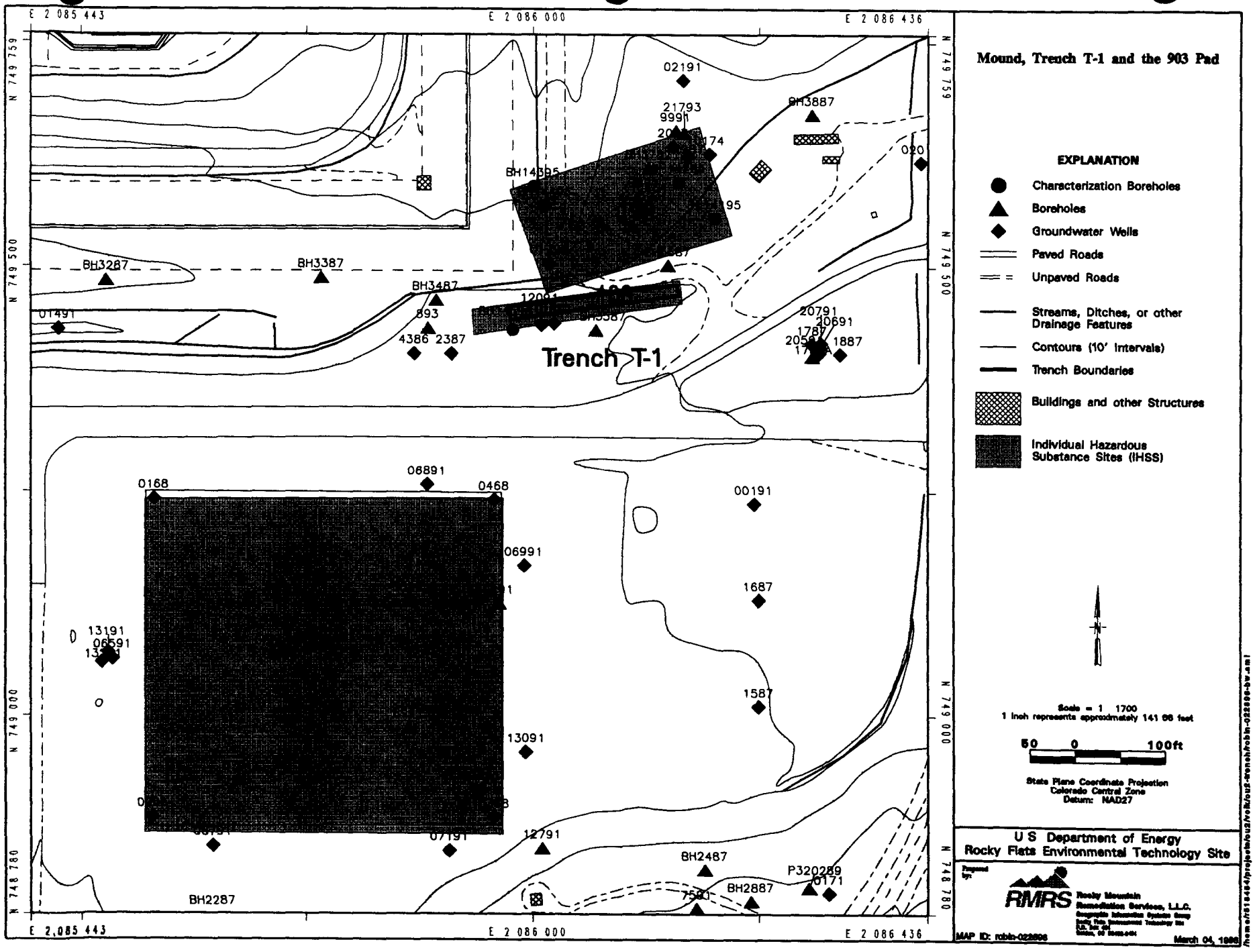
Media Groundwater			
Greater than $UTL_{99/99}$	Greater than RFCA Tier II Standards	Greater than RFCA Tier I Standards	Greater than PPRGs
	Methylene Chloride		
Barium Chromium Lead Manganese Potassium	Antimony Manganese		
Strontium-89/90 Americium-241 Cesium-137 Plutonium-239/240	Gross Alpha Gross Beta Americium-241 Uranium-233/234 uranium-238 Strontium-89/90		

PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
200	10-17	6-10	444-1,260	Yes	No

Note

A RFCA subsurface soil action level for 2-Butanone has not been determined

42


Mound, Trench T-1 and the 903 Pad
EXPLANATION
Characterization Boreholes
Boreholes
Groundwater Wells
Paved Roads
Unpaved Roads
Streams, Ditches, or other Drainage Features
Contours (10' Intervals)
Trench Boundaries
Buildings and other Structures
Individual Hazardous Substance Sites (IHSS)
Scale = 1 1700
1 inch represents approximately 141 66 feet
50 0 100ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: robin-022896
March 04, 1996
Trench T-1
E 2 085 443
E 2 086 000
E 2 086 436
N 749 759
N 749 500
N 749 000
N 748 780
02191
21793
9991
BH3887
020
BH14395
95
BH3287
BH3387
BH3487
01491
893
4386
2387
20791
20691
1887
0168
06891
0468
00191
06991
1687
13191
06591
1587
13091
12791
BH2487
P320289
0171
BH2887
BH2287

45

Exhibit 3.1.A
Trench T-1 Historical Release Report Information

PAC REFERENCE NUMBER 900 108

IHSS Reference Number 108 Operable Unit 2

Unit Name Trench T 1

Approximate Location N749 500 E2 036 000

Date(s) of Operation or Occurrence

November 1954 December 1962

Description of Operation or Occurrence

Approximately 125 drums of depleted uranium chips and lathe coolant are buried in a trench approximately 200 feet long 15 feet wide and 5 feet deep[1] The trench is located west of Gate 9 in the eastern side of the 400 acre manufacturing area of the plant The drums are covered with 2 feet of soil and the corners of the trench are marked

All of the drums buried in Trench T were from Building 444 The length of the trench was extended in December 1955 Memoranda authorizing the use of the trench and the nature of its contents are detailed in a report entitled A Summary of On Site Radioactive Waste Disposal E A Putzier April 22, 1970

At the time [illegible] was [illegible] permitted off site uranium transportation in the form of uranium oxide [illegible] ted with numerous inert materials it would not [illegible] oxidi[illegible] was a suitable alternative at the time[3]

A report from November 1954 [illegible] for placing 30 gallon drums of combustible material in 55 gallon [illegible] placed in a trench described as being located in the [illegible] area as [illegible] was the burial method for all drums in the trench

[illegible] routine weed cutting The drum was found to [illegible] mixture of [illegible] a new drum and transferred to await disposal The drum was to have been excavated [illegible] to size reduction.[5] Another account of a 1982 event may describe the same or [illegible] involving [illegible] drums uncovered by weed cutting activities One drum reportedly contained [illegible] and 1.2 microcuries per gram (Ci/g) uranium[6] (see Comments)

[illegible]

[illegible] chips are contained in the 125 buried drums

An inventory [illegible] records 53 drums [illegible] the trench from November 17 1954 to June 1 1956 Most of the records indicate the contents to be [illegible] turnings and still bottoms (residue from a distillation process) although 10 drums contained [illegible] waste[7] The drums of concreted cyanide were placed in the same trench as highly combustible waste from Building 444[8] Copper alloy was also contained in some drums

Inventory lists indicating the number of drums of oil disposed of by on site burning or burial and the origin of the drums are available from April 195[illegible] through April 1966 with the exception of a gap from August 1957 through August 1958 Eighty five of the 125 drums are documented in this record[2]

47

Best Available Copy

Two drums of special wastes from Building 444 which were placed in the trench in 1955 were removed and returned to Building 444 in 1956 at the request of the Accountability Group[9]

In 1958 authorization was granted for the additional disposal in the trench of over 15 000 pounds of depleted uranium chips from Building 444[10] In 1962 authorization was given for the disposal of approximately 7 500 pounds of depleted uranium chips It is unclear whether this entire amount was buried in the trench or in the nearby mound (PAC 900 113)

Responses to Operation or Occurrence

A radiometric survey was performed in the area in October 1977 and identified four small hot spots ranging from 500 to 18 000 cpm of activity The spots were marked and mapped[11] A radiometric survey was performed in June 1980 identifying numerous hot spots suspected to be depleted uranium Two boxes of uranium contaminated soil were removed from the southeast corner of the PSZ in the spring of 1982 during construction of the PSZ[13] Monitoring wells were installed in October 1937[14] In June 1980 a meeting was held with Waste Management and the Environmental Analysis Groups to develop a comprehensive plan for exploratory excavation of this trench[15] Trench T 1 has not yet been remediated[6]

Fate of Constituents Released to Environment

This IHSS is being studied in accordance with the IAG schedule for OU2 The IAG activities will include site investigations site characterizations and possible site remediation. The Final Phase II RFI/RI Report is to be completed by August 9 1993

Comments

Conflicting information was found during this study regarding the potential contaminants in the trench [illegible] references that mention the origin of the waste confirm that it was from Building 444 exclusively [illegible] from interviews with [illegible] employees that Building 444 processed uranium and not plutonium [illegible] references state [illegible] results from the drum uncovered in 1982 indicated the presence of pl[illegible]

There were many references (Environmental Analysis and Control Weekly Highlights from 1977 to 1982) which indicate the removal of contaminated soil from the area north of Central Avenue and west of the east [illegible] is uncertain whether the soil became contaminated from the mound area (PAC 900 113) the oil burn [illegible] (PAC 900 153) or the [illegible] which were all in close proximity

References

1502733
1500793
[3] 1500310
[4] 1600670
[5] 1700466
[6] 1601057
[7] 1600276
[8] 1601048
[9] 1600387
[10] 1600393
1502774
[12] 1502770
[13] 1501182
[14] 1500777
[15] 1502770
[16] 1500765

Other References [illegible]

1500421
1501098

48

Exhibit 3.1.B
Trench T-1 EM-31 Surveys

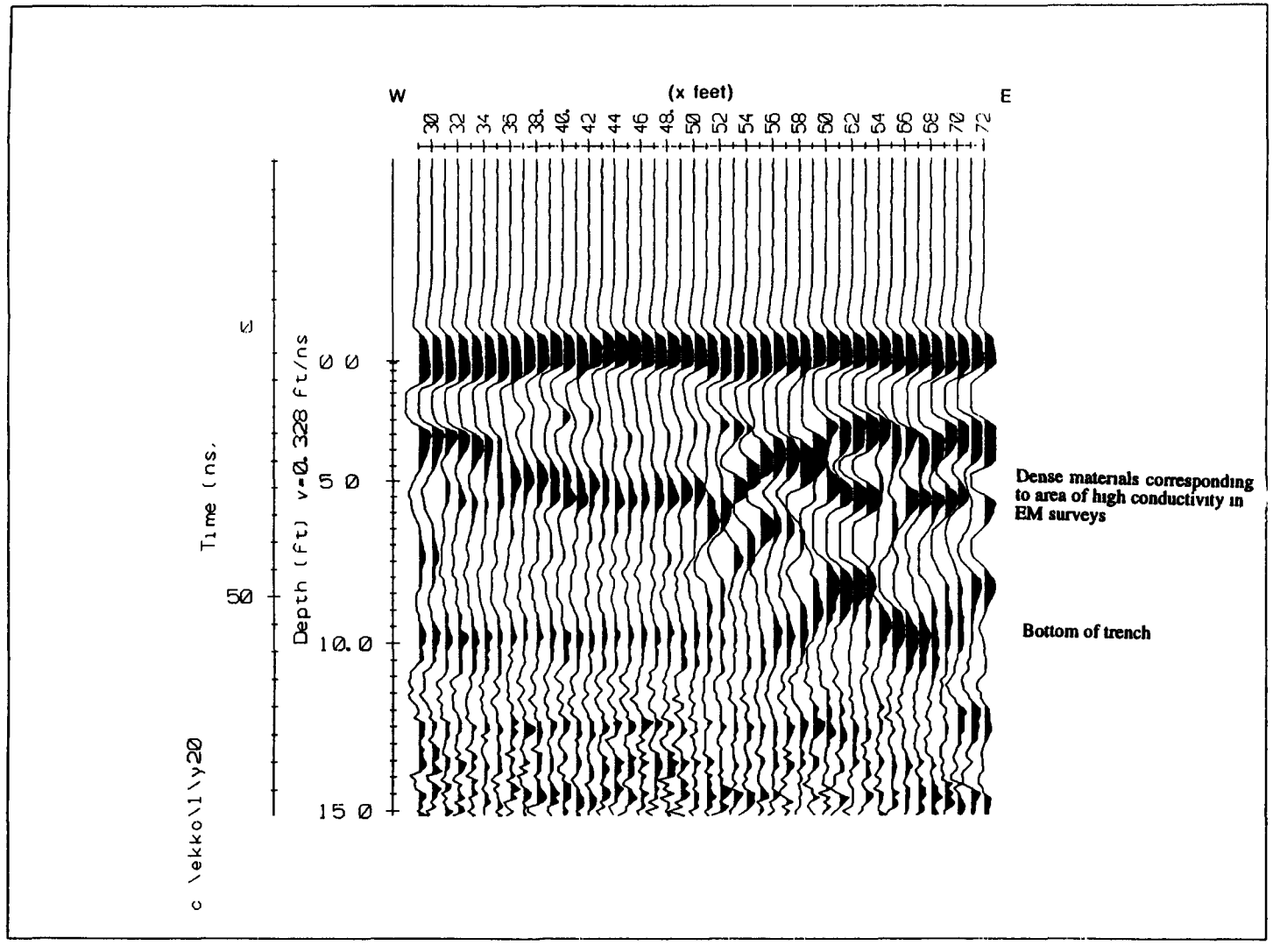
Exhibit 3.1.C
Trench T-1 EM-61 Surveys

55

Exhibit 3.1.D
Trench T-1 Ground Penetrating Radar Surveys

56

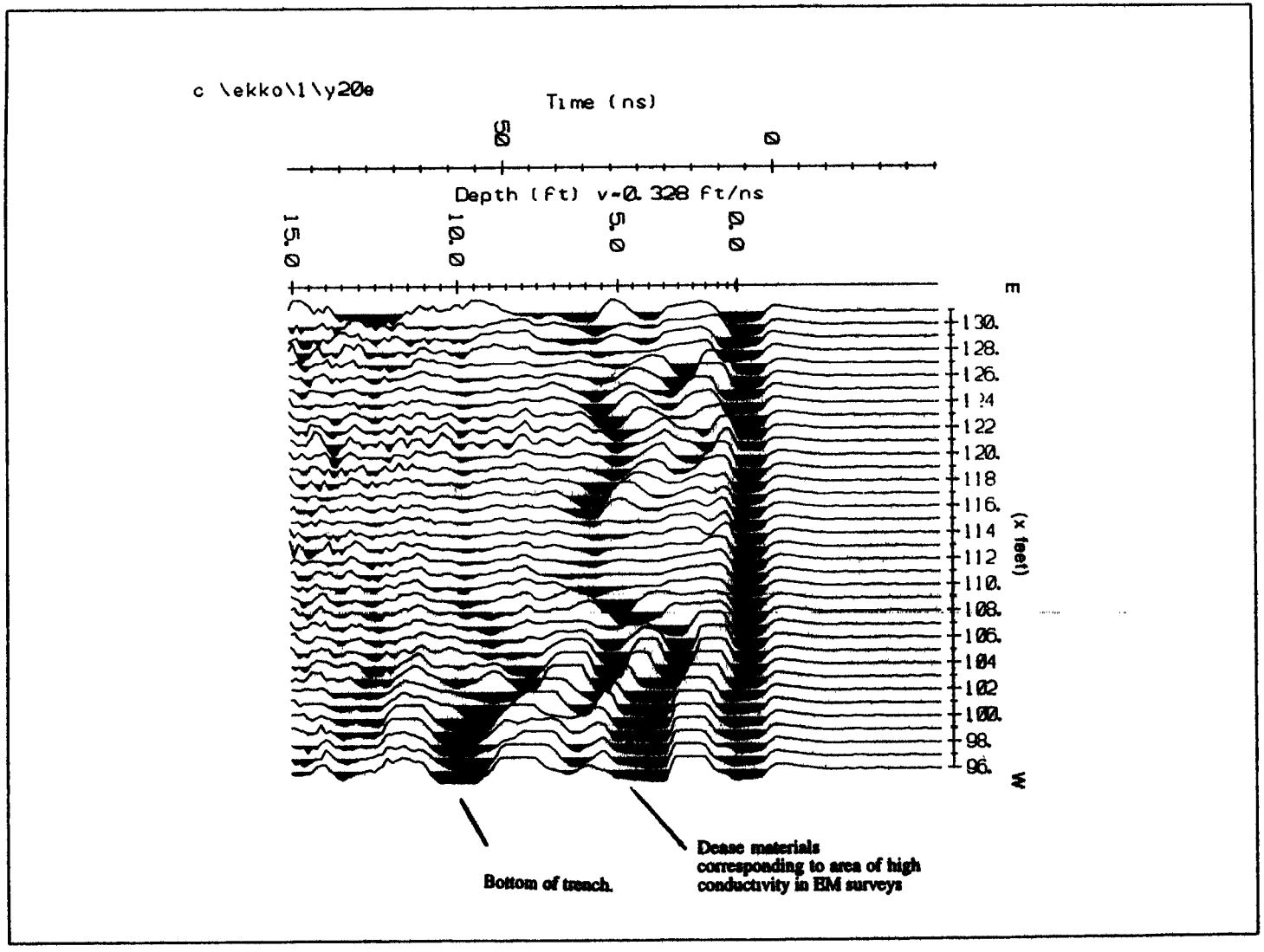
RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
WEST TO EAST ORIENTATION AT Y = 20 FEET (WESTERN END)
JUNE 1995



57

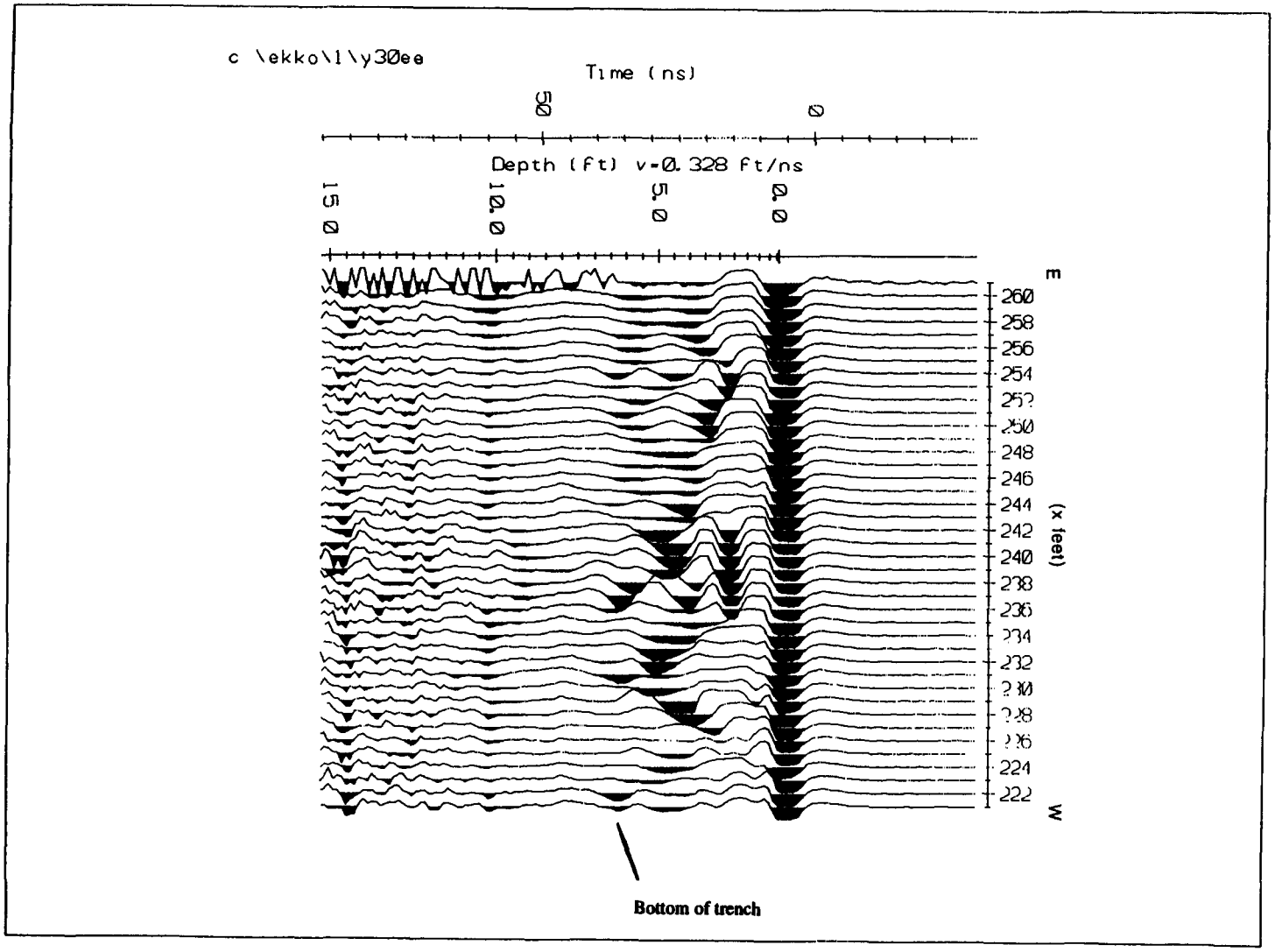
Best Available Copy

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
EAST TO WEST ORIENTATION AT Y = 20 FEET (MIDDLE)
JUNE 1995



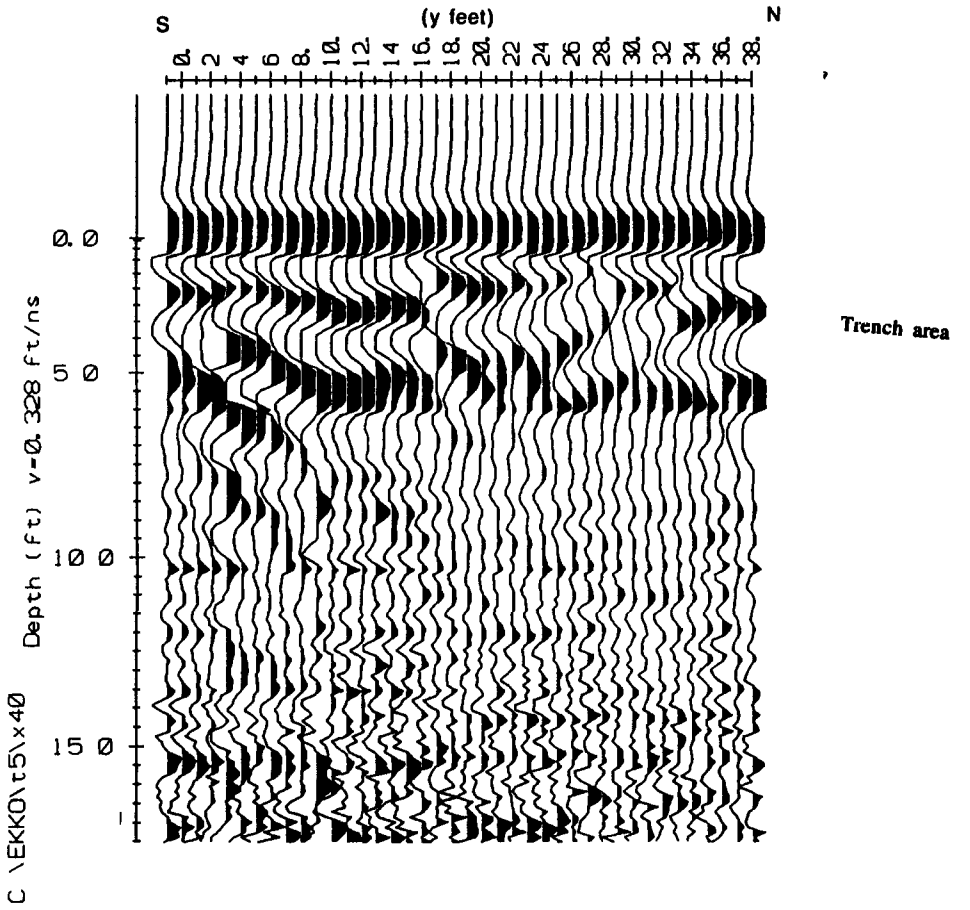
58

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
EAST TO WEST ORIENTATION AT Y = 30 FEET (EASTERN END)
JUNE 1995



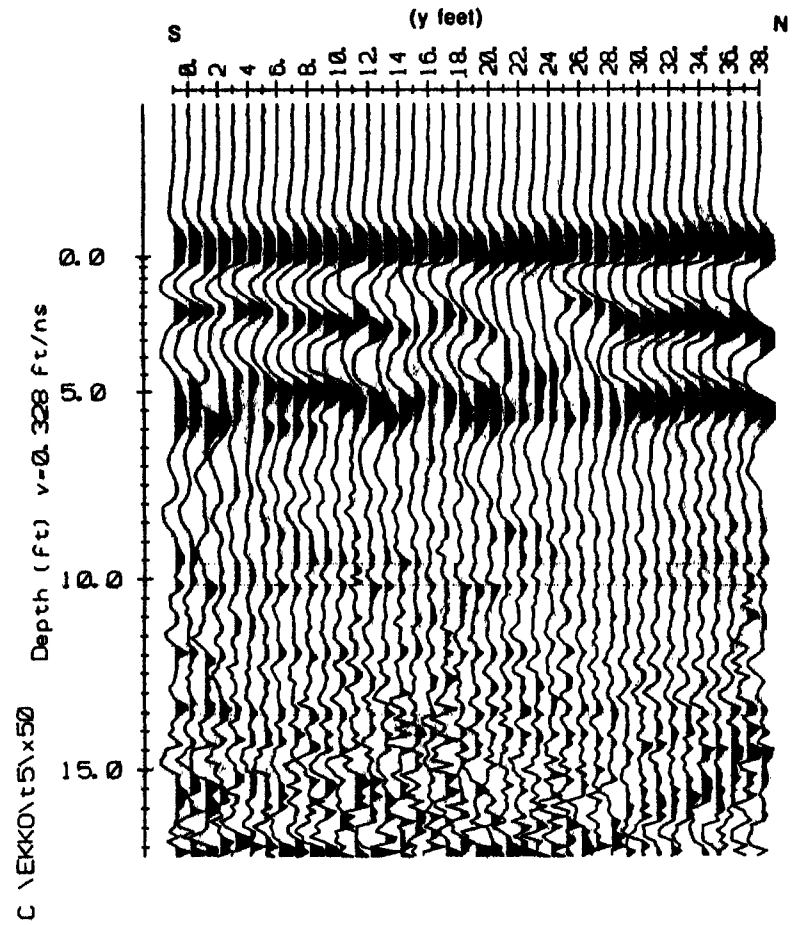
59

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=40 FEET
JUNE 1995



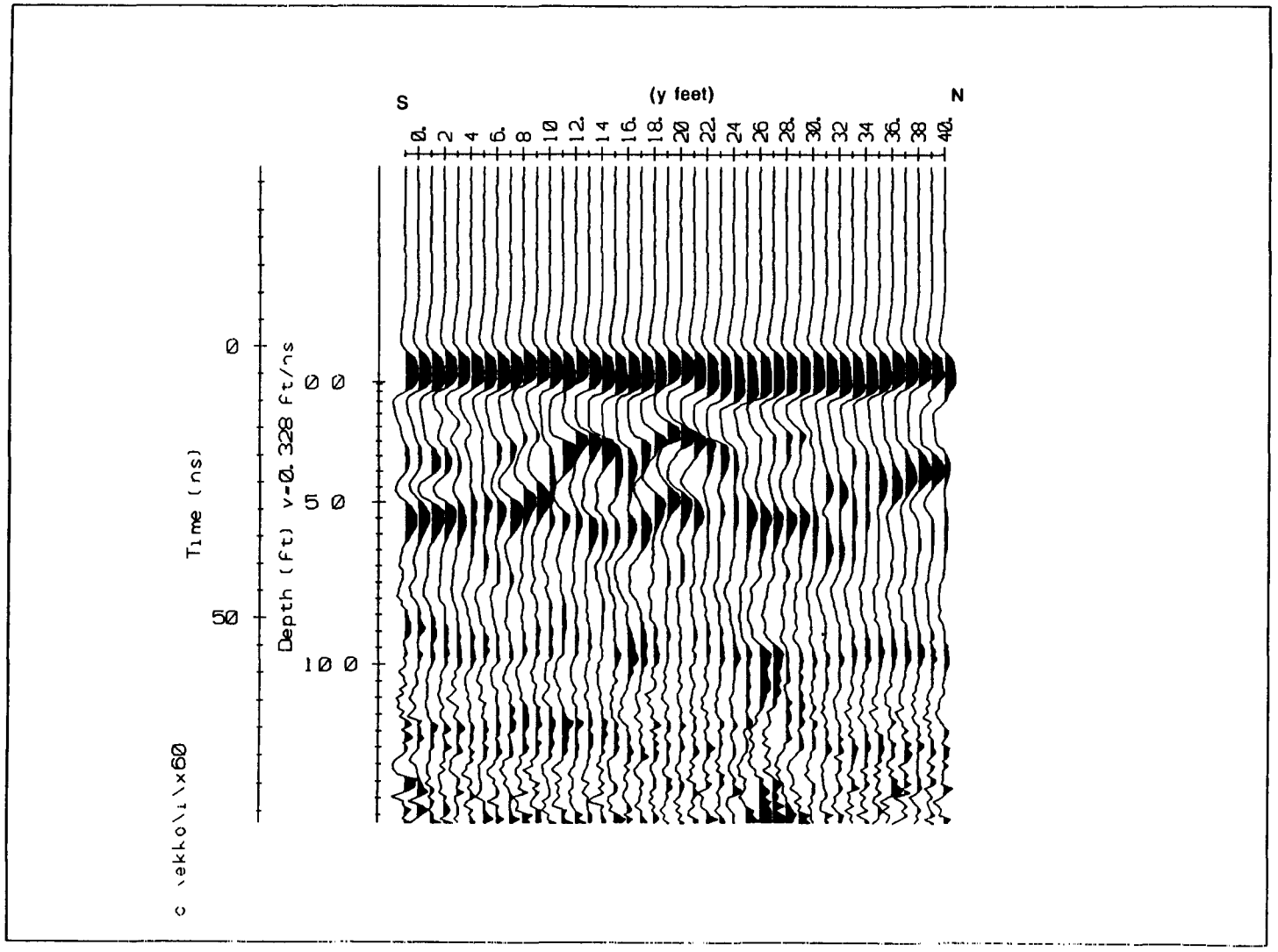
60

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=50 FEET
JUNE 1995

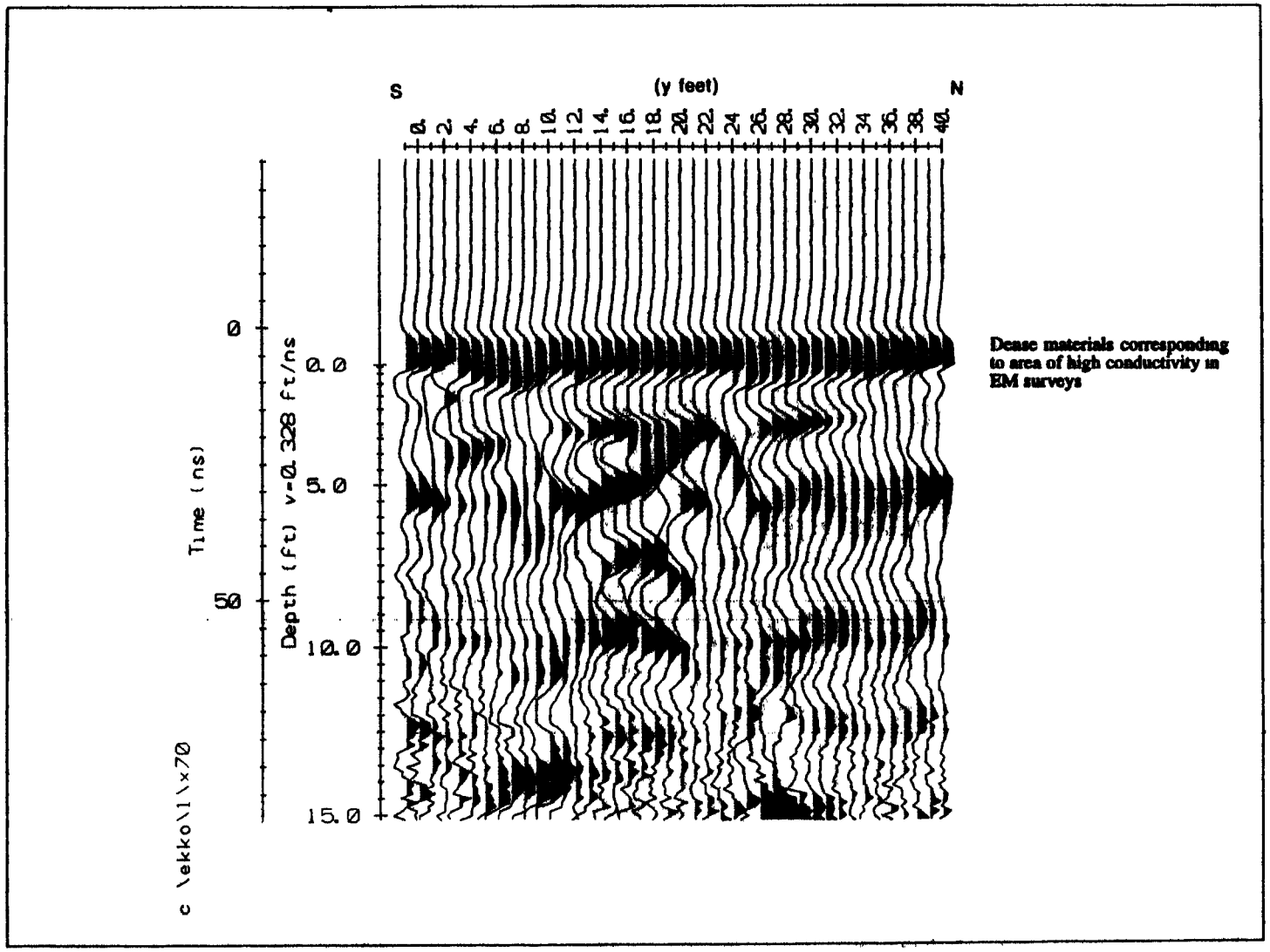


61

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=60 FEET
JUNE 1995

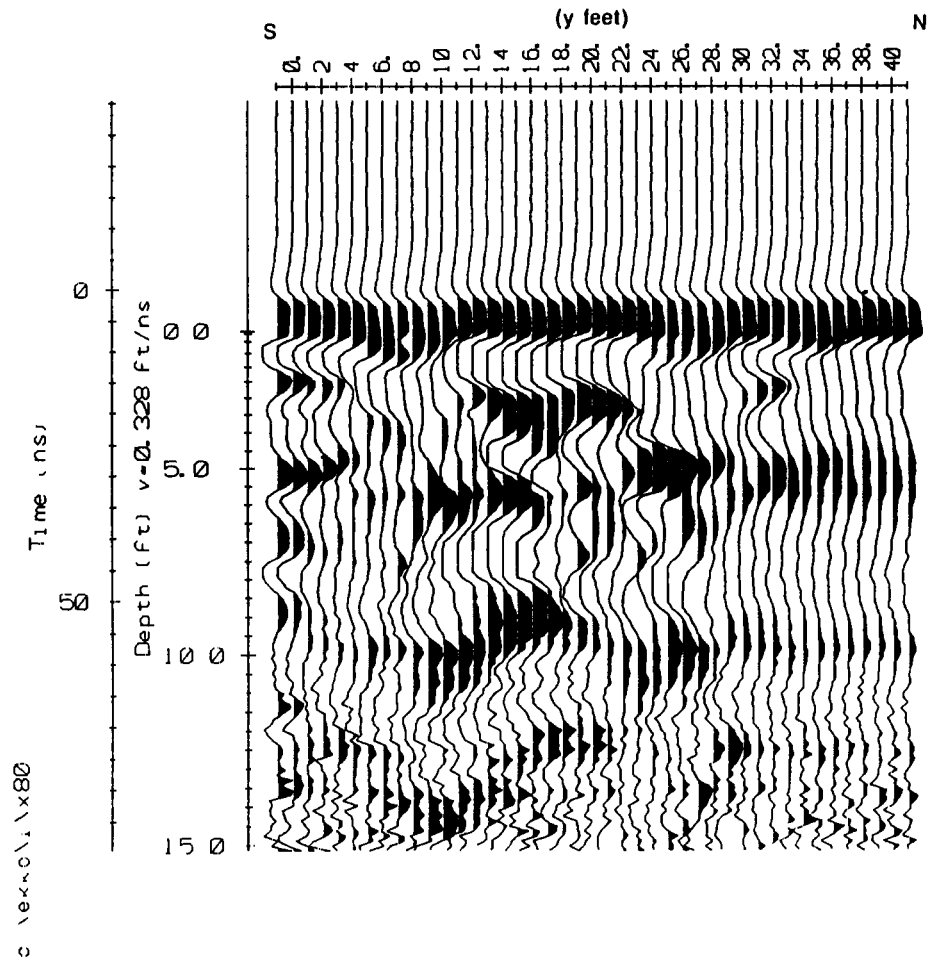


RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-1
SOUTH TO NORTH ORIENTATION AT X=70 FEET
JUNE 1995



63

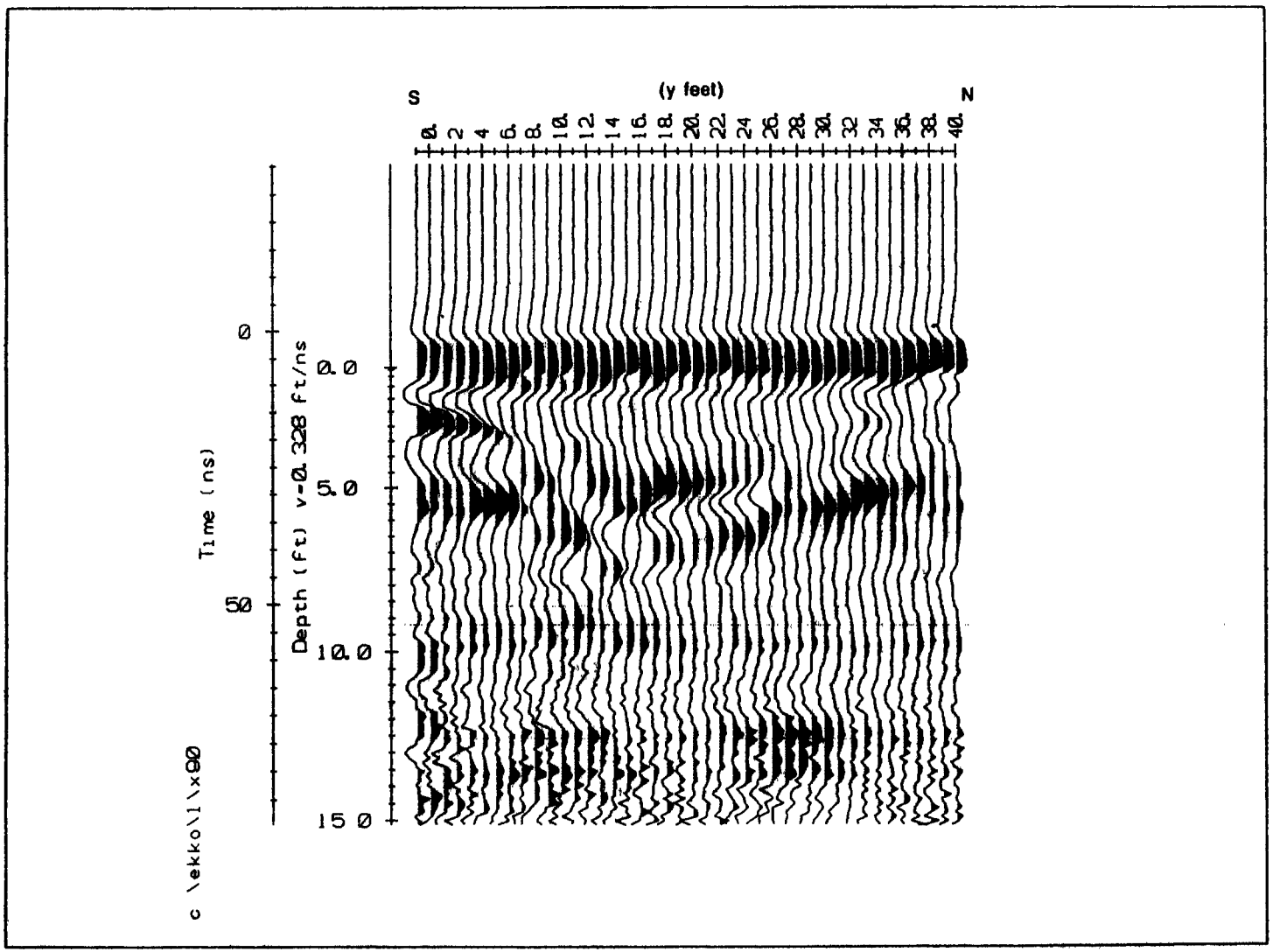
RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=80 FEET
JUNE 1995



Dense materials corresponding to area of high conductivity in EM surveys

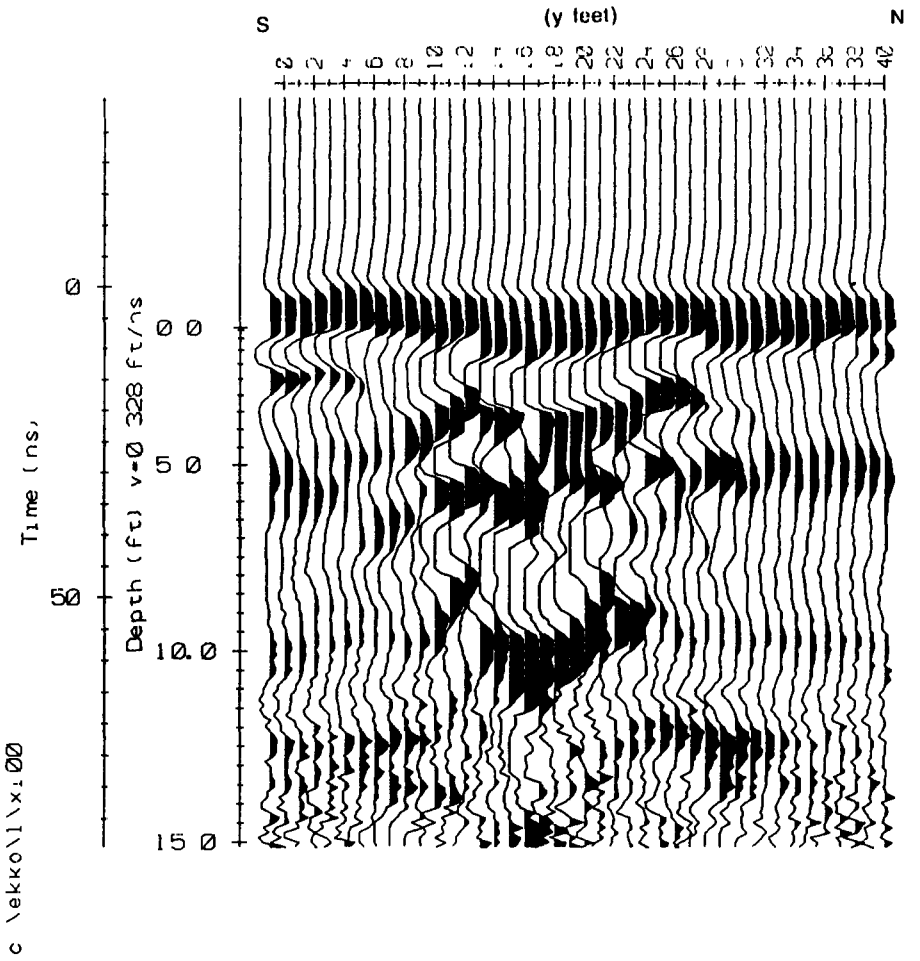
64

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-1
SOUTH TO NORTH ORIENTATION AT X=90 FEET
JUNE 1995



65

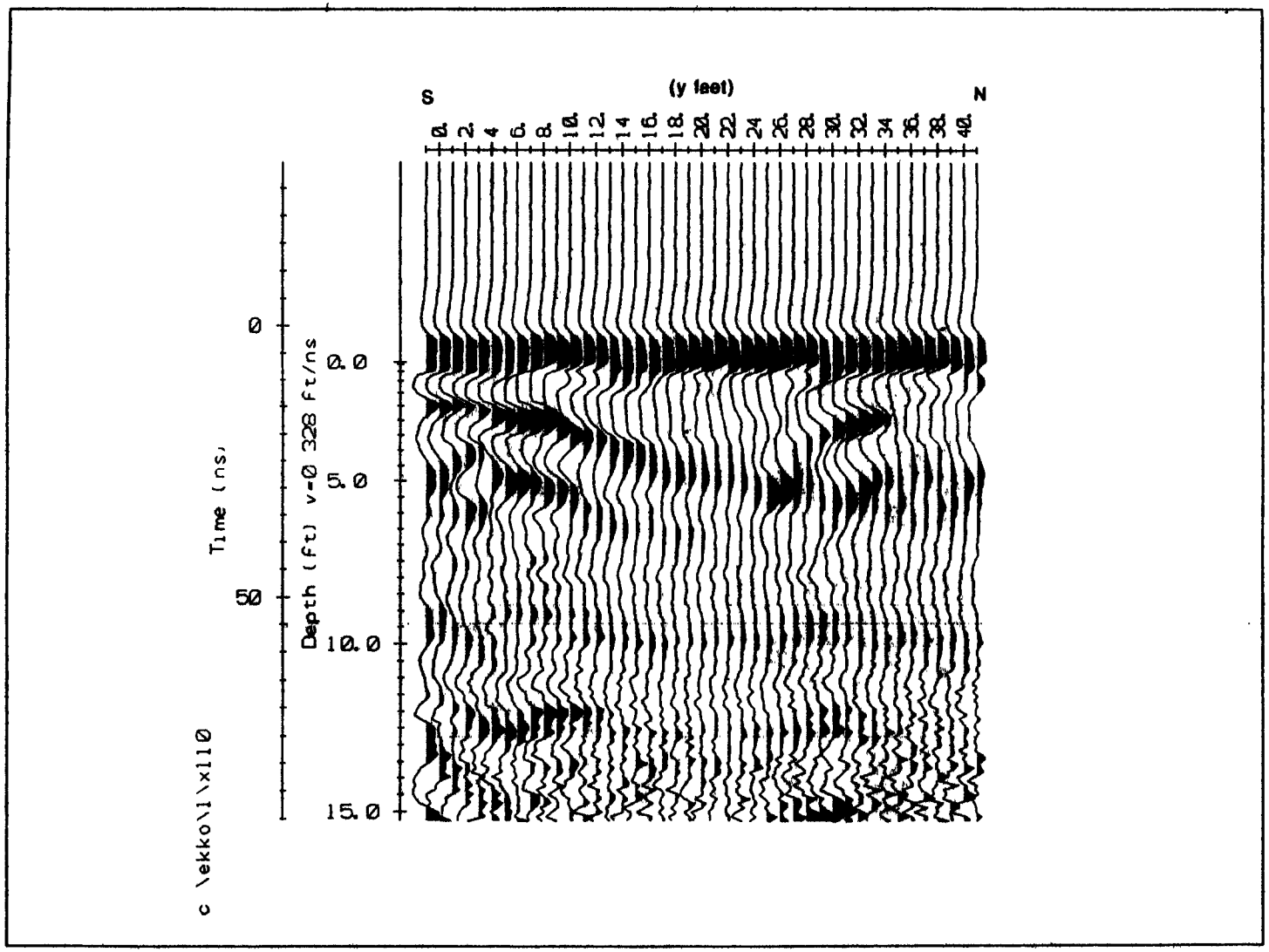
RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=100 FEET
JUNE 1995



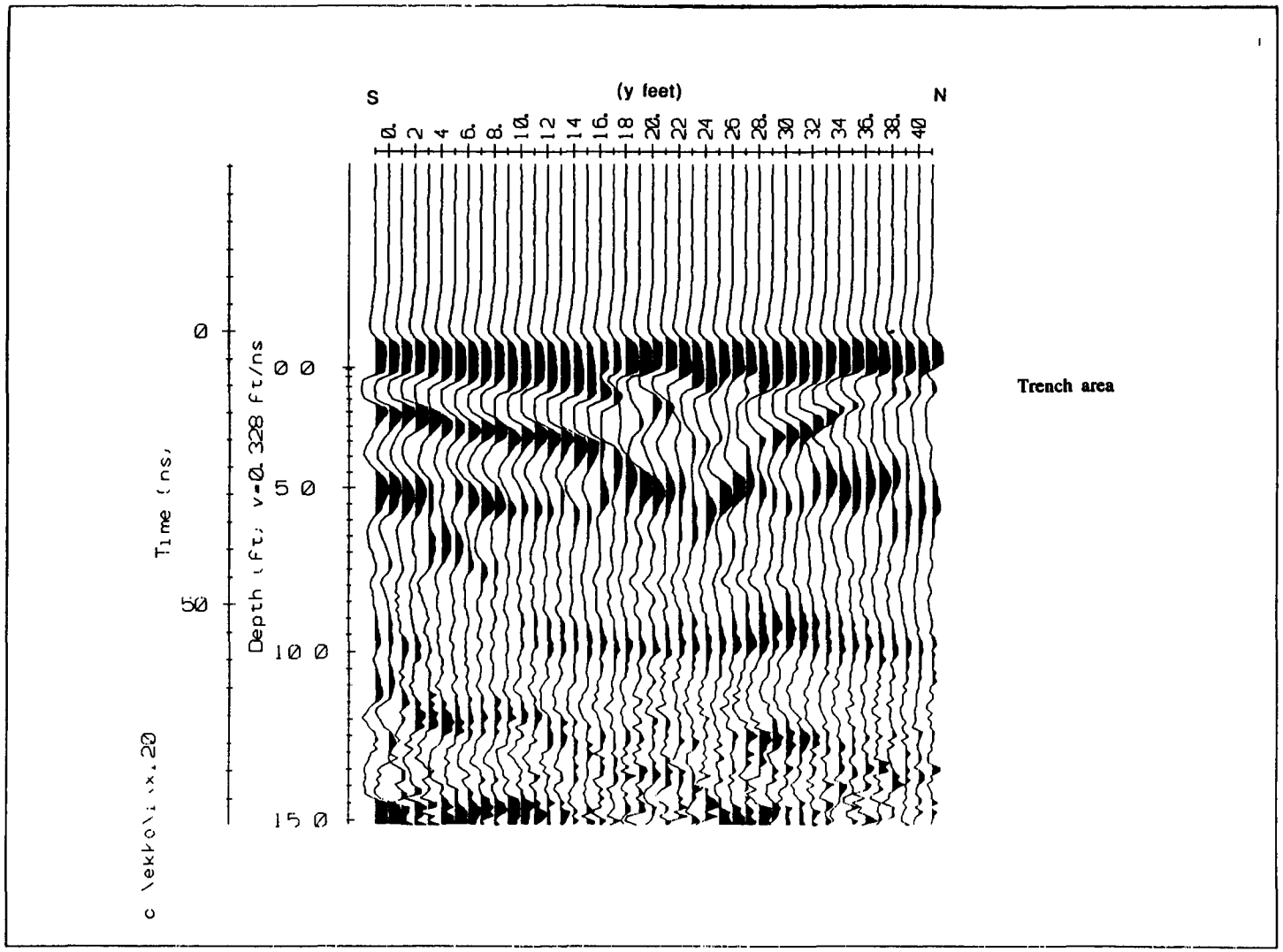
Dense materials corresponding to area of high conductivity in EM surveys

66

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-1
SOUTH TO NORTH ORIENTATION AT X=110 FEET
JUNE 1995

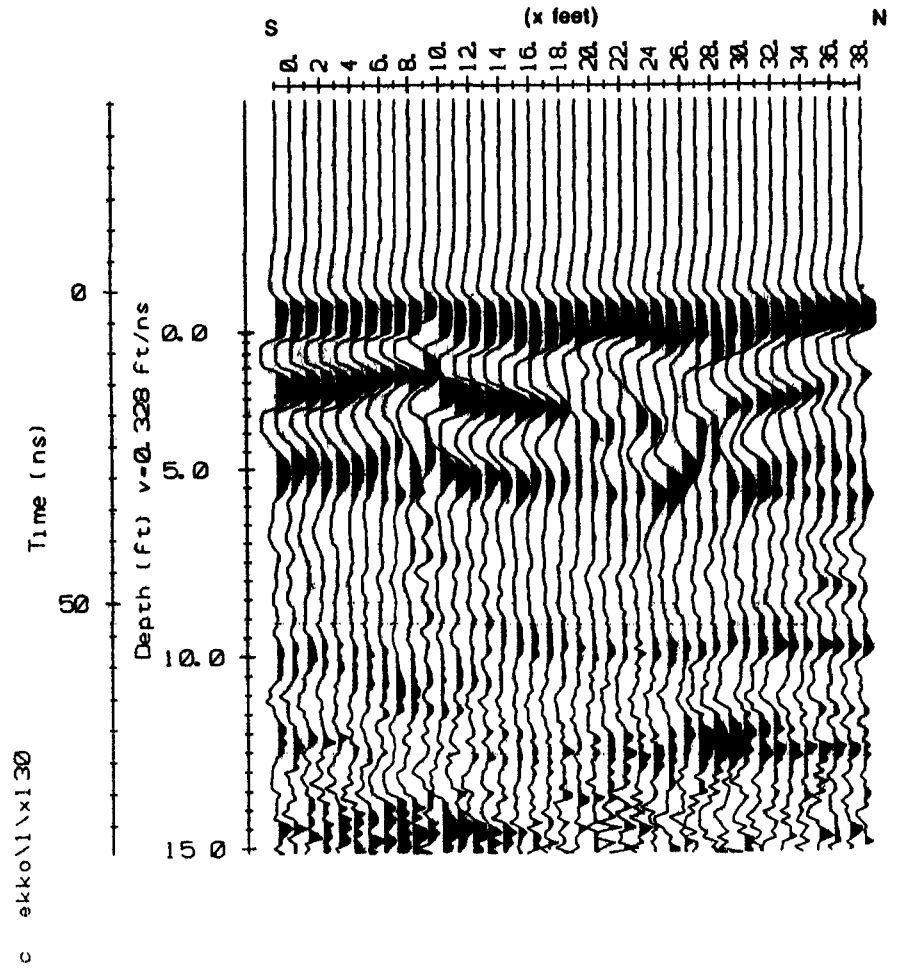


RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=120 FEET
JUNE 1995



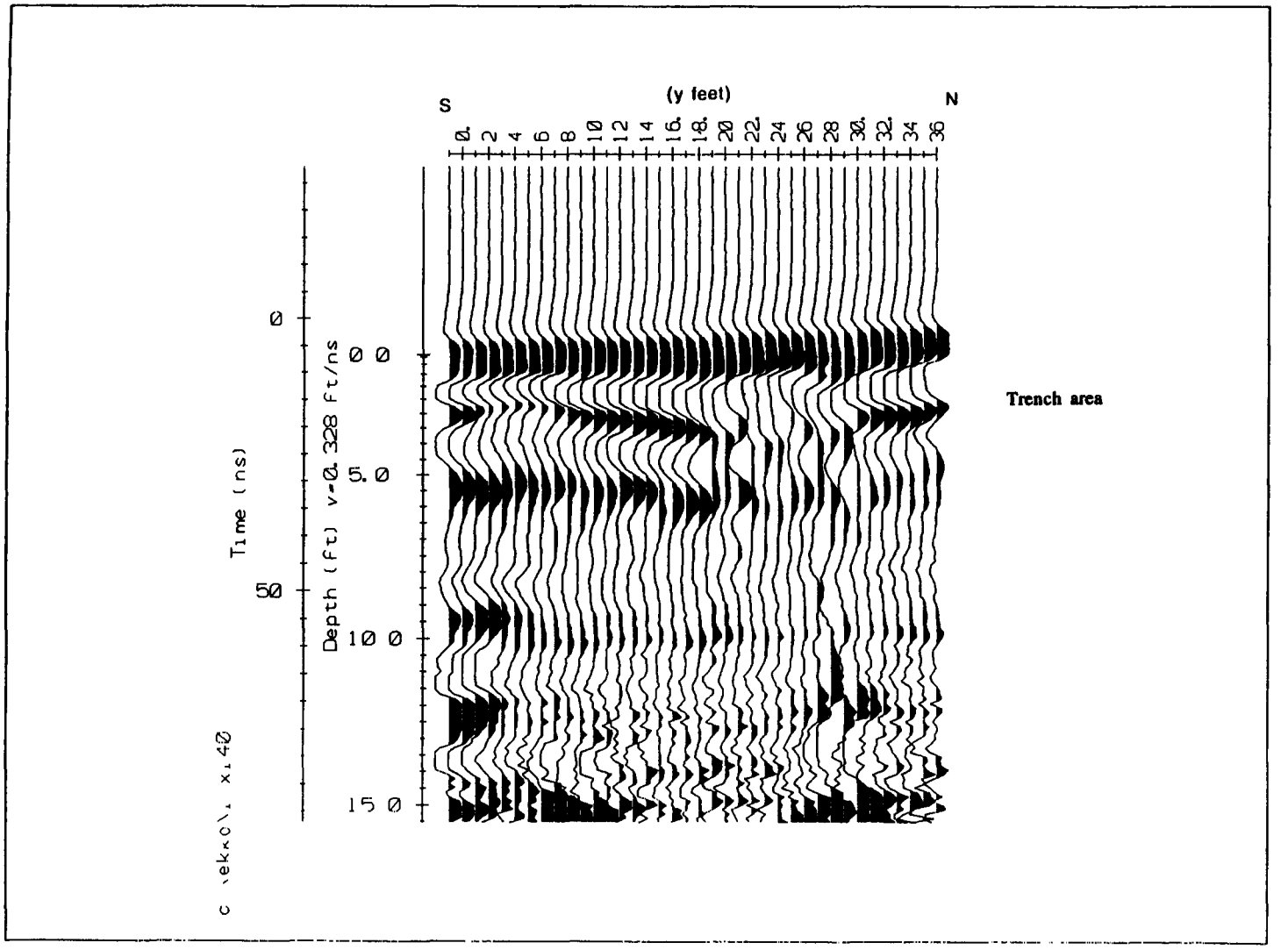
68

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-1
SOUTH TO NORTH ORIENTATION AT X=130 FEET
JUNE 1995

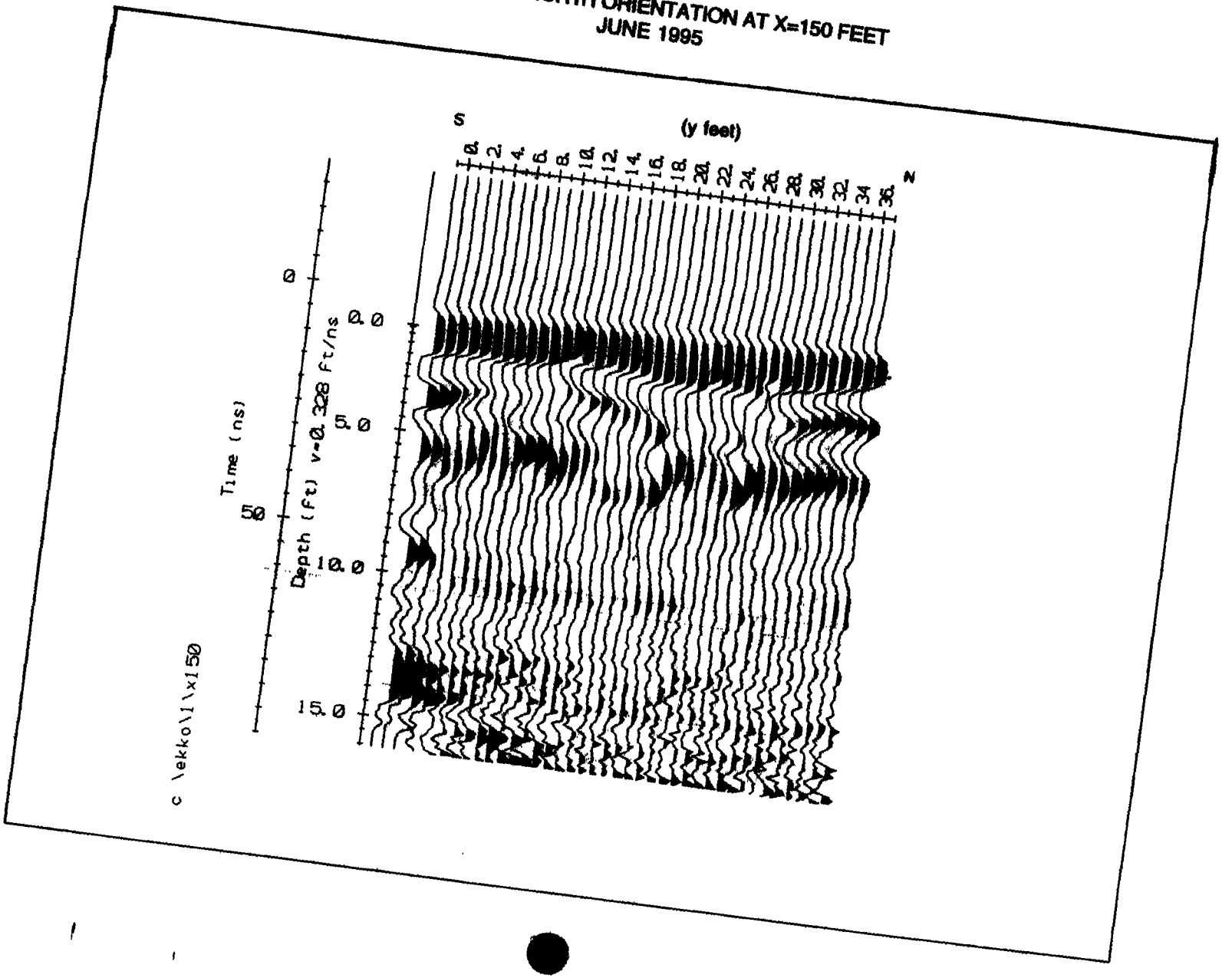


69

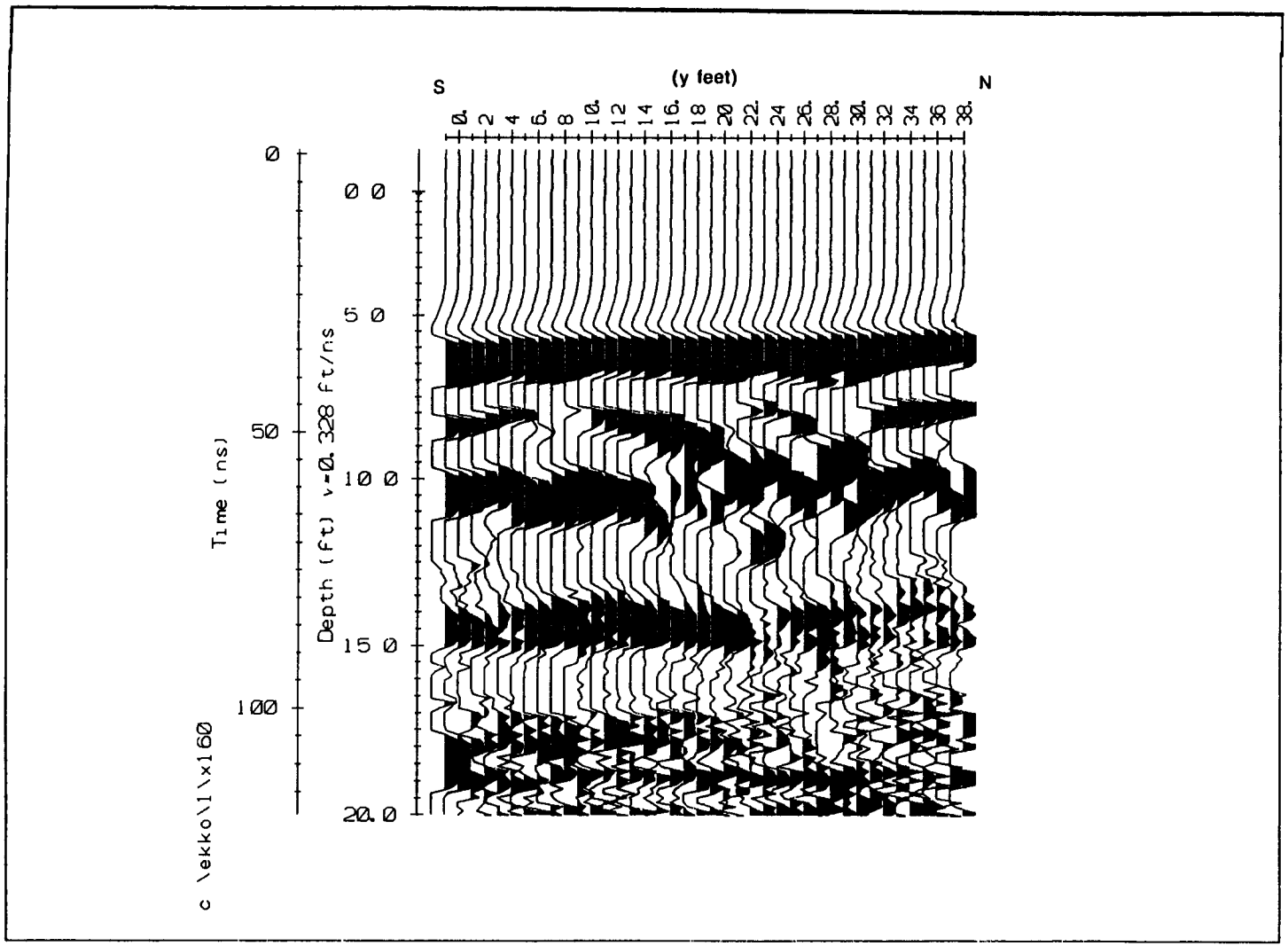
RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=140 FEET
JUNE 1995



RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-1
SOUTH TO NORTH ORIENTATION AT X=150 FEET
JUNE 1995

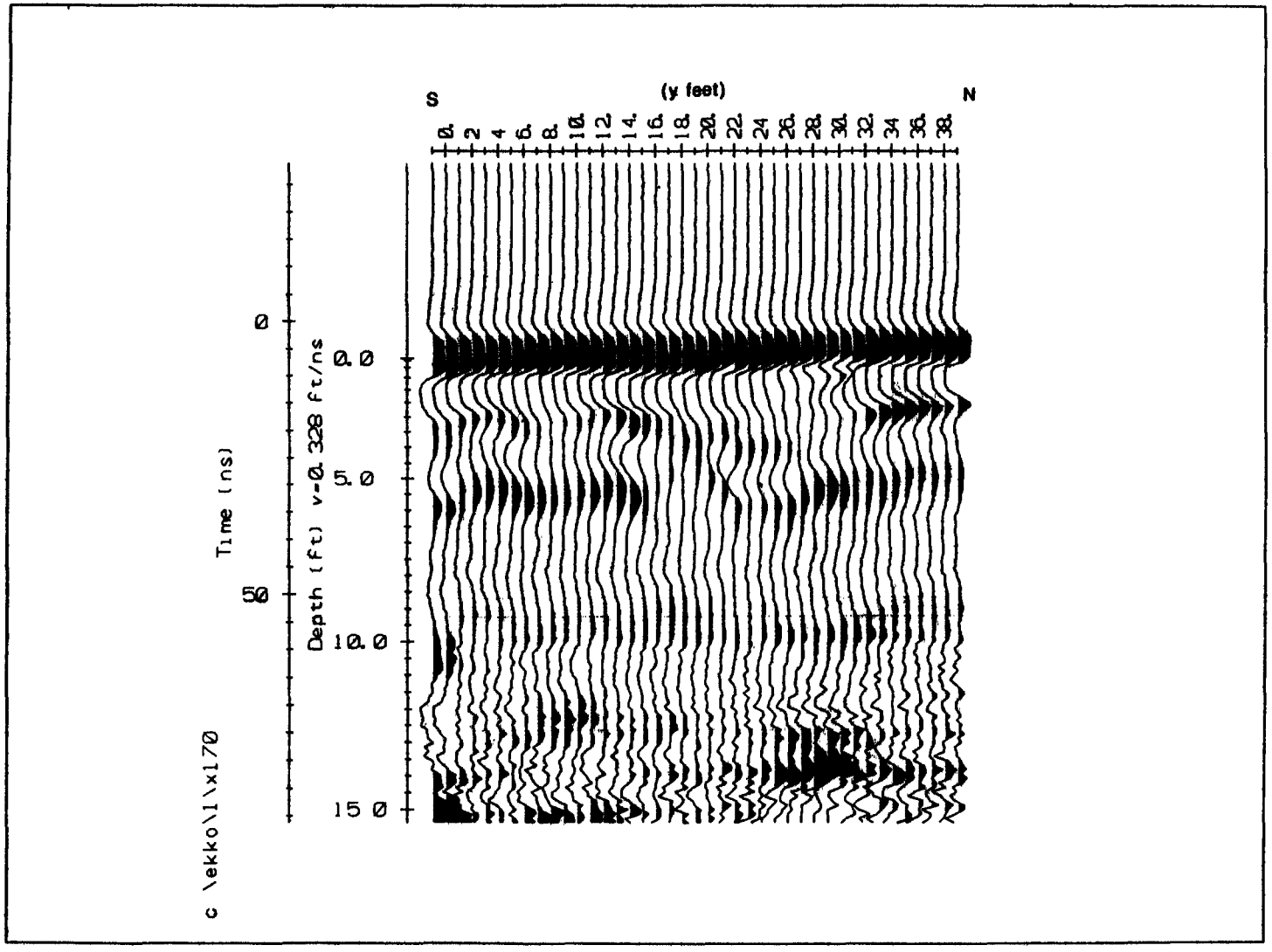


RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=160 FEET
JUNE 1995

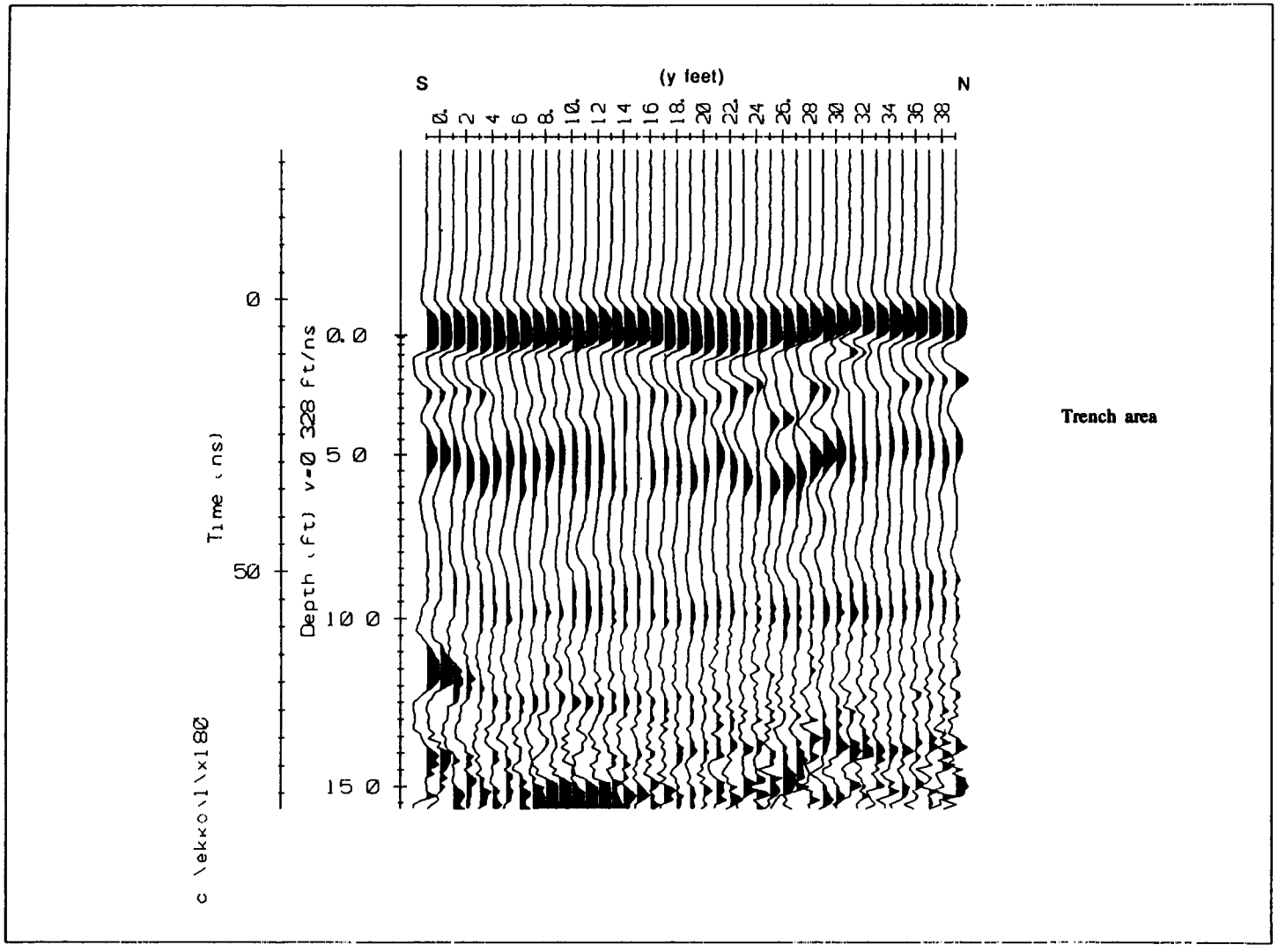


72

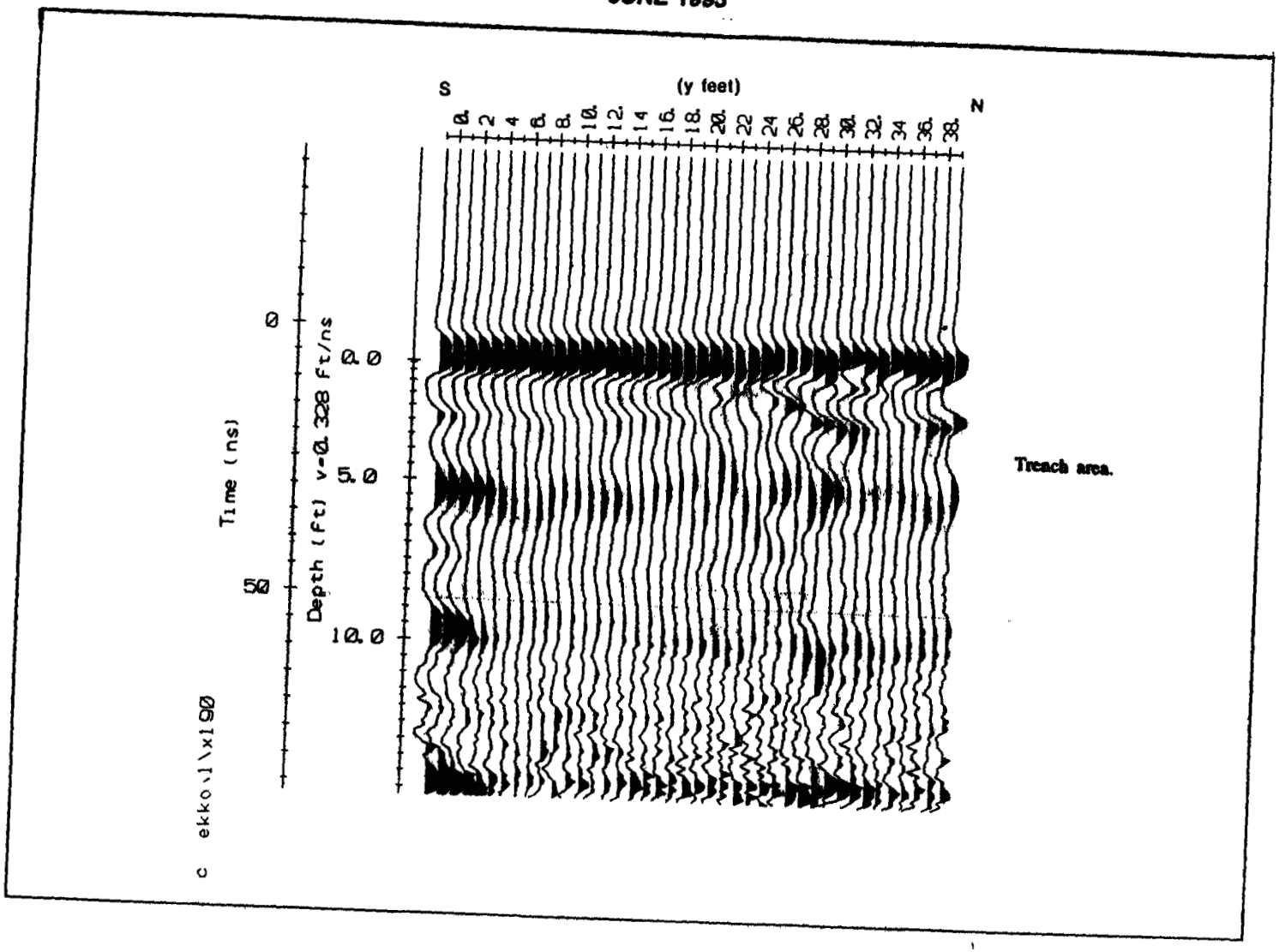
RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-1
SOUTH TO NORTH ORIENTATION AT X=170 FEET
JUNE 1995



RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=180 FEET
JUNE 1995

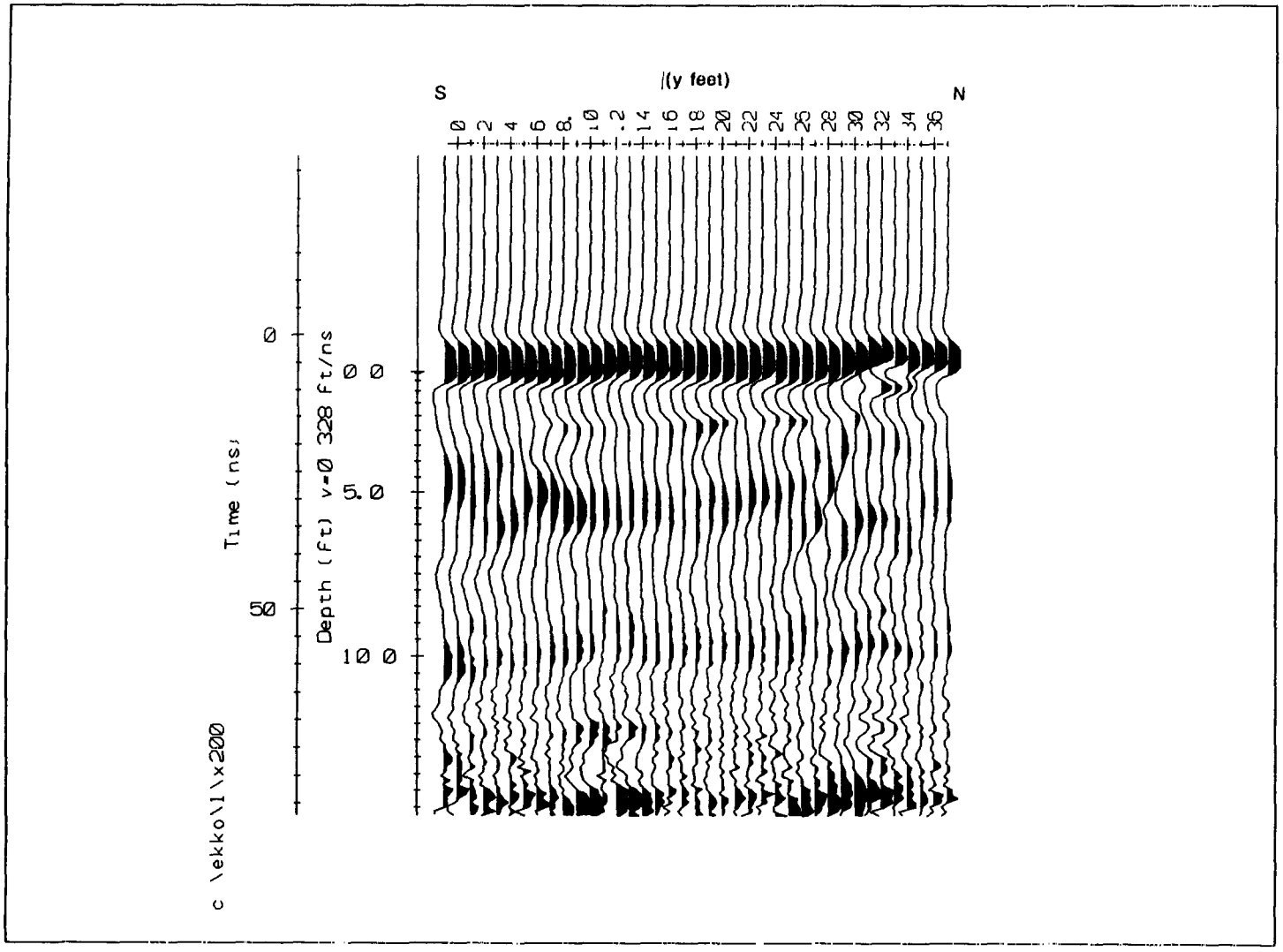


RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-1
SOUTH TO NORTH ORIENTATION AT X=190 FEET
JUNE 1995

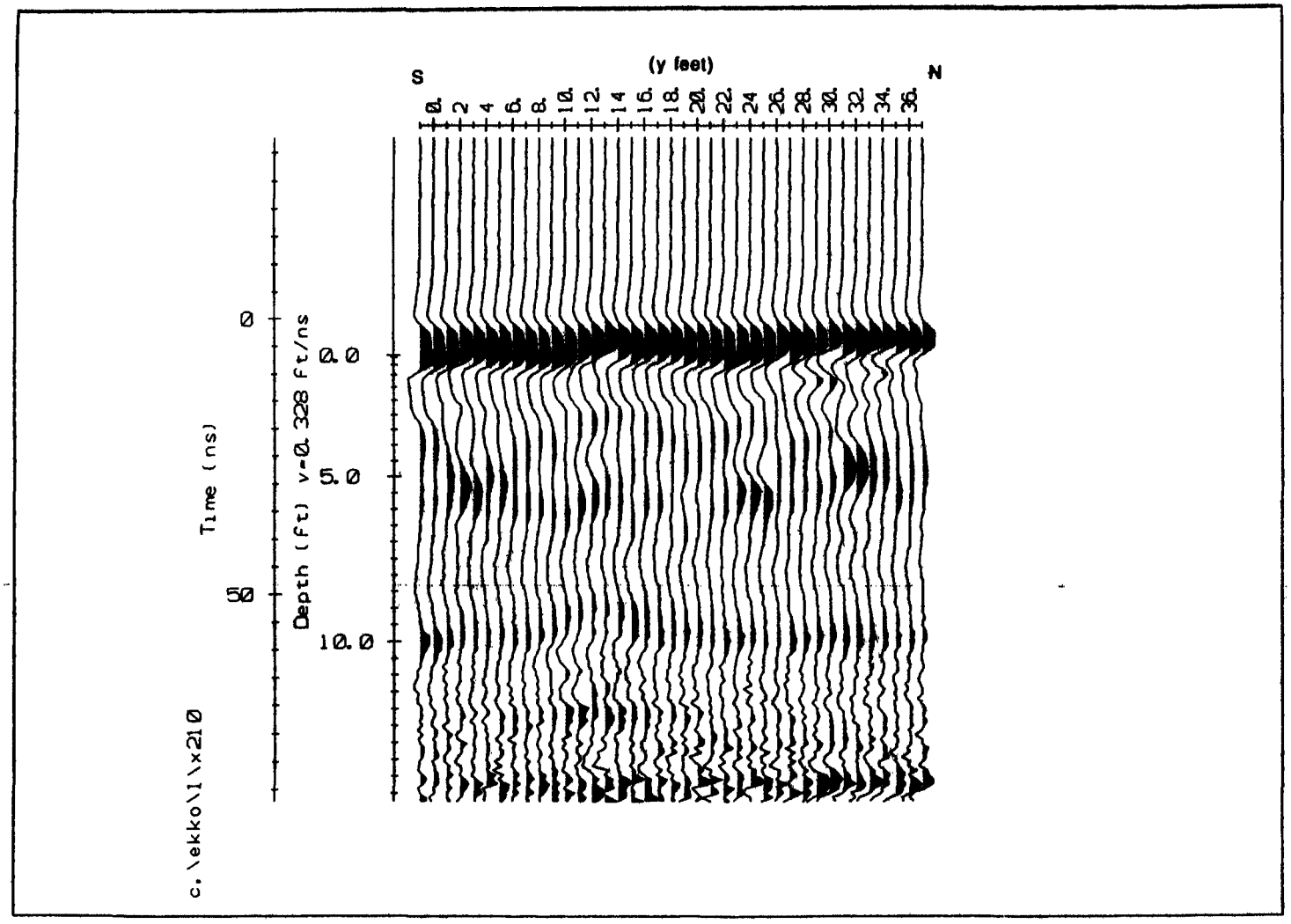


75

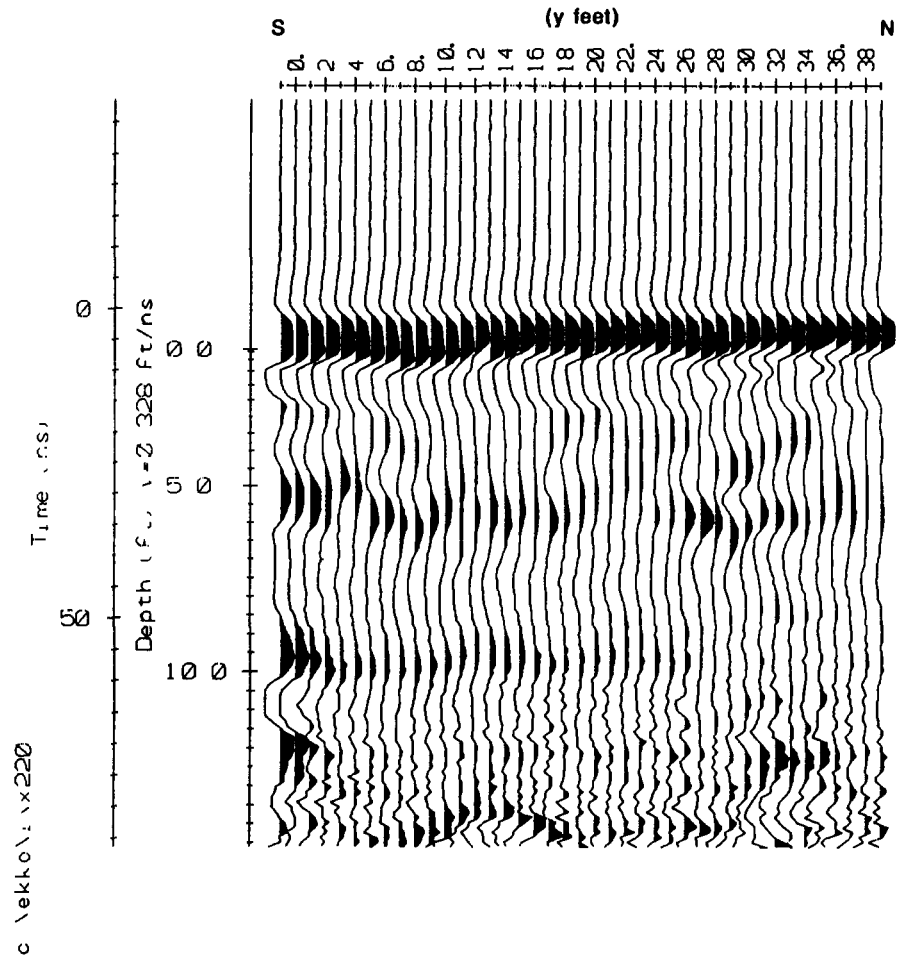
RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=200 FEET
JUNE 1995



RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-1
SOUTH TO NORTH ORIENTATION AT X=210 FEET
JUNE 1995

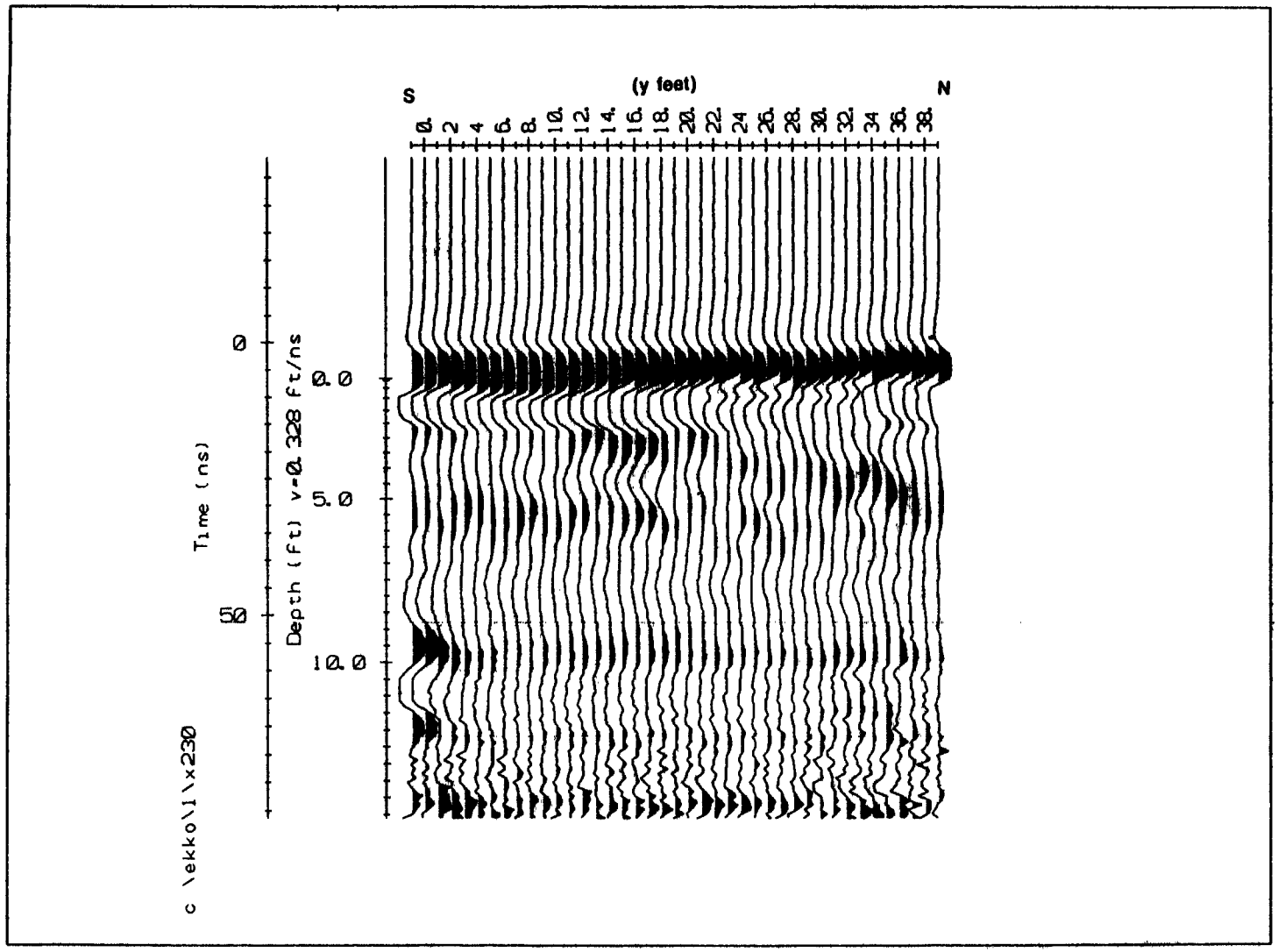


RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=220 FEET
JUNE 1995

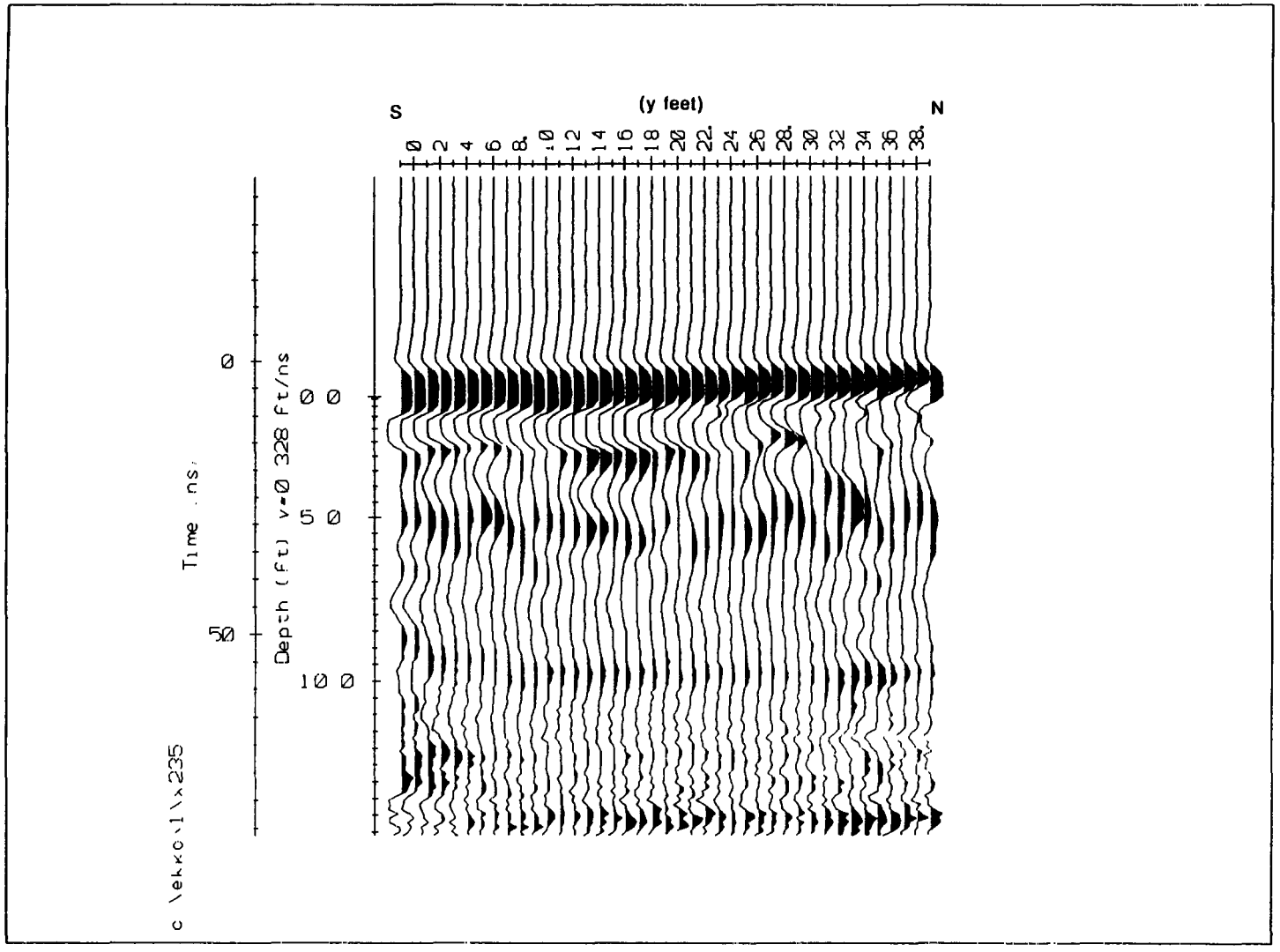


78

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-1
SOUTH TO NORTH ORIENTATION AT X=230 FEET
JUNE 1995

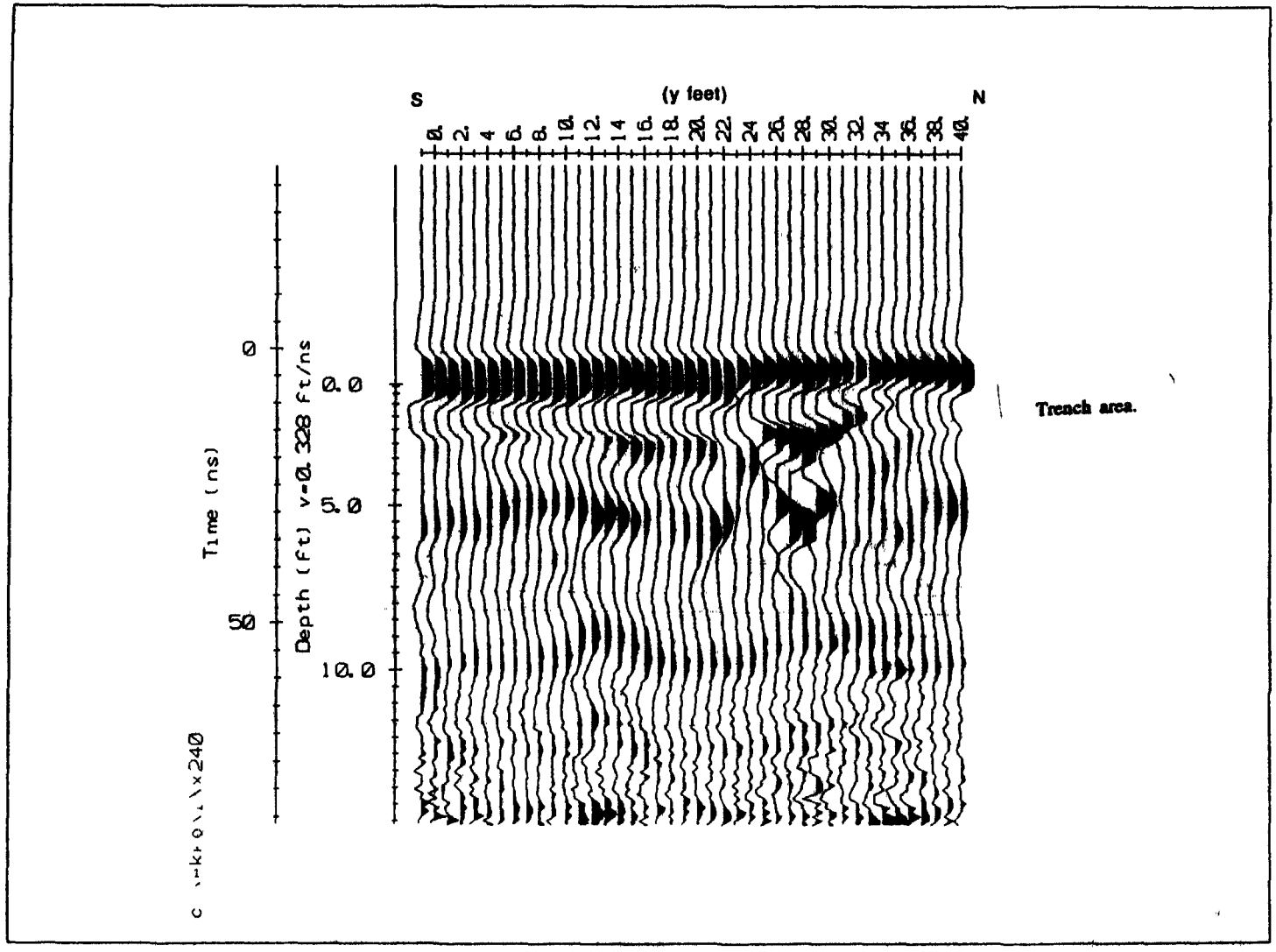


RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=235 FEET
JUNE 1995



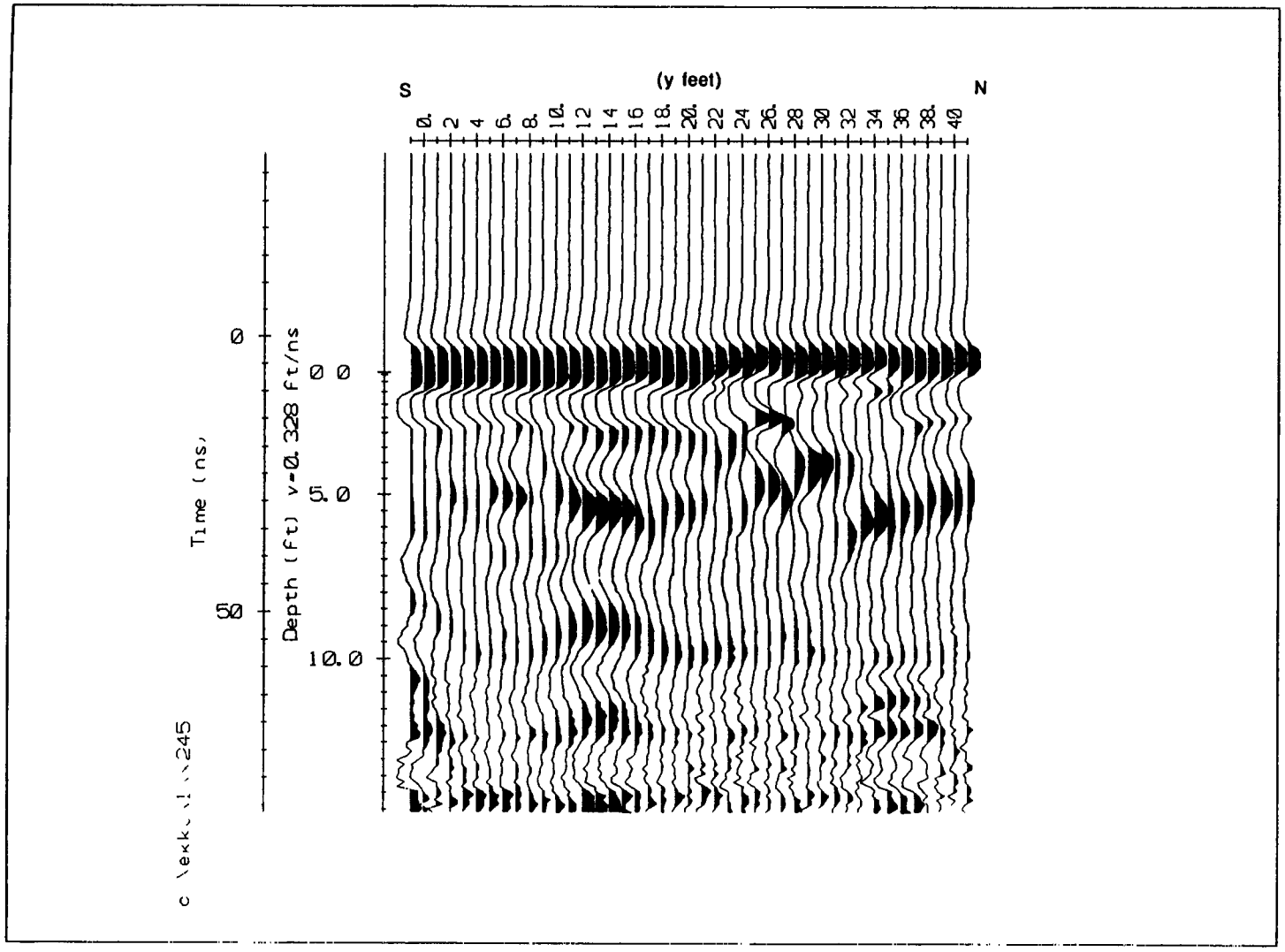
80

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-1
SOUTH TO NORTH ORIENTATION AT X=240 FEET
JUNE 1995



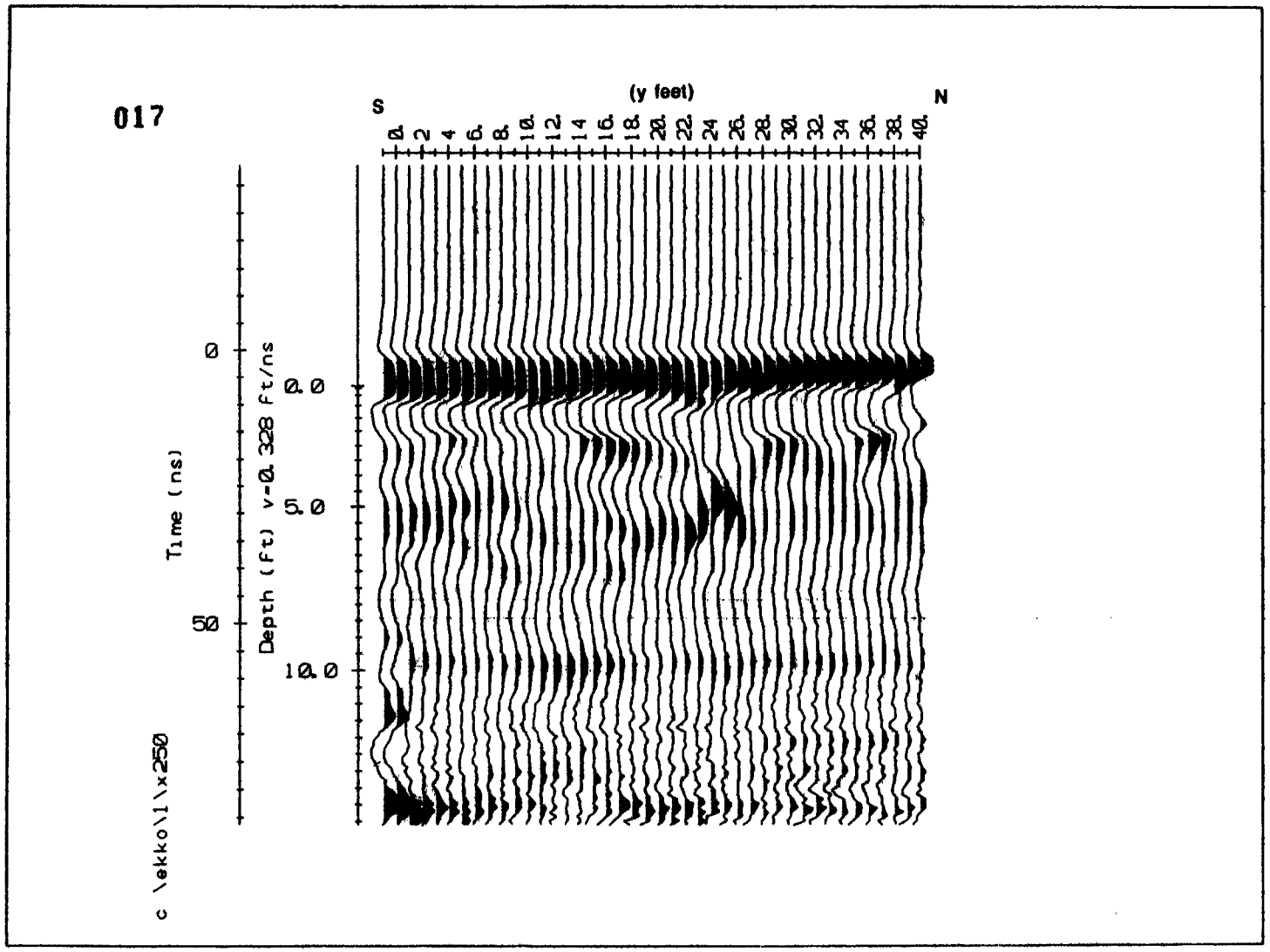
81

RFETS OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=245 FEET
JUNE 1995



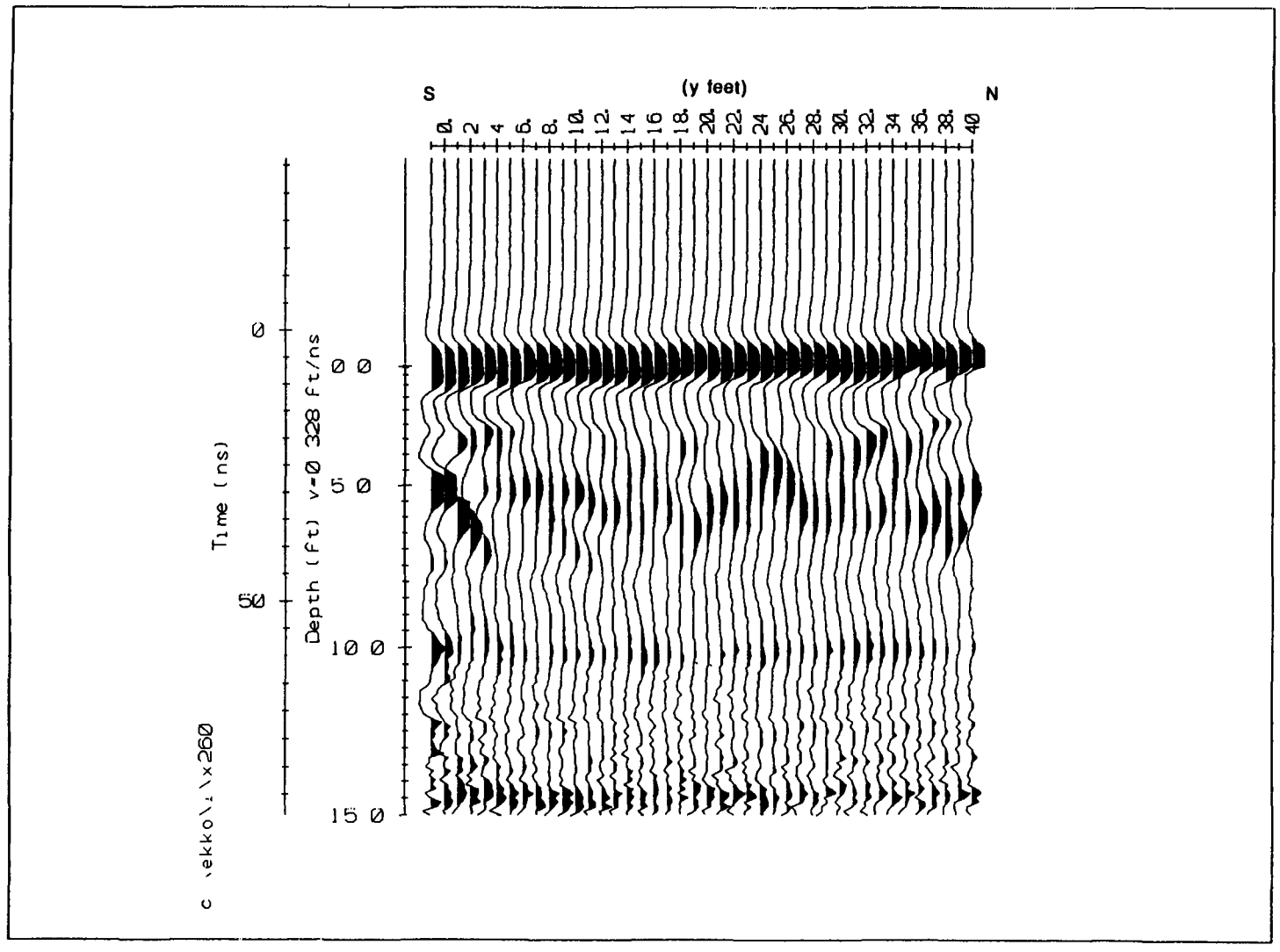
82

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-1
SOUTH TO NORTH ORIENTATION AT X=250 FEET
JUNE 1995



83

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 1
SOUTH TO NORTH ORIENTATION AT X=260 FEET
JUNE 1995



84

3 2 RYAN'S PIT (IHSS 109)

Ryan s Pit was investigated using the following methodologies

- Historical data were compiled to identify potential contaminants trench location, and size
- Aerial photographs were examined to identify disturbed areas, verify trench dimensions, and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- Two EM surveys were conducted to locate buried metallic objects and define trench boundaries
- Soil gas surveys were conducted to identify and delineate contaminant plumes
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the trench

As shown in Figure 3 2-1 Ryan s Pit, previously referred to as Trench T-2, is located approximately 150 feet south of the 903 Pad The dimensions of the pit are approximately 20 feet long 10 feet wide and five feet deep The HRR describes the pit as a waste disposal site used from 1969 and 1971 for nonradioactive liquid chemical waste VOCs disposed of at this location include tetrachloroethene, trichloroethene, and carbon tetrachloride In addition to VOC disposal, paint thinner and small quantities of construction-related chemicals may also have been placed in Ryan s Pit Only the liquids themselves were put in the pit, their containers were either reused or disposed of in other areas Material placed in the pit was supposedly screened for radionuclide activity prior to disposal Interviews with former employees confirmed the suspected location, extent and content of Ryan s Pit The pertinent section of the HRR presented in Exhibit 3 2 A (PAC Reference Number 900-109)

Field investigations conducted in 1987 through 1993 do not substantiate that only nonradioactive, noncontainerized liquids were placed in the pit

Although the general location of Ryan's Pit was known, the actual location of the pit had not been physically identified prior to the Trenches Area and Mound Site Characterization Program of 1995 To pinpoint the location of the pit aerial photographs dating from 1964 through 1972 were examined (Colorado Aerial Photo Service 1993) Photographs from 1967 through 1970 reveal patches of soil disturbance drum storage and construction related activities in the area of Ryan s Pit This site is an area approximately 10 feet wide by 20 feet long of dark staining and disturbed soil The location and dimensions of this staining and soil disturbance are consistent with information from the HRR and the personal interviews Prior to 1967 there are no indications of soil disturbance

or waste disposal activities in the area. Photographs after 1971 show surficial scarring indicating closure and abandonment of the area.

3 2 1 GEOLOGY

Surficial deposits in the area of Ryan's Pit consist of Rocky Flats Alluvium that has been reworked and transported downslope, along with other clay-rich colluvial deposits and fill material Surficial deposits are between one and eight feet thick The bedrock is weathered Arapahoe or Laramie formation consisting of silty claystone, clay and claystone (EG&G 1995c). The hydrograph from monitoring well 07391, located south of Ryan s Pit, indicates that groundwater fluctuates between 3 to 10 feet bgs

3 2.2 Site Visual Survey and Geophysical Surveys

After aerial photographs were examined, a visual survey of the area just south of the 903 Pad was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general area of Ryan's Pit Soil disturbances were identified and past geological surveys were used to delineate soil disturbances caused by construction related activities Evidence of fill deposits were also noted. In addition to the geologic characteristics of the area, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material There is a groundwater seep 15 feet upslope from the disturbed area identified as Ryan's Pit

Upon completion of the visual survey, a geophysical grid was laid out using pin flags Grid dimensions were 50 feet wide (north-south) by 200 feet long (east-west) with flags placed at five foot increments

EM-31 Survey

After establishing the geophysical grid, the EM-31 survey was performed The initial data collected from the survey did not detect any anomalies which might indicate the presence of subsurface soil disturbance The grid was then extended to the north and the south by an additional 50 feet, and extended east and west by another 100 feet making the grid dimensions 100 feet wide by 300 feet long

The extended EM-31 survey showed the presence of several small anomalies located in the northwest quadrant of the grid and a single larger anomaly located in the southeast The smaller anomalies are attributed to surficial debris (i e , metal fence posts, metal strapping, and tin sheets) and therefore are

86

not considered part of Ryan s Pit The larger anomaly appears to be approximately 20 feet long by 10 feet wide and is slightly irregular shape and pattern and represents Ryan s Pit The survey also indicates the presence of a conductive plume migrating from Ryan s Pit in a southeasterly direction Surrounding Ryan s Pit is a very large anomaly thought to represent the change in moisture content and soil properties between disturbed areas and undisturbed Rocky Flats alluvium Results of the EM-31 survey are presented in Exhibit 3 2 B

EM-61 Survey

To further define the physical characteristics of the grid area, an EM-61 survey was also performed As in the EM-31 survey results the EM-61 survey located several small anomalies which are attributed to surficial debris The larger anomaly was detected again However, the EM-61 showed a more centralized area of high magnetic activity approximately 18 feet long by about 7 feet wide The area of high conductivity within the anomaly is shadowed by a larger area of lower conductivity which is due to the high groundwater level Results of the EM-61 survey contours are presented in Exhibit 3 2 C

Ground Penetrating Radar

GPR was also considered for use in conjunction with the EM-31 and EM-61 surveys for a more definitive determination of the walls and extent of Ryan s Pit However, due to the unprecedented heavy precipitation high groundwater level and surface water precluded the use of GPR The moisture would have resulted in inaccurate GPR data therefore, this phase of the project was canceled

3 2 3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995 the vadose zone in the study area was highly saturated The increased soil moisture content made it impossible to collect samples during this phase of the characterization Soil gas surveys were conducted in 1993 by to locate areas of high volatile organic compounds within the 903 Pad Lip Area Therefore the existing soil gas data was used to confirm the presence of VOCs in subsurface soils Results from the 1993 soil gas survey are presented in Figure 3 2-2 and indicate the presence of a VOC plume migrating east-northeast

3 2 4 Subsurface Soil Sampling

Subsurface soil sampling from the Ryan s Pit area was the final step of the characterization activities Four borehole locations 13195 13295 13395 and 13495 were selected for sampling based on the

87

findings of the aerial photograph search, the geophysical surveys and the soil gas survey results Two boreholes were drilled within Ryan's Pit, one borehole was located upgradient and one borehole was located downgradient Lithologic descriptions of each borehole are presented in Exhibit 3 2 D Black stained soil at an approximate depth of four feet bgs was encountered from a borehole within Ryan's Pit (13395) The stained soil had a strong sulfur odor Elevated readings of VOCs were not observed by field monitoring instrumentation (photoionization detector), however when sensidyne tubes were employed, carbon tetrachloride and chloroform were detected in this borehole at approximate concentrations of 10 to 20 ppm and greater than 100 ppm respectively Four boreholes, 07391, 09491, 21893 and 0271, were previously drilled during the OU 2 Phase II RFI/RI Investigation Data from both characterization efforts indicate elevated levels of organic compounds, metals and radionuclides The boreholes and wells that characterize Ryan's Pit are identified in Figure 3 2-3

Organic Compounds

The following compounds were detected at concentrations greater the RFCA Subsurface Soil Action Levels, 2-methylphenol (range 28-110 µg/kg), methylene chloride (range 14,000-25,000 µg/kg), trichloroethene (range 13,000-20,000 µg/kg), and tetrachloroethene (470,000 µg/kg) as presented in Table 3 2-1 All detected concentrations are less than the PPRGs for subsurface soils, construction work scenario

Metals

Arsenic (range 20-28 5 mg/kg), barium (range 384-1899 mg/kg), beryllium (72 mg/kg), cadmium (range 1 9-11 1 mg/kg), copper (range 64 4-279 mg/kg), cobalt (204 mg/kg), lead (range 32 8-114 mg/kg), mercury (5 4 mg/kg), molybdenum (49 9 mg/kg), nickel (507 mg/kg), selenium (5 3 mg/kg), silver (range 35 3-55 8 mg/kg), and zinc (654 mg/kg) concentrations exceeded the background $UTL_{99/99}$ as presented in Table 3 2-2 The detected beryllium (72 mg/kg) concentration exceeded the PPRG for subsurface soil, construction worker scenario as shown in Table 3 2-3

Radionuclides

Gross alpha (range 57 5-501 6 pCi/g), gross beta (range 106 4-427 8 pCi/g), americium-241 (range 0 01-12 99 pCi/g), cesium-137 (range 0 19-3 1 pCi/g), plutonium 239/240 (range 0 03-20 78 pCi/g), uranium-233/234 (range 4 49-170 4), uranium-235 (range 0 18-8 62 pCi/g), and uranium-238 (range 1 86-288 4 pCi/g) activities exceeded the background $UTL_{99/99}$ as shown in Table 3 2-4 Radium-226 (range 0 8-1 2 pCi/g), radium-228 (range 1 6-2 2 pCi/g), uranium-

88

233/234 (170 4 pCi/g), and uranium-238 (range 63 99-288 4 pCi/g) activities exceeded the PPRGs for subsurface soils, construction worker scenario as presented in Table 3 2-5

3 2 5 Groundwater

There are several wells near Ryan's Pit (IHSS 109) Elevated levels of organic compounds metals and radionuclides were detected in the groundwater as follows

Organic Compounds

1,1,2,2-tetrachloroethane (range 3-5 µg/L), 1 1 2-trichloroethane (range 20-21 µg/L) 1,1-dichloroethene (range 170-380 µg/L), 1,2-dichloroethane (range 6-390 µg/L), 1,2-dichloropropane (200 µg/L), benzene (range 16-38 µg/L) bromomethane (11 µg/L) chloroform (range 150-4 800 µg/L) chloromethane (range 5 17 µg/L) hexachlorobutadiene (520 µg/L) methylene chloride (range 8-39 µg/L) tetrachloroethene (range 35-1 800 µg/L), trichloroethene (range 20-160,000 µg/L), and vinyl chloride (range 2-3 µg/L) concentrations exceeded the RFCA Tier II Groundwater Action Levels as shown in Table 3 2-6 Hexachlorobutadiene, tetrachloroethene, and trichloroethene concentrations exceeded the RFCA Tier I Groundwater Action Levels as presented in Table 3 2-7 There were no detected concentrations of organic compounds greater than the PPRGs for surface water, open-space receptor

Metals

Dissolved antimony (51 5 mg/L) dissolved barium (range 196-675 mg/L) total barium (range 519-729 mg/L), dissolved calcium (range 447,000-678,000 mg/L), total calcium (range 571,000-613 000 mg/L) dissolved magnesium (range 56,800-105,000 mg/L), total magnesium (90,000-102,000 mg/L) dissolved manganese (range 292-617 mg/L), total manganese (617 mg/L), dissolved nickel (range 31-86 1 mg/L), total potassium (range 6 350-8,690 mg/L), dissolved sodium (range 163 000-497 000 mg/L) total sodium (range 158 000-537,000 mg/L), dissolved strontium (range 1 930-3 050 mg/L) total strontium (range 2,950-3,160 mg/L), and dissolved vanadium (93 mg/L) concentrations exceed the background $UTL_{99/99}$ as presented in Table 3 2-8 Dissolved antimony (range 43-51 mg/L) total antimony (44 1 mg/kg) dissolved manganese total manganese (range 325-617 mg/L) and dissolved thallium (range 4 5-18 9 mg/L) concentrations exceeded the RFCA Tier II Groundwater Action Levels as presented in Table 3 2-9 There were no detected concentration of metals greater than the RFCA Tier I Groundwater Action Levels or PPRGs for surface water open-space receptor

84

Radionuclides

Dissolved gross beta (range 43-56 4 pCi/L), total americium-241 (0.34 pCi/L), total plutonium-239/240 (0 18 pCi/L), dissolved radium-226 (range 1 5-2.82 pCi/L), dissolved strontium-89/90 (range 1 5-2 14 pCi/L), and dissolved uranium-238 (75 7 pCi/L) activities exceeded the background $UTL_{99/99}$ as shown in Table 3 2-10 Dissolved gross alpha (range 25-67 1 pCi/L), total gross alpha (26 35 pCi/L), dissolved gross beta (range 10 7-56 pCi/L), total gross beta (11 2 pCi/L), total plutonium-239/240, dissolved strontium-89/90, dissolved uranium-233/234 (range 12-24 4 pCi/L), total uranium-233/234 (6 05 pCi/L), dissolved uranium-235 (range 1 23-1.5 pCi/L), dissolved uranium-238 (range 24-75 7 pCi/L), and total uranium-238 (19 46 pCi/L) activities exceeded the RFCA Tier II Groundwater Action Levels as shown in Table 3 2-11 There were no detected activities of radionuclides greater than the RFCA Tier I Groundwater Action Levels or PPRGs for surface water, open-space receptor

3.2.6 Summary

Results of the geophysical surveys indicate that Ryan's Pit is approximately 7 feet wide, and 18 feet long Because of the highly saturated soils the GPR could not be used to discern the exact depth of the trench although the borings indicated that it is approximately 10 feet deep These measurements indicate an approximate volume of 47 cy The dimensions agree with the HRR depiction The geophysical surveys also indicated the presence of buried metallic and/or other conductive solid or liquid materials

Because of saturated conditions, the soil gas survey could not be performed The previous soil gas survey indicates the presence of a VOC plume migrating east-northeast. The EM-31 and EM-61 surveys indicate the presence of a conductive plume moving west-southwest

Four organic compound concentrations exceeded the RFCA Subsurface Soil Action Levels Thirteen metal concentrations and seven radionuclide activities exceeded the background subsurface soil $UTL_{99/99}$ values The concentration of one metal and the activities of four radionuclides exceeded the PPRGs for subsurface soils construction worker scenario

The concentrations of 14 organic compounds exceeded the RFCA Tier II Groundwater Action Levels and the concentrations of three organic compounds exceeded the RFCA Tier I Groundwater Action Levels The concentrations of seven total and six dissolved metals exceeded the background $UTL_{99/99}$ values The concentrations of two total and three dissolved metals exceeded the RFCA Tier II Groundwater Action Levels

90

The activities of two total and three dissolved radionuclides exceeded the background $UTL_{99/99}$ values The activities of five total and six dissolved radionuclides exceeded the RFCA Tier II Groundwater Action Levels

Trench T-2 summary information is presented in Table 3 2-12

The source material at Ryan's Pit has since been removed by a removal action completed in 1995 This removal action generally confirmed the results of this investigation

61

Table 3 2-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
Trench T 2	13295	BH20811WC	8 10	5/5/95	2 Methylphenol	28	0 33	E		Y
Trench T 2	13295	BH20811WC	8 10	5/5/95	Methylene Chloride	14	0 005	BE	5 77	Y
Trench T 2	13295	BH20810WC	3 5	5/5/95	Trichloroethene	20	0 005		9 27	Y
Trench T 2	13395	BH20807WC	8 10	5/5/95	2 Butanone	0 11	0 1	DJ		Y
Trench T 2	13395	BH20807WC	8 10	5/5/95	2 Methylphenol	0 11	0 33	J		Y
Trench T 2	13395	BH20806WC	3-5	5/4/95	Methylene Chloride	25	0 005	B	5 77	Y
Trench T 2	13395	BH20806WC	3-5	5/4/95	Tetrachloroethene	470	0 005		11 5	Y
Trench T 2	13395	BH20806WC	3-5	5/4/95	Trichloroethene	19	0 005	J	9 27	Y
[redacted]										
Trench T 2	BH2587	BH258718BR	18 5-19 3	6/18/87	Trichloroethene	16			9 27	
Trench T 2	BH2587	BH258720WS		6/18/87	Trichloroethene	13			9 27	

LABORATORY QUALIFIERS
B = Indicates chemical was in both the sample and associated method blank
D = Analysis was performed at a dilution
E = Chemical exceeds calibration range of the instrument
J = Positively identified below sample quantitation limit result is estimated

NOTES
RFCA Action Levels for Benzoic Acid and 2 Butanone have not been determined

VALIDATION CODES
Y = Analytical results in validation process

92

Table 3.2-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T-2	7391	BH00477WCU2	8-14	2/10/92	Barium	394			V	372
Trench T-2	9291	BH01275WCU2	2-8	3/12/92	Barium	466	40		JA	372
Trench T 2	9291	BH01277WCU2	14-20	3/12/92	Cadmium	1.5	1		JA	1.33
Trench T 2	9291	BH01278WCU2	20-26	3/12/92	Cadmium	1.6	1		JA	1.33
Trench T 2	9291	BH01280WCU2	26-30	3/13/92	Cadmium	1 4	1		JA	1.33
Trench T 2	9291	BH01283WCU2	38-44	3/16/92	Cadmium	1.4	1		JA	1.33
Trench T 2	9291	BH01276WCU2	8-14	3/12/92	Molybdenum	49 9	40		JA	41 1
Trench T-2	9291	BH01281WCU2	32-38	3/13/92	Selenium	5.3	1		JA	5.2
Trench T-2	13195	BH20820WC	9-11	5/5/95	Arsenic	28.5	2		Y	16.2
Trench T 2	13195	BH20819WC	3-5	5/5/95	Mercury	2.8	0.1		Y	1.18
Trench T 2	13295	BH20811WC	8-10	5/5/95	Cadmium	1.8	1		Y	1.33
Trench T-2	13295	BH20811WC	8-10	5/5/95	Copper	64.4	5		Y	49.1
Trench T 2	13295	BH20811WC	8-10	5/5/95	Lead	32 8	0.6		Y	31
Trench T-2	13295	BH20811WC	8-10	5/5/95	Silver	35.3	2		Y	33.1
Trench T-2	13395	BH20808WC	3-5	5/4/95	Barydium	72	1		Y	18.3
Trench T-2	13395	BH20808WC	3-5	5/4/95	Cadmium	11.1	1		Y	1.33
Trench T-2	13395	BH20808WC	3-5	5/4/95	Chromium	123	2		Y	89.1
Trench T 2	13395	BH20808WC	3-5	5/4/95	Copper	279	5		Y	49 1
Trench T-2	13395	BH20808WC	3-5	5/4/95	Lead	114	0.6		Y	31
Trench T-2	13395	BH20808WC	3-5	5/4/95	Mercury	5.4	0 1		Y	1.18
Trench T-2	13395	BH20808WC	3-5	5/4/95	Silver	55.8	2		Y	33.1
Trench T-2	13395	BH20808WC	3-5	5/4/95	Zinc	854	4		Y	183
Trench T-2	21593	BH20880WC	20.2-26	5/24/93	Cadmium	1.4	1		V	1 33
Trench T-2	21593	BH20878WC	38-44.6	5/25/93	Cobalt	204	10		V	29.4
Trench T-2	21593	BH20878WC	38-44.6	5/25/93	Nickel	567	8		V	78.7
Trench T 2	BH2587	BH25872GWS		9/19/97	Arsenic	20			N	16.2
Trench T-2	BH2587	BH25870009D	0-9	9/19/97	Barium	1899			N	372
Trench T-2	BH2587	BH25870009	0-9	9/19/97	Cadmium	4.6			N	1.33
Trench T-2	BH2587	BH25870009D	0-9	9/19/97	Cadmium	5.2			N	1.33
Trench T 2	BH2587	BH25870910	9.5-10.4	9/19/97	Cadmium	4.4			N	1.33
Trench T-2	BH2587	BH25870WT	8.4-8.95	9/19/97	Cadmium	3.5			N	1.33
Trench T-2	BH2587	BH25871BCT	14.5-15.7	9/19/97	Cadmium	1.9			N	1.33
Trench T-2	BH2587	BH25871BBR	18.5-19.3	9/19/97	Cadmium	3.6			N	1.33
Trench T-2	BH2587	BH25872GWS		9/19/97	Cadmium	2.6			N	1.33

LABORATORY QUALIFIER

VALIDATION CODES
JA = Result accepted, but was estimated
N = Will not be validated
V = Valid result
Y = Analytical results in validation process

Table 3 2-3 Subsurface Soil Metal Concentrations Exceeding PPRGs

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	PPRG (mg/kg)
Trench T 2	13395	BH20806WC	3 5	5/4/95	Beryllium	72	1		Y	4 7

LABORATORY QUALIFIER

VALIDATION CODES
Y = Analytical results in validation process

Table 3 2-4 Subsurface Soil Radionuclide Activities Exceeding $UTL_{95/95}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 2	7391	BH00475WCU2	2-8	2/10/92	Americium-241	0 03	0.005	0 024	V	0 022
Trench T 2	7391	BH00480WCU2	14-16	2/10/92	Cesium-137	0.19	0 19		JA	0 129
Trench T 2	7391	BH00480WCU2	14-16	2/10/92	Cesium-137	0 19	0 19		JA	0 129
Trench T 2	7391	BH00477WCU2	8-14	2/10/92	Cesium-137	0.2	0.2		JA	0 129
Trench T 2	7391	BH00475WCU2	2-8	2/10/92	Plutonium-239 240	0 14	0.002	0.032	V	0 025
Trench T 2	7391	BH00480WCU2	14-16	2/10/92	Radium-226	0 8	0 19	0.23	A	1 42
Trench T-2	7391	BH00477WCU2	8-14	2/10/92	Radium-226	1	0.22	0 29	A	1 42
Trench T-2	7391	BH00475WCU2	2-8	2/10/92	Radium-226	1 1	0 18	0 29	A	2 33
Trench T 2	7391	BH00480WCU2	14-16	2/10/92	Radium-226	1 5	0.44	0.51	A	2 33
Trench T-2	7391	BH00477WCU2	8-14	2/10/92	Radium-226	1 7	0.54	0.66	A	2.33
Trench T 2	7391	BH00480WCU2	14-16	2/10/92	Tritium	870	400	280	V	504
Trench T 2	7391	BH00480WCU2	14-16	2/10/92	Tritium	570	400	280	V	504
Trench T 2	9291	BH01277WCU2	14-20	3/12/92	Plutonium-239,240	0 11	0.006	0.036	V	0.025
Trench T-2	9291	BH01277WCU2	14-20	3/12/92	Plutonium-239,240	0.11	0.006	0 036	V	0 025
Trench T 2	9291	BH01275WCU2	2-8	3/12/92	Radium-226	0 8	0 29	0.22	V	1 42
Trench T 2	9291	BH01276WCU2	8-14	3/12/92	Radium-226	0 93	0.36	0.29	V	1 42
Trench T 2	9291	BH01277WCU2	14-20	3/12/92	Radium-226	1	0.36	0.28	V	1.42
Trench T 2	9291	BH01278WCU2	20-26	3/12/92	Radium-226	1	0 33	0 26	V	1 42
Trench T 2	9291	BH01274WCU2	2-8	3/12/92	Radium-226	1 2	0.4	0.32	V	1 42
Trench T 2	9291	BH01280WCU2	26-30	3/13/92	Radium-226	1 1	0.23	0.22	V	1.42
Trench T 2	9291	BH01281WCU2	32-36	3/13/92	Radium-226	1.2	0.64	0.32	V	1 42
Trench T-2	9291	BH01275WCU2	2-8	3/12/92	Radium-226	1 6	0 55	0.42	V	2.33
Trench T-2	9291	BH01278WCU2	20-26	3/12/92	Radium-226	1 6	0.78	0.66	V	2.33
Trench T 2	9291	BH01274WCU2	2-8	3/12/92	Radium-226	1 7	0 7	0 55	V	2.33
Trench T-2	9291	BH01276WCU2	8-14	3/12/92	Radium-226	2	0.45	0.4	V	2.33
Trench T 2	9291	BH01277WCU2	14-20	3/12/92	Radium-226	2.2	0.65	0.53	V	2.33
Trench T 2	9291	BH01280WCU2	26-30	3/13/92	Radium-226	1 6	0.82	0.68	V	2.33
Trench T-2	9291	BH01281WCU2	32-36	3/13/92	Radium-226	1 7	0.49	0.55	V	2.33
Trench T-2	9491	BH01244WCU2	2.2-8	2/28/92	Radium-226	0.85	0.29	0.23		1.42
Trench T 2	9491	BH01245WCU2	8-10	2/28/92	Radium-226	1 2	0.25	0.22		1.42
Trench T-2	9491	BH01244WCU2	2.2-8	2/28/92	Radium-226	1 4	0 59	0 48	V	2.33
Trench T 2	9491	BH01245WCU2	8-10	2/28/92	Radium-226	1 6	0.79	0.6	V	2.33
Trench T-2	9491	BH01244WCU2	2.2-8	2/28/92	Tritium	640	370	240	A	504
Trench T-2	13295	BH20811WC	8-10	5/5/95	Americium-241	0.11	0 048	0 058	Y	0.022
Trench T 2	13295	BH20810WC	3-5	5/5/95	Plutonium-238,240	0 03	0 029	0.037	Y	0.025
Trench T 2	13295	BH20811WC	8-10	5/5/95	Plutonium-239,240	5 63	0 018	0 669	Y	0.025
Trench T 2	13295	BH20811WC	8-10	5/5/95	Uranium-233,234	4 49	0 119	0.601	Y	3.441
Trench T 2	13295	BH20811WC	8-10	5/5/95	Uranium-235	0 18	0 096	0.116	Y	0 153
Trench T 2	13295	BH20811WC	8-10	5/5/95	Uranium-238	4.46	0.135	0.796	Y	1.807
Trench T 2	13295	BH20806WC	3-5	5/4/95	Americium-241	12.99	0.011	1.34	Y	0 022
Trench T 2	13395	BH20807WC	8-10	5/5/95	Americium-241	0 25	0 012	0.041	Y	0.022
Trench T 2	13395	BH20806WC	3-5	5/4/95	Gross Alpha	501 6	5.64	62	Y	51 4

95

Table 3 2-4 Subsurface Soil Radionuclide Activities Exceeding $UTL_{99/99}$ Values (continued)

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T 2	13395	BH20806WC	3-5	5/4/95	Gross Beta	427 8	3 84	31 3	Y	42
Trench T 2	13395	BH20806WC	3 5	5/4/95	Plutonium 239 240	20 78	0 006	2 17	Y	0 025
Trench T 2	13395	BH20807WC	8 10	5/5/95	Plutonium 239 240	0 35	0 007	0 057	Y	0 025
Trench T 2	13395	BH20806WC	3 5	5/4/95	Uranium 233 234	170 4	0 183	22 5	Y	3 441
Trench T 2	13395	BH20806WC	3-5	5/4/95	Uranium 235	8 62	0 166	1 41	Y	0 153
Trench T 2	13395	BH20806WC	3-5	5/4/95	Uranium 238	288 4	0 156	37 8	Y	1 807
Trench T 2	13395	BH20807WC	8-10	5/5/95	Uranium 238	1 86	0 019	0 289	Y	1 807
Trench T 2	13495	BH20814WC	3-5	5/5/95	Americium 241	0 74	0 005	0 092	Y	0 022
Trench T 2	13495	BH20814WC	3 5	5/5/95	Gross Alpha	57 53	4 88	12 1	Y	51 4
Trench T 2	13495	BH20814WC	3-5	5/5/95	Gross Beta	106 4	3 71	9 8	Y	42
Trench T 2	13495	BH20815WC	8-10	5/5/95	Plutonium 239 240	0 15	0 014	0 032	Y	0 025
Trench T 2	13495	BH20814WC	3-5	5/5/95	Plutonium-239 240	4 14	0 003	0 458	Y	0 025
Trench T 2	13495	BH20814WC	3-5	5/5/95	Uranium 233 234	7 85	0 019	1 02	Y	3 441
Trench T 2	13495	BH20814WC	3-5	5/5/95	Uranium 235	1 07	0 019	0 167	Y	0 153
Trench T 2	13495	BH20815WC	8-10	5/5/95	Uranium 238	1 92	0 025	0 297	Y	1 807
Trench T 2	13495	BH20814WC	3-5	5/5/95	Uranium 238	63 99	0 027	8 05	Y	1 807
Trench T 2	21893	BH20276WC	38-44 6	5/25/93	Plutonium 239 240	0 04	0 002	0 007	A	0 025
Trench T 2	21893	BH20276WC	38-44 6	5/25/93	Plutonium 239 240	0 04	0 002	0 007	A	0 025
Trench T 2	21893	BH20261WC	26-32	5/24/93	Uranium-235	0 19	0 055	0 077	A	0 153
Trench T 2	21893	BH20261WC	26-32	5/24/93	Uranium 235	0 19	0 055	0 077	A	0 153
Trench T 2	BH2587	BH25870009D	0-9	6/18/87	Americium-241	0 22		0 18	N	0 022
Trench T 2	BH2587	BH25870009D	0-9	6/18/87	Americium 241	0 22		0 18	N	0 022
Trench T 2	BH2587	BH25870009D	0-9	6/18/87	Cesium 137	1 4		0 8	N	0 129
Trench T 2	BH2587	BH258720WS		6/18/87	Cesium-137	3 1		0 7	N	0 129
Trench T 2	BH2587	BH258720WS		6/18/87	Cesium 137	3 1		0 7	N	0 129
Trench T 2	BH2587	BH258716CT	14 5-15 7	6/18/87	Plutonium-239 240	0 04		0 07		0 025
Trench T 2	BH2587	BH25870009	0-9	6/18/87	Plutonium-239 240	0 06		0 07		0 025
Trench T 2	BH2587	BH258709WT	8 4-8 85	6/18/87	Plutonium-239 240	0 08		0 07		0 025
Trench T 2	BH2587	BH258718BR	18 5-19 3	6/18/87	Plutonium 239 240	0 1		0 08		0 025
Trench T 2	BH2587	BH25870910	9 5-10 4	6/18/87	Plutonium 239 240	0 13		0 1		0 025
Trench T 2	BH2587	BH258720WS		6/18/87	Plutonium 239 240	0 15		0 12		0 025
Trench T 2	BH2587	BH25870009D	0-9	6/18/87	Plutonium-239 240	3 2		0 4		0 025

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted but was estimated
V = Valid result
N = Will not be validated
Y = Analytical results in validation process

Table 3 2-5 Subsurface Soil Radionuclide Activities Exceeding PPRGs

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	PPRG (pCi/g)
Trench T 2	7391	BH00480WCU2	14-16	2/10/92	Radium-226	0 8	0.19	0 23	A	0 494
Trench T 2	7391	BH00477WCU2	8-14	2/10/92	Radium-226	1	0 22	0.29	A	0 494
Trench T 2	7391	BH00475WCU2	2-8	2/10/92	Radium-226	1 1	0 18	0.29	A	1 01
Trench T 2	7391	BH00480WCU2	14-16	2/10/92	Radium-226	1 5	0 44	0 51	A	1 01
Trench T 2	7391	BH00477WCU2	8-14	2/10/92	Radium-226	1 7	0 54	0 66	A	1 01
Trench T 2	9291	BH01275WCU2	2-8	3/12/92	Radium-226	0 8	0 29	0 22	V	0 494
Trench T 2	9291	BH01276WCU2	8-14	3/12/92	Radium-226	0 93	0 36	0 29	V	0 494
Trench T 2	9291	BH01277WCU2	14-20	3/12/92	Radium-226	1	0 38	0.28	V	0 494
Trench T 2	9291	BH01278WCU2	20-26	3/12/92	Radium-226	1	0 33	0 26	V	0 494
Trench T 2	9291	BH01274WCU2	2-8	3/12/92	Radium-226	1 2	0 4	0.32	V	0 494
Trench T-2	9291	BH01280WCU2	26-30	3/13/92	Radium-226	1 1	0.23	0.22	V	0 494
Trench T 2	9291	BH01281WCU2	32-38	3/13/92	Radium-226	1 2	0 64	0.32	V	0 494
Trench T-2	9291	BH01275WCU2	2-8	3/12/92	Radium-226	1 6	0 55	0 42	V	1 01
Trench T 2	9291	BH01276WCU2	20-26	3/12/92	Radium-226	1 6	0 78	0.56	V	1 01
Trench T-2	9291	BH01274WCU2	2-8	3/12/92	Radium-226	1 7	0 7	0 55	V	1 01
Trench T-2	9291	BH01276WCU2	8-14	3/12/92	Radium-226	2	0 45	0 4	V	1 01
Trench T 2	9291	BH01277WCU2	14-20	3/12/92	Radium-226	2.2	0.65	0 53	V	1 01
Trench T 2	9291	BH01280WCU2	26-30	3/13/92	Radium-226	1 6	0 82	0 68	V	1 01
Trench T 2	9291	BH01281WCU2	32-38	3/13/92	Radium-226	1 7	0 48	0 55	V	1 01
Trench T 2	9491	BH01244WCU2	2.2-8	2/28/92	Radium-226	0 85	0.29	0.23		0 75
Trench T 2	9491	BH01245WCU2	8-10	2/28/92	Radium-226	1 2	0.25	0.22		0 75
Trench T 2	9491	BH01244WCU2	2.2-8	2/28/92	Radium-226	1 4	0 59	0 46	V	1.01
Trench T 2	9491	BH01245WCU2	8-10	2/28/92	Radium-226	1 6	0 79	0 6	V	1 01
Trench T-2	13395	BH20806WC	3-5	5/4/95	Uranium-233,234	170 4	0 183	22.5	Y	12.5
Trench T 2	13396	BH20806WC	3-5	5/4/95	Uranium-238	268.4	0.156	37.8	Y	60.1
Trench T-2	13495	BH20614WC	3-5	5/5/95	Uranium-238	63.99	0.0266	8 05	Y	60.1
Trench T-2	BH2567	BH258720WS		6/18/87	Cesium-137	3 1		0.7	N	
Trench T-2	BH2567	BH258720WS		6/18/87	Cesium-137	3 1		0.7	N	

VALIDATION CODES
A = Result accepted with qualifications
N = Will not be validated
V = Valid result
Y = Analytical results in validation process

97

Table 3 2-6 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T 2	7391	GW02599IT	3/16/92	1 1 2 2 Tetrachloroethane	0 005	0 00001		0 00009	Z
Trench T 2	7391	GW02902IT	5/21/92	1 1 2 2 Tetrachloroethane	0 003	0 00001		0 00009	JA
Trench T 2	7391	GW02599IT	3/16/92	1 1 2 Trichloroethane	0 02	0 00004	E	0 005	Z
Trench T 2	7391	GW02902IT	5/21/92	1 1 2 Trichloroethane	0 021	0 00004		0 005	A
Trench T 2	7391	GW02599IT	3/16/92	1 1 Dichloroethene	0 2	0 00004	EB	0 007	Z
Trench T 2	7391	GW02902IT	5/21/92	1 1 Dichloroethene	0 19	0 00004		0 007	Z
Trench T 2	7391	GW03457IT	8/28/92	1 1 Dichloroethene	0 38	0 00013		0 007	A
Trench T 2	7391	GW01618WC	11/30/93	1 1 Dichloroethene	0 17	0 01		0 007	Y
Trench T 2	7391	GW02599IT	3/16/92	1 2 Dichloroethane	0 007	0 00003		0 005	Z
Trench T 2	7391	GW02902IT	5/21/92	1 2 Dichloroethane	0 006	0 00003		0 005	JA
Trench T 2	7391	GW01618WC	11/30/93	1 2 Dichloroethane	0 39	0 01		0 07	Y
Trench T 2	7391	GW02599IT	3/16/92	1 2 Dichloropropane	0 2	0 00003	E	0 005	Z
Trench T 2	7391	GW03457IT	8/28/92	Benzene	0 038	0 00017		0 005	A
Trench T 2	7391	GW01618WC	11/30/93	Benzene	0 016	0 01		0 005	Y
Trench T 2	7391	GW01618WC	11/30/93	Bromomethane	0 011	0 01		0 0109	Y
Trench T 2	7391	GW02599IT	3/16/92	Chloroform	0 16	0 00001	E	0 1	Z
Trench T 2	7391	GW02902IT	5/21/92	Chloroform	0 15	0 00001	E	0 1	Z
Trench T 2	7391	GW03457IT	8/28/92	Chloroform	1 7	0 00015	E	0 1	
Trench T 2	7391	GW03862IT	11/16/92	Chloroform	1 5	0 0001		0 1	V
Trench T 2	7391	GW00398WC	3/16/93	Chloroform	1 9	0 0001	D	0 1	Z
Trench T 2	7391	GW00761WC	5/21/93	Chloroform	1 5	0 005		0 1	V
Trench T 2	7391	GW01261WC	9/14/93	Chloroform	1 7	5	DJ	0 1	A
Trench T 2	7391	GW00287GA	3/10/94	Chloroform	1	0 005	J	0 1	A
Trench T 2	7391	GW00788GA	5/26/94	Chloroform	1 4	0 005	J	0 1	A
Trench T 2	7391	GW01042GA	7/25/94	Chloroform	1 2	0 005	J	0 1	A
Trench T 2	7391	GW01774GA	12/5/94	Chloroform	1 2	0 0002		0 1	V
Trench T 2	7391	GW02197GA	3/14/95	Chloroform	1 1	0 0002		0 1	V
Trench T 2	7391	GW03011GA	12/5/95	Chloroform	4 8	5	J	0 1	V1
Trench T 2	7391	GW03195GA	3/11/96	Chloroform	1 8	2 5	J	0 1	Y
Trench T 2	7391	GW02599IT	3/16/92	Chloromethane	0 005	0 0001		0 00232	Z
Trench T 2	7391	GW01618WC	11/30/93	Chloromethane	0 017	0 01		0 00232	Y
Trench T 2	7391	GW03011GA	12/5/95	Hexachlorobutadiene	0 52	5	J	0 00109	V1
Trench T 2	7391	GW02599IT	3/16/92	Methylene Chloride	0 016	0 00001	B	0 005	Z
Trench T 2	7391	GW02902IT	5/21/92	Methylene Chloride	0 008	0 00001		0 005	JA
Trench T 2	7391	GW03457IT	8/28/92	Methylene Chloride	0 039	0 00062	E	0 005	A
Trench T 2	7391	GW01618WC	11/30/93	Methylene Chloride	0 027	0 01		0 005	Y
Trench T 2	7391	GW02599IT	3/16/92	Tetrachloroethene	0 035	0 00002	E	0 005	Z
Trench T 2	7391	GW02902IT	5/21/92	Tetrachloroethene	0 12	0 00002	E	0 005	Z
Trench T 2	7391	GW03457IT	8/28/92	Tetrachloroethene	0 97	0 00014	E	0 005	

Table 3 2-6 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T-2	7391	GW03862IT	11/16/92	Tetrachloroethene	0 97	0 0002	J	0 005	A
Trench T-2	7391	GW00398WC	3/16/93	Tetrachloroethene	1 1	0.0001	D	0.005	Z
Trench T 2	7391	GW00761WC	5/21/93	Tetrachloroethene	0 71	0.005	J	0 005	A
Trench T 2	7391	GW01618WC	11/30/93	Tetrachloroethene	0.69	0.01	E	0 005	Y
Trench T 2	7391	GW00788GA	5/26/94	Tetrachloroethene	0 66	0 005	J	0 005	A
Trench T 2	7391	GW01774GA	12/5/94	Tetrachloroethene	0 6	0.0002		0.005	JA
Trench T-2	7391	GW02197GA	3/14/95	Tetrachloroethene	0 78	0.0002		0 005	V
Trench T 2	7391	GW03011GA	12/5/95	Tetrachloroethene	1 8	5	J	0.005	V1
Trench T-2	7391	GW03195GA	3/11/96	Tetrachloroethene	1 5	2.5	J	0 005	Y
Trench T 2	7391	GW02599IT	3/16/92	Trichloroethene	0 02	0.00003	E	0 005	Z
Trench T 2	7391	GW02902IT	5/21/92	Trichloroethene	0.076	0.00003	E	0 005	Z
Trench T-2	7391	GW03457IT	8/28/92	Trichloroethene	7.2	0.00026	E	0.005	
Trench T-2	7391	GW03862IT	11/16/92	Trichloroethene	150	0.0002		0.005	V
Trench T 2	7391	GW00398WC	3/16/93	Trichloroethene	93	0.0001	D	0.005	V
Trench T 2	7391	GW00761WC	5/21/93	Trichloroethene	90	0 005	BE	0 005	Z
Trench T 2	7391	GW01261WC	9/14/93	Trichloroethene	86	5	D	0 005	V
Trench T 2	7391	GW01618WC	11/30/93	Trichloroethene	2 5	0 01	E	0.005	Y
Trench T 2	7391	GW00267GA	3/10/94	Trichloroethene	52	0 005	B	0.005	V
Trench T-2	7391	GW00788GA	5/26/94	Trichloroethene	64	0 005		0.005	V
Trench T 2	7391	GW01042GA	7/25/94	Trichloroethene	61	0.005		0.005	V
Trench T-2	7391	GW01774GA	12/5/94	Trichloroethene	65	0 0002		0.005	V
Trench T-2	7391	GW02197GA	3/14/95	Trichloroethene	67	0.0002		0 005	V
Trench T-2	7391	GW03011GA	12/5/95	Trichloroethene	160	5	B	0 005	V1
Trench T 2	7391	GW03195GA	3/11/96	Trichloroethene	99	2.5		0.005	Y
Trench T 2	7391	GW02599IT	3/16/92	Vinyl Chloride	0.003	0.00001		0.002	Z
Trench T 2	7391	GW02902IT	5/21/92	Vinyl Chloride	0.003	0.00001		0.002	JA
Trench T-2	7391	GW03457IT	8/28/92	Vinyl Chloride	0.002	0.0002		0 002	JA

LABORATORY QUALIFIERS
B = Indicates chemical was in both the sample and associated method blank
D = Analysis was performed at a dilution
E = Chemical exceeds calibration range of the instrument
J = Positively identified below sample quantitation level result is estimated

VALIDATION CODES
A = Result accepted with qualifications
J = Positively identified below the sample quantitation limit Result is estimated
V = Valid result
Y = Analytical results in validation process
Z = Validation was not requested or performed

Table 3 2-7 Groundwater Organic Compound Concentrations Exceeding RFCA Tier I Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER I ACTION LEVEL(mg/L)	VALIDATON CODE
Trench T 2	7391	GW03011GA	12/5/95	Hexachlorobutadiene	0 52	5	J	0 109	V1
Trench T 2	7391	GW03457IT	8/28/92	Tetrachloroethene	0 97	0 00014	E	0 5	
Trench T 2	7391	GW03862IT	11/16/92	Tetrachloroethene	0 97	0 0002	J	0 5	A
Trench T 2	7391	GW00398WC	3/16/93	Tetrachloroethene	1 1	0 0001	D	0 5	Z
Trench T 2	7391	GW00761WC	5/21/93	Tetrachloroethene	0 71	0 005	J	0 5	A
Trench T 2	7391	GW01618WC	11/30/93	Tetrachloroethene	0 69	0 01	E	0 5	Y
Trench T 2	7391	GW00788GA	5/26/94	Tetrachloroethene	0 66	0 005	J	0 5	A
Trench T 2	7391	GW01774GA	12/5/94	Tetrachloroethene	0 6	0 0002		0 5	JA
Trench T 2	7391	GW02197GA	3/14/95	Tetrachloroethene	0 78	0 0002		0 5	V
Trench T 2	7391	GW03011GA	12/5/95	Tetrachloroethene	1 8	5	J	0 5	V1
Trench T 2	7391	GW03195GA	3/11/96	Tetrachloroethene	1 5	2 5	J	0 5	Y
Trench T 2	7391	GW03457IT	8/28/92	Trichloroethene	7 2	0 00028	E	0 5	
Trench T 2	7391	GW03862IT	11/16/92	Trichloroethene	150	0 0002		0 5	V
Trench T 2	7391	GW00398WC	3/16/93	Trichloroethene	93	0 0001	D	0 5	V
Trench T 2	7391	GW00761WC	5/21/93	Trichloroethene	90	0 005	BE	0 5	Z
Trench T 2	7391	GW01261WC	9/14/93	Trichloroethene	86	5	D	0 5	V
Trench T 2	7391	GW01618WC	11/30/93	Trichloroethene	2 5	0 01	E	0 5	Y
Trench T 2	7391	GW00287GA	3/10/94	Trichloroethene	52	0 005	B	0 5	V
Trench T 2	7391	GW00788GA	5/26/94	Trichloroethene	64	0 005		0 5	V
Trench T 2	7391	GW01042GA	7/25/94	Trichloroethene	61	0 005		0 5	V
Trench T 2	7391	GW01774GA	12/5/94	Trichloroethene	65	0 0002		0 5	V
Trench T 2	7391	GW02197GA	3/14/95	Trichloroethene	67	0 0002		0 5	V
Trench T 2	7391	GW03011GA	12/5/95	Trichloroethene	160	5	B	0 5	V1
Trench T 2	7391	GW03195GA	3/11/96	Trichloroethene	99	2 5		0 5	Y

LABORATORY QUALIFIERS
B = Indicates chemical was in both the sample and associated method blank
D = Analysis was performed at a dilution
E = Chemical exceeds calibration range of the instrument
J = Positively identified below sample quantitation level result is estimated

VALIDATION CODES
A = Result accepted with qualifications
J = Positively identified below the sample quantitation limit Result is estimated
V = Valid result
Y = Analytical results in validation process
Z = Validation was not requested or performed

Table 3 2-8 Groundwater Dissolved Metal Concentrations Exceeding UTL_{0000} Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND UTL_{0000}
Trench T 2	7391	GW01618WC	11/30/93	Antimony	51 5	36	J	Y	47.8
Trench T 2	7391	GW02599IT	3/16/92	Barium	514	200		V	171 2
Trench T 2	7391	GW02902IT	5/21/92	Barium	675	200		V	171 2
Trench T 2	7391	GW03457IT	8/28/92	Barium	593	5 1		V	171 2
Trench T 2	7391	GW03862IT	11/16/92	Barium	499	200		V	171 2
Trench T 2	7391	GW00398WC	3/16/93	Barium	411	17		V	171 2
Trench T 2	7391	GW00761WC	5/21/93	Barium	478	200		V	171.2
Trench T 2	7391	GW01261WC	9/14/93	Barium	391	16		V	171 2
Trench T 2	7391	GW01618WC	11/30/93	Barium	382	23		Y	171 2
Trench T-2	7391	GW00287GA	3/10/94	Barium	265	200		V	171 2
Trench T 2	7391	GW00788GA	5/26/94	Barium	284	200		V	171.2
Trench T 2	7391	GW01042GA	7/25/94	Barium	299	200		Z	171.2
Trench T 2	7391	GW01774GA	12/5/94	Barium	228	1		V	171.2
Trench T 2	7391	GW02197GA	3/14/95	Barium	198	0.6	B	V	171 2
Trench T-2	7391	GW02589GA	5/18/95	Barium	406	200		Y	171.2
Trench T 2	7391	GW02599IT	3/16/92	Calcium	678000	5000		V	141250
Trench T-2	7391	GW02902IT	5/21/92	Calcium	580000	5000		V	141250
Trench T 2	7391	GW03457IT	8/28/92	Calcium	548000	18 3		V	141250
Trench T 2	7391	GW03862IT	11/16/92	Calcium	639000	5000		V	141250
Trench T 2	7391	GW00398WC	3/16/93	Calcium	644000	149		V	141250
Trench T 2	7391	GW00761WC	5/21/93	Calcium	534000	5000		V	141250
Trench T 2	7391	GW01261WC	9/14/93	Calcium	529000	380		V	141250
Trench T-2	7391	GW01618WC	11/30/93	Calcium	545000	29		Y	141250
Trench T 2	7391	GW00287GA	3/10/94	Calcium	478000	5000		V	141250
Trench T-2	7391	GW00788GA	5/26/94	Calcium	443000	5000		V	141250
Trench T-2	7391	GW01774GA	12/5/94	Calcium	380000	7		V	141250
Trench T-2	7391	GW02197GA	3/14/95	Calcium	405000	19.7		V	141250
Trench T-2	7391	GW02589GA	5/18/95	Calcium	457000	5000		Y	141250
Trench T-2	7391	GW02599IT	3/16/92	Magnesium	105000	5000		V	31880
Trench T-2	7391	GW02902IT	5/21/92	Magnesium	91700	5000		V	31880
Trench T-2	7391	GW03457IT	8/28/92	Magnesium	88500	20.6		V	31880
Trench T 2	7391	GW03862IT	11/16/92	Magnesium	96500	5000		V	31880
Trench T-2	7391	GW00398WC	3/16/93	Magnesium	94400	249		V	31880
Trench T 2	7391	GW00761WC	5/21/93	Magnesium	84600	5000		V	31880
Trench T 2	7391	GW01261WC	9/14/93	Magnesium	78200	430		V	31880
Trench T 2	7391	GW01618WC	11/30/93	Magnesium	80600	45		Y	31880
Trench T 2	7391	GW00287GA	3/10/94	Magnesium	70800	5000		V	31880
Trench T 2	7391	GW00788GA	5/26/94	Magnesium	68400	5000		V	31880
Trench T 2	7391	GW01774GA	12/5/94	Magnesium	56800	12		V	31880

Table 3 2-8 Groundwater Dissolved Metal Concentrations Exceeding $UTL_{99/99}$ Values (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND UTL 99/99
Trench T 2	7391	GW02197GA	3/14/95	Magnesium	59800	19 9		V	31880
Trench T 2	7391	GW02589GA	5/18/95	Magnesium	73600	5000		Y	31880
Trench T 2	7391	GW02599IT	3/16/92	Manganese	617	15		V	263
Trench T 2	7391	GW02902IT	5/21/92	Manganese	417	15		V	263
Trench T 2	7391	GW03457IT	8/28/92	Manganese	302	1 4		V	263
Trench T 2	7391	GW03862IT	11/16/92	Manganese	292	15		V	263
Trench T 2	7391	GW02599IT	3/16/92	Nickel	58 2	40		V	34
Trench T 2	7391	GW03457IT	8/28/92	Nickel	39 1	9 9		JA	34
Trench T 2	7391	GW01618WC	11/30/93	Nickel	34 1	10	J	Y	34
Trench T 2	7391	GW00788GA	5/26/94	Nickel	36	40	B	V	34
Trench T 2	7391	GW01042GA	7/25/94	Nickel	65 8	40		Z	34
Trench T 2	7391	GW01774GA	12/5/94	Nickel	74 1	5		V	34
Trench T 2	7391	GW02197GA	3/14/95	Nickel	86 1	4 1		V	34
Trench T 2	7391	GW02589GA	5/18/95	Nickel	81 9	40		Y	34
Trench T 2	7391	GW02599IT	3/16/92	Sodium	163000	5000		V	146840
Trench T 2	7391	GW02902IT	5/21/92	Sodium	497000	5000		V	146840
Trench T 2	7391	GW03457IT	8/28/92	Sodium	313000	38 8		V	146840
Trench T 2	7391	GW03862IT	11/16/92	Sodium	282000	5000		V	146840
Trench T 2	7391	GW00398WC	3/16/93	Sodium	277000	584		V	146840
Trench T 2	7391	GW00761WC	5/21/93	Sodium	338000	5000		V	146840
Trench T 2	7391	GW01261WC	9/14/93	Sodium	278000	380		V	146840
Trench T 2	7391	GW01618WC	11/30/93	Sodium	298000	55		Y	146840
Trench T 2	7391	GW00287GA	3/10/94	Sodium	261000	5000		V	146840
Trench T 2	7391	GW00788GA	5/26/94	Sodium	272000	5000		V	146840
Trench T 2	7391	GW01774GA	12/5/94	Sodium	219000	10		V	146840
Trench T 2	7391	GW02197GA	3/14/95	Sodium	205000	12 2		V	146840
Trench T 2	7391	GW02589GA	5/18/95	Sodium	236000	5000		Y	146840
Trench T 2	7391	GW02599IT	3/16/92	Strontium	3050	200		V	1840
Trench T 2	7391	GW02902IT	5/21/92	Strontium	3040	200		V	1840
Trench T 2	7391	GW03457IT	8/28/92	Strontium	2940	6 5		V	1840
Trench T 2	7391	GW03862IT	11/16/92	Strontium	3110	200		V	1840
Trench T 2	7391	GW00398WC	3/16/93	Strontium	3100	1		V	1840
Trench T 2	7391	GW00761WC	5/21/93	Strontium	2830	200		JA	1840
Trench T 2	7391	GW01261WC	9/14/93	Strontium	2690	1		V	1840
Trench T 2	7391	GW01618WC	11/30/93	Strontium	2790	2		Y	1840
Trench T 2	7391	GW00287GA	3/10/94	Strontium	2300	200		JA	1840
Trench T 2	7391	GW00788GA	5/26/94	Strontium	2270	200		JA	1840
Trench T 2	7391	GW02197GA	3/14/95	Strontium	1930	0 3		V	1840
Trench T 2	7391	GW02589GA	5/18/95	Strontium	2280	200		Y	1840

Table 3 2-8 Groundwater Dissolved Metal Concentrations Exceeding $UTL_{95/95}$ Values (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 2	7391	GW01042GA	7/25/94	Vanadium	93	50		Z	38.7

LABORATORY QUALIFIER
B = Detected concentration was less than the contract required detection limit and above the instrument detection limit
J = Estimated quantification

VALIDATION CODES
JA = Result accepted, but was estimated
V = Valid result
Y = Analytical results in validation process
Z = Validation was not requested or performed

Table 3 2-8 Groundwater Total Metal Concentrations Exceeding $UTL_{99/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND UTL 99/99
Trench T 2	7391	GW02599IT	3/16/92	Barium	519	200		V	296
Trench T 2	7391	GW02902IT	5/21/92	Barium	729	200		V	296
Trench T 2	7391	GW03457IT	8/28/92	Barium	654	5 1		V	296
Trench T 2	7391	GW03862IT	11/16/92	Barium	540	200		V	296
Trench T 2	7391	GW02599IT	3/16/92	Calcium	613000	5000		V	141900
Trench T 2	7391	GW02902IT	5/21/92	Calcium	594000	5000		V	141900
Trench T 2	7391	GW03457IT	8/28/92	Calcium	594000	18 3		V	141900
Trench T 2	7391	GW03862IT	11/16/92	Calcium	571000	5000		V	141900
Trench T 2	7391	GW02599IT	3/16/92	Magnesium	102000	5000		V	32120
Trench T 2	7391	GW02902IT	5/21/92	Magnesium	91800	5000		V	32120
Trench T 2	7391	GW03457IT	8/28/92	Magnesium	94200	20 6		V	32120
Trench T 2	7391	GW03862IT	11/16/92	Magnesium	90000	5000		V	32120
Trench T 2	7391	GW02599IT	3/16/92	Manganese	617	15	E	V	606
Trench T 2	7391	GW02599IT	3/16/92	Potassium	8690	5000		V	4980
Trench T 2	7391	GW02902IT	5/21/92	Potassium	7210	5000	E	JA	4980
Trench T 2	7391	GW03457IT	8/28/92	Potassium	7450	1030		V	4980
Trench T 2	7391	GW03862IT	11/16/92	Potassium	6350	5000		V	4980
Trench T 2	7391	GW02599IT	3/16/92	Sodium	158000	5000		V	139900
Trench T 2	7391	GW02902IT	5/21/92	Sodium	537000	5000		V	139900
Trench T 2	7391	GW03457IT	8/28/92	Sodium	338000	38 8		V	139900
Trench T 2	7391	GW03862IT	11/16/92	Sodium	289000	5000		V	139900
Trench T 2	7391	GW02599IT	3/16/92	Strontium	2980	200		V	1060
Trench T 2	7391	GW02902IT	5/21/92	Strontium	3090	200		V	1060
Trench T 2	7391	GW03457IT	8/28/92	Strontium	3160	6 5		V	1060
Trench T 2	7391	GW03862IT	11/16/92	Strontium	2950	200		V	1060

LABORATORY QUALIFIER
E = Reported value is estimated due to interference

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result

Table 3 2-9 Groundwater Dissolved Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (µ g/L)
Trench T 2	7391	GW01616WC	11/30/93	Antimony	51	36	J	Y	6
Trench T 2	7391	GW02589GA	5/18/95	Antimony	43	60	B	Y	6
Trench T 2	7391	GW02599IT	3/16/92	Manganese	617	15		V	183
Trench T 2	7391	GW02902IT	5/21/92	Manganese	417	15		V	183
Trench T 2	7391	GW03457IT	8/28/92	Manganese	302	1		V	183
Trench T 2	7391	GW03862IT	11/16/92	Manganese	292	15		V	183
Trench T 2	7391	GW00761WC	5/21/93	Thallium	18	10		V	2
Trench T-2	7391	GW01042GA	7/25/94	Thallium	4	10	B	Z	2

LABORATORY QUALIFIER
B = Detected concentration was less than contract required detection limit and above instrument detection limit
J = Estimated quantification

VALIDATION CODES
V = Valid result
Y = Analytical results in validation process
Z = Validation was not requested or performed

Table 3 2-9 Groundwater Total Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (µ g/L)
Trench T 2	7391	GW03457IT	8/28/92	Antimony	44 1	18 8		JA	6
Trench T 2	7391	GW02599IT	3/16/92	Manganese	617	15	E	V	183
Trench T 2	7391	GW02902IT	5/21/92	Manganese	477	15		V	183
Trench T 2	7391	GW03457IT	8/28/92	Manganese	339	1 4		V	183
Trench T 2	7391	GW03862IT	11/16/92	Manganese	325	15		V	183

LABORATORY QUALIFIER
E = Reported value is estimated due to interference

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result

Table 3 2-10 Groundwater Dissolved Radionuclide Activities Exceeding $UTL_{95/95}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 2	7391	GW02599IT	3/16/92	Gross Beta	56.41	10	9.3	A	37 71
Trench T 2	7391	GW03457IT	8/28/92	Gross Beta	44	30	20	V	37 71
Trench T 2	7391	GW00398WC	3/16/93	Gross Beta	43	13	14	A	37 71
Trench T 2	7391	GW02599IT	3/16/92	Radium-226	2.822	0 07	0 532	A	1 18
Trench T 2	7391	GW02902IT	5/21/92	Radium-226	2 773	0 06	0.523	A	1 18
Trench T-2	7391	GW03862IT	11/16/92	Radium-226	1 899	0 09	0 393	A	1 18
Trench T 2	7391	GW00398WC	3/16/93	Radium-226	1 8	0 35	0 41	A	1 18
Trench T-2	7391	GW00761WC	5/21/93	Radium-226	2	0 193	0.382	V	1 18
Trench T 2	7391	GW01261WC	9/14/93	Radium-226	2.1	0 06	0.06	A	1 18
Trench T 2	7391	GW00287GA	3/10/94	Radium-226	1 4	0.09	0.13	V	1 18
Trench T 2	7391	GW01042GA	7/25/94	Radium-226	1 265	0.0905	0.25	Y	1 18
Trench T 2	7391	GW02197GA	3/14/95	Radium-226	1 3572	0 2159	0.3651	Y	1 18
Trench T 2	7391	GW02589GA	5/18/95	Radium-226	1 5	0.049	0.06	Y	1 18
Trench T 2	7391	GW02902IT	5/21/92	Strontium-89 90	2.141	0 6	0.939	JA	1 164
Trench T 2	7391	GW00768GA	5/26/94	Strontium-89 90	1 5	1 5	0.95	V	1 164
Trench T-2	7391	GW02599IT	3/16/92	Uranium-238	75 73	0 095	10	A	52 6

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted, but was estimated
V = Valid result
Y = Analytical results in validation process

Table 3 2-10 Groundwater Total Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T 2	7391	GW00788GA	5/26/94	Americium 241	0 34	0 03	0 082	V	0 04
Trench T 2	7391	GW02197GA	3/14/95	Plutonium-239 240	0 18	0 008	0 029	Y	0 06

VALIDATION CODES
V = Valid result
Y = Analytical results in validation process

108

Table 3 2-11 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T 2	7391	GW02599IT	3/16/92	Gross Alpha	67 11	7 1	16.6	A	7
Trench T 2	7391	GW02902IT	5/21/92	Gross Alpha	30.06	5.7	12 9	A	7
Trench T 2	7391	GW03862IT	11/16/92	Gross Alpha	37.38	8 9	14.3	A	7
Trench T 2	7391	GW00396WC	3/16/93	Gross Alpha	40	6 59	9 7	A	7
Trench T-2	7391	GW00761WC	5/21/93	Gross Alpha	25	21 2	16 3	V	7
Trench T 2	7391	GW01261WC	9/14/93	Gross Alpha	40	5 1	6 4	V	7
Trench T 2	7391	GW00287GA	3/10/94	Gross Alpha	25	4 5	5.1	V	7
Trench T 2	7391	GW00788GA	5/26/94	Gross Alpha	25	4.2	4.8	V	7
Trench T 2	7391	GW02197GA	3/14/95	Gross Alpha	26.0704	19 0418	15.3441	Y	7
Trench T 2	7391	GW02589GA	5/18/95	Gross Alpha	28	3.5	5 1	Y	7
Trench T 2	7391	GW03011GA	12/5/95	Gross Alpha	27 44	5.19	7 73	Y	7
Trench T 2	7391	GW02599IT	3/16/92	Gross Beta	56.41	10	9 3	A	5
Trench T-2	7391	GW02902IT	5/21/92	Gross Beta	10 77	13	7 17	A	5
Trench T 2	7391	GW03457IT	8/28/92	Gross Beta	44	30	20	V	5
Trench T 2	7391	GW03862IT	11/16/92	Gross Beta	28.61	15	9.51	A	5
Trench T 2	7391	GW00396WC	3/16/93	Gross Beta	43	13	14	A	5
Trench T-2	7391	GW01261WC	9/14/93	Gross Beta	12	12	7 9	V	5
Trench T 2	7391	GW00287GA	3/10/94	Gross Beta	18	11	7 7	V	5
Trench T 2	7391	GW00788GA	5/26/94	Gross Beta	29	4 9	3.6	V	5
Trench T 2	7391	GW02197GA	3/14/95	Gross Beta	35.507	21.2152	14 4206	Y	5
Trench T 2	7391	GW02589GA	5/18/95	Gross Beta	31	11	8.3	Y	5
Trench T 2	7391	GW03011GA	12/5/95	Gross Beta	24.45	11 5	7.04	Y	5
Trench T 2	7391	GW02902IT	5/21/92	Strontium-89 90	2.141	0.6	0.939	JA	0.852
Trench T 2	7391	GW00788GA	5/26/94	Strontium-89,90	1 5	1.5	0 95	V	0.852
Trench T 2	7391	GW02599IT	3/16/92	Uranium-233,234	24 42	0.095	3 67	A	1 07
Trench T-2	7391	GW02902IT	5/21/92	Uranium-233,234	14 67	0	2.42	A	1 07
Trench T-2	7391	GW03457IT	8/28/92	Uranium-233,234	16	0.5	2.5	V	1 07
Trench T 2	7391	GW03862IT	11/16/92	Uranium-233,234	19.58	0 141	3.13	A	1.07
Trench T 2	7391	GW00396WC	3/16/93	Uranium-233,234	22	0.066	0.89	A	1 07
Trench T-2	7391	GW00761WC	5/21/93	Uranium-233,234	17	0.1623	2.0181	A	1 07
Trench T 2	7391	GW01615WC	11/30/93	Uranium-233,234	14	0 1	1.5	Y	1 07
Trench T 2	7391	GW00287GA	3/10/94	Uranium-233,234	16	0 22	3.1	V	1.07
Trench T-2	7391	GW02589GA	5/18/95	Uranium-233,234	12	0 1	1.3	Y	1 07
Trench T 2	7391	GW03011GA	12/5/95	Uranium-233,234	16 98	0.336	3.35	Y	1 07
Trench T 2	7391	GW02599IT	3/16/92	Uranium-235	1 454	0 095	0.547	A	1 01
Trench T-2	7391	GW03457IT	8/28/92	Uranium-235	1 5	0 3	0.51	V	1 01
Trench T 2	7391	GW03862IT	11/16/92	Uranium-235	1.238	0.1	0.514	A	1 01
Trench T 2	7391	GW00761WC	5/21/93	Uranium-235	1 3	0 1032	0.4468	A	1 01
Trench T 2	7391	GW02599IT	3/16/92	Uranium-238	75 73	0 095	10	A	0 768

Table 3 2-11 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T 2	7391	GW02902IT	5/21/92	Uranium 238	33 97	0 162	4 84	A	0 768
Trench T 2	7391	GW03457IT	8/28/92	Uranium-238	40	0 4	5 4	V	0 768
Trench T 2	7391	GW03862IT	11/16/92	Uranium-238	39 13	0 173	5 61	A	0 768
Trench T 2	7391	GW00398WC	3/16/93	Uranium 238	37	0 032	1 2	A	0 768
Trench T 2	7391	GW00761WC	5/21/93	Uranium-238	34	0 1867	3 4395	A	0 768
Trench T 2	7391	GW01618WC	11/30/93	Uranium 238	24	0 084	2 3	Y	0 768
Trench T 2	7391	GW00287GA	3/10/94	Uranium-238	26	0 3	4 9	V	0 768
Trench T 2	7391	GW02589GA	5/18/95	Uranium-238	33	0 067	3 3	Y	0 768
Trench T 2	7391	GW03011GA	12/5/95	Uranium-238	33 35	0 359	6 05	Y	0 768

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted but was estimated
V = Valid result
Y = Analytical results in validation process

Table 3 2-11 Groundwater Total Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL (pCi/L)
Trench T 2	7391	GW00788GA	5/26/94	Americium-241	0 34	0 03	0 082	V	.
Trench T 2	7391	GW01042GA	7/25/94	Gross Alpha	26.35	8 85	10	V	7
Trench T 2	7391	GW01042GA	7/25/94	Gross Beta	11 2	9.27	5 07	V	5
Trench T 2	7391	GW02197GA	3/14/95	Plutonium-239 240	0 18	0 008	0 029	Y	0 151
Trench T 2	7391	GW01042GA	7/25/94	Uranium-233 234	9 05	0 806	2 11	A	1 07
Trench T 2	7391	GW01042GA	7/25/94	Uranium-238	19.46	0 628	3 71	A	0 768

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result
Y = Analytical results in validation process

TABLE 3 2-12 TRENCH T-2 SUMMARY INFORMATION

CONTAMINANTS		
Media Subsurface Soils		
Greater than $UTL_{99/99}$	Greater than RFCA Standards	Greater than PPRGs
	2 methyphenol Methylene chloride Trichloroethene Tetrachloroethene	
Arsenic Barium Beryllium Cadmium Copper Cobalt Lead Mercury Molybdenum Nickel Selenium Silver Zinc		Beryllium
Gross alpha Gross beta Americium 241 Cesium-137 Plutonium 239/240 Uranium 233/234 Uranium 235 Uranium 238		Radium 226 Radium 228 Uranium-233/234 Uranium 238

112

TABLE 3.2-12 TRENCH T-2 SUMMARY INFORMATION (continued)

Media Groundwater			
Greater than $UTL_{95/95}$	Greater than RFCA Tier II Standards	Greater than RFCA Tier I Standards	Greater than PPRGs
	1,1,2,2-tetrachloroethane 1,1,2-trichloroethane 1,1-dichloroethene 1,2-dichloroethane 1,2-dichloropropane Benzene Bromomethane Chloroform Chloromethane Hexachlorobutadiene Methylene chloride Tetrachloroethene Trichloroethene Vinyl chloride	Hexachlorobutadiene Tetrachloroethene Trichloroethene	
Antimony Barium Calcium Magnesium Manganese Nickel Potassium Sodium Strontium Vanadium	Antimony Manganese Thallium		
Gross beta Americium-241 Plutonium-239/240 Radium-226 Strontium-89/90 Uranium-238	Gross Alpha Gross Beta Plutonium-239/240 Strontium-89/90 Uranium-233/234 Uranium-235 Uranium-238		

PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
18 feet	7	10	47	Yes	Yes VOC plume migrating east-northeast

113

TABLE 3.2-12 TRENCH T-2 SUMMARY INFORMATION (continued)

Note

Source removed through an accelerated action

A RFCA subsurface soil action level for 2-Butanone has not been determined

Exhibit 3.2.A
Trench T-2 Historical Release Report Information

117

PAC REFERENCE NUMBER 900-109

IHSS Reference Number 109, Operable Unit 2

Unit Name Trench T-2

Approximate Location N748,500, E2,086,000

Date(s) of Operation or Occurrence

July 1954? - August 1968? (see Comments)

Description of Operation or Occurrence

The function of Trench T-2 was similar to that of the East Trenches (Trenches T-3 through T-11, PAC NE-110 and PAC NE-111) and there is no distinction made in their operation. No documentation was found which specifies when Trench T-2 received its first waste nor when its use was discontinued. All of these trenches received sewage sludge from the on-site sanitary treatment plant in addition to some crushed empty drums Collectively, approximately 275,000 pounds of sanitary sewer sludge and 300 flattened empty drums are buried in the trenches The trenches are 10 feet deep and covered with approximately 2 feet of soil [1]

Authorization was given in July 1954 for the disposal of sludge in on-site trenches [2] A threshold level of activity in the sludge when it was produced was the determination for on-site burial or off-site disposal [3] Activity levels for sludge buried onsite were of the same order of magnitude as the upper limit criterion recommended for sludge that may be used for fertilizer [4]

Physical/Chemical Description of Constituents Released

Sewage sludge was contaminated with uranium and plutonium The radioactivity in the sludge ranged between 8.4×10^5 dpm/kg in August 1964 to 7.9×10^6 dpm/kg in June 1960 and contained a total alpha radioactivity on the order of 100 to 150 millicuries [5] Trenches constructed in earlier years are expected to have mostly uranium contamination with an increasing plutonium fraction in trenches constructed in the later years [6]

Flattened drums had surface residues of depleted uranium [7] These drums may have held oils from Building 444, Building 881 and Building 883 The oils from Building 881 and Building 883 probably contained enriched uranium [8]

A recommendation was made in September 1962 for the disposal of clay from the clay-lined solar pond in the dried sewage sludge trench [9] It is not known which trench was active at that time

Permission was granted by the Waste Disposal Co-Ordination group on December 15, 1964 to dump 2 400 gallons of liquid waste from Building 444 into the sewage sludge trench. The liquid waste was comprised of lathe coolant and water with other liquids The average concentration was 150 000 disintegrations per minute per liter The total activity was approximately 1.35×10^8 disintegrations per minute and approximately 1 35 kilograms of depleted uranium [10]

Responses to Operation or Occurrence

Burial of sludge in the trenches ceased when the Present Landfill began operation in August 1968 [11]

Best Available Copy

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of constituents released This IHSS is being studied in accordance with the IAG schedule for OU2 However, the information gathered for this unit for this report indicate that previously identified potential constituents released to the environment are inaccurate (see Comments) The IAG activities will include site investigations, site characterizations, and site remediation The Final Phase II RFI/RI Report is to be completed by August 9, 1993

Comments

After a review of the information gathered for this project, it is believed that Trench T-2 was not used in the same manner as the East Trenches as indicated in RCRA 3004(u) Based on a review of historical documents, an evaluation of many historical photographs, and interviews with former RFP personnel who were directly involved with plant waste disposal activities, it is believed that Trench T-2 was used from approximately 1969 to 1971 for the disposal of nonradioactive liquid chemical wastes and that Trench T-2 was known as "Ryan s Pit." Specific reasons for this conclusion follow

Previously, Trench T-2 was believed to have been used similarly to the East Trenches (T-3 through T-11) because of discussion in a 1970 document entitled "A Summary of On Site Radioactive Waste Disposal "[2] However, the discussion is rather vague "There appears to be 7 locations used for sludge burial " Later documents are based on reference 2 and there are no earlier documents which identify the location and activities of Trench T-2

An evaluation of aerial and low-angle oblique photographs was made and included the years 1953 1955 1957 1964, 1969, 1970, and 1971[12] Activities involving on-site burial of sludge from the sanitary wastewater treatment plant occurred from July 1954 through August 1968 These photographs clearly indicate the existence of the East Trenches in various stages of development Yet none of the photographs from 1953 through 1968 provides any indication of ground disturbances in the area of Trench T-2

Furthermore, the photographs indicate the trench as being open in 1969 and 1970 The burial of sanitary wastewater treatment sludge on plantsite ceased by August 14, 1968 at which time sludge began to be disposed of in the Present Landfill (PAC NW-114)

Trench T-2 is different from the East Trenches in being isolated in the area south of the 903 storage area and inside the security fence It is also somewhat smaller than any one of the trenches in the East Trench Area The dimensions of Trench T-2 as recalled by a retired RFP employee are approximately 20 feet long 10 feet wide and 5 feet deep[15] CEARP documents the dimensions of the East Trenches as 300 feet long 50 feet wide and 10 feet deep

Instead, it is believed that Trench T-2 was used for the disposal of liquid waste between 1969 and 1971 Close up photographs of the area are available from 1969, 1970, and 1971 In 1969 and 1970, there clearly is an open trench in the area south of the 903 Pad and in the general area as located in the 1970 report. The size of the trench is of a magnitude recalled by the retired RFP employee and not the dimension given in CEARP In the May 1971 photograph, the trench is backfilled and graded, but still visible

Several interviews conducted for this report provided information about the dumping of solvents in a trench in this area in the time period of the late 1960s and early 1970s The trench was referred to as "Ryan s Pit" named for a member of the Waste Disposal Co-Ordination Group who was involved with solvent disposal The operation of this trench, as recalled by interviewees, is as follows After radiation screening identified the solvents as nonradioactive, the solvents were dumped in the trench as a method of disposal The solvents were disposed of in small quantities Solvents that may have been dumped included perchloroethylene trichloroeth-

119

ane, and possibly carbon tetrachloride though not as likely These were the solvents typically used as the RFP at the time Other chemicals which were dumped included paint thinner and small quantities of construction-related chemicals[14 15] This description of the operation is consistent with the review of aerial photographs

Other IHSSs identified in the area have conflicting or otherwise unclear descriptions in RCRA 3004(u) Adjacent areas, the West Scrap Metal Storage Area and the East Scrap Metal Storage Area (PAC 119 1 and PAC 119 2) were identified in 3004(u) as locations where solvent storage and spills occurred Photographs and interviewee recollection corroborate the activity that occurred in these areas was the storage of scrap metal and not the storage of solvents People interviewed for CEARP describe the dumping of solvents along the Southeast Perimeter Road. It is probable that the interviewees for CEARP were referring to Trench T-2 and not the scrap metal storage areas Trench T-2 had accesses from the Southeast Perimeter Road and was located within a few hundred yards of it.

PAC 800-103 and PAC 800-104 were identified in 3004(u) as a Chemical Burial area and a Liquid Dumping area, respectively, with locations described in CEARP Phase 1 as being "east of Building 881 " These areas were subsequently mapped on the IAG map as being directly east of the building. This could not be confirmed during the research for the HRR and it is probable that these activities actually took place in Trench T-2 CEARP Phase 1 indicates that an area east of Building 881 was used for the disposal of unknown liquids and drums into a pit which was located in an area of scrap metal and "junk" on the ground surface This is consistent with the identification of Trench T 2 as the disposal area because the East Scrap Metal Storage Area (PAC 900-119 2) is immediately west of Trench T 2 and would have had scrap metal and "junk on the ground surface The narratives for PACs 800-103 800-104 900-119 1, and 900-119 2 provide further discussion of reasons for this hypothesis

In conclusion it is proposed that PAC 800-103 and PAC 800-104 be combined with this PAC and defined as PAC 900-109 Trench T-2 Liquid Chemical Disposal Trench and the dates of operation be from approximately 1969 through approximately 1971

References

[1] 1500898
[2] 1500793
[3] 1601048
[4] 1600370
[5] 1600173
[6] 1601057
[7] 1500292
[8] 1501098
[9] 1700445
[10] 1600414
[11] 1500793
[12] 1500716
1502710
[13] 1502642
1700834
1800275
1800272
1502643
[14] 1502788
[15] 1502785

Other References of Interest

1501100
1500887
1600810
1600122
1500768
1500357
1600371
1500765

120

Exhibit 3.2.B
Trench T-2 EM-31 Surveys

Exhibit 3.2.C
Trench T-2 EM-61 Surveys

Exhibit 3.2.D
Trench T-2 Borehole Logs

128

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 11 00	GROUND ELEVATION (FT) 5959 90	PROJECT NUMBER 012 NTS	LOG OF BORING NUMBER
NORTH	748629	AREA TRENCH T-2	CASING DIAMETER (IN)	GEOLOGIST MONTY GOSNEY	13195
EAST	2085760	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED 05/05/95	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5959	0				0 0-3 0' No sample collected
				0 00 /3 00	5958	1				
					5957	2				
					5956	3			SW	3 0-4 0' gray sandy soil, rocky *2 C-F gravel, unconsolidated No recovery (4 0-5 0')
				1 00 /2 00	5955	4				
	6H208190				5954	5			CL	5 0-6 2' Clay gray, silty No recovery (6 2-7 0')
				1 20 /2 00	5953	6				
					5952	7			CL	7 0-7 3' Clay gray, mottley brown specks to streaks, slightyly plastic No recovery (7 3-9 0')
				0 30 /2 00	5951	8				
					5950	9			CL	9 0-10 8' Clay gray clay, no mottling, semi plastic No recovery (10 8-11 0')
				1 80 /2 00		10				

129

Best Available Copy

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 11 00	GROUND ELEVATION (FT) 5959 90	PROJECT NUMBER 002 NTS	LOG OF BORING NUMBER
NORTH	748629	AREA TRENCH T 2	CASING DIAMETER (IN)	GEOLOGIST MONTY GOSNEY	13195
EAST	2085760	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED 05/05/95	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	BH20820MC	0% 50%	100% 0%	100% 1 00 /2 00	5959	10				
					5958	11				Total Depth Drilled 11 00
					5957	12				
					5956	13				
					5955	14				
					5954	15				
					5953	16				
					5952	17				
					5951	18				
					5950	19				
					5949	20				

130

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT) 5956 00	PROJECT NUMBER OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	748627	AREA TRENCH T-2	CASING DIAMETER (IN)	GEOLOGIST MONTY GOSNEY	13295
EAST	2085805	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED 05/05/95	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS

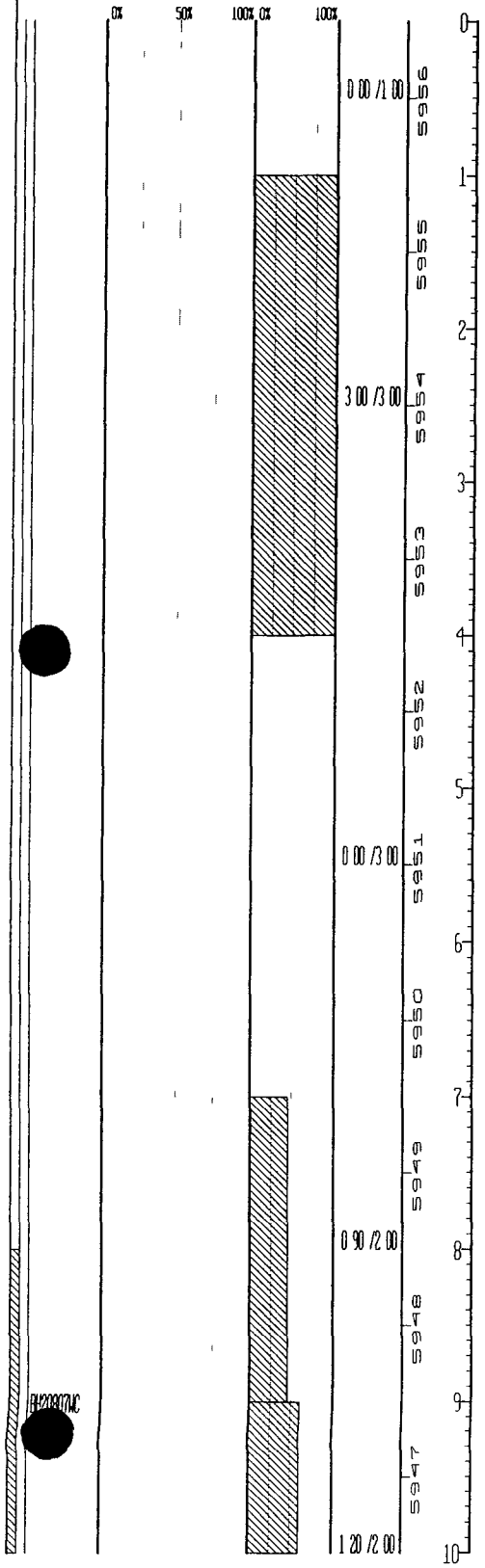
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5956	0				0 0-3 0' No sample collected
					5955	1				
				0 00 /3 00						
					5954	2				
					5953	3			CL	3 0-5 0' Clay gray, dry, non plastic
				2 00 /2 00	5952	4				
					5951	5			NO RECOVERY	5 0-6 0' No recovery
				0 00 /1 00						
					5950	6			CL	6 0-6 8' Clay gray, moderately plastic No recovery (6 8-8 0')
				0 80 /2 00	5949	7				
					5948	8			CL	8 0-9 75' Silty Clay gray, slight odor at 10 0' core was saturated with water No recovery (9 75-10 0')
				1 75 /2 00	5947	9				
						10				Total Depth Drilled 10 00

131

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 11 00	GROUND ELEVATION (FT)	5956 50	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	748625	AREA TRENCH T-2	CASING DIAMETER (IN)		GEOLOGIST	LZ GARDINER	13395
EAST	2085798	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	1 00	DATE DRILLED	05/04/95	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS (POOR DESCRIPTIONS)

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	0 0-1 0' No sample collected
CL	1 0-3 5' Silty Clay with some sand and gravel light gray, mottled 3 5-4 0' Silty Clay black to dark brown, moist, (?) discolored
NO RECOVERY	4 0-5 0' No recovery
CL	5 0-7 0' Recovery not recorded Silty clay, some gravel
CL	7 0-7 9' Clay gray, mottled orange to brown specks No recovery (7 9-9 0')
CL	9 0-10 2' Clay light gray, mottled with orange, little to no plasticity, dry

132

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 11 00	GROUND ELEVATION (FT) 5956 50	PROJECT NUMBER 002 RFI/RI	LOG OF BORING NUMBER
NORTH	748625	AREA TRENCH T-2	CASING DIAMETER (IN)	GEOLOGIST LZ GARDINER	13395
EAST	2085798	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED 05/04/95	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS (POOR DESCRIPTIONS)

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM(FT)	DEPTH(FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
0%		50%	100% 0%	100% 1 20 /2 00	5946	10			NO RECOVERY	10 2-11 0' No recovery
					5945	11				Total Depth Drilled 11 00
					5944	12				
					5943	13				
					5942	14				
					5941	15				
					5940	16				
					5939	17				
					5938	18				
					5937	19				
						20				

133

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT 049/089 FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 1

Borehole Number 13495
Location - North ~~[illegible]~~ East ~~[illegible]~~
Date 5/5/95
Geologist Monty Gosney
Drilling Equip Geoprobe

Surface Elevation NA
Area T-2
Total Depth 10
Company WCFS Project No 4040A
Sample Type Geoprobe

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0-10 ft								0		
								1		
								2		
3-5 ft 0 0	3-5 ft 38-50 ft	14" 3-5 ft	BH 20814WC 3-5 ft					3		Brown Clay, Black Mottled ~~Black~~ specks 05-5-95 AT 45-50 ft #4 white granite, Mixed with C-F Gravels - Clay was Dry 3-5 ft
								4		
5-7 ft 18"	Refusal at 6 ft offset 5-7 ft	24" 5-7 ft						5		5-7 ft LIGHT Brown Clay -
								6		
7-8 ft 0 0 ft	VOID 0	0						7		7-8 ft VOID space
8-10 ft 0 0 ft	8-10 ft 82-100 ft	22" 7-10 ft	BH 20815WC 8-10 ft					8		LIGHT Brown Clay - Some Mixed Quartz & Granite size 2-4 C-F Gravel 8-10 ft
								9		
								10		

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

Rg'd by [illegible] 6/14/95

134

(4011 930-0134-930)(Form GT 1A)(03/01/92)

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT 050/089 FORM GT 1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG

PAGE 1 OF 1

Date 5/5/95

Borehole Number 13495

Rig Geologist Monty Gosney

Company WCFS

FEET

0

1

2

3

3-5 ft
Brown clay, Black mottling specks,
AT 4.5-5.0 ft #4 white granite, mixed with C-F gravels
Clay was dry
Sample # BH20814WC

4

5

5-7 ft
Gray clay

6

7

possible DO 10 7-8 ft

8

8-10 ft
Light Brown clay, some mixed Quartz, & Granite #2,4
C-F Gravel
Sample # BH20815WC

9

10

NOTES

135

(4011 930-0135 930)(Form GT 1B)(03/01/92)

3 3 TRENCH T-4 (IHSS 111 1)

Trench T-4 was investigated using the following methodologies

- Historical data were compiled to identify potential contaminants, trench location, and size
- Aerial photographs were examined to identify disturbed areas, verify trench dimensions and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- Two EM surveys were conducted to locate buried metallic objects and define trench boundaries
- GPR surveys were conducted to better determine trench depth and dimensions
- Soil gas surveys were conducted to identify and delineate contaminant plumes
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the trench

As shown in Figure 3 3-1 Trench T-4 is located approximately 300 feet north of the East Access Road adjacent to Trench T-3 (IHSS 110) The dimensions of the trench are approximately 110 feet long, 15 feet wide, and 10 feet deep The trench was reportedly used for disposal of sanitary sewage sludge potentially contaminated with uranium and plutonium and flattened empty drums contaminated with uranium Activities of the sewage sludge were reported between 382 pCi/g and 3 590 pCi/g Older sludge had mostly uranium with an increasing plutonium fraction in later sludge placed in the trenches Total alpha radioactivity in the trench is estimated to be 100 to 150 millicurie (0 1 Ci to 0 15 Ci) Trench T-4 may also contain some asphalt planking from the Solar Evaporation Ponds contaminated with plutonium and uranium The pertinent section of the HRR is included in Exhibit 3 3 A (PAC Reference Number NE111 1-NE111 8)

Although the general location of Trench T-4 was known, the exact location of the trench had not been physically identified prior to the Trenches Area and Mound Site Characterization Program of 1995 Aerial photographs dating from 1964 through 1972 were examined to ascertain the period of operation approximate the length and width identify staging areas and gather information which might confirm the contents of the trench (Colorado Aerial Photo Service, 1993) Photographs from 1967 through 1970 show this site as approximately 20 feet wide and 120 feet long, with dark staining and disturbed soil The location and dimensions of this staining and soil disturbance are consistent with information from the HRR Prior to 1967 there are no indications of soil disturbance or waste disposal activities in the area Photographs after 1970 show surficial scarring indicating closure and abandonment of the area

136

3 3 1 Geology

Surficial deposits consist of Rocky Flats Alluvium to a depth of approximately 18 feet overlying the Arapahoe and Laramie Formations Artificial fill deposits correspond with the area identified as Trench T-4 The Rocky Flats Alluvium consists of clayey gravels, and gravel-sand-clay mixtures

The top of bedrock in the Trench T-4 area is approximately 18 feet bgs and is predominately sandstone, clayey sandstone, and silty sandstone The channel of the Arapahoe Formation Number 1 Sandstone is approximately 40 feet thick and is found in contact with the Rocky Flats Alluvium beneath Trench T-4 (EG&G 1995c) The hydrograph from monitoring well 03191, located east of T-4, indicates that the groundwater fluctuates between 17 bgs feet to below the contact of the surficial deposits and bedrock.

3.3.2 Site Visual Survey and Geophysical Surveys

After aerial photographs were examined, a visual survey of the Trench T-4 area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general area of Trench T-4 Soil disturbances such as mounding and subsidence were identified and recent geologic characterization information were used to delineate between unconsolidated Rocky Flats Alluvium and soil disturbance caused by construction related activities Evidence of fill deposits were also noted In addition to the geologic characteristics of the area, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material. The area did not show any evidence of surficial water or seeps

Upon completion of the visual survey, a geophysical grid was laid out using pin flags. The grid was divided into two sections T-4W (50 feet wide by 100 feet long) and T-4E (65 feet wide 125 feet long) making the total grid dimensions 65 feet wide (north-south) by 220 feet long (east-west) with flags placed at five foot increments.

EM-31 Survey

After establishing the geophysical grid, the EM-31 survey was performed. The initial data collected from the survey depicts anomalies in the top eight feet which extend lengthwise for about 120 feet Both the vertical and horizontal dipole modes of the EM-31 survey indicate anomalies which are 10 to 17 feet wide and extend for 120 feet and represent Trench T-4 This depiction is consistent with the HRR and aerial photographs These anomalies strongly support the presence of metallic objects and/or other conductive solid or liquid materials in the trench The EM-31 survey results also

137

indicate a small conductive plume migrating east-northeast Results of the EM-31 survey are presented in Exhibit 3 3 B

EM-61 Survey

To further define the anomalies an EM-61 survey was also performed with results similar to the EM-31 survey In contrast to the EM-31 survey, the EM-61 showed a more centralized region of high magnetic activity at the western end of the trench approximately 7 feet wide and 25 feet long This anomaly depicts the area within the trench most likely to contain the buried flattened drums referred to in the HRR The EM-61 survey results are presented in Exhibit 3 3 C

Ground Penetrating Radar

GPR was used in conjunction with the EM-31 and EM-61 surveys to better define the dimensions of Trench T-4 Results from the GPR survey indicate the trench bottom varies from 8 to 9 feet bgs The width of the trench varies from 14 to 16 feet The GPR survey indicates the presence of 10 linear feet of dense material 45 feet from the western edge of the trench and again at 40 feet from the eastern edge of the trench These areas are between 5 and 8 feet bgs This is consistent with the findings of the EM surveys GPR survey results are presented in Exhibit 3 3 D

3 3 3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995 the vadose zone within Trench T-4 area was highly saturated The increased soil moisture content tended attenuate soil gas readings, making sample collection difficult However 42 samples were collected during this phase of the characterization and 30 were analyzed for total volatile organic content using field instrumentation To verify total VOC readings 12 samples were collected and sent to an onsite laboratory for general chemistry analysis using method 8010

Based on the trench boundaries determined by the geophysical surveys, soil gas sampling locations were placed along two horizontal lines located 10 feet apart on either side of the centerline of the trench Soil gas samples were collected every 10 feet along these lines at depths of five and nine feet bgs If a sample had a field measurement above 100 ppm the field crew stepped off 10 feet from that location and collected an additional sample This procedure was repeated until readings less than 100 ppm were obtained This methodology was employed to identify whether a VOC contaminant plume existed within or extends outside of the trench boundaries

138

The soil gas survey results identify a VOC contaminant plume emanating from the eastern third of the trench and migrating east-northeast towards South Walnut Creek At five feet bgs the maximum concentration of total VOCs (1,291 ppm) was detected at location SG2T04005C (15 feet north of the trench boundary) The maximum concentration for total VOCs (5,119 ppm) at the nine foot bgs was detected at location SB2T04004 located in the center of the trench with additional high concentrations ranging from 1,310 ppm to 4,598 ppm located within 10 feet in any direction of this location At both the five and 10 foot bgs, VOC contaminant plumes can be identified to the north-northeast of the trench The higher VOC concentrations were detected at the nine foot bgs level

While collecting samples at location SG2T04005 located 15 feet east of the center of the trench, residual of an oily liquid was discovered on the push rod of the Geoprobe The crew offset the rig approximately one foot and attempted to recover a sample of this liquid for analysis, but was unable to collect a sample During the sampling activities, flattened drums were encountered at SG2T04004 and SG2T04011 necessitating offsetting the rig one foot from the original sampling locations Soil gas investigation results are presented in Figure 3.3-2

3 3 4 Subsurface Soil Sampling

Subsurface soil sampling from Trench T-4 was the final step of the characterization activities Seven borehole locations, 10595, 10695, 10795, 10895, 10995, 12995, and 13995 were selected for soil sampling based on the findings of the aerial photograph search, the geophysical surveys and the soil gas survey results Lithologic descriptions of each borehole are presented in Exhibit 3 3.E. In addition, boreholes and wells 02891, 03091, 03191, 0574, 0674, 10291, 10391, 12591, 12691, 21091, 21193, 21993, B217589, BH4187 and BH4287, were drilled and sampled previously Data from all characterization efforts indicate elevated levels of organic compounds, metals and radionuclides Figure 3 3-3 identifies those boreholes and wells that characterize Trench T-4

Organic Compounds

Methylene chloride (8,200 µg/kg), tetrachloroethene (range 12,000-37,000 µg/kg) and trichloroethene (range 11,000-680,000 µg/kg) were detected at concentrations exceeding the RFCA Subsurface Soils Action Levels as presented in Table 3 3-1 Detected concentrations did not exceed the PPRGs for subsurface soils, construction worker scenario

Metals

Beryllium (22 9 mg/kg), cadmium (range 1 4-10 5 mg/kg), chromium (range 89 2-127 mg/kg), copper (132 mg/kg), lead (59 5 mg/kg), mercury (6 0 mg/kg), silver (68 5 mg/kg), and zinc (437

mg/kg) concentrations exceeded the background $UTL_{99/99}$ as shown in Table 3 3-2 Detected concentrations did not exceed the PPRGs for subsurface soils, construction worker scenario

Radionuclides

Gross beta (range 52 09-71 87 pCi/g), americium-241 (range 0 02-5 91 pCi/g), cesium-137 (0 16 pCi/g) plutonium-239/240 (range 0 03-16 58 pCi/g) uranium-233/234 (range 5 53-191 7 pCi/g) uranium-235 (range 0 52-11 5 pCi/ kg) and uranium-238, (range 22 31-113 1 pCi/g) activities exceeded the background $UTL_{99/99}$ as presented in Table 3 3-3 Radium-226 (range 0 59-0 91 pCi/g), radium-228 range 1 14-2 14 pCi/g), uranium-233/234 (191 7 pCi/g), and uranium-238 (113 1 pCi/g) activities exceeded the PPRGs for subsurface soils, construction worker scenario as shown in Table 3 3-4

3 3 5 Groundwater

There are several wells located in the Trench T-4 area Elevated levels of organic compounds metals and radionuclides were detected in the groundwater as follows

Organic Compounds

Carbon tetrachloride (range 53-4 500 µg/L) chloroform (160 µg/L), hexachlorobutadiene (2 µg/L), methylene chloride (range 9-14 µg/L), tetrachloroethene (range 16-1,000 µg/L), and trichloroethene (range 5-110 µg/L) concentrations exceeded the RFCA Tier II Groundwater Action Levels as presented in Table 3 3-5 Detected concentrations of carbon tetrachloride (range 51-4 500 µg/L) tetrachloroethene (1,000 µg/L), and trichloroethene (560 µg/L) exceeded the RFCA Tier I Groundwater Action Levels as presented in Table 3 3-6

Metals

Total aluminum (30 900 µg/L), total antimony (57 3 µg/L) dissolved barium (range 177-251 µg/L) total barium (range 301-634 µg/L) dissolved calcium (range 145,000-180 000 µg/L) total calcium (range 146,000-172000 µg/L), dissolved chromium (27 6 µg/L), dissolved copper (111 µg/L), total copper (49 2 µg/L), dissolved iron (38 200 µg/L) total iron (43 900 µg/L), total lead (range 18 5-31 1 µg/L), dissolved manganese (range 302-663 µg /L), dissolved nickel (39 5 µg/L) total potassium (range 5120-7 080 µg/L) dissolved vanadium (51 9 µg/L), total vanadium (90 µg/L) concentrations exceeded the background $UTL_{99/99}$ as shown in Table 3 3-7 Dissolved antimony (range 10 1-30 7 µg/L) total antimony (range 8 7-57 3 µg/L) dissolved manganese

140

(range 252-663 µg/L), and total manganese (range 206-700 µg/L) concentrations exceeded the RFCA Tier II Groundwater Action Levels as presented in Table 3.3-8 Detected concentrations did not exceed the RFCA Tier I Groundwater Action Levels or the PPRGs for surface water, open-space receptor

Radionuclides

Total americium-241 (0 09 pCi/L), total plutonium-239/240 (range 0 09-0.35 pCi/L), total radium-226 (range 135-2 6 pCi/L), and dissolved radium-226 (1 4 pCi/L) activities exceeded the background $UTL_{99/99}$ as shown in Table 3.3-9 Dissolved gross alpha (11 3 pCi/L), total gross alpha (7 09 pCi/L), dissolved gross beta (range 5 6-8 4 pCi/L), total plutonium-239/240 (range 0 30-0 35 pCi/L), dissolved strontium-89/90 (0 90 pCi/L), dissolved uranium-233/234 (range 1 3-6 38 pCi/L), total uranium-233/234 (1 61 pCi/L), dissolved uranium-235 (1 33 pCi/L), and dissolved uranium-238 (range 0 94-4 15 pCi/L) activities exceeded the RFCA Tier II Groundwater Action Levels as presented in Table 3 3-10 Detected activities were less than the RFCA Tier I Groundwater Action Levels and the PPRGs for surface water, open-space receptor

3.3 6 Summary

The geophysical surveys indicated that the trench is approximately 120 feet long, 10 to 17 feet wide, and 8 to 9 feet deep This corresponds to 360 to 680 cy of buried material The surveys also indicate the presence of buried metallic objects and/or other conductive liquid or solid materials which correlates with the information in the HRR.

The soil gas survey indicated a VOC plume migrating in an east-northeasterly direction The EM-31 survey indicates the presence of a small conductive plume moving east-northeast.

Concentrations of three organic compounds exceeded the RFCA Subsurface Soil Action Levels The concentration of sevens metals and the activities of seven radionuclides exceeded subsurface soil background $UTL_{99/99}$ values

The concentrations of six organic compounds exceeded the RFCA Tier II Groundwater Action Levels The concentrations of nine total and seven dissolved metals exceeded the background $UTL_{99/99}$ values The concentrations of two total and two dissolved metals exceeded the RFCA Tier II Groundwater Action Levels The activities of four total and two dissolved radionuclides exceeded background $UTL_{99/99}$ values The activities of three total and six dissolved radionuclides exceeded the RFCA Tier II Groundwater Action Levels

141

Trench T-4 summary information is presented in Table 3 3-11

Source material at Trench T-4 was removed by an early removal action in 1996 The removal action generally confirmed the results of this investigation

142

Table 3 3-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Trench T 4	10291	BH00175WCU2	4 8	12/6/91	Tetrachloroethene	12	0 62		11 5	V
Trench T 4	10595	BH20766WC	3-8	5/1/95	Tetrachloroethene	37	0 005		11 5	Y
Trench T 4	10695	BH20768WC	8 8 5	5/1/95	Methylene Chloride	8 2	0 005	BJ	5 77	Y
Trench T 4	10695	BH20767WC	3-8	5/1/95	Tetrachloroethene	12	0 005		11 5	Y
Trench T 4	10695	BH20768WC	8 8 5	5/1/95	Tetrachloroethene	17	0 005	J	11 5	Y
Trench T 4	10695	BH20767WC	3-8	5/1/95	Trichloroethene	11	0 005		9 27	Y
Trench T 4	10695	BH20768WC	8-8 5	5/1/95	Trichloroethene	680	0 005		9 27	Y
Trench T 4	10795	BH20829WC	6-10	5/10/95	Tetrachloroethene	12	0 005		11 5	Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

LABORATORY QUALIFIERS
B = Indicates chemical was in both the sample and associated method blank
J = Positively identified below sample quantitation limit, result is estimated

NOTES
RFCA Action Levels for Benzoic Acid and 2 Butanone have not been determined

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted but was estimated
V = Valid result
Y = Analytical results in validation process

Table 3 3-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{99/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T-4	10291	BH00177WCU2	2-8	12/6/91	Beryllium	22.9	1		JA	18.3
Trench T-4	10291	BH00177WCU2	2-8	12/6/91	Cadmium	10.5	1		JA	1.33
Trench T-4	10291	BH00177WCU2	2-8	12/6/91	Chromium	127	2		JA	89.1
Trench T-4	10291	BH00177WCU2	2-8	12/6/91	Copper	132	5		JA	49.1
Trench T-4	10291	BH00177WCU2	2-8	12/6/91	Lead	59.5	1		JA	31
Trench T-4	10291	BH00177WCU2	2-8	12/6/91	Mercury	6	0.1		JA	1.16
Trench T-4	10291	BH00177WCU2	2-8	12/6/91	Silver	68.5	2		V	33.1
Trench T-4	10291	BH00177WCU2	2-8	12/6/91	Zinc	437	4		JA	183
Trench T-4	10291	BH00177WCU2	2-8	12/6/91	Chromium	89.2	2		Y	89.1
Trench T-4	10695	BH20830WC	7.7 10	5/11/95	Antimony	15.3	12		A	15.1
Trench T-4	B217589	B789BR0003	0-3	10/17/89	Cadmium	1.4			N	1.33
Trench T-4	BH4187	BH41870012	0-10.8	8/17/87	Cadmium	1.6			N	1.33
Trench T-4	BH4187	BH4187012D	0-10.8	8/17/87	Cadmium	1.4			N	1.33
Trench T-4	BH4187	BH418712UC	12-14.5	8/17/87	Cadmium	2.3			N	1.33
Trench T-4	BH4187	BH418714CT	14.5-17	8/17/87	Cadmium	1.6			N	1.33
Trench T-4	BH4187	BH418717BR	17 19.5	8/17/87	Calcium	58300			N	53250
Trench T-4	BH4187	BH4187012D	0-10.8	8/17/87	Arsenic	16			N	16.2
Trench T-4	BH4287	BH428717WT	17-18.8	8/18/87	Barium	397			N	372
Trench T-4	BH4287	BH428729DH	29.5-32	8/19/87	Cadmium	2.2			N	1.33
Trench T-4	BH4287	BH42870009	0-8.3	8/18/87	Cadmium	2.5			N	1.33
Trench T-4	BH4287	BH4287008D	0-8.3	8/18/87	Cadmium	2.2			N	1.33
Trench T-4	BH4287	BH428717WT	17 18.8	8/18/87	Cadmium	2.2			N	1.33
Trench T-4	BH4287	BH428722CT	22-24.2	8/18/87	Cadmium	2.8			N	1.33
Trench T-4	BH4287	BH428727BR	27-29.5	8/19/87	Cadmium	2.5			N	1.33
Trench T-4	BH4287	BH428729DH	29.5-32	8/19/87	Manganese	1670			N	1190
Trench T-4	BH4287	BH428729DH	29.5-32	8/19/87						

LABORATORY QUALIFIER

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted, but was estimated
N = Will not be validated
V = Valid result
Y = Analytical results in validation process

Table 3 3-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND UTL 99/99
Trench T 4	574	GT0006IT		2/25/92	Amencium 241	0 03	0 02	0 013		0 022
Trench T 4	574	GT0006IT		2/25/92	Plutonium 239 240	0 12	0 03	0 028		0 025
Trench T 4	674	GT0005IT		2/25/92	Plutonium 239 240	0 05	0 03	0 018		0 025
Trench T 4	10291	BH00177WCU2	2 8	12/6/91	Americium 241	3 29	0 02	0 363		0 022
Trench T 4	10291	BH00193WCU2	38-44	12/10/91	Americium 241	0 02	0 02	0 012		0 022
Trench T 4	10291	BH00177WCU2	2-8	12/6/91	Plutonium 239 240	15 12	0 03	2 4		0 025
Trench T 4	10291	BH00197WCU2	56-60	12/10/91	Plutonium 239 240	0 06	0 03	0 026		0 025
Trench T 4	10291	BH00197WCU2	56-60	12/10/91	Plutonium 239 240	0 06	0 03	0 026		0 025
Trench T 4	10291	BH00194WCU2	44-50	12/10/91	Plutonium-239 240	0 11	0 03	0 036		0 025
Trench T 4	10291	BH00193WCU2	38-44	12/10/91	Plutonium-239 240	0 16	0 03	0 043		0 025
Trench T 4	10291	BH00177WCU2	2-8	12/6/91	Uranium-233 234	191 7	0 3	24 3		3 441
Trench T 4	10291	BH00177WCU2	2 8	12/6/91	Uranium-235	11 5	0 3	1 61		0 153
Trench T-4	10291	BH00177WCU2	2 8	12/6/91	Uranium 238	113 1	0 3	14 4		1 807
Trench T-4	10391	BH00379WCU2	20-26	12/9/91	Americium 241	0 02	0 02	0 013		0 022
Trench T 4	10391	BH00379WCU2	20-26	12/9/91	Americium-241	0 02	0 02	0 013		0 022
Trench T-4	10391	BH00381WCU2	26-32	12/9/91	Americium-241	0 02	0 02	0 014		0 022
Trench T-4	10391	BH00381WCU2	26-32	12/9/91	Americium-241	0 02	0 02	0 014		0 022
Trench T 4	10391	BH00388WCU2	50-56	12/10/91	Americium 241	0 02	0 02	0 013		0 022
Trench T 4	10391	BH00387WCU2	50-56	12/10/91	Americium 241	0 03	0 02	0 013		0 022
Trench T-4	10391	BH00391WCU2	56-62	12/10/91	Americium 241	0 04	0 02	0 015		0 022
Trench T 4	10391	BH00391WCU2	56-62	12/10/91	Americium 241	0 04	0 02	0 015		0 022
Trench T 4	10391	BH00385WCU2	38-44	12/10/91	Americium 241	0 06	0 02	0 022		0 022
Trench T-4	10391	BH00384WCU2	32 38	12/10/91	Americium-241	0 47	0 02	0 074		0 022
Trench T-4	10391	BH00373WCU2	2 2-8 1	12/9/91	Plutonium-239 240	0 03	0 03	0 013		0 025
Trench T 4	10391	BH00381WCU2	26-32	12/9/91	Plutonium-239 240	0 03	0 03	0 019		0 025
Trench T 4	10391	BH00381WCU2	26-32	12/9/91	Plutonium 239 240	0 03	0 03	0 019		0 025
Trench T 4	10391	BH00379WCU2	20-26	12/9/91	Plutonium-239 240	0 03	0 03	0 026		0 025
Trench T-4	10391	BH00375WCU2	8 1 14	12/9/91	Plutonium-239 240	0 09	0 03	0 035		0 025
Trench T 4	10391	BH00388WCU2	50-56	12/10/91	Plutonium-239 240	0 08	0 03	0 026		0 025
Trench T 4	10391	BH00391WCU2	56-62	12/10/91	Plutonium-239 240	0 08	0 03	0 028		0 025
Trench T 4	10391	BH00387WCU2	50-56	12/10/91	Plutonium-239 240	0 13	0 03	0 046		0 025
Trench T 4	10391	BH00386WCU2	44-50	12/10/91	Plutonium-239 240	0 21	0 03	0 048		0 025
Trench T 4	10391	BH00385WCU2	38-44	12/10/91	Plutonium-239 240	0 29	0 03	0 056		0 025
Trench T 4	10391	BH00384WCU2	32-38	12/10/91	Plutonium-239 240	3 11	0 03	0 393		0 025
Trench T 4	10595	BH20766WC	3-8	5/1/95	Americium-241	0 03	0 01	0 012	Y	0 022
Trench T 4	10595	BH20766WC	3-8	5/1/95	Plutonium-239 240	0 13	0 008	0 028	Y	0 025
Trench T-4	10595	BH20766WC	3-8	5/1/95	Uranium-238	5 67	0 013	0 668	Y	1 807
Trench T-4	10695	BH20767WC	3-8	5/1/95	Americium-241	5 91	0 011	0 599	Y	0 022
Trench T-4	10695	BH20767WC	3-8	5/1/95	Plutonium-239 240	16 58	0.002	1 64	Y	0 025
Trench T-4	10795	BH20829WC	6-10	5/10/95	Americium-241	0 21	0 009	0 042	Y	0 022
Trench T 4	10795	BH20829WC	6-10	5/10/95	Gross Beta	71 87	3 84	7 42	Y	42
Trench T 4	10795	BH20829WC	6-10	5/10/95	Plutonium-239 240	0 81	0 007	0 131	Y	0 025

Table 3 3-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{95/95}$ Values (continued)

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T-4	10795	BH20629WC	6-10	5/10/95	Uranium-233,234	7 3	0.019	0.888	Y	3.441
Trench T-4	10795	BH20629WC	6-10	5/10/95	Uranium-235	0.52	0.007	0.096	Y	0 153
Trench T-4	10795	BH20629WC	6-10	5/10/95	Uranium-238	31 03	0.007	3.83	Y	1.807
Trench T-4	10695	BH20630WC	7 7 10	5/11/95	Americium-241	0 06	0.01	0.019	Y	0.022
Trench T-4	10695	BH20630WC	7 7 10	5/11/95	Gross Beta	52.09	3.8	6.91	Y	42
Trench T-4	10695	BH20630WC	7 7 10	5/11/95	Plutonium-239,240	0 37	0 006	0 073	Y	0 025
Trench T-4	10695	BH20630WC	7 7 10	5/11/95	Uranium-233,234	5.53	0.004	0.849	Y	3.441
Trench T-4	10695	BH20630WC	7 7 10	5/11/95	Uranium-235	0.35	0.009	0.082	Y	0 153
Trench T-4	10695	BH20778WC	3-7	5/2/95	Uranium-238	2.3	0.01	0.27	Y	1 807
Trench T-4	10695	BH20630WC	7 7-10	5/11/95	Uranium-238	22.31	0.009	2.53	Y	1.807
Trench T-4	10995	BH20785WC	8-8.8	5/4/95	Americium-241	0.04	0.006	0.013	Y	0.022
Trench T-4	10995	BH20784WC	3.3-8	5/4/95	Plutonium-239,240	0 06	0.032	0.042	Y	0.025
Trench T-4	B217589	5789BR0913	9-13	10/17/89	Cesium-137	0 16	0 16	0 12	JA	0.129
Trench T-4	B217589	5789BR0913	9-13	10/17/89	Cesium-137	0 16	0 16	0 12	JA	0.129
Trench T-4	B217589	5789BR0003	0-3	10/17/89	Plutonium-239,240	0.65	0.009	0.047		0.025
Trench T-4	B217589	5789BR1722D	17.3-22	10/17/89	Radium-226	0.59	0.41	0.29	A	1 42
Trench T-4	B217589	5789BR1722	17.3-22	10/17/89	Radium-226	0.74	0.43	0 32	A	1 42
Trench T-4	B217589	5789BR1317	13-17 3	10/17/89	Radium-226	0.91	0.37	0.29	A	1.42
Trench T-4	B217589	5789BR0913	9-13	10/17/89	Radium-226	1 14	0 51	0.41	A	2 33
Trench T-4	B217589	5789BR1722	17 3-22	10/17/89	Radium-226	1 17	0.48	0 44	A	2.33
Trench T-4	B217589	5789BR1317	13-17.3	10/17/89	Radium-226	2.14	0.76	0.62	A	2.33
Trench T-4	B217589	5789BR1722	17.3-22	10/17/89	Strontium-90	1.06	1.32	0.89		1 05
Trench T-4	B217589	5789BR1722	17.3-22	10/17/89	Strontium-90	1.06	1.32	0.89		1 05
Trench T-4	B217589	5789BR1722D	17.3-22	10/17/89	Tritium	650	520	340		504
Trench T-4	B217589	5789BR1722D	17.3-22	10/17/89	Tritium	650	520	340		504
Trench T-4	BH4187	BH418712UC	12-14.5	8/17/87	Americium-241	0.05		0.1	N	0.022
Trench T-4	BH4187	BH418712UC	12-14.5	8/17/87	Americium-241	0.05		0.1	N	0.022
Trench T-4	BH4187	BH418701 2D	0-12	8/17/87	Americium-241	0.05		0.09	N	0.022
Trench T-4	BH4187	BH418701 2D	0-12	8/17/87	Plutonium-239,240	0 05		0.14		0.025
Trench T-4	BH4187	BH418701 2	0-12	8/17/87	Plutonium-239,240	0.17		0.18		0.025
Trench T-4	BH4287	BH428700 3D	0-8.3	8/19/87	Americium-241	0.04		0.11	N	0.022
Trench T-4	BH4287	BH428722CT	22-24.5	8/19/87	Americium-241	0.05		0.09	N	0.022
Trench T-4	BH4287	BH428722CT	22-24.5	8/19/87	Americium-241	0.05		0.09	N	0.022
Trench T-4	BH4287	BH428700 3	0-8.3	8/19/87	Americium-241	0.07		0.09	N	0.022
Trench T-4	BH4287	BH428727 5R	27-29.5	8/19/87	Americium-241	0.05		0.09	N	0.022
Trench T-4	BH4287	BH428729DH	29.5-32	8/19/87	Americium-241	0 05		0.1	N	0.022
Trench T-4	BH4287	BH428729DH	29.5-32	8/19/87	Americium-241	0 05		0.1	N	0 022
Trench T-4	BH4287	BH428700 3	0-8.3	8/19/87	Plutonium-239,240	0.18		0 14		0.025

146

Table 3 3-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{99/99}$ Values (continued)

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{99/99}$

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted but was estimated
N = Will not be validated
Y = Analytical results in validation process

Table 3 3-4 Subsurface Soil Radionuclide Activities Exceeding PPRGs

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	PPRG (pCi/g)
Trench T-4	10291	BH00177WCU2	2-8	12/6/91	Uranium-233 234	191 7	0 3	24 3		0 779
Trench T-4	10291	BH00177WCU2	2-8	12/6/91	Uranium-238	113.1	0.3	14.4		0 733
Trench T-4	B217589	5789BR1722D	17 22	10/17/89	Radium-226	0 59	0 41	0 29	A	0 494
Trench T-4	B217589	5789BR1722	17 22	10/17/89	Radium-226	0 74	0 43	0 32	A	0.494
Trench T-4	B217589	5789BR1317	13-17	10/17/89	Radium-226	0 91	0 37	0 29	A	0 494
Trench T-4	B217589	5789BR0913	9-13	10/17/89	Radium-228	1 14	0 51	0 41	A	1 01
Trench T-4	B217589	5789BR1722	17 22	10/17/89	Radium-228	1 17	0 48	0 44	A	1 01
Trench T 4	B217589	5789BR1317	13-17	10/17/89	Radium-228	2.14	0 78	0 62	A	1 01

VALIDATION CODES

A = Result accepted with qualifications

Table 3 3-5 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T-4	3091	GW02134IT	12/14/91	Carbon Tetrachloride	0 058	0 00002		0 005	A
Trench T 4	3091	GW02568IT	3/5/92	Carbon Tetrachloride	0 053	0 00002	E	0 005	
Trench T-4	3091	GW02881IT	5/12/92	Carbon Tetrachloride	0 1	0 00002	E	0 005	
Trench T 4	3091	GW03409IT	8/19/92	Carbon Tetrachloride	0 27	0 00014	E	0 005	
Trench T-4	3091	GW03914IT	10/22/92	Carbon Tetrachloride	0 1	0 0005		0 005	A
Trench T-4	3091	GW00334WC	3/4/93	Carbon Tetrachloride	0 28	0 0002		0 005	V
Trench T-4	3091	GW00734WC	5/5/93	Carbon Tetrachloride	0 29	0 0002	E	0 005	Z
Trench T-4	3091	GW01308WC	9/2/93	Carbon Tetrachloride	0 26	0 0002		0 005	V
Trench T-4	3091	GW01672WC	12/8/93	Carbon Tetrachloride	0 36	0 0002	D	0 005	Y
Trench T-4	3091	GW00312GA	2/22/94	Carbon Tetrachloride	0 24	0 0003		0 005	V
Trench T-4	3091	GW00803GA	5/12/94	Carbon Tetrachloride	0 36	0 0003		0 005	V
Trench T-4	3091	GW01415GA	9/8/94	Carbon Tetrachloride	0 34	0 0003		0 005	V
Trench T-4	3091	GW01808GA	11/16/94	Carbon Tetrachloride	0 44	0 0003	E	0 005	Z
Trench T-4	3091	GW02667GA	6/19/95	Carbon Tetrachloride	0 33	0 0005	E	0 005	Y
Trench T-4	3091	GW02134IT	12/14/91	Tetrachloroethene	0 016	0 00002		0 005	A
Trench T-4	3091	GW02568IT	3/5/92	Tetrachloroethene	0 019	0 00002		0 005	
Trench T-4	3091	GW02881IT	5/12/92	Tetrachloroethene	0 019	0 00002	E	0 005	
Trench T-4	3091	GW03409IT	8/19/92	Tetrachloroethene	0 023	0 00014	E	0 005	
Trench T-4	3091	GW03914IT	10/22/92	Tetrachloroethene	0 022	0 0005		0 005	A
Trench T-4	3091	GW00334WC	3/4/93	Tetrachloroethene	0 022	0 0001		0 005	V
Trench T-4	3091	GW00734WC	5/5/93	Tetrachloroethene	0 019	0 0001		0 005	V
Trench T-4	3091	GW01308WC	9/2/93	Tetrachloroethene	0 032	0 0001		0 005	V
Trench T-4	3091	GW01672WC	12/8/93	Tetrachloroethene	0 035	0 0001	D	0 005	Y
Trench T-4	3091	GW00312GA	2/22/94	Tetrachloroethene	0 039	0 0002		0 005	V
Trench T-4	3091	GW00803GA	5/12/94	Tetrachloroethene	0 029	0 0002		0 005	V
Trench T-4	3091	GW01415GA	9/8/94	Tetrachloroethene	0 037	0 0002		0 005	V
Trench T-4	3091	GW01808GA	11/16/94	Tetrachloroethene	0 039	0 0002		0 005	V
Trench T-4	3091	GW02667GA	6/19/95	Tetrachloroethene	0 05	0 0005		0 005	Y
Trench T-4	3091	GW02134IT	12/14/91	Trichloroethene	0 021	0 00003		0 005	A
Trench T-4	3091	GW02568IT	3/5/92	Trichloroethene	0 037	0 00003	E	0 005	
Trench T-4	3091	GW02881IT	5/12/92	Trichloroethene	0 029	0 00003	E	0 005	
Trench T-4	3091	GW03409IT	8/19/92	Trichloroethene	0 04	0 00028	E	0 005	
Trench T-4	3091	GW03914IT	10/22/92	Trichloroethene	0 031	0 0005		0 005	A
Trench T-4	3091	GW00334WC	3/4/93	Trichloroethene	0 036	0 0001		0 005	V
Trench T-4	3091	GW00734WC	5/5/93	Trichloroethene	0 031	0 0001		0 005	V
Trench T-4	3091	GW01308WC	9/2/93	Trichloroethene	0 039	0 0001		0 005	V
Trench T-4	3091	GW01672WC	12/8/93	Trichloroethene	0 041	0 0001	D	0 005	Y
Trench T-4	3091	GW00312GA	2/22/94	Trichloroethene	0 038	0 0002		0 005	V
Trench T-4	3091	GW00803GA	5/12/94	Trichloroethene	0 04	0 0002		0 005	V

Table 3 3-5 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T-4	3091	GW01415GA	9/8/94	Trichloroethene	0 041	0 0002		0 005	V
Trench T-4	3091	GW01808GA	11/16/94	Trichloroethene	0.045	0.0002		0 005	V
Trench T-4	3091	GW02667GA	6/19/95	Trichloroethene	0 039	0.0005		0.005	Y
Trench T-4	3191	GW02992GA	11/27/95	Carbon Tetrachloride	0 005	0 0005		0.005	Y
Trench T-4	3191	GW02165IT	12/18/91	Methylene Chloride	0 009	0.00001		0 005	JA
Trench T-4	3191	GW02882IT	5/12/92	Trichloroethene	0.005	0.00003		0 005	V
Trench T-4	12691	GW02437IT	2/13/92	Carbon Tetrachloride	0.075	0.00002	B	0 005	
Trench T-4	12691	GW02889IT	5/29/92	Carbon Tetrachloride	4 5	0.00002		0.005	
Trench T-4	12691	GW03423IT	9/10/92	Carbon Tetrachloride	0 4	0.00014	E	0.005	
Trench T-4	12691	GW03923IT	10/23/92	Carbon Tetrachloride	0 11	0.0005		0 005	A
Trench T-4	12691	GW00343WC	3/1/93	Carbon Tetrachloride	0 82	0.0002		0.005	V
Trench T-4	12691	GW00741WC	5/5/93	Carbon Tetrachloride	0.84	0.0002	E	0.005	Z
Trench T-4	12691	GW01316WC	9/15/93	Carbon Tetrachloride	0.9	0.0002		0.005	V
Trench T-4	12691	GW01743WC	12/16/93	Carbon Tetrachloride	1.2	0.0002		0.005	Y
Trench T-4	12691	GW00367GA	3/14/94	Carbon Tetrachloride	0.59	0.0003	D	0 005	V
Trench T-4	12691	GW00389GA	3/14/94	Carbon Tetrachloride	0.66	0 0003	D	0.005	V
Trench T-4	12691	GW00807GA	5/31/94	Carbon Tetrachloride	0 88	0.0003		0 005	V
Trench T-4	12691	GW00808GA	5/31/94	Carbon Tetrachloride	0 78	0.0003		0 005	V
Trench T-4	12691	GW01424GA	9/8/94	Carbon Tetrachloride	0 84	0.0003		0 005	Z
Trench T-4	12691	GW01425GA	9/8/94	Carbon Tetrachloride	0.81	0.0003		0.005	V
Trench T-4	12691	GW01817GA	11/30/94	Carbon Tetrachloride	0.43	0.0003		0.005	Z
Trench T-4	12691	GW01818GA	11/30/94	Carbon Tetrachloride	0.59	0.0003		0.005	V
Trench T-4	12691	GW02142GA	2/24/95	Carbon Tetrachloride	0 643	0.0125	DE	0.005	Y
Trench T-4	12691	GW02143GA	2/24/95	Carbon Tetrachloride	0.66	0.025	D	0 005	Y
Trench T-4	12691	GW03030GA	12/14/95	Carbon Tetrachloride	0.56	0.017		0.005	V1
Trench T-4	12691	GW03033GA	12/14/95	Carbon Tetrachloride	0 55	0.017		0.005	V1
Trench T-4	12691	GW03211GA	3/18/96	Carbon Tetrachloride	0.59	0.017		0.005	Y
Trench T-4	12691	GW03214GA	3/18/96	Carbon Tetrachloride	0.51	0.017		0.005	Y
Trench T-4	12691	GW02889IT	5/29/92	Chloroform	0.16	0.00001		0.1	
Trench T-4	12691	GW03211GA	3/18/96	Hexachlorobutadiene	0.002	0.017	J	0.00109	Y
Trench T-4	12691	GW03211GA	3/18/96	Methylene Chloride	0.014	0.017	JB	0.005	Y
Trench T-4	12691	GW03214GA	3/18/96	Methylene Chloride	0.013	0.017	JB	0.005	Y
Trench T-4	12691	GW02437IT	2/13/92	Tetrachloroethene	0.063	0.00002	E	0.005	
Trench T-4	12691	GW02889IT	5/29/92	Tetrachloroethene	1	0.00002		0.005	
Trench T-4	12691	GW03423IT	9/10/92	Tetrachloroethene	0 15	0.00014	E	0 005	
Trench T-4	12691	GW03923IT	10/23/92	Tetrachloroethene	0.05	0.0005		0.005	A
Trench T-4	12691	GW00343WC	3/1/93	Tetrachloroethene	0.14	0 0001		0.005	V
Trench T-4	12691	GW00741WC	5/5/93	Tetrachloroethene	0.13	0.0001		0.005	V
Trench T-4	12691	GW01316WC	9/15/93	Tetrachloroethene	0 15	0.0001		0.005	V

Table 3 3-5 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T-4	12691	GW01743WC	12/16/93	Tetrachloroethene	0 18	0 0001		0 005	Y
Trench T-4	12691	GW00387GA	3/14/94	Tetrachloroethene	0 12	0 0002	D	0 005	V
Trench T-4	12691	GW00388GA	3/14/94	Tetrachloroethene	0 13	0 0002	D	0 005	V
Trench T-4	12691	GW00807GA	5/31/94	Tetrachloroethene	0 18	0 0002		0 005	V
Trench T-4	12691	GW00808GA	5/31/94	Tetrachloroethene	0 15	0 0002		0 005	V
Trench T-4	12691	GW01424GA	9/8/94	Tetrachloroethene	0 16	0 0002		0 005	Z
Trench T-4	12691	GW01425GA	9/9/94	Tetrachloroethene	0 15	0 0002		0 005	V
Trench T-4	12691	GW01817GA	11/30/94	Tetrachloroethene	0 078	0 0002		0 005	Z
Trench T-4	12691	GW01818GA	11/30/94	Tetrachloroethene	0 13	0 0002		0 005	V
Trench T-4	12691	GW02142GA	2/24/95	Tetrachloroethene	0 133	0 0125	D	0 005	Y
Trench T-4	12691	GW02143GA	2/24/95	Tetrachloroethene	0 144	0 025	D	0 005	Y
Trench T-4	12691	GW03030GA	12/14/95	Tetrachloroethene	0 14	0 017		0 005	V1
Trench T-4	12691	GW03033GA	12/14/95	Tetrachloroethene	0 13	0 017		0 005	V1
Trench T-4	12691	GW03211GA	3/18/96	Tetrachloroethene	0 13	0 017		0 005	Y
Trench T-4	12691	GW03214GA	3/18/96	Tetrachloroethene	0 12	0 017		0 005	Y
Trench T-4	12691	GW02437IT	2/13/92	Trichloroethene	0 058	0 00003	E	0 005	11 6
Trench T-4	12691	GW02889IT	5/29/92	Trichloroethene	0 56	0 00003		0 005	
Trench T-4	12691	GW03423IT	9/10/92	Trichloroethene	0 083	0 00028	E	0 005	
Trench T-4	12691	GW03923IT	10/23/92	Trichloroethene	0 058	0 0005		0 005	A
Trench T-4	12691	GW00343WC	3/1/93	Trichloroethene	0 082	0 0001		0 005	V
Trench T-4	12691	GW00741WC	5/5/93	Trichloroethene	0 085	0 0001		0 005	V
Trench T-4	12691	GW01316WC	9/15/93	Trichloroethene	0 085	0 0001		0 005	V
Trench T-4	12691	GW01743WC	12/16/93	Trichloroethene	0 11	0 0001		0 005	Y
Trench T-4	12691	GW00387GA	3/14/94	Trichloroethene	0 069	0 0002	D	0 005	V
Trench T-4	12691	GW00388GA	3/14/94	Trichloroethene	0 068	0 0002	D	0 005	V
Trench T-4	12691	GW00807GA	5/31/94	Trichloroethene	0 098	0 0002		0 005	V
Trench T-4	12691	GW00808GA	5/31/94	Trichloroethene	0 088	0 0002		0 005	V
Trench T-4	12691	GW01424GA	9/8/94	Trichloroethene	0 082	0 0002		0 005	Z
Trench T-4	12691	GW01425GA	9/9/94	Trichloroethene	0 076	0 0002		0 005	V
Trench T-4	12691	GW01817GA	11/30/94	Trichloroethene	0 053	0 0002	X	0 005	Z
Trench T-4	12691	GW01818GA	11/30/94	Trichloroethene	0 067	0 0002		0 005	V
Trench T-4	12691	GW02142GA	2/24/95	Trichloroethene	0 07	0 0125	D	0 005	Y
Trench T-4	12691	GW02143GA	2/24/95	Trichloroethene	0 073	0 025	D	0 005	Y
Trench T-4	12691	GW03030GA	12/14/95	Trichloroethene	0 085	0 017		0 005	V1
Trench T-4	12691	GW03033GA	12/14/95	Trichloroethene	0 086	0 017		0 005	V1
Trench T-4	12691	GW03211GA	3/18/96	Trichloroethene	0 076	0 017		0 005	Y
Trench T-4	12691	GW03214GA	3/18/96	Trichloroethene	0 072	0 017		0 005	Y
Trench T-4	23193	GW00924WC	6/8/93	Trichloroethene	0 01	0 0001		0 005	V
Trench T-4	23193	GW00417GA	3/16/94	Trichloroethene	0 007	0 0002		0 005	V

Table 3 3-5 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T-4	23193	GW00628GA	4/25/94	Trichlorpethene	0 008	0.0002		0.005	V
Trench T-4	23193	GW01155GA	8/8/94	Trichloroethene	0.008	0 0005		0 005	V
Trench T-4	23193	GW01663GA	10/24/94	Trichloroethene	0 006	0.0005		0 005	Y
Trench T-4	23193	GW02097GA	2/15/95	Trichloroethene	0 006	0.0002		0 005	V

LABORATORY QUALIFIERS
B = Indicates chemical was in both the sample and associated method blank
D = Analysis was performed at a dilution
E = Chemical exceeds calibration range of the instrument
J = Positively identified below sample quantitation level result is estimated
X = Open and defined by laboratory

VALIDATION CODES
A = Result accepted with qualifications
J = Positively identified below the sample quantitation limit. Result is estimated
V = Valid result
Y = Analytical results in validation process
Z = Validation was not requested or performed

Table 3 3-6 Groundwater Organic Compound Concentrations Exceeding RFCA Tier I Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER I ACTION LEVEL(mg/L)	VALIDATON CODE
Trench T 4	12691	GW02889IT	5/29/92	Carbon Tetrachlonde	4 5	0 00002		0 5	
Trench T 4	12691	GW00343WC	3/1/93	Carbon Tetrachlonde	0 82	0 0002		0 5	V
Trench T-4	12691	GW00741WC	5/5/93	Carbon Tetrachlonde	0 84	0 0002	E	0 5	Z
Trench T-4	12691	GW01316WC	9/15/93	Carbon Tetrachlonde	0 9	0 0002		0 5	V
Trench T-4	12691	GW01743WC	12/16/93	Carbon Tetrachloride	1 2	0 0002		0 5	Y
Trench T-4	12691	GW00387GA	3/14/94	Carbon Tetrachlonde	0 59	0 0003	D	0 5	V
Trench T-4	12691	GW00388GA	3/14/94	Carbon Tetrachlonde	0 66	0 0003	D	0 5	V
Trench T-4	12691	GW00807GA	5/31/94	Carbon Tetrachlonde	0 88	0 0003		0 5	V
Trench T-4	12691	GW00808GA	5/31/94	Carbon Tetrachlonde	0 78	0 0003		0 5	V
Trench T-4	12691	GW01424GA	9/8/94	Carbon Tetrachloride	0 84	0 0003		0 5	Z
Trench T-4	12691	GW01425GA	9/9/94	Carbon Tetrachlonde	0 81	0 0003		0 5	V
Trench T 4	12691	GW01818GA	11/30/94	Carbon Tetrachloride	0 59	0 0003		0 5	V
Trench T-4	12691	GW02142GA	2/24/95	Carbon Tetrachloride	0 643	0 0125	DE	0 5	Y
Trench T-4	12691	GW02143GA	2/24/95	Carbon Tetrachloride	0 66	0 025	D	0 5	Y
Trench T-4	12691	GW03030GA	12/14/95	Carbon Tetrachlonde	0 56	0 017		0 5	V1
Trench T-4	12691	GW03033GA	12/14/95	Carbon Tetrachlonde	0 55	0 017		0 5	V1
Trench T-4	12691	GW03211GA	3/18/96	Carbon Tetrachlonde	0 59	0 017		0 5	Y
Trench T-4	12691	GW03214GA	3/18/96	Carbon Tetrachloride	0 51	0 017		0 5	Y
Trench T-4	12691	GW02889IT	5/29/92	Tetrachloroethene	1	0 0002		0 5	
Trench T 4	12691	GW02889IT	5/29/92	Trichloroethene	0 56	0 0003		0 5	

LABORATORY QUALIFIERS
D = Analysis was performed at a dilution
E = Chemical exceeds calibration range of the instrument

VALIDATION CODES
V = Valid result
Y = Analytical results in validation process
Z = Validation was not requested or performed

Table 3 3-7 Groundwater Dissolved Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T-4	3091	GW02134IT	12/14/91	Barium	178	200	B	V	171 2
Trench T-4	3091	GW02568IT	3/5/92	Barium	195	200	B	V	171 2
Trench T-4	3091	GW02881IT	5/12/92	Barium	199	200	BE	JA	171.2
Trench T-4	3091	GW03409IT	8/19/92	Barium	199	5 1		V	171 2
Trench T-4	3091	GW03914IT	10/22/92	Barium	202	2.1		V	171 2
Trench T-4	3091	GW00334WC	3/4/93	Barium	200	200	B	V	171 2
Trench T-4	3091	GW00734WC	5/5/93	Barium	177	200	B	V	171 2
Trench T-4	3091	GW01308WC	9/2/93	Barium	179	200	B	V	171 2
Trench T-4	3091	GW00312GA	2/22/94	Barium	202	23		V	171 2
Trench T-4	3091	GW00803GA	5/12/94	Barium	230	37		V	171.2
Trench T-4	3091	GW01415GA	9/8/94	Barium	211	14		V	171 2
Trench T-4	3091	GW01808GA	11/16/94	Barium	210	1		Y	171 2
Trench T-4	3091	GW02667GA	6/19/95	Barium	208	200		Y	171 2
Trench T-4	3191	GW02156IT	12/19/91	Manganese	302	15		V	263
Trench T-4	12691	GW02437IT	2/13/92	Barium	246	200		V	171 2
Trench T-4	12691	GW02889IT	5/29/92	Barium	234	200		V	171 2
Trench T-4	12691	GW03423IT	9/10/92	Barium	210	2 1		V	171 2
Trench T-4	12691	GW03923IT	10/23/92	Barium	220	2 1		V	171 2
Trench T-4	12691	GW00343WC	3/1/93	Barium	257	17		V	171 2
Trench T-4	12691	GW00741WC	5/5/93	Barium	219	200		V	171.2
Trench T-4	12691	GW01316WC	9/15/93	Barium	231	16		V	171 2
Trench T-4	12691	GW01749WC	12/16/93	Barium	247	200		V	171.2
Trench T-4	12691	GW00387GA	3/14/94	Barium	241	23		V	171.2
Trench T-4	12691	GW00388GA	3/14/94	Barium	244	23		V	171.2
Trench T-4	12691	GW00807GA	5/31/94	Barium	243	37		V	171.2
Trench T-4	12691	GW00808GA	5/31/94	Barium	237	37		V	171.2
Trench T-4	12691	GW01424GA	9/8/94	Barium	241	14		V	171.2
Trench T-4	12691	GW01425GA	9/8/94	Barium	251	14		V	171.2
Trench T-4	12691	GW01617GA	11/30/94	Barium	244	1		V	171.2
Trench T-4	12691	GW01818GA	11/30/94	Barium	237	1		Y	171.2
Trench T-4	12691	GW02142GA	2/24/95	Barium	248	12		V	171.2
Trench T-4	12691	GW02596GA	5/28/95	Barium	240	10		Y	171.2
Trench T-4	12691	GW03030GA	12/14/95	Barium	236	200		Y	171.2
Trench T-4	12691	GW02437IT	2/13/92	Calcium	156000	5000		V	141250
Trench T-4	12691	GW02889IT	5/29/92	Calcium	157000	5000		V	141250
Trench T-4	12691	GW03423IT	9/10/92	Calcium	145000	17 4		V	141250
Trench T-4	12691	GW03923IT	10/23/92	Calcium	148000	17 4		V	141250
Trench T-4	12691	GW00343WC	3/1/93	Calcium	150000	149		V	141250
Trench T-4	12691	GW00741WC	5/5/93	Calcium	151000	5000		V	141250

Table 3 3-7 Groundwater Dissolved Metal Concentrations Exceeding $UTL_{90/95}$ Values (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{90/95}$
Trench T-4	12691	GW01316WC	9/15/93	Calcium	150000	360		V	141250
Trench T 4	12691	GW01743WC	12/16/93	Calcium	159000	5000		V	141250
Trench T-4	12691	GW00387GA	3/14/94	Calcium	153000	31		V	141250
Trench T 4	12691	GW00388GA	3/14/94	Calcium	154000	31		V	141250
Trench T-4	12691	GW00807GA	5/31/94	Calcium	160000	88	E	JA	141250
Trench T 4	12691	GW00808GA	5/31/94	Calcium	154000	88	E	JA	141250
Trench T-4	12691	GW01424GA	9/8/94	Calcium	158000	56		V	141250
Trench T-4	12691	GW01425GA	9/9/94	Calcium	167000	56		V	141250
Trench T-4	12691	GW01817GA	11/30/94	Calcium	155000	7		V	141250
Trench T-4	12691	GW01818GA	11/30/94	Calcium	152000	7		Y	141250
Trench T-4	12691	GW02142GA	2/24/95	Calcium	157000	20		V	141250
Trench T-4	12691	GW02596GA	5/26/95	Calcium	157000	25		Y	141250
Trench T-4	12691	GW03030GA	12/14/95	Calcium	157500	5000		Y	141250
Trench T-4	12691	GW01818GA	11/30/94	Copper	111	2		Y	43
Trench T-4	23193	GW01180WC	8/17/93	Chromium	27 6	3		JA	13 51
Trench T-4	23193	GW01180WC	8/17/93	Iron	38200	7		V	1553
Trench T-4	23193	GW01180WC	8/17/93	Manganese	663	2		V	263
Trench T-4	23193	GW01180WC	8/17/93	Nickel	39 5	14		V	34
Trench T-4	23193	GW01180WC	8/17/93	Vanadium	51 9	5		V	38 7

LABORATORY QUALIFIER
B = Detected concentration was less than the contract required detection limit and above the instrument detection limit
E = Reported value is estimated due to interference

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result
Y = Analytical results in validation process

Table 3 3-7 Groundwater Total Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µg/L)	DETECTION LIMIT (µg/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T-4	3091	GW02134IT	12/14/91	Antimony	57 3	60	B	V	49.8
Trench T-4	3091	GW02134IT	12/14/91	Barium	501	200		V	296
Trench T-4	3091	GW02568IT	3/5/92	Barium	378	200		V	296
Trench T-4	3091	GW02861IT	5/12/92	Barium	301	200		V	296
Trench T-4	3091	GW03409IT	8/19/92	Barium	392	5.1		V	296
Trench T-4	3091	GW03914IT	10/22/92	Barium	414	2.1		V	296
Trench T-4	3091	GW02134IT	12/14/91	Lead	31 1	3		JA	18.4
Trench T-4	3091	GW03409IT	8/19/92	Lead	18.5	0.8		V	18.4
Trench T-4	3091	GW02134IT	12/14/91	Potassium	6850	5000		V	4980
Trench T-4	3091	GW02568IT	3/5/92	Potassium	5220	5000		V	4980
Trench T-4	3091	GW03409IT	8/19/92	Potassium	5120	1030		V	4980
Trench T-4	3091	GW03914IT	10/22/92	Potassium	5440	779		V	4980
Trench T-4	3191	GW02862IT	5/12/92	Potassium	7520	5000		V	4980
Trench T-4	12691	GW02437IT	2/13/92	Aluminum	30900	200	*	JA	24780
Trench T-4	12691	GW02437IT	2/13/92	Barium	634	200		V	296
Trench T-4	12691	GW02437IT	2/13/92	Calcium	172000	5000		V	141900
Trench T-4	12691	GW02869IT	5/29/92	Calcium	156000	5000		V	141900
Trench T-4	12691	GW03423IT	9/10/92	Calcium	154000	18.3		V	141900
Trench T-4	12691	GW03923IT	10/23/92	Calcium	146000	17.4		V	141900
Trench T-4	12691	GW02437IT	2/13/92	Copper	49.2	25		V	40.6
Trench T-4	12691	GW02437IT	2/13/92	Iron	48900	100		V	30465
Trench T-4	12691	GW02437IT	2/13/92	Lead	24.8	3		JA	18.4
Trench T-4	12691	GW02437IT	2/13/92	Potassium	6990	5000	E	V	4980
Trench T-4	12691	GW02437IT	2/13/92	Vanadium	90	50	E	JA	67
Trench T-4	23193	GW01180WC	8/17/93	Barium	468	16		V	296
Trench T-4	23193	GW00417GA	3/16/94	Barium	431	200		V	296
Trench T-4	23193	GW00628GA	4/25/94	Barium	302	200		V	296
Trench T-4	23193	GW01180WC	8/17/93	Copper	46.8	2		V	40.6
Trench T-4	23193	GW00417GA	3/16/94	Copper	44.3	25		V	40.6
Trench T-4	23193	GW00417GA	3/16/94	Iron	33300	100		V	30465
Trench T-4	23193	GW01180WC	8/17/93	Lead	25.5	2	N	JA	18.4
Trench T-4	23193	GW00417GA	3/16/94	Lead	29.3	3	*	JA	18.4
Trench T-4	23193	GW00417GA	3/16/94	Manganese	700	15		V	606
Trench T-4	23193	GW00417GA	3/16/94	Potassium	7080	5000		V	4980
Trench T-4	23193	GW00628GA	4/25/94	Potassium	5250	5000		V	4980

156

Table 3 3-7 Groundwater Total Metal Concentrations Exceeding $UTL_{99/99}$ Values (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (μ g/L)	DETECTION LIMIT (μ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{99/99}$

LABORATORY QUALIFIER
B = Detected concentration was less than the contract required detection limit and above the instrument detection limit
E = Reported value is estimated due to interference
= Matrix duplicate analysis did not meet advisory limits

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result

Table 3 3-8 Groundwater Dissolved Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (µ g/L)
Trench T-4	3091	GW02134IT	12/14/91	Antimony	10	60	B	JA	6
Trench T-4	3091	GW03409IT	8/19/92	Antimony	30	18		JA	6
Trench T-4	3191	GW02156IT	12/19/91	Manganese	302	15		V	183
Trench T-4	12691	GW01743WC	12/16/93	Antimony	21	60	B	V	6
Trench T-4	12691	GW02596GA	5/26/95	Antimony	10	2	B	Y	6
Trench T-4	12691	GW02437IT	2/13/92	Manganese	252	15		V	183
Trench T-4	23193	GW01180WC	8/17/93	Manganese	663	2		V	183

LABORATORY QUALIFIER
B = Detected concentration was less than contract required detection limit and above instrument detection limit

VALIDATION CODES
JA = Result accepted, but was estimated
V = Valid result
Y = Analytical results in validation process

158

Table 3 3-8 Groundwater Total Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (µ g/L)
Trench T-4	3091	GW02134IT	12/14/91	Antimony	57 3	60	B	V	6
Trench T 4	3091	GW03409IT	8/19/92	Antimony	27 2	18 8		JA	6
Trench T-4	3091	GW02134IT	12/14/91	Manganese	484	15		V	183
Trench T-4	3091	GW02568IT	3/5/92	Manganese	206	15		V	183
Trench T-4	3091	GW03409IT	8/19/92	Manganese	211	1 4		V	183
Trench T-4	3091	GW03914IT	10/22/92	Manganese	214	2 1		V	183
Trench T-4	3191	GW02156IT	12/19/91	Manganese	320	15		V	183
Trench T-4	3191	GW02882IT	5/12/92	Manganese	183	15		V	183
Trench T-4	12691	GW02437IT	2/13/92	Antimony	8 7	60	BN	JA	6
Trench T-4	12691	GW03423IT	9/10/92	Antimony	23 9	18 8		JA	6
Trench T 4	12691	GW02437IT	2/13/92	Manganese	601	15	E	JA	183
Trench T-4	23193	GW00924WC	6/8/93	Manganese	188	15		V	183
Trench T-4	23193	GW00417GA	3/16/94	Manganese	700	15		V	183
Trench T-4	23193	GW00628GA	4/25/94	Manganese	300	15		V	183

LABORATORY QUALIFIER
B = Detected concentration was less than contract required detection limit and above instrument detection limit
E = Reported value is estimated due to interference
N = Spike recoveries in the matrix spike sample did not meet advisory limits

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result

Table 3 3-9 Groundwater Dissolved Radionuclide Activities Exceeding UTL_{0000} Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	BACKGROUND UTL_{0000}
Trench T-4	12891	GW00741WC	5/5/93	Radium-226	1 4	0 09	0 13		1 18

VALIDATION CODES

Table 3 3-9 Groundwater Total Radionuclide Activities Exceeding $UTL_{90/90}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	BACKGROUND $UTL_{90/90}$
Trench T 4	3091	GW00312GA	2/22/94	Americium-241	0 09	0 073	0 066	V	0 04
Trench T-4	3091	GW00334WC	3/4/93	Plutonium-239 240	0 3	0 006	0 036	A	0 06
Trench T-4	3091	GW00734WC	5/5/93	Plutonium-239 240	0 35	0 088	0 15	V	0 06
Trench T-4	3091	GW01308WC	9/2/93	Plutonium-239 240	0 09	0 01	0 05	V	0 06
Trench T-4	23193	GW00924WC	6/8/93	Radium-226	1 7	0 08	0 11	A	1 29
Trench T-4	23193	GW00417GA	3/16/94	Radium-226	2 6	0 09	0 17	V	1 29
Trench T-4	23193	GW01155GA	8/8/94	Radium-226	1 5	0 12	0 19	Y	1 29

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result
Y = Analytical results in validation process

Table 3 3-10 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T-4	3091	GW01672WC	12/8/93	Gross Beta	6 4	4 4	3.1	Y	5
Trench T-4	3091	GW02134IT	12/14/91	Strontium-89 90	0 9048	0 7	0 501	A	0 852
Trench T-4	3091	GW02134IT	12/14/91	Uranium-233 234	1 417	0 13	0 826	A	1 07
Trench T-4	3091	GW02568IT	3/5/92	Uranium-233,234	1 48	0	0 538	A	1 07
Trench T-4	3091	GW02881IT	5/12/92	Uranium-233,234	1 461	0 102	0 568	A	1 07
Trench T-4	3091	GW03409IT	8/19/92	Uranium-233,234	1 3	0 6	0.64	A	1.07
Trench T-4	3091	GW03914IT	10/22/92	Uranium-233 234	1.298	0	0 638	A	1 07
Trench T-4	3091	GW00334WC	3/4/93	Uranium-233,234	1 4	0 1714	0.4901	A	1 07
Trench T-4	3091	GW00734WC	5/5/93	Uranium-233,234	2.4	0 18	0 85	A	1 07
Trench T-4	3091	GW01306WC	9/2/93	Uranium-233,234	3	0 037	0.83	A	1 07
Trench T-4	3091	GW01672WC	12/8/93	Uranium-233,234	1 1	0 087	0.39	Y	1 07
Trench T-4	3091	GW00312GA	2/22/94	Uranium-233,234	1 7	0 2	0 63	V	1 07
Trench T-4	3091	GW00803GA	5/12/94	Uranium-233,234	1 574	0 157	0.376	V	1 07
Trench T-4	3091	GW01415GA	9/8/94	Uranium-233,234	3.8093	0 2163	0.8438	V	1 07
Trench T-4	3091	GW01808GA	11/16/94	Uranium-233,234	2.6826	0.5582	1.0479	Y	1 07
Trench T-4	3091	GW02667GA	8/19/95	Uranium-233,234	1 7	0.32	0 64	Y	1 07
Trench T-4	3091	GW01808GA	11/16/94	Uranium-235	1 3392	0 42	0 724	Y	1 01
Trench T-4	3091	GW02134IT	12/14/91	Uranium-238	1 23	0 13	0 58	A	0 768
Trench T-4	3091	GW02568IT	3/5/92	Uranium-238	0 9473	0 091	0.424	A	0 768
Trench T-4	3091	GW00334WC	3/4/93	Uranium-238	1 1	0.1714	0.4372	JA	0.768
Trench T-4	3091	GW00734WC	5/5/93	Uranium-238	1 5	0 069	0.66	A	0 768
Trench T-4	3091	GW01306WC	9/2/93	Uranium-238	1 7	0 066	0.58	A	0 768
Trench T-4	3091	GW01672WC	12/8/93	Uranium-238	1 4	0.14	0 45	Y	0 768
Trench T-4	3091	GW00312GA	2/22/94	Uranium-238	0 96	0.31	0.46	V	0 768
Trench T-4	3091	GW00803GA	5/12/94	Uranium-238	1 156	0 104	0.315	V	0.768
Trench T-4	3091	GW01415GA	9/8/94	Uranium-238	1 9766	0.1841	0.5995	V	0.768
Trench T-4	3091	GW01808GA	11/16/94	Uranium-238	1 607	0.4356	0.7938	Y	0.768
Trench T-4	3091	GW02667GA	8/19/95	Uranium-238	1.2	0.32	0.51	Y	0 768
Trench T-4	3191	GW02882IT	5/12/92	Gross Alpha	11 13	1.4	3.75	A	7
Trench T-4	3191	GW02882IT	5/12/92	Gross Beta	8.474	1.9	1.79	A	5
Trench T-4	3191	GW02992GA	11/27/95	Gross Beta	8.638	1.96	1.36	Y	5
Trench T-4	3191	GW02156IT	12/19/91	Uranium-233,234	6.367	0.113	1 465	A	1.07
Trench T-4	3191	GW02882IT	5/12/92	Uranium-233,234	4.708	0	1.14	A	1.07
Trench T-4	3191	GW02156IT	12/19/91	Uranium-238	3.622	0 113	1.027	A	0.768
Trench T-4	3191	GW02882IT	5/12/92	Uranium-238	4.147	0.104	1.05	A	0.768
Trench T-4	12691	GW02437IT	2/13/92	Uranium-233,234	4 64	0.206	1.32	A	1 07
Trench T-4	12691	GW02889IT	5/29/92	Uranium-233,234	4 1	0 078	0.82	V	1 07
Trench T-4	12691	GW03623IT	10/23/92	Uranium-233,234	2.559	0	0.844	A	1 07
Trench T-4	12691	GW00343WC	3/1/93	Uranium-233,234	3.816	0 2918	1 11	A	1 07

Table 3 3-10 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T-4	12691	GW00741WC	5/5/93	Uranium-233 234	3 3	0 045	0 95	A	1 07
Trench T 4	12691	GW01316WC	9/15/93	Uranium-233 234	3 9	0 14	1 1	A	1 07
Trench T-4	12691	GW01743WC	12/16/93	Uranium-233 234	3 1987	0 1884	0 7453	Y	1 07
Trench T-4	12691	GW00387GA	3/14/94	Uranium-233 234	3 7	0 12	1	V	1 07
Trench T-4	12691	GW00388GA	3/14/94	Uranium-233 234	3	0 094	0 8	V	1 07
Trench T-4	12691	GW00807GA	5/31/94	Uranium-233 234	3 1	0 18	0 86	V	1 07
Trench T-4	12691	GW00808GA	5/31/94	Uranium-233 234	3 1	0 13	0 88	V	1 07
Trench T-4	12691	GW01424GA	9/8/94	Uranium-233 234	3 9517	0 3824	1 0977	V	1 07
Trench T-4	12691	GW01425GA	9/9/94	Uranium-233 234	3 8165	0 1871	0 7994	V	1 07
Trench T-4	12691	GW01817GA	11/30/94	Uranium-233 234	2 44	0 2283	0 6483	Y	1 07
Trench T-4	12691	GW01818GA	11/30/94	Uranium-233 234	3 0787	0 2217	0 7765	Y	1 07
Trench T-4	12691	GW02142GA	2/24/95	Uranium-233 234	3 7	0 46	1 1	V	1 07
Trench T-4	12691	GW02143GA	2/24/95	Uranium-233 234	2 5	0 33	0 87	V	1 07
Trench T-4	12691	GW02596GA	5/26/95	Uranium-233 234	4 3	0 4	1 2	Y	1 07
Trench T-4	12691	GW02597GA	5/26/95	Uranium-233 234	3 1	0 097	0 37	Y	1 07
Trench T-4	12691	GW03030GA	12/14/95	Uranium-233 234	3 102	0 277	0 976	Y	1 07
Trench T-4	12691	GW03033GA	12/14/95	Uranium-233 234	2 86	0 252	0 924	Y	1 07
Trench T-4	12691	GW02437IT	2/13/92	Uranium-238	3 162	0 147	1 05	A	0 768
Trench T 4	12691	GW02889IT	5/29/92	Uranium-238	2 3	0 05	0 6	V	0 768
Trench T-4	12691	GW03923IT	10/23/92	Uranium-238	1 273	0 121	0 572	A	0 768
Trench T-4	12691	GW00343WC	3/1/93	Uranium-238	1 814	0 2562	0 72	A	0 768
Trench T-4	12691	GW00741WC	5/5/93	Uranium-238	3 1	0 045	0 91	A	0 768
Trench T-4	12691	GW01316WC	9/15/93	Uranium-238	3 2	0 21	0 94	A	0 768
Trench T-4	12691	GW01743WC	12/16/93	Uranium-238	1 6225	0 1824	0 519	Y	0 768
Trench T-4	12691	GW00387GA	3/14/94	Uranium-238	2 1	0 18	0 7	V	0 768
Trench T-4	12691	GW00388GA	3/14/94	Uranium-238	1 8	0 21	0 59	V	0 768
Trench T-4	12691	GW00807GA	5/31/94	Uranium-238	1 6	0 18	0 58	V	0 768
Trench T-4	12691	GW00808GA	5/31/94	Uranium-238	1 7	0 26	0 61	V	0 768
Trench T-4	12691	GW01424GA	9/8/94	Uranium-238	3 8406	0 3527	1 0765	V	0 768
Trench T-4	12691	GW01425GA	9/9/94	Uranium-238	2 5105	0 1933	0 6449	V	0 768
Trench T-4	12691	GW01817GA	11/30/94	Uranium-238	2 2189	0 1681	0 608	Y	0 768
Trench T-4	12691	GW01818GA	11/30/94	Uranium-238	2 5736	0 2422	0 7125	Y	0 768
Trench T-4	12691	GW02142GA	2/24/95	Uranium-238	2 1	0 24	0 76	V	0 768
Trench T-4	12691	GW02143GA	2/24/95	Uranium-238	2 1	0 33	0 78	V	0 768
Trench T-4	12691	GW02596GA	5/26/95	Uranium-238	1 7	0 28	0 71	Y	0 768
Trench T-4	12691	GW02597GA	5/26/95	Uranium-238	2 2	0 084	0 3	Y	0 768
Trench T-4	12691	GW03030GA	12/14/95	Uranium-238	1 78	0 151	0 694	Y	0 768
Trench T-4	12691	GW03033GA	12/14/95	Uranium-238	1 596	0 222	0 649	Y	0 768
Trench T-4	23193	GW00924WC	6/8/93	Uranium-233 234	2 1	0 055	0 61	A	1 07

Table 3 3-10 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T-4	23193	GW00417GA	3/16/94	Uranium-233,234	2	0 11	0 64	V	1.07
Trench T-4	23193	GW00628GA	4/25/94	Uranium-233,234	2 9	0.213	0.754	V	1 07
Trench T-4	23193	GW01155GA	8/8/94	Uranium-233,234	2.5	0 36	0.88	Y	1 07
Trench T-4	23193	GW01803GA	10/24/94	Uranium-233,234	1 5893	0.2261	0 4924	Y	1 07
Trench T-4	23193	GW02097GA	2/15/95	Uranium-233,234	1 7668	0 1303	0.4067	A	1 07
Trench T-4	23193	GW00924WC	6/8/93	Uranium-238	0.89	0 055	0.39	A	0 768
Trench T-4	23193	GW00628GA	4/25/94	Uranium-238	0 91	0.2207	0.424	V	0 768
Trench T-4	23193	GW01155GA	8/8/94	Uranium-238	1.2	0.34	0.85	Y	0.768
Trench T-4	23193	GW02097GA	2/15/95	Uranium-238	0.77	0 1099	0.2637	A	0.768
Trench T-4	B217589	GW00450WC	3/21/93	Gross Beta	6 2	1.89	1 6	A	5
Trench T-4	B217589	GW03965IT	12/15/92	Uranium-233,234	2.1	0.212	0.6234	A	1 07
Trench T-4	B217589	GW00450WC	3/21/93	Uranium-233,234	2	0.05	0 29	A	1 07
Trench T-4	B217589	GW03965IT	12/15/92	Uranium-238	1 6	0.1706	0.5267	JA	0 768
Trench T-4	B217589	GW00450WC	3/21/93	Uranium-238	0.86	0.05	0 19	A	0 768

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted, but was estimated
V = Valid result
Y = Analytical results in validation process

164

Table 3 3-10 Groundwater Total Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL (pCi/L)
Trench T 4	3091	GW00334WC	3/4/93	Plutonium-239 240	0 3	0 006	0 036	A	0 151
Trench T-4	3091	GW00734WC	5/5/93	Plutonium-239 240	0 35	0 088	0 15	V	0 151
Trench T-4	23193	GW02421GA	4/18/95	Gross Alpha	7 09	3 745	3 462	Y	7
Trench T-4	23193	GW02421GA	4/18/95	Uranium 233 234	1 61	0 087	0 365	Y	1 07

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result
Y = Analytical results in validation process

TABLE 3 3-11 TRENCH T-4 SUMMARY INFORMATION

CONTAMINANTS		
Media. Subsurface Soils		
Greater than $UTL_{95/95}$	Greater than RFCA Standards	Greater than PPRGs
	Methylene chloride Tetrachloroethene Trichloroethene	
Antimony Arsenic Beryllium Cadmium Chromium Copper Lead Manganese Mercury Silver Zinc		
Gross beta Americium-241 Cesium-137 Plutonium-239/240 Uranium-233/234 Uranium-235 Uranium-238		Radium-226 Radium-228 Uranium-233/234 Uranium-238

Media Groundwater			
Greater than $UTL_{95/95}$	Greater than RFCA Tier II Standards	Greater than RFCA Tier I Standards	Greater than PPRGs
	Carbon tetrachloride Chloroform Hexachlorobutadiene Methylene chloride Tetrachloroethene Trichloroethene	Carbon Tetrachloride Tetrachloroethene Trichloroethene	

TABLE 3.3-11 TRENCH T-4 SUMMARY INFORMATION (continued)

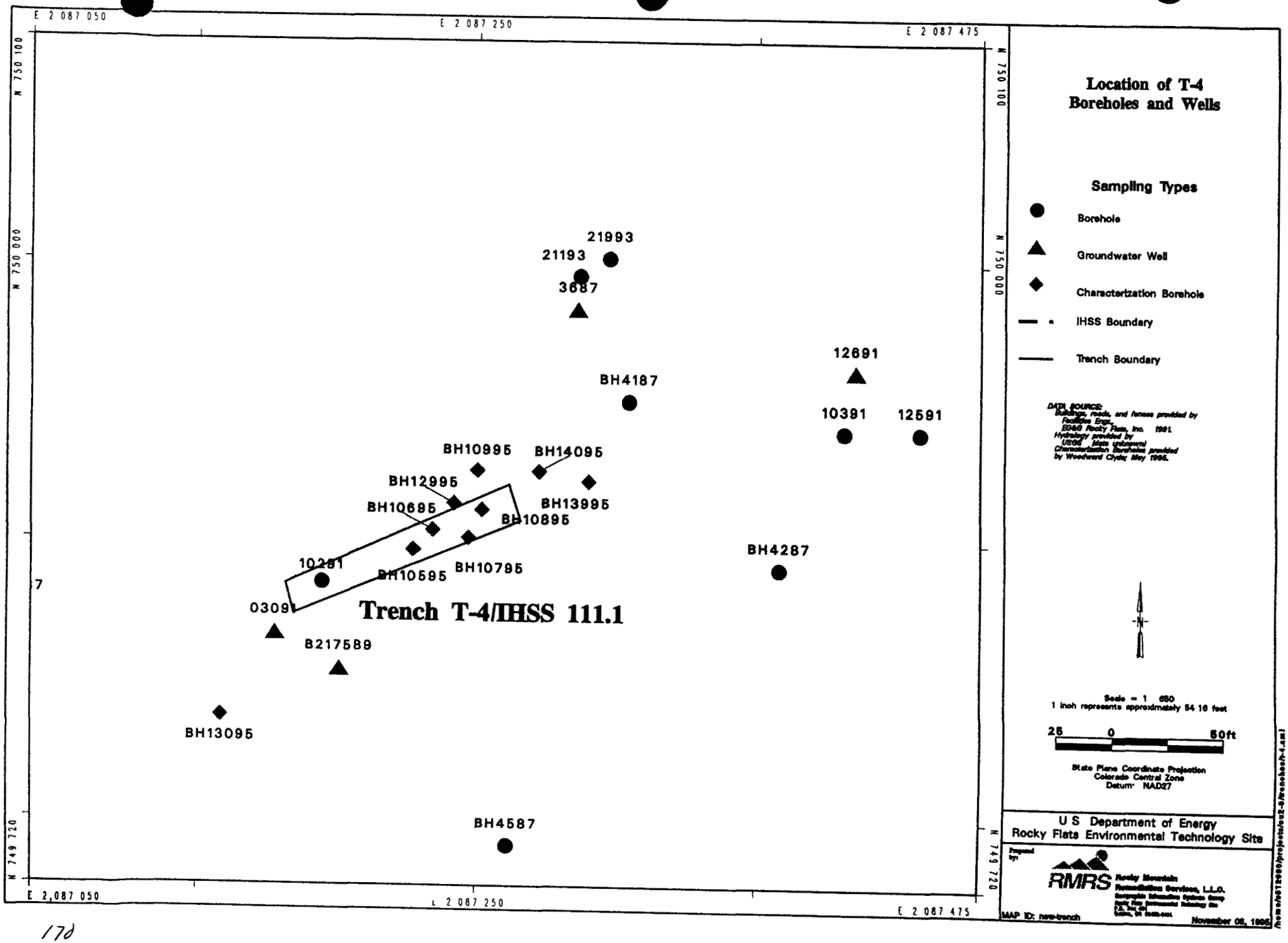
Aluminum Antimony Barium Calcium Chromium Copper Iron Lead Manganese Nickel Potassium Vanadium	Antimony Manganese		
Americium-241 Plutonium-239/240 Radium-226	Gross Alpha Gross Beta Plutonium-239/240 Strontium-89/90 Uranium-233/234 Uranium-235 Uranium-238		

PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
120	10-17	8-9	360-680	Yes	Yes VOC and conductive plumes migrating east-northeast

Note

Source removed through an accelerated action

RFCA subsurface soil action levels for 2-butanone and benzoic acid have not been determined


E 2 087 050
E 2 087 250
E 2 087 475
N 750 100
N 750 000
N 749 720
E 2,087 050
E 2 087 250
E 2 087 475
21993
21193
3687
12691
BH4187
10391
12591
BH10995
BH14095
BH12995
BH13995
BH10695
BH10895
BH4287
10281
BH10595
BH10795
0309
Trench T-4/IHSS 111.1
B217589
BH13095
BH4587
Location of T-4
Boreholes and Wells
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Eng., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 1996.
N
Scale = 1 650
1 inch represents approximately 54 16 feet
25 0 50ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: new-trench
November 08, 1996

17d

Exhibit 3.3.A
Trench T-4 Historical Release Report Information

171

PAC REFERENCE NUMBER NE 111 1 NE 11

FASS Reference Number 111 1 111 S Operable Unit 2

Unit Name Trenches T-4 through T-11

Approximate Location N750 000 E2 087,500

Best Available Copy

Date(s) of Operation or Occurrence

The exact dates of operation are unknown except for the period of July 29 195[illegible] through August 14 1968[1] Trenches T 9 T 10 and T-11 were differentiated from the other trenches and added to the disposal trench inventory in 1977[2] See the "Comments" section below for additional discussion of this point

Description of Operation or Occurrence

Trenches T-4 through T-11 along with Trench T 2 (PAC 900 109) and Trench [illegible] (PAC NE 110) were used primarily for the disposal of sanitary wastewater treatment plant sludge The sludge removed from the wastewater treatment plant was placed on sludge drying beds The dried material removed from the sludge drying beds was placed in the disposal trenches The sanitary sludge disposal trenches are reported to be approximately 10 feet deep and are provided with two feet of soil cover[3] The trenches are variable in length with the average length being approximately 250 feet.[4] The total amount of sludge disposed in Trenches T 2 through T 11 is estimated at 125 000 kilograms[5] Some amounts of additional materials were also disposed [illegible] T 9 and T 11 These other materials consisted of asphalt planking (approximately 130 000 square [illegible] of asphalt planking) in T-4 and T 11 from the re-design of Solar Pond 207A (PAC 000-101) in 1963 and scrap [illegible] in T 9[5]

At the same time that Trenches T 9 T 10 and T 11 were [illegible] the numbering system for the trenches was slightly modified Whereas earlier doc[illegible] consistent numbering system [illegible] a 1983 document a trench that had previously been [illegible] This 1983 document [illegible] the T-4 trench essentially as an addition [illegible] designated Trench T 9 as essentially an extension of Trench T 7[illegible] but in earlier doc[illegible] referred to as Trench T 5 Trench T 10 had not been identified or named prior to 198[illegible] Trench T 5 in the 1983 document was a trench not previously identified (comparison of [illegible]

Physical/Chemical Description of Constituents Released

Some [illegible] and plutonium contamination is pres[illegible] sludge [illegible] have [illegible] primarily uranium contamination with newer [illegible] contamination [illegible] total long lived alpha activity present in the sludge [illegible] /g in August 195[illegible] to a maximum of 3 591 pCi/g in June 1960 [illegible] drums that may have been disposed in any of trenches T 2 [illegible] that had been held in the drum[6] The burning of the contam[illegible] (PAC 900-153) from March 1957 to mid 1965[6] not in the trenches [illegible] in total number could be present in any of Trenches T 3 through T [illegible] that Trench T-4 (currently designated Trench T 11 as discussed [illegible]

On at least one occasion it is believed that 2 [illegible] gallon[illegible] was also disposed in one of the East Trenches [illegible] this is total alpha activity The acu[illegible] approximately 1 3 kilograms (kg) of depleted uranium [illegible] was in drums

Responses to Operation or Occurrence

Soil samples were collected from the [illegible] during the 1977 to 1983 time frame Soil fro[illegible] and from 2 4 to 450 pCi/g uranium activity [illegible] pCi/g [illegible]

172

activity and from 40 to 126 pCi/g uranium activity. Trench T 11 was found to contain 4.5 to 50 pCi/g plutonium activity and 0.9 to 158 pCi/g uranium activity.[5]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents disposed in Trenches T-4 through T 11. This IHSS is being studied in accordance with the IAG schedule for OU2. The IAG activities will include site investigations, site characterizations, and possible remediation. The Final Phase II RFI/RI Report is to be completed by March 12, 1993.

Comments

Trench T 3, along with these trenches, are also called the East Trenches.

Trenches T-4 through T 11 (PAC NE 111) have few operational differences from Trenches T 2 (PAC 900-109) and T-3 (PAC NE 110).

The sludge disposed of in these trenches should consist primarily of concentrated organic matter typically present in sanitary wastewater treatment plant sludge.

From August 1968 until February 1970 sanitary wastewater treatment plant sludge was disposed in the RFP sanitary landfill.[1] After February 1970 sanitary wastewater treatment plant sludge was shipped offsite for disposal.[9]

To date no documentation has been found that records the time frame during which any particular trench was receiving waste. Similarly, none of the RR interviewees were knowledgeable on dates of operation of individual trenches.

The locations of the [illegible] Plate 2 differ from the IAG map but are taken from the OU2 [illegible] RFI/RI Work Plan (Illuvial [illegible]).

References	Other references of interest	
1500793	1500296	1501097
1501719	[illegible]00430	150[illegible]
[3] 500895	[illegible]00340	1500[illegible]0
[4] 150[illegible]	[illegible]0287	150[illegible]
[5] 1500990	[illegible]0901	1500887
[6] 1500[illegible]	[illegible]0304	1500[illegible]
1500[illegible]79	[illegible]0458	1500921
[8] 1700[illegible]	[illegible]0888	

173

Exhibit 3.3.B
Trench T-4 EM-31 Surveys

174

Exhibit 3.3.C
Trench T-4 EM-61 Surveys

Exhibit 3.3.D
Trench T-4 Ground Penetrating Radar Surveys

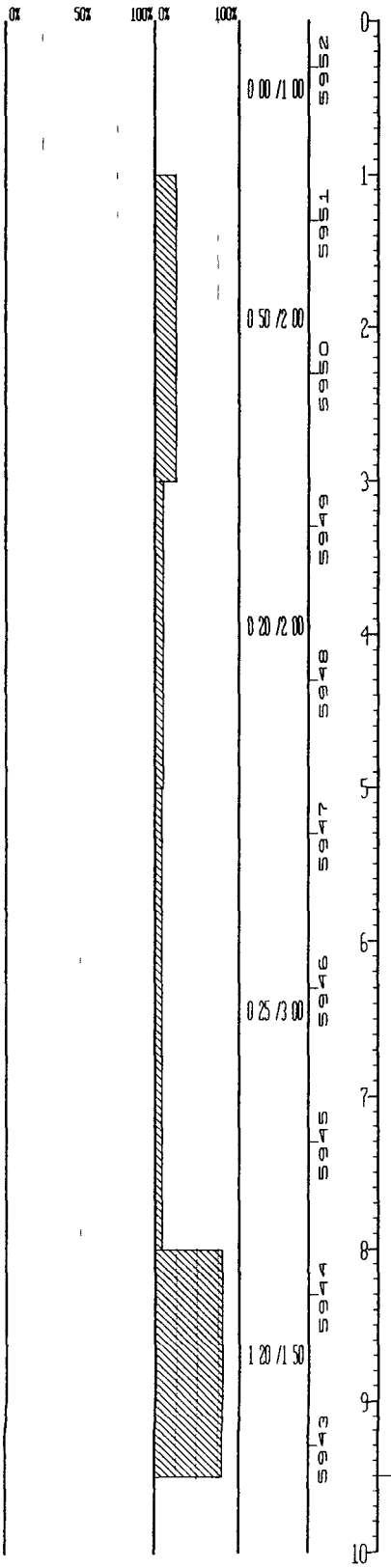
Exhibit 3.3.E
Trench T-4 Borehole Logs

182

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 9 50	GROUND ELEVATION (FT)	5952 30	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749870	AREA TRENCH T-4	CASING DIAMETER (IN)		GEOLOGIST	DK NICHOLSON	10595
EAST	2087222	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	1 00	DATE DRILLED	05/01/95	

REMARKS OU2 TRENCHES SOIL TYPES ESTIMATED FROM DESCRIPTION

CHEMICAL SAMPLE DEPTH
GRADATIONAL DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



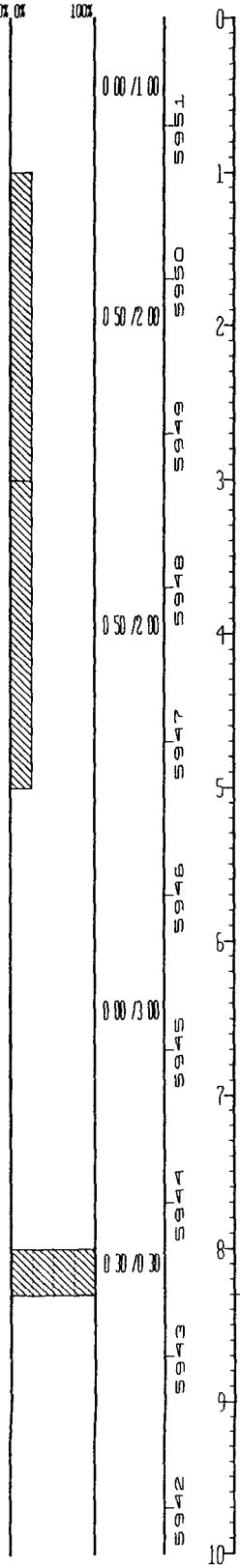
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	0 0-1 0' No sample collected
GC	1 0-1 5' Gravel with some sand and clay Fe staining No recovery (1 5-3 0')
CL	3 0-3 2' Clay gravelly, sandy, dark brown, small fragments of metal, void space @ 4 0' (backfill) NO recovery (3 2-5 0')
CL	5 0-5 25' Void space, sand, clayey, wet, gray-black, tarry meterial present (backfill and waste) No recovery (5 25-8 0')
GM	8 0-9 2' Gravel sandy, gray, iron staining, wet, some gray material (liquid), some caliche No recovery (9 2-9 5')
	Total Depth Drilled 9 50

183

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 8 30	GROUND ELEVATION (FT) 5951 70	PROJECT NUMBER 002 RFI/RI	LOG OF BORING NUMBER
NORTH	749879	AREA TRENCH T-4	CASING DIAMETER (IN)	GEOLOGIST DK NICHOLSON	10695
EAST	2087230	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED 05/01/95	

REMARKS 002 TRENCHES SOIL TYPES ESTIMATED FROM DESCRIPTION

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



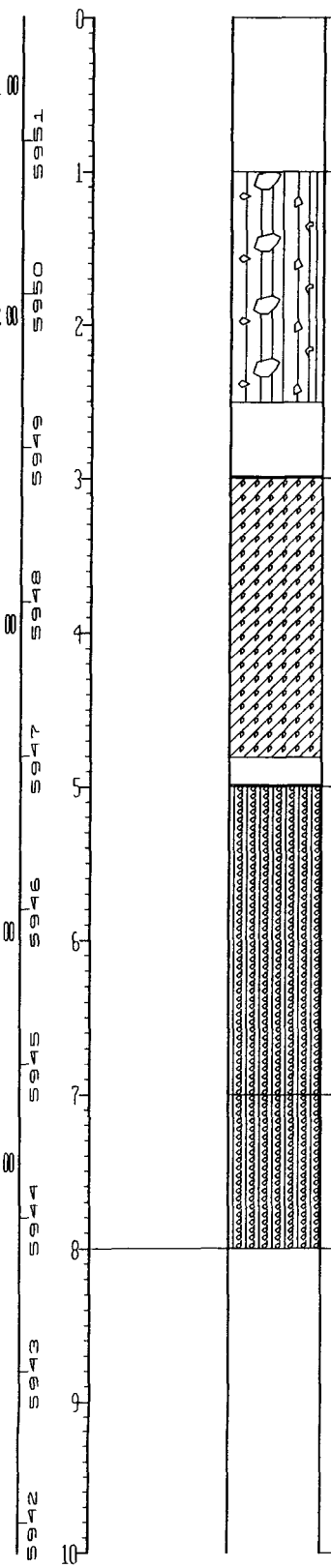
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	0 0-1 0' No sample collected
GM	1 0-1 5' Gravel sandy, clayey, calcareous, white-tan, dry, and sand, gravelly, black, dry No recovery (1 5-3 0')
SC	3 0- 3 5' Sand clayey, cemented with caliche, white to brown, moist No recovery (3 5-5 0')
NO RECOVERY	5 0-8 0' No recovery
SM	8 0-8 3' Sand silty, clayey, moist, tan-reddish, caliche

Total Depth Drilled 8 30

184

STATE PLANE COORDINATE	TOTAL DEPTH (FT) 8 00	GROUND ELEVATION (FT)	5951 80	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH 749876	AREA TRENCH T-4	CASING DIAMETER (IN)		GEOLOGIST	DK NICHOLSON	10795
EAST 2087246	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	1 00	DATE DRILLED	05/02/95	
REMARKS OU2 TRENCHES SOIL TYPES ESTIMATED FROM DESCRIPTION						

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	0 0-1 0' No sample collected
GM	1 0-2 5' Gravel sandy, silty, calcareous, dry, white, pink, brown No recovery (2 5-3 0')
SC	3 0-4 8' Sand silty, clayey, calcareous, dry, brown and pink No recovery (4 8-5 0')
SM	5 0-7 0' Sand silty, gravelly, calcareous, dry, brown, white, pink
SM	7 0-8 0' Sand same as above
	Total Depth Drilled 8 00

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 8 00	GROUND ELEVATION (FT)	5952 20	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749889	AREA TRENCH T 4	CASING DIAMETER (IN)		GEOLOGIST	DK NICHOLSON	10895
EAST	2087252	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	1 00	DATE DRILLED	05/02/95	

REMARKS OU2 TRENCHES SOIL TYPES ESTIMATED FROM DESCRIPTION

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH

SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% 50% 100%)

PERCENT RECOVERY (0% 100%)

RECOVERY/INTERVAL: 0 00 /1 00; 1 30 /2 00; 0 50 /2 00; 0 50 /2 00; 0 00 /1 00

DATUM(FT): 5952, 5951, 5950, 5949, 5948, 5947, 5946, 5945, 5944, 5943

DEPTH(FT): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

WELL OR PIEZOMETER CONSTRUCTION

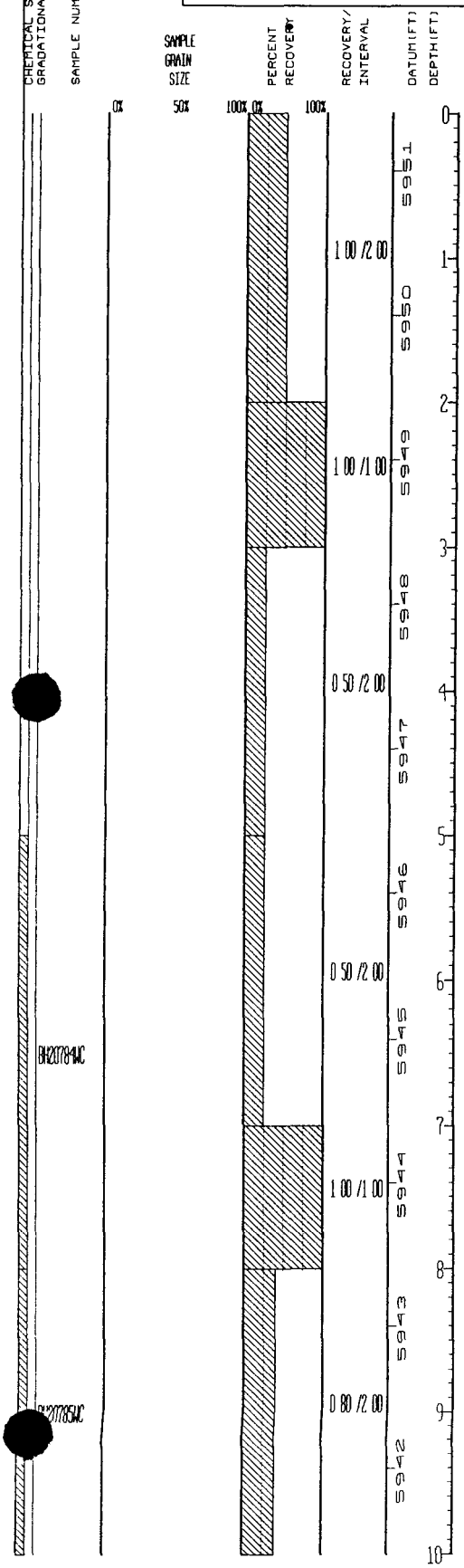
LITHOLOGY

UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	0 0-1 0' No sample collected
GM	1 0-2 3' Gravel sandy, silty, clacareous, dry, white, tan, pink No recovery (2 3-3 0')
GM	3 0-3 5' Gravel same as above, dry No recovery (3 5-5 0')
GM	5 0-5 5' Gravel same as above, moist No recovery (5 5-7 0')
NO RECOVERY	7 0-8 0' No recovery
	Total Depth Drilled 8 00

186

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 31 20	GROUND ELEVATION (FT) 5951 40	PROJECT NUMBER 002 RFI/RI	LOG OF BORING NUMBER
NORTH	749906	AREA NORTH OF TRENCH 4	CASING DIAMETER (IN)	GEOLOGIST JP GIROD	10995
EAST	2087250	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 6 00	DATE DRILLED 05/04/95	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS

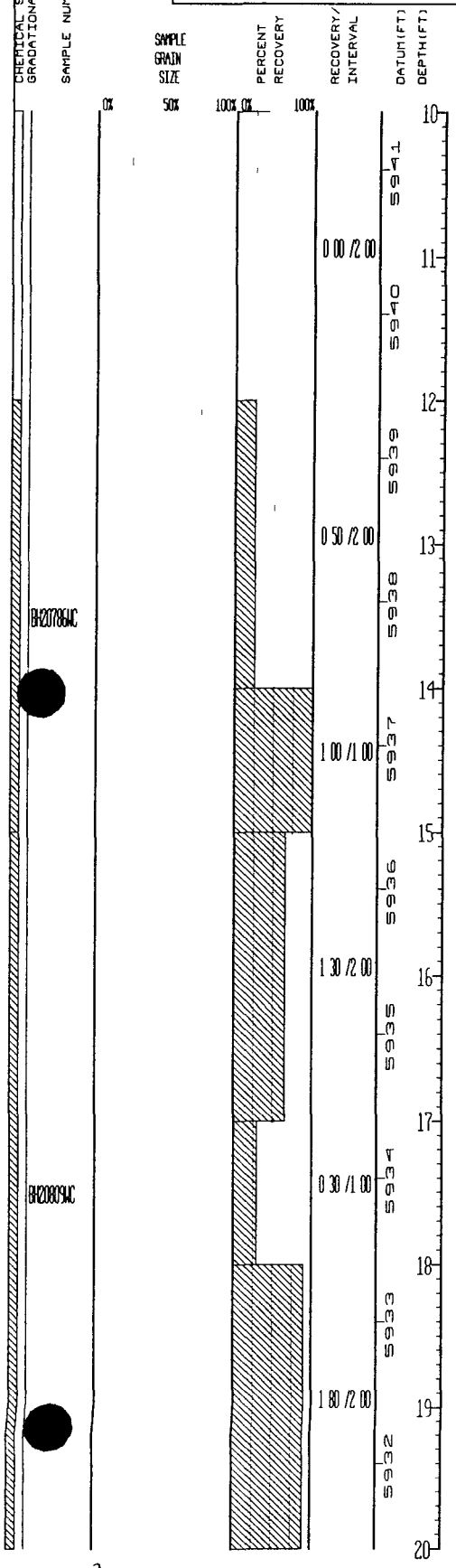


WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		GM	0 0-1 0' Sandy Gravel with some silt and clay reddish brown to dark yellowish brown, gravel up to 1 5" dia , subangular to subrounded, poorly graded, quartzite Sand f-c grained, subangular to angular, poorly graded, quartz, quartzite, FeOx staining, moist No recovery (1 0-2 0')
		CL	2 0-2 7' Gravelly Clay with some sand reddish brown, gravel up to 1 5" dia , subangular, quartzite, FeOx staining, moist
		GC	2 7-3 0' Clayey Gravel with some sand CaCO3 present, reddish brown, gravel up to 1" dia , consists of broken up gravel/cobbles, quartz, quartzite, FeOx staining, moist
		GC	3 0-3 5' Clayey Gravel with some sand same as above, moist No recovery (3 5-5 0')
		SP	5 0-5 5' Gravelly Sand with silt mod yellowish brown, f-c grained poorly graded, angular to subrounded, quartz, gravel up to 2" dia , quartz, FeOx staining No recovery (5 5-7 0')
		SP	7 0-8 0' Gravelly Sand with silt same as above, moist
		SP	8 0-8 8' Gravelly Sand with silt same as above No recovery (8 8-10 0')

167

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 31 20	GROUND ELEVATION (FT) 5951 40	PROJECT NUMBER 002 RFI/RI	LOG OF BORING NUMBER
NORTH	749906	AREA NORTH OF TRENCH 4	CASING DIAMETER (IN)	GEOLOGIST JP GIROD	10995
EAST	2087250	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 6 00	DATE DRILLED 05/04/95	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS



WELL OR PIEZOMETER CONSTRUCTION

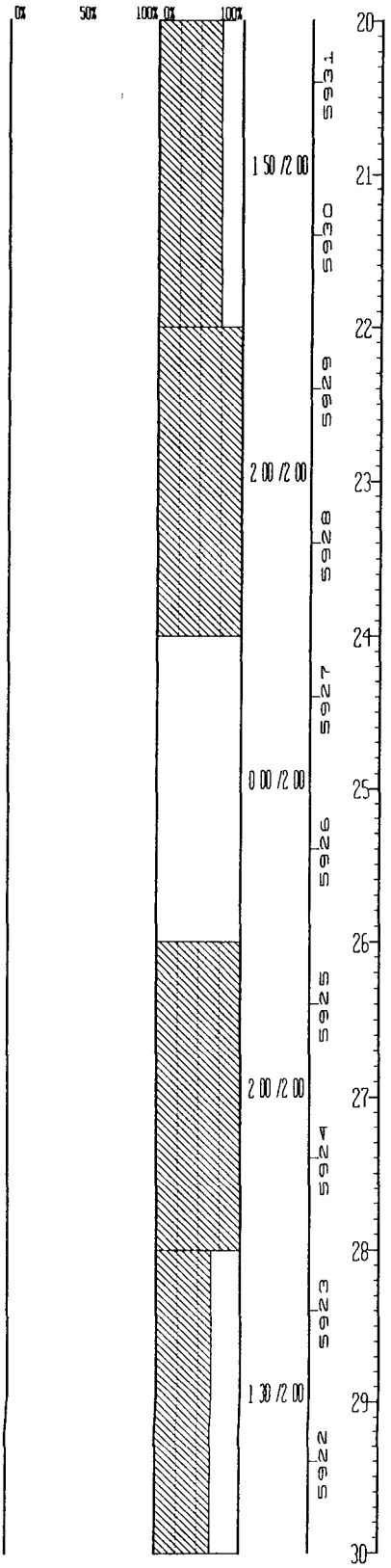
LITHOLOGY

UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
NO RECOVERY	10 0-12 0' No recovery
SP	12 0-12 5' same as above, moist No recovery (12 5-14 0')
GP	14 0-15 0' Sandy Gravel with silt gravel up to 2" dia , poorly graded, angular, quartzite, sand f-m grained, angular to subangular, quartz, quartzite, FeOx staining predominant, moist, used for composite sample
SW	15 0-16 3' Gravelly Sand with silt gravel up to 1" dia , angular, quartzite, sand f-c grained, well to mod graded, quartz, quartzite, FeOx staining predominant, moist No recovery (16 3-17 0')
SILTY CLAYSTONE	17 0-17 3' Top of Bedrock 17 0' Silty Claystone with some sand, gray, dry No recovery (17 3-18 0')
SANDSTONE	18 0-19 8' Sandstone Arapahoe #1, mod yellow brown, dry No recovery (19 8-20 0')

A8

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 31 20	GROUND ELEVATION (FT) 5951 40	PROJECT NUMBER OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749906	AREA NORTH OF TRENCH 4	CASING DIAMETER (IN)	GEOLOGIST JP GIROD	10995
EAST	2087250	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 6 00	DATE DRILLED 05/04/95	
REMARKS	SOIL TYPES ESTIMATED FROM DESCRIPTIONS				

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER



WELL OR PIEZOMETER CONSTRUCTION

LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	SANDSTONE	20 0-21 5' Sandstone f g , FeOx staining, frosted grains, quartz No recovery (21 5-22 0')
	SILTY SANDSTONE	22 0-24 0' Silty Sandstone f g , FeOx staining, frosted grains, quartz
	NO RECOVERY	No recovery (24 0-26 0') A little scrape on the sides, sandstone, f-m grained, tan-orange
	SANDSTONE	26 0-28 0' Sandstone friable, f-m grained, laminated, appearance with color banding, orange, rust, tan, grey, moist
	SANDSTONE	28 0-29 3' Sandstone f-m grained, same as above No recovery (29 3-30 0')

189

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 31 20	GROUND ELEVATION (FT) 5951 40	PROJECT NUMBER OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749906	AREA NORTH OF TRENCH 4	CASING DIAMETER (IN)	GEOLOGIST JP GIROD	10995
EAST	2087250	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 6 00	DATE DRILLED 05/04/95	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1 20 /1 20	5921	30			SANDSTONE	30 0-31 2' Sandstone f-m grained, orange, moist
					5920	31				Total Depth Drilled 31 20
					5919	32				
					5918	33				
					5917	34				
					5916	35				
					5915	36				
					5914	37				
					5913	38				
					5912	39				
						40				

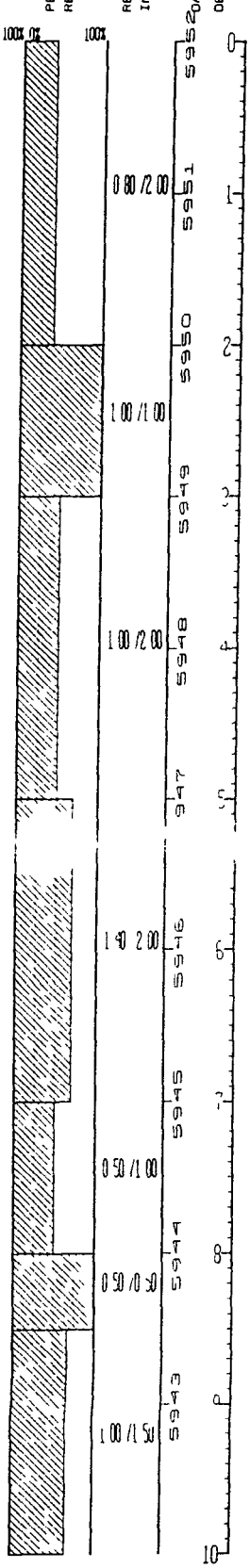
190

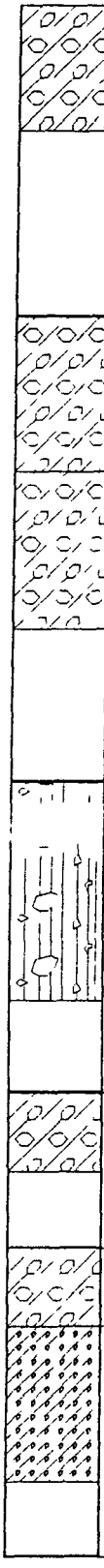
STATE PLANE COORDINATE		TOTAL DEPTH (FT) 20 00	GROUND ELEVATION (FT)	5952 00	PROJECT NUMBER	002 RFI/RI	LOG OF BORING NUMBER
NORTH	749891	AREA NE TRENCHES	CASING DIAMETER (IN)		GEOLOGIST	DK NICHOLSON	12995
EAST	2087240	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	6 00	DATE DRILLED	05/10/95	

REMARKS SOIL TYPES DETERMINED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION





UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GC	0 0-0 8' Gravel silty, clayey, brown, dry No recovery (0 8-2 0')
GC	2 0-3 0' Gravel same as above
GC	3 0-4 0' Gravel silty, clayey, calcareous reddish-brown slightly moist No recovery (4 0-5 0')
[illegible]	[illegible] lower part of interval red [illegible] oxidation No recovery (6 4-7 0')
GC	7 0-7 5' Gravel sandy, clayey red-brown slightly moist No recovery (7 5-8 0')
GC	8 0-9 5' Gravel same as above
SC	8 5-9 5' Sand clayey, gravelly red-brown, slightly moist No recovery (9 5-10 0')

191

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 20 00	GROUND ELEVATION (FT) 5952 00	PROJECT NUMBER 002 RFI/RI	LOG OF BORING NUMBER
NORTH	749891	AREA NE TRENCHES	CASING DIAMETER (IN)	GEOLOGIST DK NICHOLSON	12995
EAST	2087240	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 6 00	DATE DRILLED 05/10/95	

REMARKS SOIL TYPES DETERMINED FROM DESCRIPTIONS

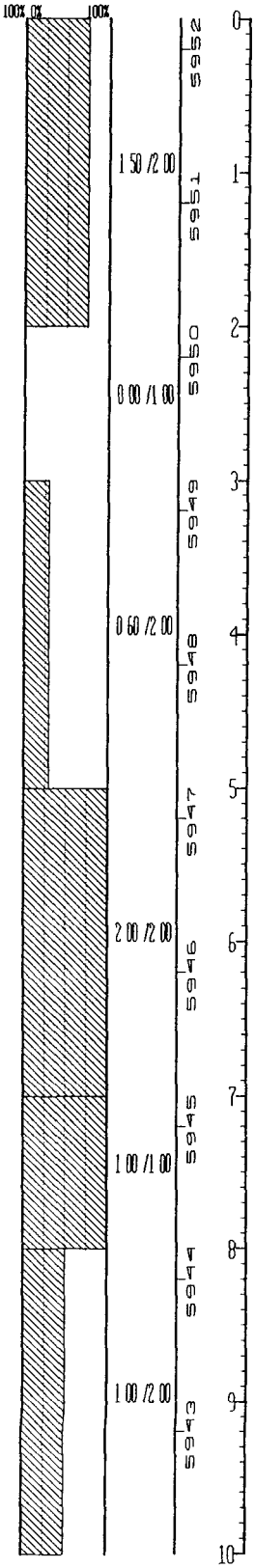
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY / INTERVAL	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					10			NO RECOVERY	10 0-11 0' No recovery Ran center bit
				0 00 /1 00	11			SC	11 0-12 0' Sand f c grained, gravelly, clayey, red-brown, slightly moist
				1 00 /1 00	12			SC	12 0-12 4' Sand clayey, gravelly, brown slightly moist No recover, (12 4-13 0')
				0 40 /1 00	13			SC	13 0-13 4 Sand same as above No recover, (13 4-14 0')
				0 40 /1 00	14			SC	14 0-14 2' Sand same as above No recovery (14 2-15 0')
				0 20 /1 00	15			[illegible]	[illegible] No recovery (15 9-17 0')
				0 90 /2 00	16				
				1 00 /1 00	17			SANDSTONE	17 0-18 0' Top of Bedrock 17 0' Sandstone f g, tan-orange, 'l sandstone
				2 00 /2 00	18			SANDSTONE	18 0-20 0' Sandstone same as above
					19				
					20				Total Depth Drilled 20 00

192

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 21 00	GROUND ELEVATION (FT)	5952 20	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749902	AREA TRENCH T-4	CASING DIAMETER (IN)		GEOLOGIST	DK NICHOLSON	13995
EAST	2087300	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	6 00	DATE DRILLED	05/11/95	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH
GRADATIONAL DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50%)
PERCENT RECOVERY (100% 0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GC	0 0-1 5' Clayey Gravel with some silt red-brown, slightly moist No recovery (1 5-2 0')
NO RECOVERY	2 0-3 0' No recovery
GC	3 0-3 6' Clayey Gravel with some sand orange-brown, slightly moist No recovery (3 6-5 0')
GM	5 0-7 0' Sandy Gravel with some silt calcareous, white to pink orange, brown and gray, dry
SM	7 0-8 0' Gravelly Sand with some silt and clay slightly moist, reddish brown
SM	8 0-9 0' Sandy Gravel with some silt and clay slightly moist, brown No recovery (9 0-10 0')

143

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 21 00	GROUND ELEVATION (FT) 5952 20	PROJECT NUMBER 002 RFI/RI	LOG OF BORING NUMBER
NORTH	749902	AREA TRENCH T 4	CASING DIAMETER (IN)	GEOLOGIST DK NICHOLSON	13995
EAST	2087300	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 6 00	DATE DRILLED 05/11/95	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0 50 /2 00	5942	10			SM	10 0-10 5' Gravelly Sand with some clay brown, slightly moist No recovery (10 5-12 0')
				0 00 /1 00	5941	11				
					5940	12			NO RECOVERY	12 0-13 0' No recovery
				1 20 /2 00	5939	13			GM	13 0-14 2' Sandy Gravel with some silt and trace clay calcareous, slightly moist No recovery (14 2-15 0')
					5938	14				
				0 70 /2 00	5937	15			GM	15 0-15 7' Same as 13 0-14 2' No recovery (15 7-17 0')
					5936	16				
				1 00 /1 00	5935	17			SM	17 0-18 0' Gravelly Sand with some clay light brown, moist No recovery (18 0-20 0')
					5934	18				
				0 00 /2 00	5933	19				
						20				

194

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 21 00	GROUND ELEVATION (FT) 5952 20	PROJECT NUMBER 002 RFI/RI	LOG OF BORING NUMBER
NORTH	749902	AREA TRENCH T-4	CASING DIAMETER (IN)	GEOLOGIST DK NICHOLSON	13995
EAST	2087300	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 6 00	DATE DRILLED 05/11/95	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1 00 /1 00	5932	20			SC	20 0-21 0' Sand with some clay f g, tan, moist
					5931	21				Total Depth Drilled 21 00
					5930	22				
					5929	23				
					5928	24				
					5927	25				
					5926	26				
					5925	27				
					5924	28				
					5923	29				
						30				

195

3 4 TRENCH T-5 (IHSS 111 2)

Trench T-5 was investigated using the following methodologies

- Historical data were compiled to identify potential contaminants, trench location, and size
- Aerial photographs were examined to identify disturbed areas, verify trench dimensions, and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- Two EM surveys were conducted to locate buried metallic objects and define trench boundaries
- GPR surveys were conducted to better determine trench depth and dimensions
- Soil gas surveys were conducted to identify and delineate contaminant plumes
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the trench

As shown in Figure 3 4-1 Trench T-5 is located immediately south of Central Avenue, north of Trench T-6 (IHSS 111 3) and northeast of Trench T-9 (IHSS 111 6) The trench was reportedly used for disposal of sanitary sewage sludge potentially contaminated with uranium and plutonium and flattened empty drums contaminated with uranium Activities of the sewage sludge were reported between 382 pCi/g and 3 590 pCi/g Older sludge had mostly uranium with an increasing plutonium fraction in later sludge placed in the trenches Total alpha radioactivity in the trench is estimated to be 100 to 150 millicurie (0 1 Ci to 0 15 Ci) Trench T-5 may also contain some asphalt planking from the Solar Evaporation Ponds contaminated with plutonium and uranium The pertinent section of the Historical Release Report (HRR) is presented in Exhibit 3 4 A (PAC Reference Number NE111 1-NE111 8)

Although the general location of Trench T-5 was known, the exact location of the trench had not been physically identified prior to the Trenches Area and Mound Site Characterization Program of 1995 Aerial photographs dating from 1964 through 1972 were examined to ascertain the period of operation, approximate the length and width, identify staging areas, and gather information which might confirm the contents of the trench (Colorado Aerial Photo Service, 1993) Photographs from 1967 through 1970 show this site as approximately 20 feet wide and 60 feet long, of dark staining and disturbed soil The location and dimensions of this staining and soil disturbance are consistent with information from the HRR Prior to 1967 there are no indications of soil disturbance or waste disposal activities in the area Photographs after 1970 show surficial scarring indicating closure and abandonment of the area

196

3 4 1 Geology

Surficial deposits in the Trench T-5 area consist of the Rocky Flats Alluvium, which ranges in thickness from approximately 16 to 37 feet The Rocky Flats Alluvium in the vicinity of Trench T-5 is underlain by the Arapahoe Formation, which is primarily claystone (EG&G 199c) The hydrograph from monitoring well 08091, located south of T-5, indicates that groundwater fluctuates between 12 feet to below the bedrock contact

3 4 2 Site Visual Survey and Geophysical Surveys

After aerial photographs were examined, a visual survey of the Trench T-5 area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general area of Trench T-5 Soil disturbances such as mounding and subsidence were identified and recent geologic characterization information were used to delineate between Rocky Flats Alluvium and soil disturbance caused by construction related activities In addition to the geologic characteristics of the area, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material The area did not show any evidence of surficial water or seeps.

Upon completion of the visual survey, a geophysical grid was laid out using pin flags The grid dimensions were 65 feet (north-south) wide by 220 feet long (east-west) with flags placed at five foot increments

EM-31 Survey

After establishing the geophysical grid, the EM-31 survey was performed The EM-31 survey showed the presence of one large anomaly approximately 20 feet wide and 120 feet long located centrally in the grid which represents the trench area. The anomaly indicates the presence of buried metallic objects and/or other conductive solid or liquid material in Trench T-5. Results of the EM-31 survey are presented in Exhibit 3 4 B

EM-61 Survey

To further define the physical characteristics of the grid area, EM-61 was also performed As seen in the EM-31 survey results, the EM-61 survey located the same anomaly The EM-61 survey showed a greater response in the western third of the trench indicating the presence of buried metallic objects which corresponds with the HRR information The EM-61 survey contours are presented in Exhibit 3 4 C

Ground Penetrating Radar

The information obtained from the GPR indicates that the trench is approximately 7-15 feet deep and 10-16 feet wide The GPR surveys are presented in Exhibit 3 4 D

3 4 3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995, the vadose zone within Trench T-5 area was highly saturated The increased soil moisture content tended to attenuate soil gas readings making sample collection difficult However, 28 samples were collected during this phase of the characterization, and were analyzed for total volatile organic content using field instrumentation To verify VOC readings eight samples were collected and sent to an onsite laboratory for general chemistry analysis using method 8010 Soil gas survey results are presented in Figure 3 4-2

Based on the trench boundaries determined above, soil gas locations were placed along two horizontal lines located 10 feet apart on either side of the centerline of the trench Soil gas samples were collected every 10 feet along these lines at depths of five and nine feet bgs If a sample had a field measurement above 100 ppm the field crew stepped off 10 feet from that location and collected an additional sample This procedure was repeated until readings less than 100 ppm were obtained

Results of the soil gas survey do not indicate any areas of high VOC concentrations or a VOC plume

3 4 4 Subsurface Soil Sampling

Subsurface soil sampling from Trench T-5 was the final step of the characterization activities Two boreholes were drilled and sampled at Trench T-5 to characterize the vertical extent of potential contamination in the subsurface soil Lithologic descriptions of each borehole are presented in Exhibit 3 4 E In addition five boreholes were drilled and samples during the OU 2 Phase II RFI/RI effort Results from the subsurface soil sampling investigations indicate elevated levels of one organic compound and some metals and radionuclides Figure 3 4-3 identifies those boreholes and wells that characterize Trench T-5

Organic Compounds

No organic compounds were detected at a concentrations exceeding the RFCA Subsurface Soil Action Levels as shown in Table 3 4-1

Metals

Arsenic (range 12 7-14 6 mg/kg), cadmium (range 1 4-20 8 mg/kg), calcium (range 75,600-151,000 mg/kg), nickel (173 mg/kg), potassium (12,200 mg/kg), and sodium (2,370 mg/kg) were detected at concentrations greater than the background $UTL_{99/99}$ as shown in Table 3.4-2

Radionuclides

Americium-241 (range 0 03-2.09 pCi/g), and plutonium-239/240 (range: 0 03-11 8 pCi/g) were detected at concentrations greater than the background $UTL_{99/99}$ as presented in Table 3 4-3 Radium-226 (range 0 51-0 66) and radium-228 (range 1 1-1 7 pCi/g) were detected at activities greater than the PPRG for subsurface soils, construction worker scenario as shown in Table 3 4-4

3 4 5 Groundwater

Gross alpha (14 05 pCi/L), gross beta (7.47 pCi/L), uranium-233,234 (8 47 pCi/L) and uranium-238 (3 9 pCi/L) were detected at activities exceeding the RFCA Tier II Action Levels as presented in Table 3 4-5

3 4.6 Summary

Based on the geophysical surveys, the dimensions of the trench are 10 to 16 feet wide, 112 feet long, and 10 to 16 feet deep which corresponds to 414 to 1,060 cy of material

The soil gas survey did not indicate the presence of a VOC plume and the EM-31 survey did not indicate the presence of a conductive plume The EM-61 survey indicated the presence of buried metallic objects

The data collected was combined with data from previous investigations for comparison to background concentrations, negotiated cleanup levels, and PPRGs All organic contaminants detected area fall below the RFCA Subsurface Action Levels. Five metals exceeded the background $UTL_{99/99}$ but were less than the PPRGs for subsurface soils, construction worker scenario Two radionuclide activities were greater than background $UTL_{99/99}$ values and two radionuclide activities were greater than the PPRGs for subsurface soils, construction worker scenario Therefore, Trench T-5 should not require remediation

Trench T-5 summary information is presented in Table 3 4-6

199

Table 3 4-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

LABORATORY QUALIFIERS

NOTES
RFCA Action Levels for Benzoic Acid and 2 Butanone have not been determined

VALIDATION CODES
V = Valid result

200

Table 3 4-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 5	8091	BH100324WCU2	2-6	1/28/92	Calcium	231000	1000		V	53250
Trench T-5	8091	BH100324WCU2	2-6	1/28/92	Strontium	206	40		JA	186
Trench T-5	8191	BH100305WCU2	0.9-6	1/23/92	Calcium	144000	1000		JA	53250
Trench T-5	8191	BH100319WCU2	38-44	1/24/92	Chromium	304	2		Z	89.1
Trench T 5	8191	BH100319WCU2	38-44	1/24/92	Nickel	173	8		Z	78.7
Trench T-5	11495	BH120746WC	3-6	4/27/95	Cadmium	11.4	1		Y	1.33
Trench T-5	11595	BH120747WC	3-6	4/27/95	Cadmium	20.8	1		Y	1.33
Trench T 5	11595	BH120746WC	8-10	4/27/95	Calcium	151000	1000		Y	53250
Trench T-5	11595	BH120747WC	3-6	4/27/95	Potassium	12200	1000		Y	7276
Trench T 5	11595	BH120747WC	3-6	4/27/95	Sodium	2370	1000		Y	2000
Trench T-5	BH5367	BH1536700DH	0-10.8	9/11/87	Cadmium	2.3			N	1.33
Trench T-5	BH5367	BH1536702DH	2-3.3	9/11/87	Cadmium	2	.		N	1.33
Trench T-5	BH5367	BH1536706DH	8-8.9	9/11/87	Cadmium	1.4	.		N	1.33
Trench T-5	BH5367	BH1536716DH		9/14/87	Cadmium	2.3			N	1.33
Trench T-5	BH5367	BH1536700DH	0-10.8	9/11/87	Calcium	75600	.		N	53250
Trench T-5	BH5367	BH1536702DH	2-3.3	9/11/87	Calcium	102000	.		N	53250
Trench T-5	BH5367	BH1536702DH	2-3.3	9/15/87	Cadmium	2.4	.		N	1.33
Trench T-5	BH5367	BH1536710DH	9.5-10.9	9/15/87	Cadmium	1.4	.		N	1.33
Trench T 5	BH5367	BH1536712WT	12-14	9/15/87	Cadmium	1.7	.		N	1.33
Trench T-5	BH5367	BH155871424	14.5-23.5	9/15/87	Cadmium	3.8	.		N	1.33
Trench T-5	BH5367	BH1536702DH	2-3.3	9/15/87	Calcium	80000			N	53250

LABORATORY QUALIFIER

VALIDATION CODES
JA = Result accepted, but was estimated
N = Will not be validated
V = Valid result
Y = Analytical results in validation process
Z = Validation was not requested or performed

201

Table 3 4-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{95/95}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 5	8091	BH00326WCU2	8 14	1/28/92	Tritium	510	300	208	JA	504
Trench T 5	8091	BH00326WCU2	8-14	1/28/92	Tritium	510	300	208	JA	504
Trench T 5	8191	BH00314WCU2	26-32	1/24/92	Americium 241	0 05	0 01	0 026	V	0 022
Trench T 5	8191	BH00312WCU2	20-26	1/23/92	Plutonium 239 240	0 03	0 003	0 018	A	0 025
Trench T 5	8191	BH00312WCU2	20-26	1/23/92	Plutonium-239 240	0 03	0 003	0 018	A	0 025
Trench T 5	8191	BH00305WCU2	0 9-8	1/23/92	Radium-226	0 51	0 3	0 13	V	1 42
Trench T 5	8191	BH00314WCU2	26-32	1/24/92	Radium-226	0 51	0 18	0 19	V	1 42
Trench T 5	8191	BH00317WCU2	32 38	1/24/92	Radium 226	0 61	0 11	0 14	V	1 42
Trench T 5	8191	BH00319WCU2	38-44	1/24/92	Radium 226	0 66	0 14	0 16	V	1 42
Trench T 5	8191	BH00309WCU2	14-20	1/23/92	Radium-228	1 1	0 42	0 36	V	2 33
Trench T 5	8191	BH00305WCU2	0 9-8	1/23/92	Radium-228	1 3	0 39	0 28	V	2 33
Trench T 5	8191	BH00312WCU2	20-26	1/23/92	Radium-228	1 3	0 46	0 36	V	2 33
Trench T 5	8191	BH00307WCU2	8 14	1/23/92	Radium-228	1 5	0 56	0 42	V	2 33
Trench T 5	8191	BH00319WCU2	38-44	1/24/92	Radium-228	1 5	0 25	0 36	V	2 33
Trench T 5	8191	BH00317WCU2	32 38	1/24/92	Radium-228	1 6	0 27	0 41	V	2 33
Trench T 5	8191	BH00314WCU2	26-32	1/24/92	Radium-228	1 7	0 24	0 42	V	2 33
Trench T 5	11495	BH20749WC	3-8	4/27/95	Americium 241	1 77	0 058	0 324	Y	0 022
Trench T 5	11495	BH20749WC	3-8	4/27/95	Plutonium 239 240	11 18	0 029	1 35	Y	0 025
Trench T 5	11595	BH20747WC	3-6	4/27/95	Americium-241	2 09	0 007	0 227	Y	0 022
Trench T 5	11595	BH20747WC	3-6	4/27/95	Plutonium 239 240	14 12	0 003	1 49	Y	0 025
Trench T 5	BH5387	BH538708DH	8-9 9	9/11/87	Americium 241	0 04		0 06	N	0 022
Trench T 5	BH5387	BH538708DH	8-9 9	9/11/87	Americium-241	0 04		0 06	N	0 022
Trench T 5	BH5387	BH538702DH	2 3 5	9/11/87	Americium-241	0 06		0 11	N	0 022
Trench T 5	BH5387	BH538700DH	0-18 8	9/11/87	Americium-241	0 53		0 2	N	0 022
Trench T 5	BH5387	BH538714DH	14 2 16 2	9/14/87	Americium-241	0 03		0 09	N	0 022
Trench T 5	BH5387	BH538716DH	16 2 17 9	9/14/87	Americium-241	0 07		0 08	N	0 022
Trench T 5	BH5387	BH538720CT	20 6-22 6	9/14/87	Americium-241	0 07		0 08	N	0 022
Trench T 5	BH5387	BH538719WT	18 6-20 6	9/14/87	Americium-241	0 1		0 09	N	0 022
Trench T 5	BH5387	BH538708DH	8-9 9	9/11/87	Plutonium-239 240	0 13		0 21		0 025
Trench T 5	BH5387	BH538706DH	6-7 8	9/11/87	Plutonium-239 240	0 14		0 12		0 025
Trench T 5	BH5387	BH538702DH	2 3 5	9/11/87	Plutonium-239 240	0 98		0 24		0 025
Trench T 5	BH5387	BH538700DH	0-18 8	9/11/87	Plutonium-239 240	6		0 2		0 025
Trench T 5	BH5387	BH538714DH	14 2-16 2	9/14/87	Plutonium-239 240	0 03		0 15		0 025
Trench T 5	BH5587	BH55871424	14 5-23 5	9/15/87	Americium-241	0 1		0 13	N	0 022
Trench T 5	BH5587	BH55871424	14 5-23 5	9/15/87	Americium-241	0 1		0 13	N	0 022
Trench T 5	BH5587	BH558729CT	29 5-32	9/9/87	Plutonium-239 240	0 03		0 09		0 025
Trench T 5	BH5587	BH558732BR	32-34 1	9/15/87	Plutonium-239 240	0 05		0 1		0 025
Trench T 5	BH5587	BH558734DH	34 5-36 6	9/15/87	Plutonium-239,240	0 05		0 1		0 025
Trench T 5	BH5587	BH558734DH	34 5-36 6	9/15/87	Plutonium-239 240	0 05		0 1		0 025
Trench T 5	BH5587	BH558702DH	2-3 3	9/15/87	Plutonium-239 240	0 06		0 09		0 025
Trench T 5	BH5587	BH558712WT	12 14	9/15/87	Plutonium-239 240	0 07		0 11		0 025
Trench T 5	BH5587	BH55871424	14 5-23 5	9/15/87	Plutonium-239 240	0 07		0 13		0 025

202

Table 3 4-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{95/95}$ Values (continued)

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 5	BH5587	BH558727UC	27 29 2	9/15/87	Plutonium-239 240	0 08		0 13		0 025
Trench T 5	BH5587	BH558710DH	9 5-10.9	9/15/87	Plutonium-239,240	0.09		0 16		0 025

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted but was estimated
N = Will not be validated
V = Valid result
Y = Analytical results in validation process

Table 3 4-4 Subsurface Soil Radionuclide Activities Exceeding PPRGs

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	PPRG (pCi/g)
Trench T 5	8191	BH00305WCU2	0 9-8	1/23/92	Radium 226	0 51	0 3	0 13	V	0 494
Trench T 5	8191	BH00314WCU2	26-32	1/24/92	Radium 226	0 51	0 18	0 19	V	0 494
Trench T 5	8191	BH00317WCU2	32 38	1/24/92	Radium 226	0 61	0 11	0 14	V	0 494
Trench T 5	8191	BH00319WCU2	38-44	1/24/92	Radium-226	0 66	0 14	0 16	V	0 494
Trench T 5	8191	BH00309WCU2	14-20	1/23/92	Radium-228	1 1	0 42	0 36	V	1 01
Trench T 5	8191	BH00305WCU2	0 9-8	1/23/92	Radium 228	1 3	0 39	0 28	V	1 01
Trench T 5	8191	BH00312WCU2	20-26	1/23/92	Radium-228	1 3	0 46	0 36	V	1 01
Trench T 5	8191	BH00307WCU2	8-14	1/23/92	Radium-228	1 5	0 56	0 42	V	1 01
Trench T 5	8191	BH00319WCU2	38-44	1/24/92	Radium 228	1 5	0 25	0 36	V	1 01
Trench T 5	8191	BH00317WCU2	32 38	1/24/92	Radium-228	1 6	0 27	0 41	V	1 01
Trench T 5	8191	BH00314WCU2	26-32	1/24/92	Radium 228	1 7	0 24	0 42	V	1 01

VALIDATION CODES
V = Valid result

Table 3 4-5 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T 5	8091	GW02926IT	5/19/92	Gross Alpha	14 05	1 7	4 47	A	7
Trench T 5	8091	GW02926IT	5/19/92	Gross Beta	7 474	1 6	1 54	A	5
Trench T 5	8091	GW02926IT	5/19/92	Uranium-233,234	8 472	0 147	1 69	A	1 07
Trench T 5	8091	GW02926IT	5/19/92	Uranium-238	3 946	0	1 02	A	0 768

VALIDATION CODES
A = Result accepted with qualifications

205

TABLE 3.4-6 TRENCH T-5 SUMMARY INFORMATION

CONTAMINANTS		
Media: Subsurface Soils		
Greater than $UTL_{99/99}$	Greater than RFCA Standards	Greater than PPRGs
Cadmium Calcium Chromium Nickel Potassium Sodium Strontium		
Gross beta Americium-241 Plutonium-239/240		Radium-226 Radium-228

Media: Groundwater			
Greater than $UTL_{99/99}$	Greater than RFCA Tier II Standards	Greater than RFCA Tier I Standards	Greater than PPRGs
	Gross alpha Gross beta Uranium-233,234 Uranium-238		

PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
112	10-16	10-16	420-1,060	Yes	No

Note

A RFCA subsurface soil action level has not been determined for 2-butanone

206

Exhibit 3.4.A
Trench T-5 Historical Release Report Information

PAC REFERENCE NUMBER NE 111.1 - NE 111.8

SS Reference Number 111.1 - 111.8 Operable Unit 2

Unit Name Trenches T-4 through T-11

Approximate Location N750 000 E2 087,500

Best Available Copy

Date(s) of Operation or Occurrence

The exact dates of operation are unknown except for the period of July 29 1954 through August 14, 1968[1] Trenches T 9 T 10 and T-11 were differentiated from the other trenches and added to the disposal trench inventory in 1977[2] See the "Comments" section below for additional discussion of this point

Description of Operation or Occurrence

Trenches T-4 through T 11 along with Trench T 2 (PAC 900 109) and Trench T 3 (PAC NE 110) were used primarily for the disposal of sanitary wastewater treatment plant sludge The sludge removed from the wastewater treatment plant was placed on sludge drying beds The dried material removed from the sludge drying beds was placed in the disposal trenches The sanitary sludge disposal trenches are reported to be approximately 10 feet deep and are provided with two feet of soil cover[3] The trenches are variable in length with the average length being approximately 250 feet[4] The total amount of sludge disposed in Trenches T 2 through T 11 is estimated at 125 000 kilograms[5] Some amounts of additional materials were also disposed in Trenches T 4 T 9 and T 11 These other materials consisted of asphalt planking (approximately 130 000 square feet of asphalt planking) in T-4 and T 11 from the re design of Solar Pond 207A (PAC 000-101) in 1963 and scrap metal and junk in T 9[5]

At the same time that Trenches T 9 T 10 and T 11 were identified (1977) it appears that the numbering system for the trenches was slightly modified Whereas earlier documents had presented a consistent numbering system in a 1983 document a trench that had previously been referred to as Trench T-4 became T 11[5] This 1983 document placed the T-4 trench essentially as an [illegible] to Trench T [illegible] This same 1983 document designated Trench T 9 as essentially an extension of Trench T 7[5] but in earlier documents this trench had been referred to as Trench T 5[1] Trench T 10 had not been identified or named prior to 1983 The trench identified as Trench T 5 in the 1983 document was a trench not previously identified (comparison of maps in references 1 and 5)

Physical Chemical Description of Constituents Disposed

[illegible] and plutonium contamination is present in this sludge [illegible] reported that the older sludge would have [illegible] uranium contamination with newer sludge [illegible] an increasing amount of plutonium contamination [illegible] alpha activity present in the sludge was reported between a minimum of 382 pCi/g in August 1964 [illegible] of 3 591 pCi/g in June 1960 [illegible] contamination may also be present in flattened drums that may have been disposed in any of trenches T 2 through T 11 following burning of the contaminated oils that had been held in the drum[6] The burning of the contaminated oils had been done in Oil Burn Pit No-2 (PAC 900-153) from March 1957 to mid 1965[6] not in the trenches These flattened drums estimated at up to 200 in total number could be present in any of Trenches T 2 through T 11 [illegible] as estimated in a 1973 document that Trench T-4 [illegible] designated Trench T 11 as discussed above) contains 16 2 grams of uranium 235[7]

On at least one occasion it is believed that 2 400 gallons of water and lathe coolant generated in Building 444 was also disposed in one of the East Trenches [illegible] average activity of 150 000 dpm/l It is believed that [illegible] alpha activity The [illegible] reported as 1 35 x 10⁴ dpm with approximately 1 3 [illegible] depleted uranium present [illegible] unknown whether or not this material was in drums

Response to Operation or Occurrence

[illegible] were collected from the [illegible] identified in 1977 (Trenches T 9 T 10 and T-11) during [illegible] time frame Soil from [illegible] from 0 40 to 68 pCi/g in plutonium activity and from [illegible] to [illegible] pCi/g uranium activity [illegible] T 10 was found to contain from 0 18 to 14 pCi/g plutonium

211

activity and from 40 to 126 pCi/g uranium activity Trench T-11 was found to contain 4.5 to 50 pCi/g plutonium activity and 0.9 to 158 pCi/g in uranium activity[5]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents disposed in Trenches T-4 through T-11 This IHSS is being studied in accordance with the IAG schedule for OU2 The IAG activities will include site investigations site characterizations and possible remediation The Final Phase II RFI/RI Report is to be completed by March 12 1993

Comments

Trench T-3 along with these trenches are also called the East Trenches

Trenches T-4 through T-11 (PAC NE 111) have few operational differences from Trenches T-2 (PAC 900-109) and T-3 (PAC NE 110)

The sludge disposed of in these trenches should consist primarily of concentrated organic matter typically present in sanitary wastewater treatment plant sludge

From August 1968 until February 1970 sanitary wastewater treatment plant sludge was disposed in the [illegible] landfill[1] After February 1970 sanitary wastewater treatment plant sludge was shipped offsite for disposal[9]

To date no documentation has been found that records the time frame during which any particular [illegible] receiving waste Similarly none of the HRR interviewees were knowledgeable on dates of operation of [illegible] trenches

The locations of these trenches on Plate 2 differ from the IAG map but are taken from [illegible] Work Plan (Alluvial) (July 1991)

References	Other references of interest	
[1] 1500793	1500296	150109[illegible]
[2] 1501719	1600430	150[illegible]
[3] 1500898	1500340	150[illegible]
[4] 1502713	1500287	150[illegible]
1500890	1500901	150[illegible]
[6] 1500656	1500304	150[illegible]
[7] 1500579	1500458	150[illegible]
[8] 1700445	1500888	

212

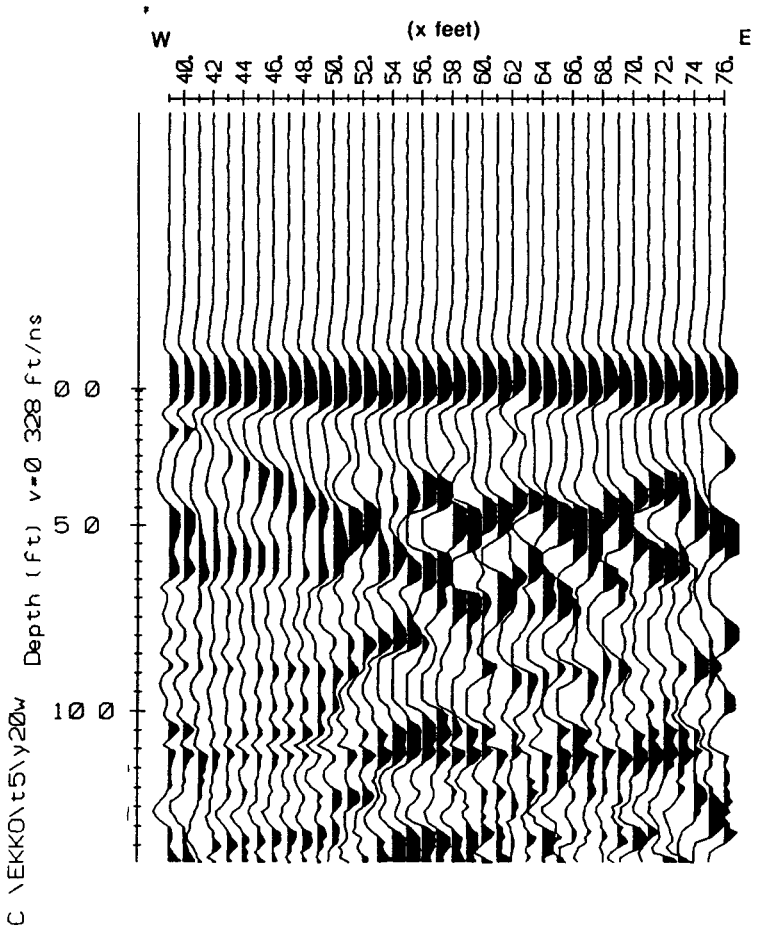
Exhibit 3.4.B
Trench T-5 EM-31 Surveys

213

Exhibit 3.4.C
Trench T-5 EM-61 Surveys

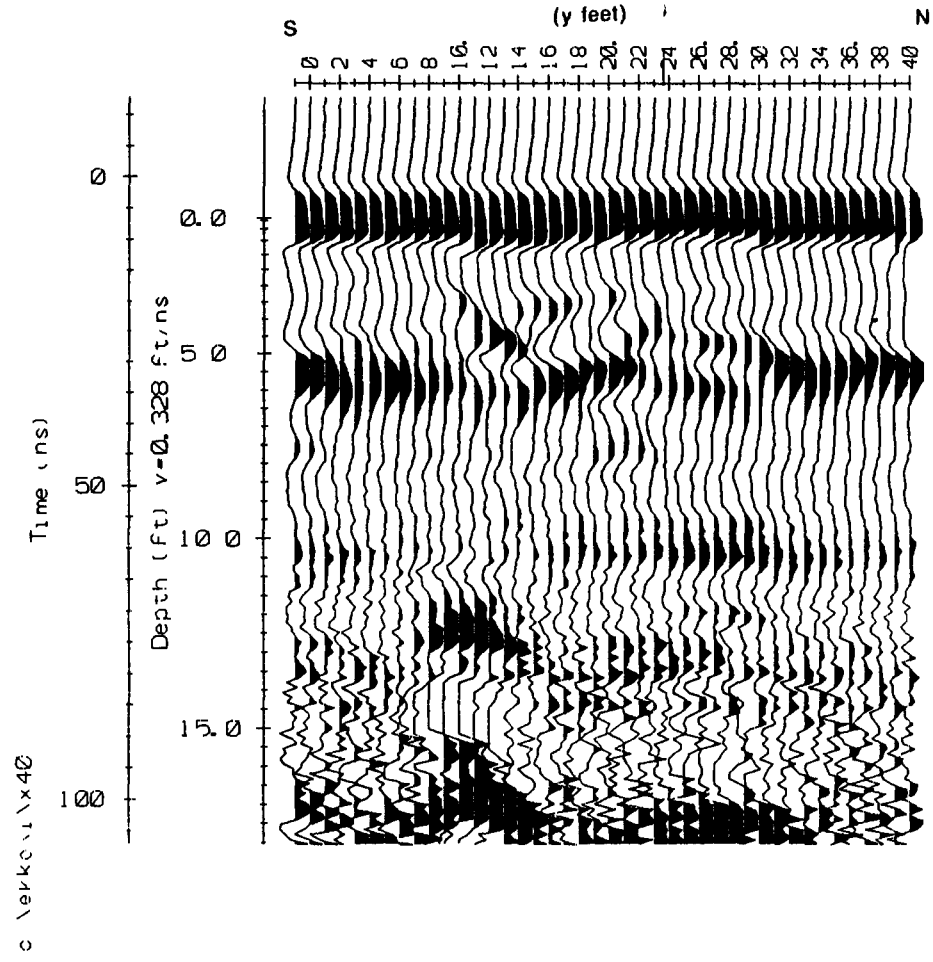
Exhibit 3.4.D
Trench T-5 Ground Penetrating Radar Surveys

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-5
WEST TO EAST ORIENTATION AT Y=20 FEET (WESTERN END)
JUNE 1995

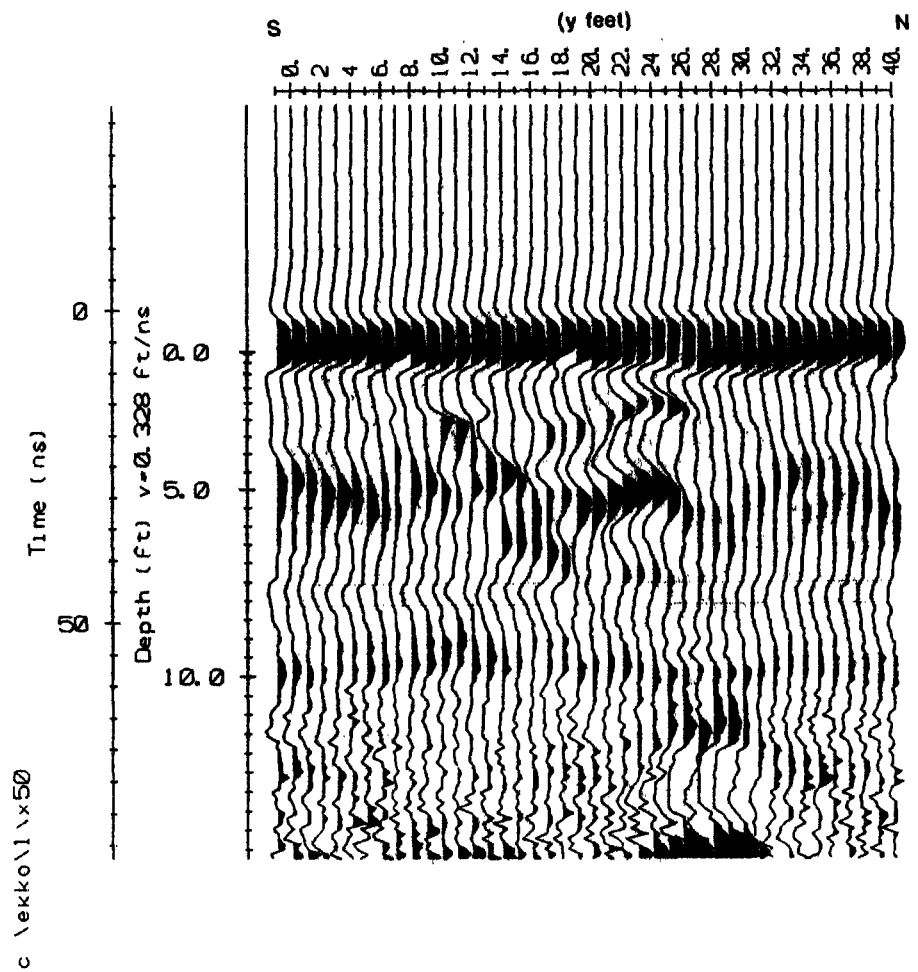


Dense materials corresponding to area of high conductivity in EM surveys

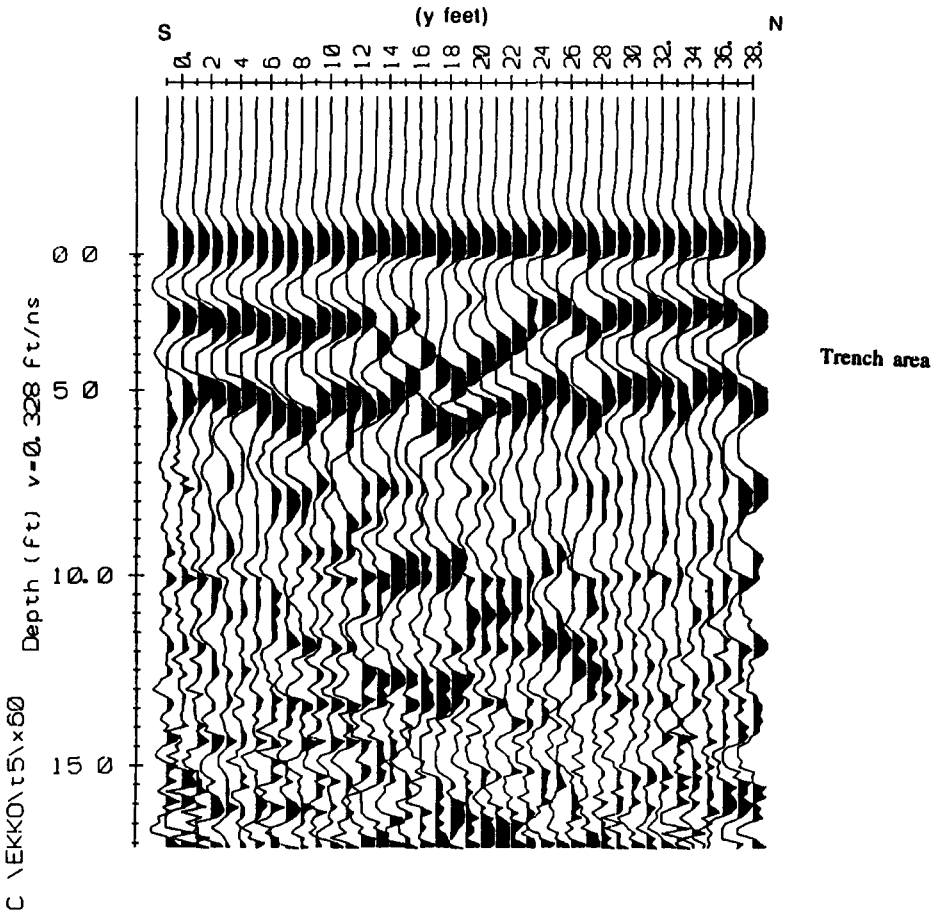
RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 5
SOUTH TO NORTH ORIENTATION AT X=40 FEET
JUNE 1995



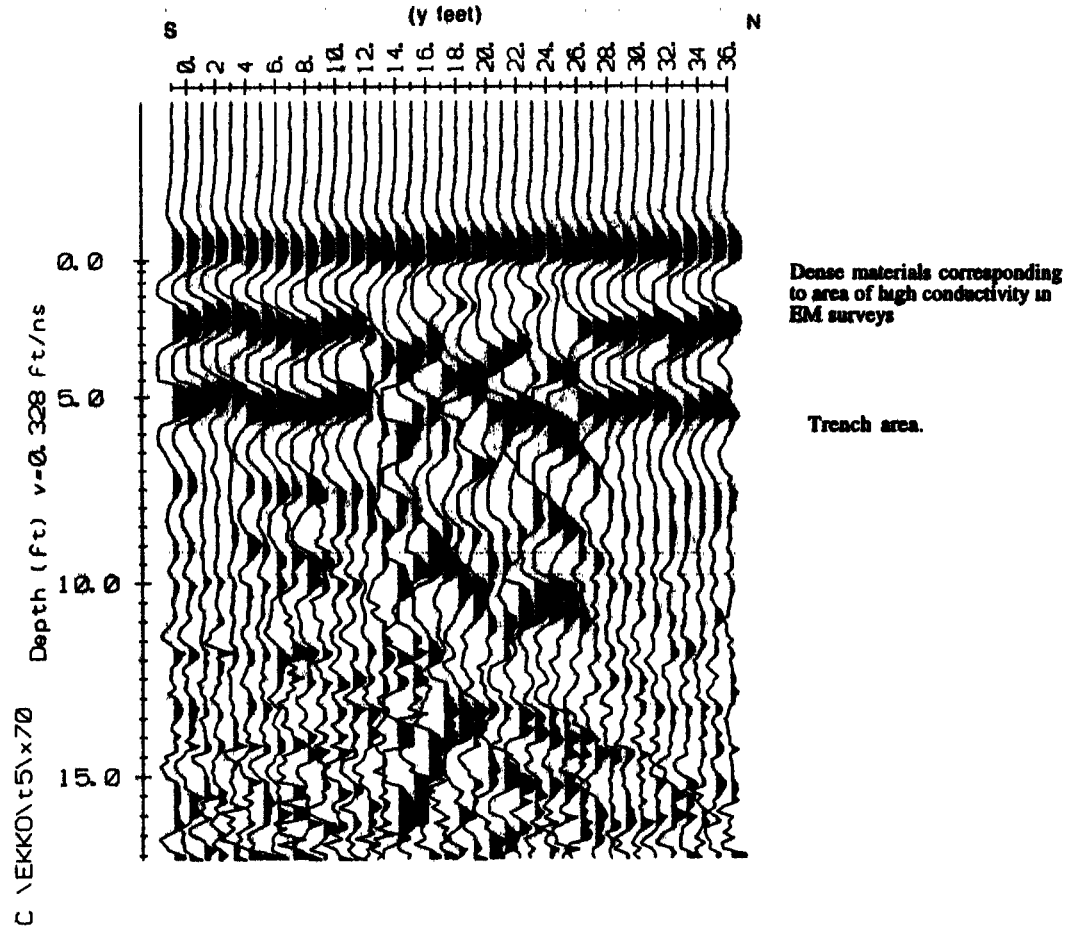
RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-5
SOUTH TO NORTH ORIENTATION AT X=50 FEET
JUNE 1995



RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 5
SOUTH TO NORTH ORIENTATION AT X=60 FEET
JUNE 1995

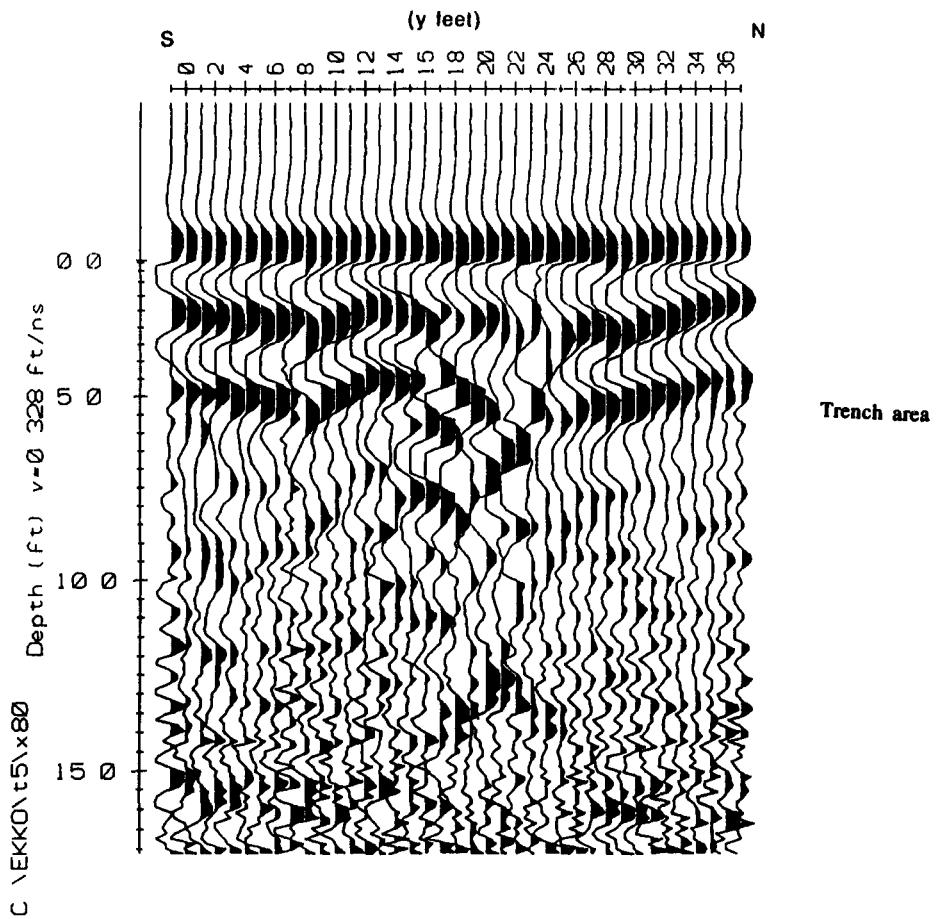


RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-5
SOUTH TO NORTH ORIENTATION AT X=70 FEET
JUNE 1995

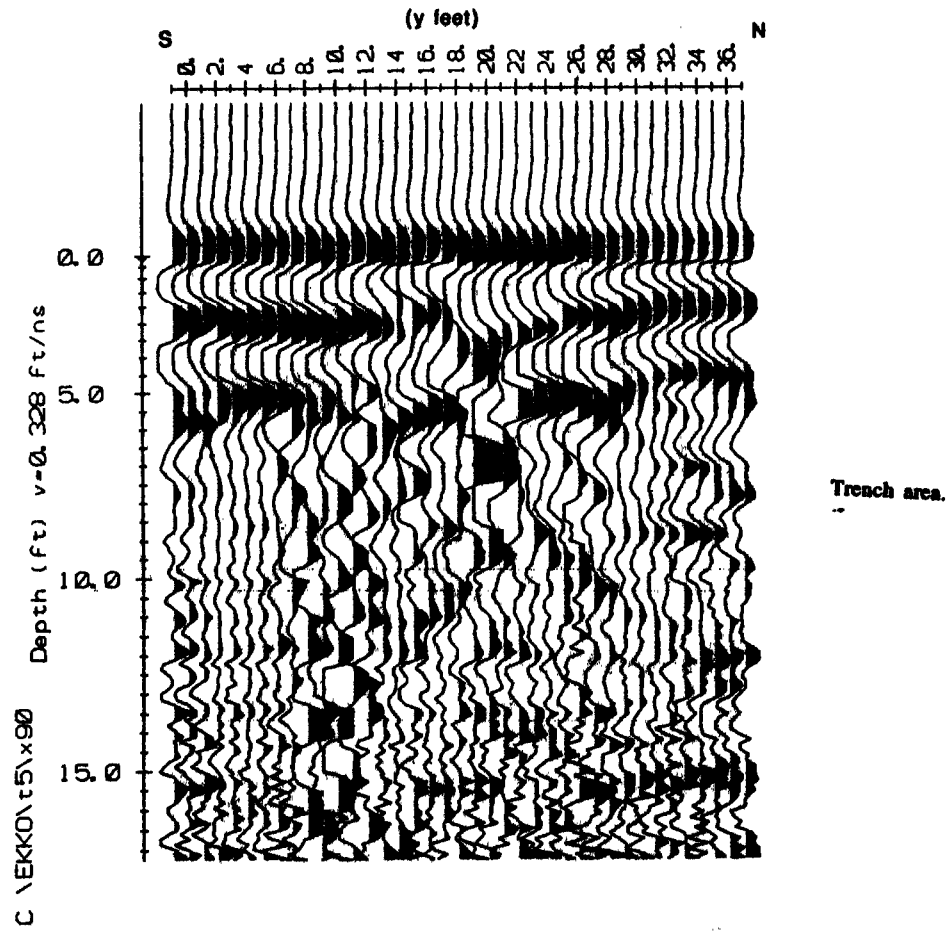


225

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 5
SOUTH TO NORTH ORIENTATION AT X=80 FEET
JUNE 1995



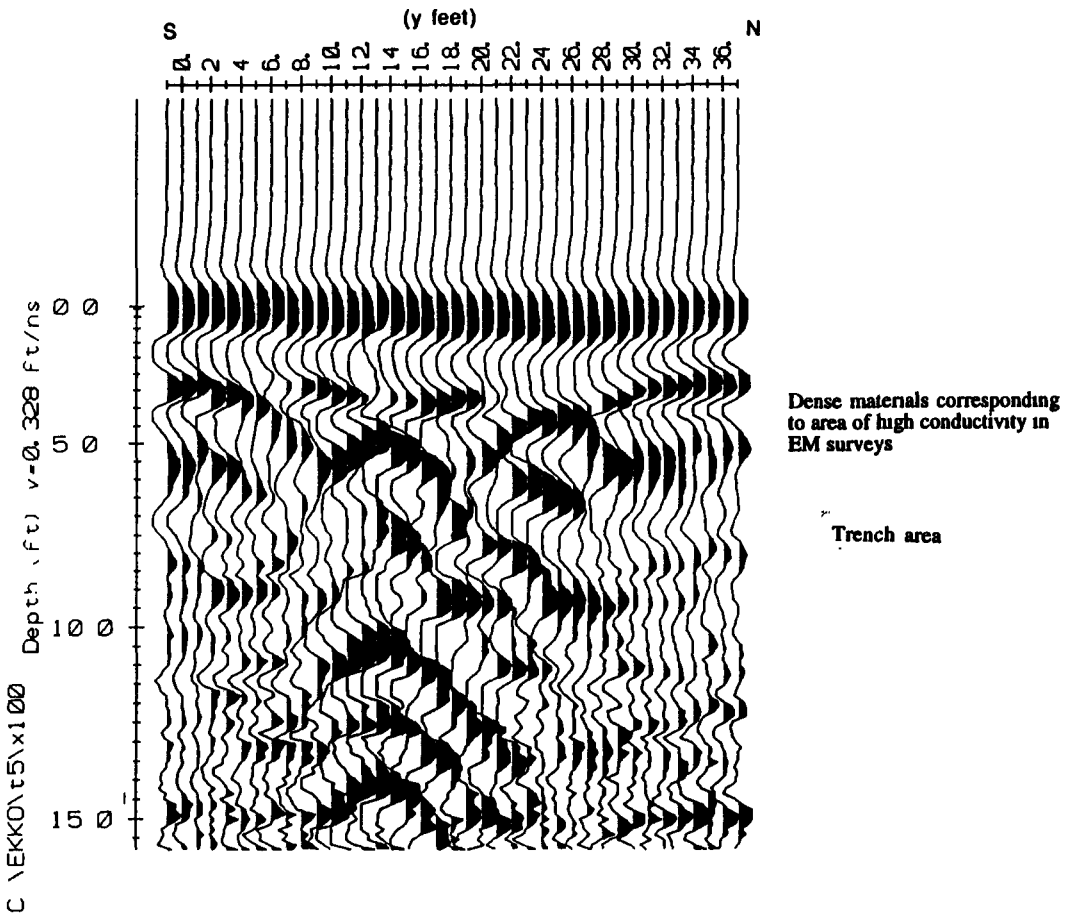
RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-5
SOUTH TO NORTH ORIENTATION AT X=90 FEET
JUNE 1995



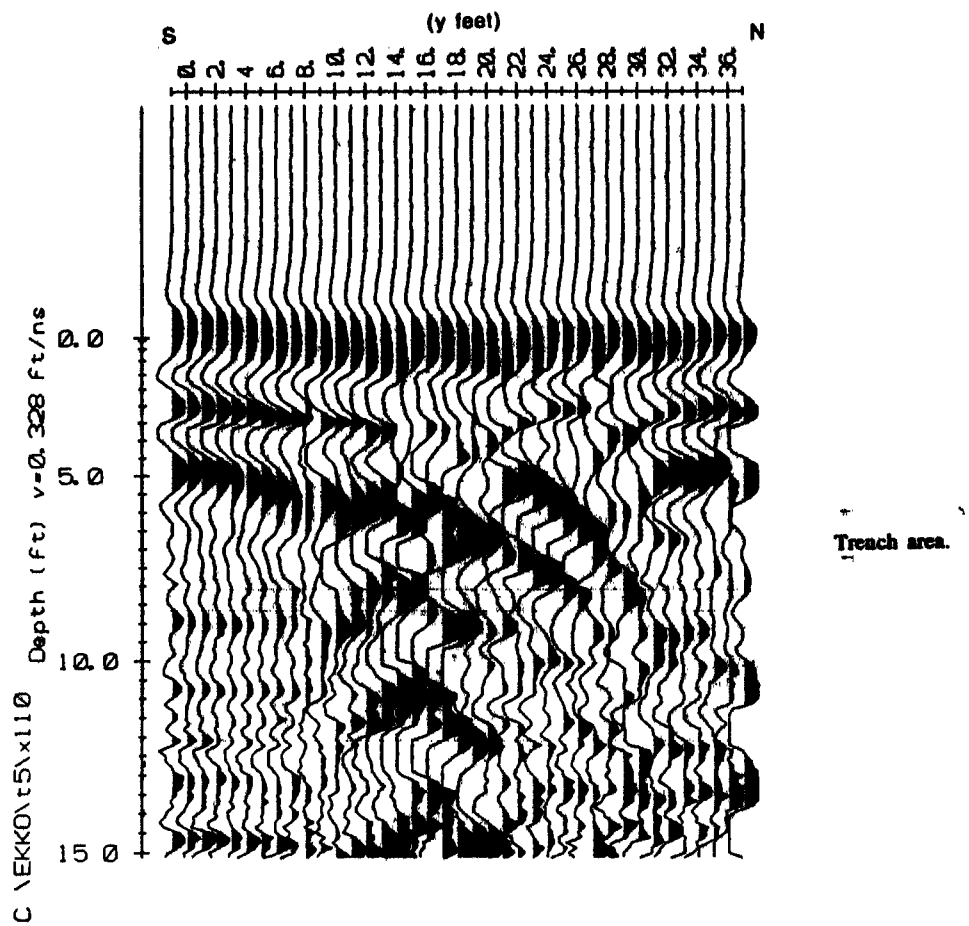
Trench area.

227

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 5
SOUTH TO NORTH ORIENTATION AT X=100 FEET
JUNE 1995

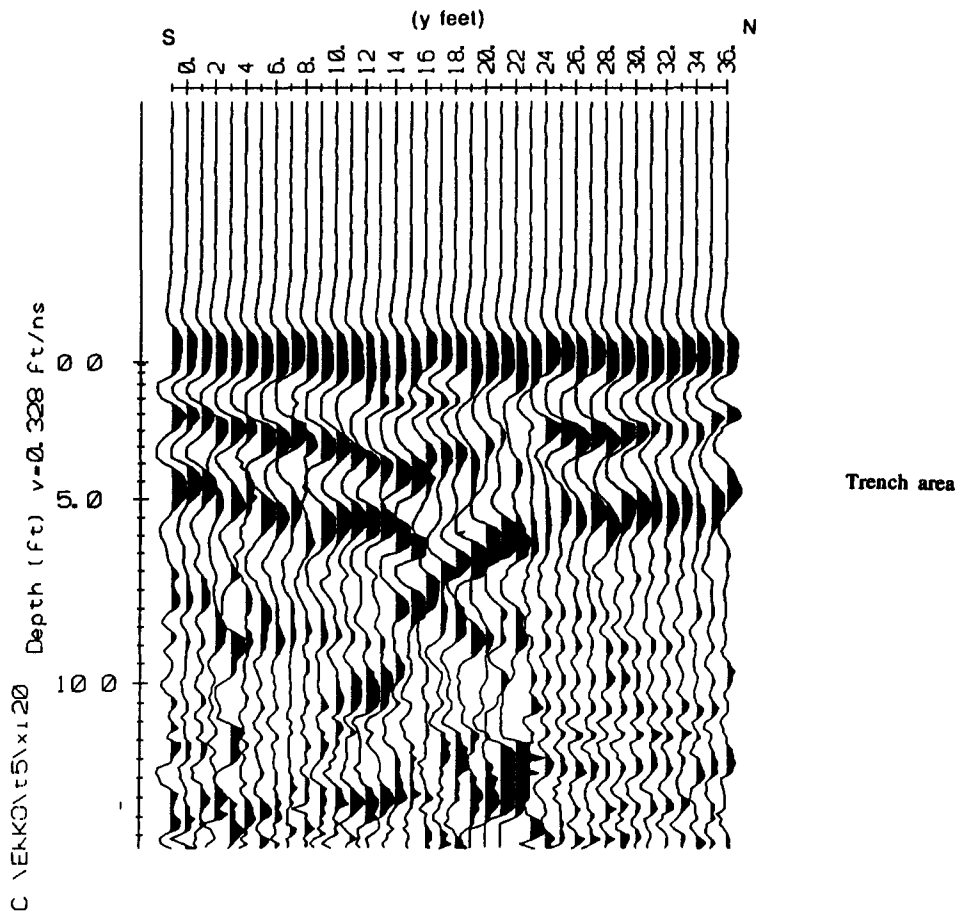


RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 5
SOUTH TO NORTH ORIENTATION AT X=110 FEET
JUNE 1995

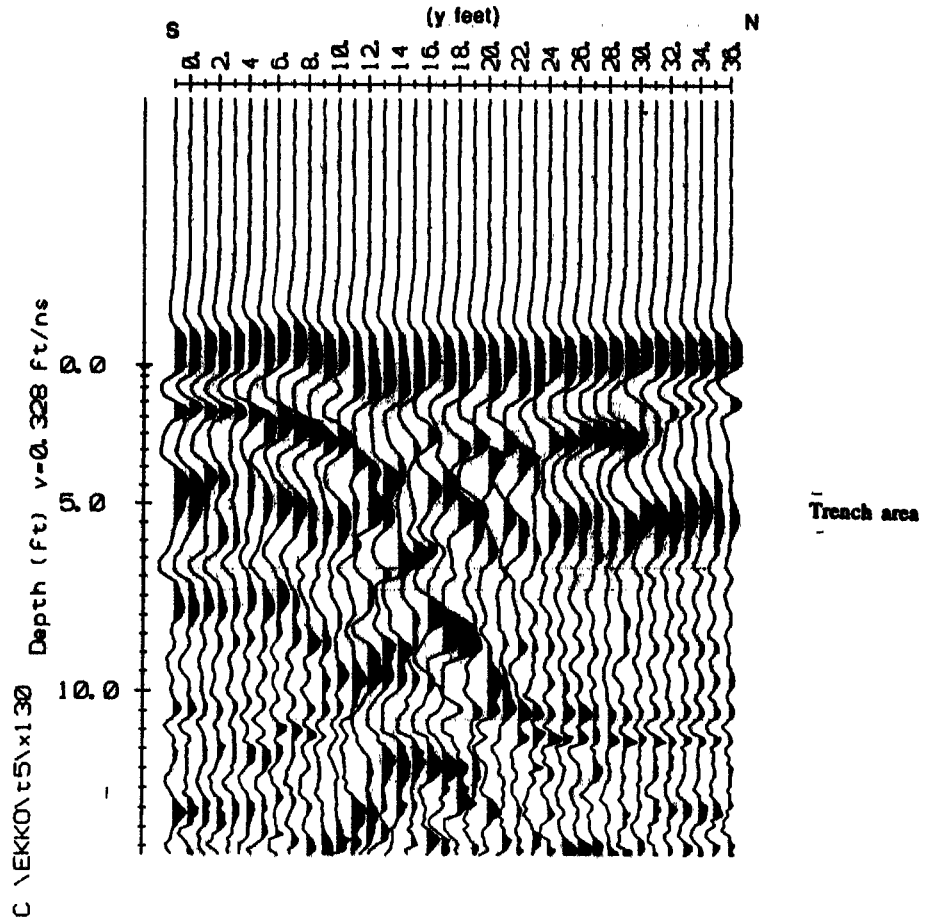


229

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 5
SOUTH TO NORTH ORIENTATION AT X=120 FEET
JUNE 1995

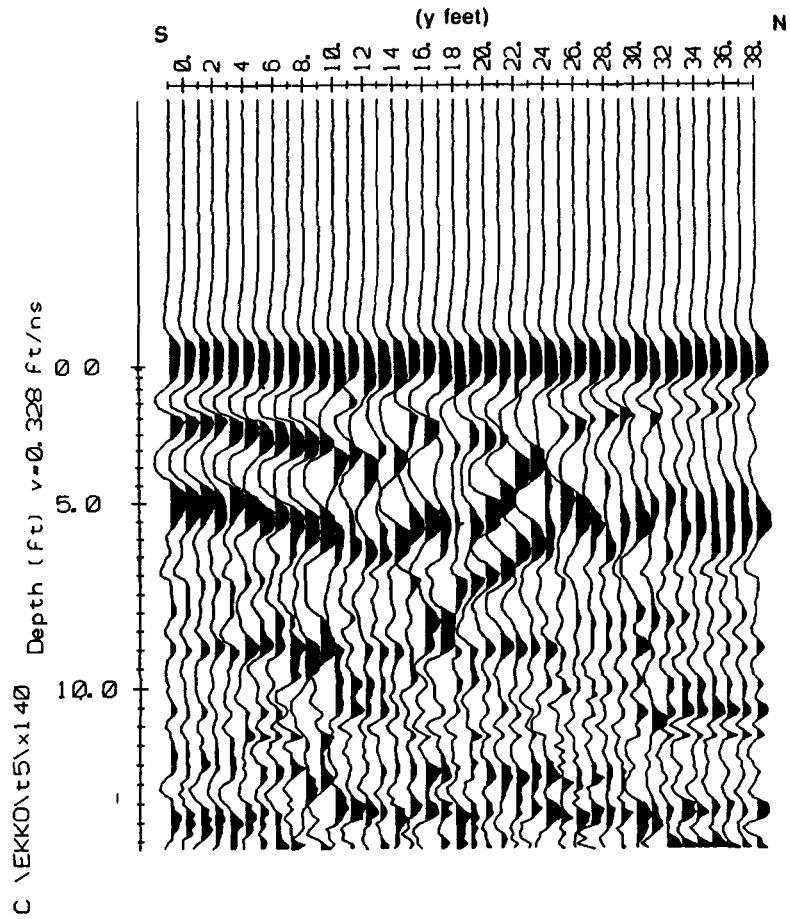


RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 5
SOUTH TO NORTH ORIENTATION AT X=130 FEET
JUNE 1995



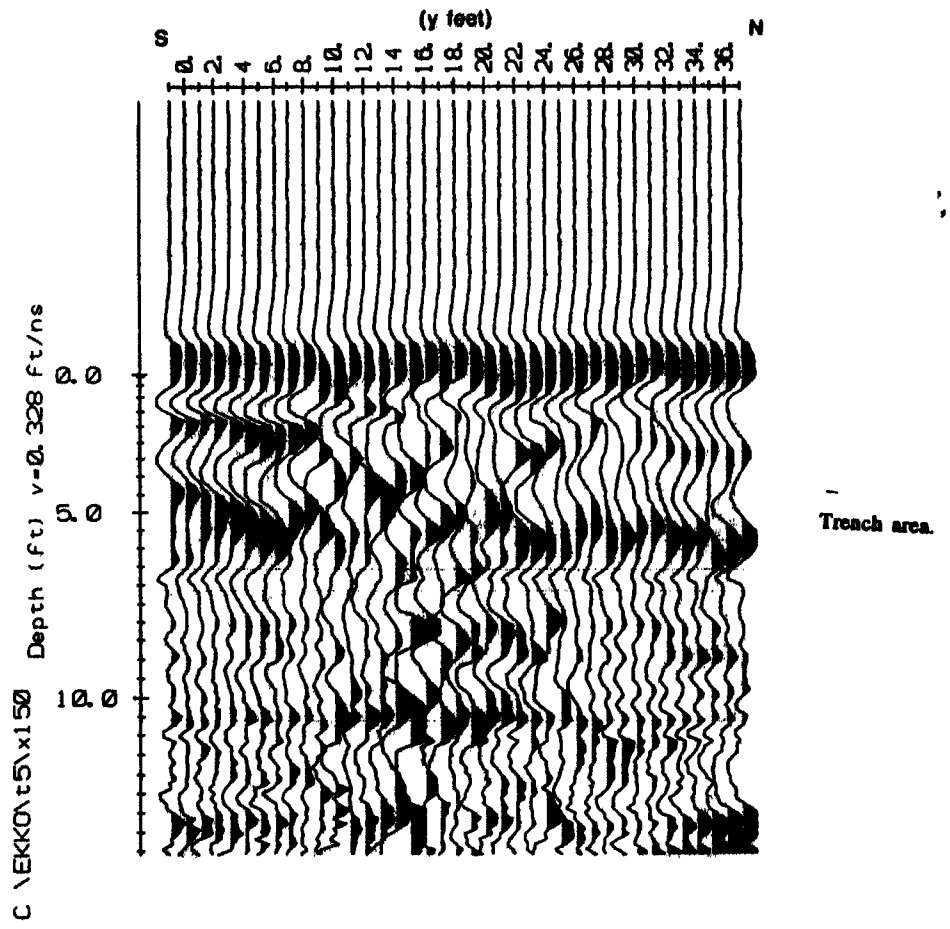
231

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-5
SOUTH TO NORTH ORIENTATION AT X=140 FEET
JUNE 1995



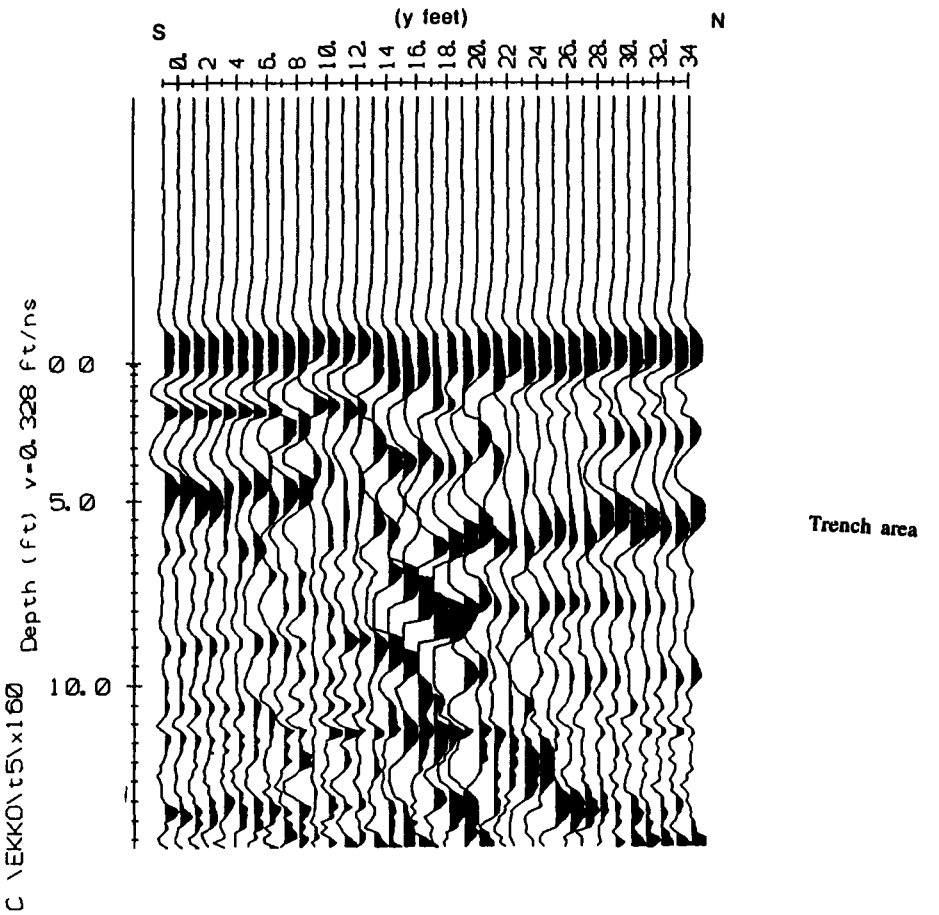
232

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-5
SOUTH TO NORTH ORIENTATION AT X=150 FEET
JUNE 1995



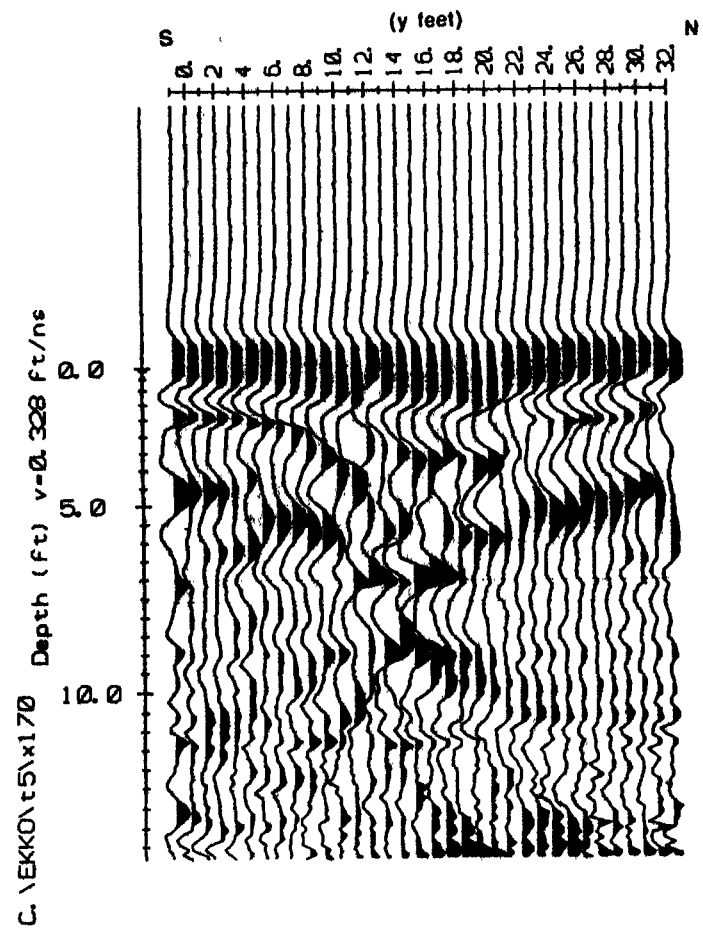
233

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 5
SOUTH TO NORTH ORIENTATION AT X=160 FEET
JUNE 1995



234

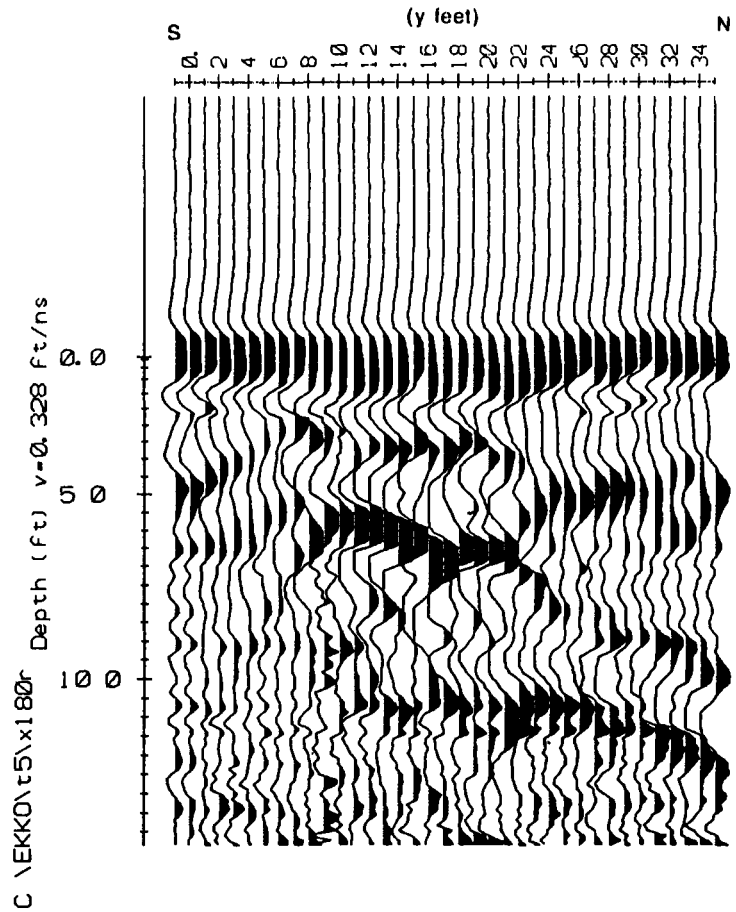
RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-5
SOUTH TO NORTH ORIENTATION AT X=170 FEET
JUNE 1995



Trench area.

235

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 5
SOUTH TO NORTH ORIENTATION AT X=180 FEET
JUNE 1995



236

Exhibit 3 4 E
Trench T-5 Borehole Logs

23

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT) 5947 40	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749688	AREA T 5, IHSS 111 2	CASING DIAMETER (IN)	GEOLOGIST	LA GUST	11495
EAST	2087904	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED	04/27/95	
REMARKS OU2 TRENCHES						

CHEMICAL SAMPLE DEPTH / GRADATIONAL DEPTH / SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION

Sample Number	Recovery/Interval	Unified Soils Classification or Rock Type	Description
			0 0 1 0 No sample collected
	0 25 /3 00	GC	1 0 1 25 Clayey Gravel black abundant caliche moist max gravel No recovery (1 25 3 0)
BH20749WC	0 00 /5 00		3 0 8 0 Fill material Void spaces (5 0 6 0 6 5 7 0) All recovery used for VOA s No description
[illegible]WC	2 00 /7 00	SC	8 0 10 0 Sand clayey orange and tan minor caliche moist

232

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT) 5947 40	PROJECT NUMBER 002 RFI/RI	LOG OF BORING NUMBER
NORTH	749693	AREA TRENCH T 5	CASING DIAMETER (IN)	GEOLOGIST LA GUST	11595
EAST	2087939	LOCATOR NUMBER N8	BORE-OLE DIAMETER (IN) 1 00	DATE DRILLED 04/27/95	
REMARKS 002 TRENCHES					

CHEMICAL SAMPLE DEPTH / GRADATIONAL DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5947	0				0 0 1 0 No sample collected push directly to 1 0 for soil sample ID
				1 00 / 3 00	5946	1			GC	1 0 2 0 Clayey Gravel 2 max gravel size 1/2 brown moist Asphalt black Started collecting sample at 1 0 (run #1) No recovery (2 0 3 0)
					5945	2				
					5944	3				3 0 5 0 Sample collected for VOA No recovery (5 0 6 0)
	B-20749C			2 00 / 3 00	5943	4				
					5942	5				
					5941	6				No recovery (6 0 8 0)
				3 00 / 4 00	5940	7				
					5939	8			SC	8 0 10 0 Sandy Clay with some caliche moist some asphalt 1/2 diameter gravel strong petroleum odor
	B-20750C			4 00 / 5 00	5938	9				
						10				Total Depth Drilled 10 00

239

3 5 TRENCH T-6 (IHSS 111 3)

Trench T-6 was investigated using the following methodologies

- Historical data were compiled to identify potential contaminants trench location and size
- Aerial photographs were examined to identify disturbed areas, verify trench dimensions, and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- One EM survey was conducted to locate buried metallic objects and define trench boundaries
- GPR surveys were conducted to better determine trench depth and dimensions
- Soil gas surveys were conducted to identify and delineate contaminant plumes
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the trench

As shown in Figure 3 5-1, Trench T-6 is located south of the East Access Road and Trench T-5 (IHSS 111 2), north of Trench T-7 (IHSS 111 4), and east of Trench T-9 (IHSS 111 6) The trench was reportedly used for disposal of sanitary sewage sludge potentially contaminated with uranium and plutonium and flattened empty drums contaminated with uranium Activities of the sewage sludge were reported between 382 pCi/g and 3 590 pCi/g Older sludge had mostly uranium with an increasing plutonium fraction in later sludge placed in the trenches Total alpha radioactivity in the trench is estimated to be 100 to 150 millicurie (0 1 Ci to 0 15 Ci) Trench T-6 may also contain some asphalt planking from the Solar Evaporation Ponds contaminated with plutonium and uranium The pertinent section of the Historical Release Report (HRR) is presented in Exhibit 3 5 A (PAC Reference Number NE111 1-NE111 8)

Although the general location of Trench T-6 was known, the exact location of the trench had not been physically identified prior to the Trenches Area and Mound Site Characterization Program of 1995 Aerial photographs dating from 1954 through 1972 were examined to ascertain the period of operation approximate the length and width identify staging areas and gather information which might confirm the contents of the trench (Colorado Aerial Photo Service, 1993) Photographs from 1967 through 1970 show this site as approximately 20 feet wide and 60 feet long with dark staining and disturbed soil The location and dimensions of this staining and soil disturbance are consistent with information from the HRR Prior to 1967 there are no indications of soil disturbance or waste disposal activities in the area Photographs after 1970 show surficial scarring indicating closure and abandonment of the area

240

3.5 1 Geology

Surficial deposits in the Trench T-6 area consists of the Rocky Flats Alluvium, which ranges in thickness from 14 to 37 feet. Alluvium is thinner at the Trench T-6 area on the west end of the trench and thicker on the east end The Rocky Flats Alluvium in the vicinity of Trench T-6 is underlain by the Arapahoe Formation, which is predominately claystone (EG&G 1995c). The depth to groundwater seasonally fluctuates from 12 feet bgs to below the alluvium/bedrock contact.

3 5.2 Site Visual Survey and Geophysical Surveys

After aerial photographs were examined, a visual survey of the Trench T-6 area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general area of Trench T-6 Soil disturbances such as mounding and subsidence were identified and recent geologic characterization information were used to delineate between the Rocky Flats Alluvium and soil disturbance caused by construction related activities. In addition to the geologic characteristics of the area, changes in vegetation were used in the identification of the more recently disturbed soil and revegetated fill material The area did not show any evidence of surficial water or seeps

Upon completion of the visual survey, a geophysical grid was laid out using pin flags. Grid dimensions were 35 feet wide (north-south) by 185 feet long (east-west) with flags placed at five foot increments

EM-31 Survey

After establishing the geophysical grid, the EM-31 survey was performed The EM-31 survey quadrature response, horizontal dipole did not show any anomalies, nor conductive plumes The quadrature response, vertical dipole indicates an area of low conductivity approximately 10 feet wide and 75 feet long which represents the trench boundaries The EM-31 survey did not indicate the presence of metallic or other conductive solid or liquid material in the trench Therefore, an EM-61 survey was not performed EM-31 survey results are presented as Exhibit 3 5 B

Ground Penetrating Radar

GPR was used in conjunction with the EM-31 survey This information allows for a more definitive determination of the walls and the horizontal extent of Trench T-6 The information obtained from the GPR indicates that the trench is approximately 5 feet deep and 10-12 feet wide The GPR survey results are presented in Exhibit 3 5 C

3 5 3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995 the vadose zone within the Trench T-6 area was highly saturated The increased moisture content of the tended to attenuate soil gas readings, making sample collection difficult However 28 sample were collected during this phase of the characterization and analyzed for total volatile organic content using field instrumentation To verify readings of total VOCs, 12 samples were collected and sent to an onsite laboratory for general chemistry analysis using method 8010

Based on the trench boundaries determined above a soil gas sampling grid was laid out along horizontal lines located 10 feet on either side of the centerline of the trench Soil gas samples were collected every 10 feet along these lines at depths of five and nine feet bgs If a sample had a field measurement above 100 ppm the field crew stepped off 10 feet from that location and collected an additional sample This procedure was repeated until readings less than 100 ppm were obtained This methodology was employed to identify whether a VOC contaminant plume existed within or extends outside of the trench boundaries Soil gas investigation results are presented in Figure 3 5-2

Soil gas concentrations ranged from 0 to 1270 ppm The maximum detected was 1,270 ppm at five feet bgs at location SG2T06008 There did not appear to be any spatial trends with respect to soil gas data indicating that there is no well defined source in this trench

3 5 4 Subsurface Soil Sampling

Subsurface soil sampling from Trench T-6 area was the final step of the characterization activities Based on the soil gas results, two boreholes were drilled in the eastern third of the trench and sampled to characterize the vertical extent of potential contamination in the subsurface soil Lithologic descriptions of each borehole are presented in Exhibit 3 5 D In addition, two boreholes were drilled and sampled during the OU 2 Phase II RFI/RI investigation Data from both characterization efforts indicate elevated levels of radionuclides Figure 3 5-3 identifies the boreholes that characterize Trench T-6

Organic Compounds

No organic compounds were detected at concentrations above the RFCA Action Levels for subsurface soils or PPRGs for subsurface soils, construction worker scenario

Metals

There were no metals detected at concentrations above the background $UTL_{99/99}$ or the PPRGs for subsurface soils, construction worker scenario

Radionuclides

Americium-241 (range. 0 03-0 04 pCi/g), plutonium-239/240 (range 0 10-0 39 pCi/g), uranium-233/234 (6 93 pCi/g), and uranium-235 (0.23 pCi/g) were detected at concentrations above the background $UTL_{99/99}$ as presented in Table 3 5-1 Radium-226 (0.54 pCi/g) and radium-228 (1 2 pCi/g) activities exceeded the PPRGs for subsurface soils, construction worker scenario as shown in Table 3 5-2

3.5 5 Groundwater

There is no upper hydrostratigraphic groundwater present at Trench T-6

3.5.6 Summary

The investigation indicates a 10 to 15 foot wide by 75 foot long trench without any indication of buried metallic objects and/or other conductive solids or liquids The GPR survey indicates the trench is 5 feet deep which corresponds to an approximate volume of 140 to 210 cy of buried material

The soil gas survey does not indicate the presence of a VOC plume, nor does the EM survey indicate the presence of a conductive plume

The data collected from the boreholes were combined with data from previous investigations for comparison to background concentrations, negotiated cleanup levels, and PPRGs. No organic compounds were detected at concentrations above the RFCA Action Levels for subsurface soils or PPRGs for subsurface soils, construction worker scenario There were no metals detected at concentrations above the background $UTL_{99/99}$ or PPRGs for subsurface soils, construction worker scenario Three radionuclides had activities greater than the background $UTL_{99/99}$ activities but less than the PPRGs for subsurface soils, construction worker scenario Therefore, remedial action at Trench T-6 is not required

Trench T-6 summary information is presented in Table 3 5-3

Table 3 5-1 Subsurface Soil Radionuclide Activities Exceeding $UTL_{90/90}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{90/90}$
Trench T 6	10591	BH00469WCU2	8-14	2/4/92	Americium 241	0 04	0 002	0 018	A	0 022
Trench T 6	10591	BH00469WCU2	8-14	2/4/92	Americium-241	0 04	0 002	0 018	A	0 022
Trench T 6	10591	BH00465WCU2	14-18	2/4/92	Plutonium 239 240	0 16	0 012	0 058	A	0 025
Trench T 6	10591	BH00469WCU2	8 14	2/4/92	Plutonium 239 240	0 39	0 002	0 07	A	0 025
Trench T 6	10591	BH00469WCU2	8-14	2/4/92	Radium-226	0 54	0 15	0 19	A	1 42
Trench T 6	10591	BH00465WCU2	14-18	2/4/92	Radium-228	1 2	0 27	0 39	A	2 33
Trench T 6	11695	BH20740WC	3-6	4/27/95	Americium 241	0 03	0 007	0 013	Y	0 022
Trench T 6	11695	BH20741WC	8-10	4/27/95	Plutonium 239 240	0 1	0 012	0 026	Y	0 025
Trench T 6	11695	BH20740WC	3-6	4/27/95	Plutonium-239 240	0 25	0 003	0 044	Y	0 025
Trench T 6	11695	BH20741WC	8-10	4/27/95	Uranium 233 234	6 93	0 006	0 87	Y	3 441
Trench T 6	11695	BH20741WC	8-10	4/27/95	Uranium 235	0 23	0 012	0 053	Y	0 153

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted but was estimated
N = Will not be validated
Y = Analytical results in validation process

244

Table 3 5-2 Subsurface Soil Radionuclide Activities Exceeding PPRGs

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	PPRG (pCi/g)
Trench T-6	10591	BH00469WCU2	8-14	2/4/92	Radium-226	0.54	0 15	0 19	A	0 494
Trench T-6	10591	BH00465WCU2	8-14	2/4/92	Radium-228	1.2	0.27	0 39	A	1 01

VALIDATION CODES
A = Result accepted with qualifications

245

TABLE 3.5-3 TRENCH T-6 SUMMARY INFORMATION

CONTAMINANTS					
Media: Subsurface Soils					
Greater than $UTL_{99/99}$		Greater than RFCA Standards		Greater than PPRGs	
Americium-241 Plutonium-239/240 Uranium-233/234 Uranium-235				Radium-226 Radium-228	
PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
75	10-15	5	140-210	No	No

Note.

There is no upper hydrostratigraphic groundwater present at Trench T-6

Exhibit 3.5.A
Trench T-6 Historical Release Report Information

20

PAC REFERENCE NUMBER NE 111 NE 11

LMSS Reference Number 111 1 111 8 Operable Unit 2

Unit Name Trenches T-4 through T-11

Best Available Copy

Approximate Location N750 000 E2 087,500

Date(s) of Operation or Occurrence

The exact dates of operation are unknown except for the period of July 29 1954 through August 14 1968[1] Trenches T 9 T 10 and T-11 were differentiated from the other trenches and added to the disposal trench inventory in 1977[2] See the "Comments" section below for additional discussion of this point

Description of Operation or Occurrence

Trenches T-4 through T 11 along with Trench T 2 (PAC 900 109) and Trench T 3 (PAC NE 110) were used primarily for the disposal of sanitary wastewater treatment plant sludge The sludge removed from the wastewater treatment plant was placed on sludge drying beds The dried material removed from the sludge drying beds was placed in the disposal trenches The sanitary sludge disposal trenches [illegible] to be approximately 10 feet deep and are provided with two feet of soil cover[3] The trenches are variable in length with the average length being approximately 250 feet[4] The total amount of sludge disposed in Trenches T 2 through T 11 is estimated at 125 000 kilograms[5] Some amounts of additional materials were also disposed [illegible] T 9 and T 11 These other materials consisted of asphalt planking (approximately 130 000 square feet of asphalt planking) in T-4 and T 11 from the re-design of Solar Pond 207A (PAC 000-101) in 1963 and [illegible] and junk in T 9[5]

At the same time that Trenches T 9 T 10 and T [illegible] the numbering system for the trenches was slightly modified Whereas earlier [illegible] consistent numbering system in a 1983 document a trench that had previously [illegible] T 11[5] This 1983 document placed the T-4 trench essentially as an addition [illegible] designated Trench T 9 as essentially an extension of Trench T 7[5] but in [illegible] referred to as Trench T [illegible] Trench T 10 had not been identified or named [illegible] as Trench T 5 in the 1983 document was a trench not previously identified [illegible] 1 and 5)

Physical/Chemical Description of Constituents [illegible]

Some uranium and plutonium contamination [illegible] older sludge would have had primarily uranium contamination with [illegible] plutonium contamination Total long lived alpha activity present in the [illegible] of 382 pCi/g in August 1964 to a maximum of 3 591 pCi/g in June 1960 [illegible] in flattened drums that may have been disposed in any of trenches T 2 [illegible] contaminated oils that had been held in the drum[6] The burning of the [illegible] in Pit No-2 (PAC 900-153) from March 1957 to mid 1965[6] not in the [illegible] up to 200 in total number could be present in any of Trenches T 3 [illegible] document that Trench T-4 currently designated Trench T 11 as discussed [illegible] 35

On at least one occasion it is believed that 2 [illegible] in Building [illegible] was also disposed in one of the East Trenches [illegible] dpm [illegible] believed that this is total alpha activity The activity [illegible] approximately 1 [illegible] kilograms (kg) of depleted uranium present [illegible] was in drums

Responses to Operation or Occurrence

Soil samples were collected from the [illegible] T 9 T 10 and T 11) during the 1977 to 1983 time frame Soil from [illegible] and from 2 4 to 4 0 pCi/g uranium activity [illegible] 0 18 to 14 pCi/g plutonium

activity and from 40 to 126 pCi/g uranium activity. Trench T 11 was found to contain 4.5 to 50 pCi/g plutonium activity and 0.9 to 158 pCi/g in uranium activity.[5]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents disposed in Trenches T-4 through T 11. This IHSS is being studied in accordance with the IAG schedule for OU2. The IAG activities will include site investigations, site characterizations, and possible remediation. The Final Phase II RFI/RI Report is to be completed by March 12, 1993.

Comments

Trench T 3, along with these trenches, are also called the East Trenches.

Trenches T-4 through T 11 (PAC NE 111) have few operational differences from Trenches T 2 (PAC 900-109) and T-3 (PAC NE 110).

The sludge disposed of in these trenches should consist primarily of concentrated organic matter typically present in sanitary wastewater treatment plant sludge.

From August 196[illegible] until February 1970 sanitary wastewater treatment plant sludge was disposed in the [illegible] sanitary landfill.[1] After February 1970, sanitary wastewater treatment plant sludge was shipped offsite for disposal.[9]

To date no documentation has been found that records the time frame during which any particular trench was receiving waste. Similarly, none of the HRR interviewees were knowledgeable on dates of operation of individual trenches.

The locations of [illegible] trenches on Plate 2 differ from the IAG map but are taken from the OU2 [illegible] Work Plan [illegible]

References	Other references of interest	
[1] 1500[illegible]	1500296	1501097
[illegible]	[illegible]430	1500399
[3] 1500895	[illegible]0	1500460
[4] 1502[illegible]	[illegible]287	[illegible]
[5] 1500890	[illegible]01	1500887
[6] 1500656	[illegible]	1500768
[7] 1500579	[illegible]	1500921
[8] 1700445	[illegible]	

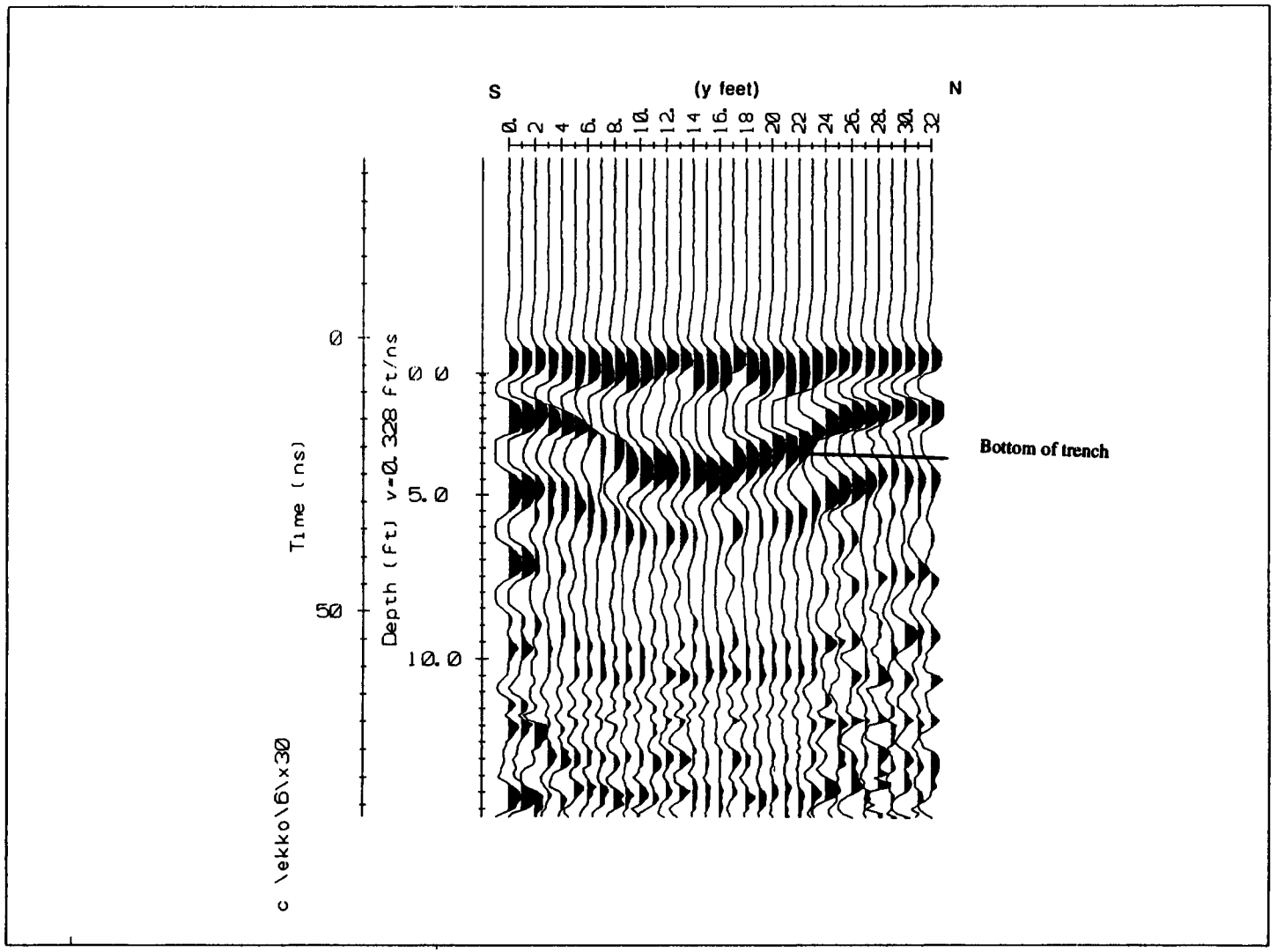
Historical Release Report NE 8 [illegible] 1992

Exhibit 3.5.B
Trench T-6 EM-31 Surveys

253

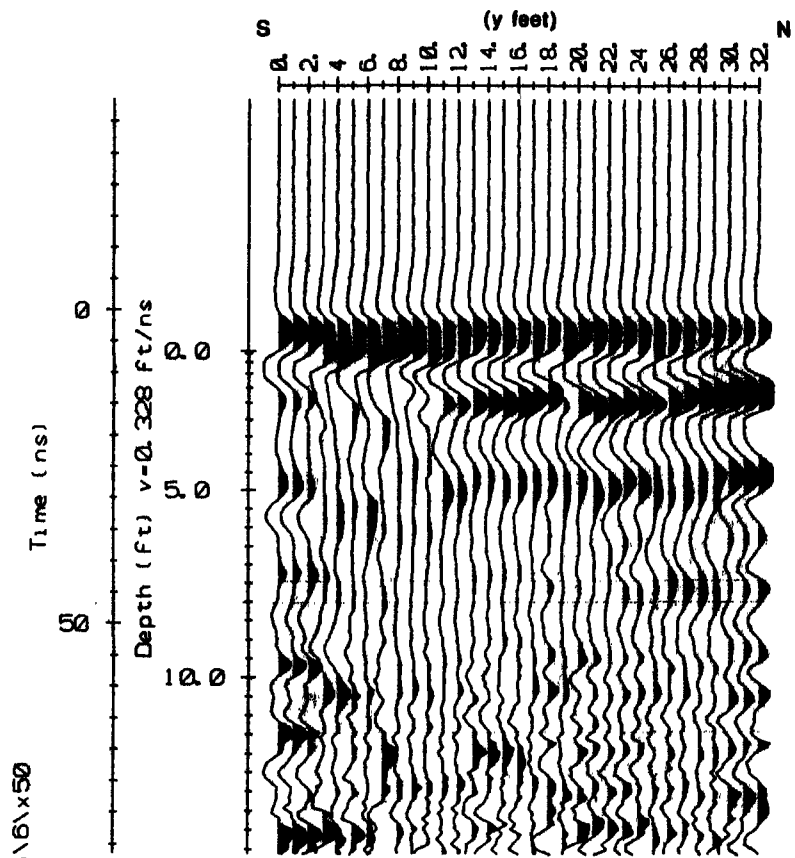
Exhibit 3.5.C
Trench T-6 Ground Penetrating Radar Surveys

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-6
SOUTH TO NORTH ORIENTATION AT X=30 FEET
JUNE 1995



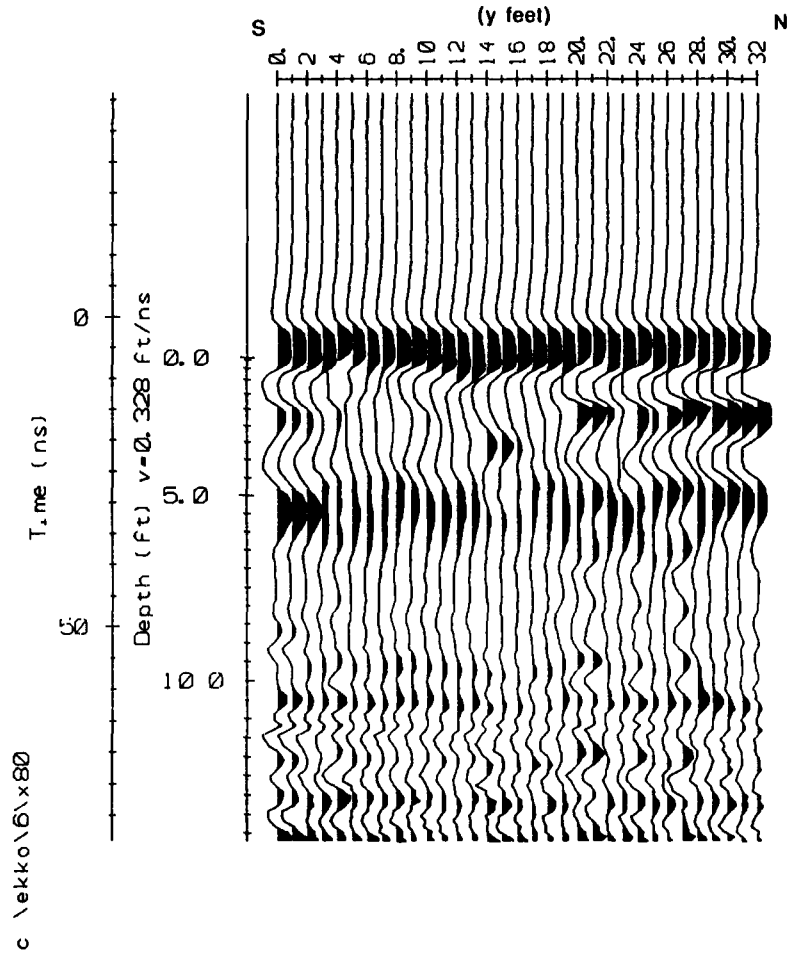
215

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-6
SOUTH TO NORTH ORIENTATION AT X=50 FEET
JUNE 1995

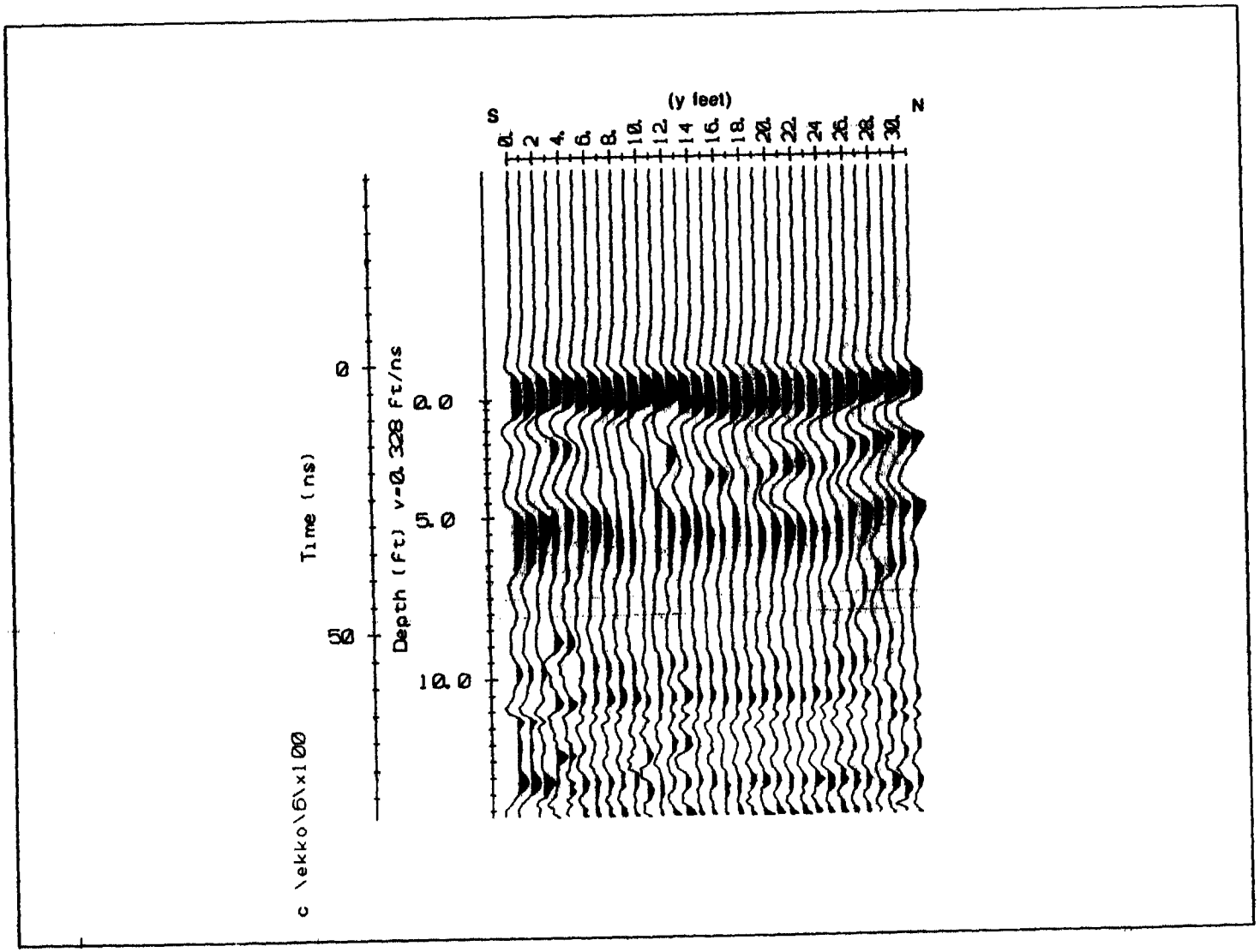


260

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 6
SOUTH TO NORTH ORIENTATION AT X=80 FEET
JUNE 1995

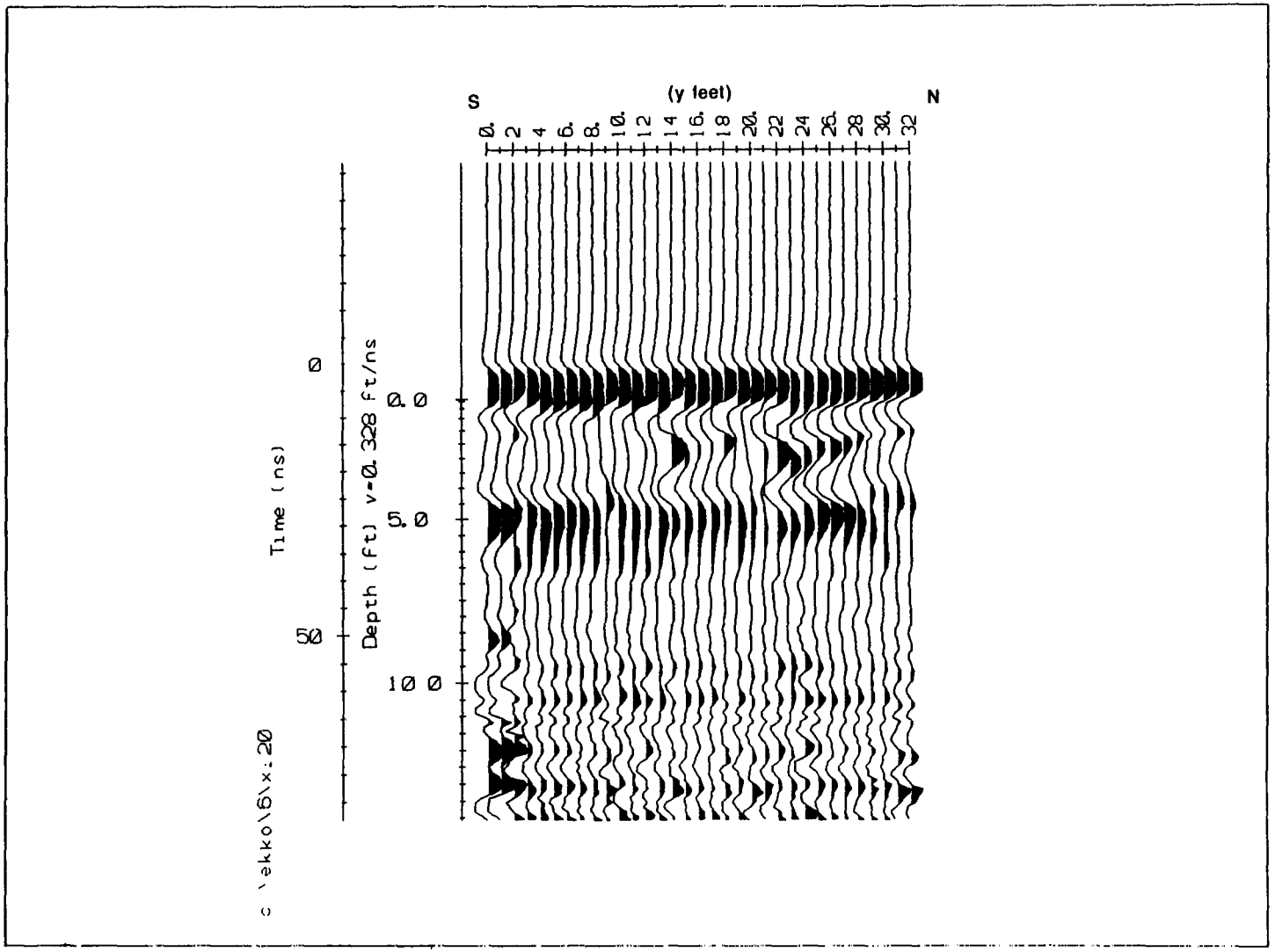


RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-6
SOUTH TO NORTH ORIENTATION AT X=100 FEET
JUNE 1995



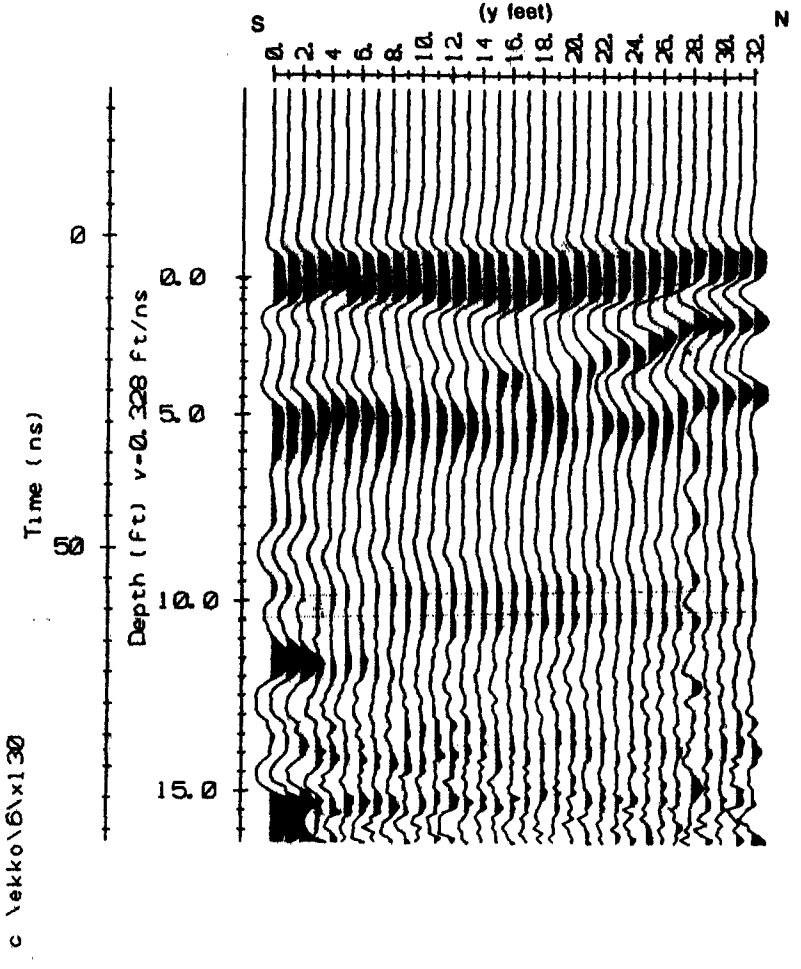
262

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 6
SOUTH TO NORTH ORIENTATION AT X=120 FEET
JUNE 1995



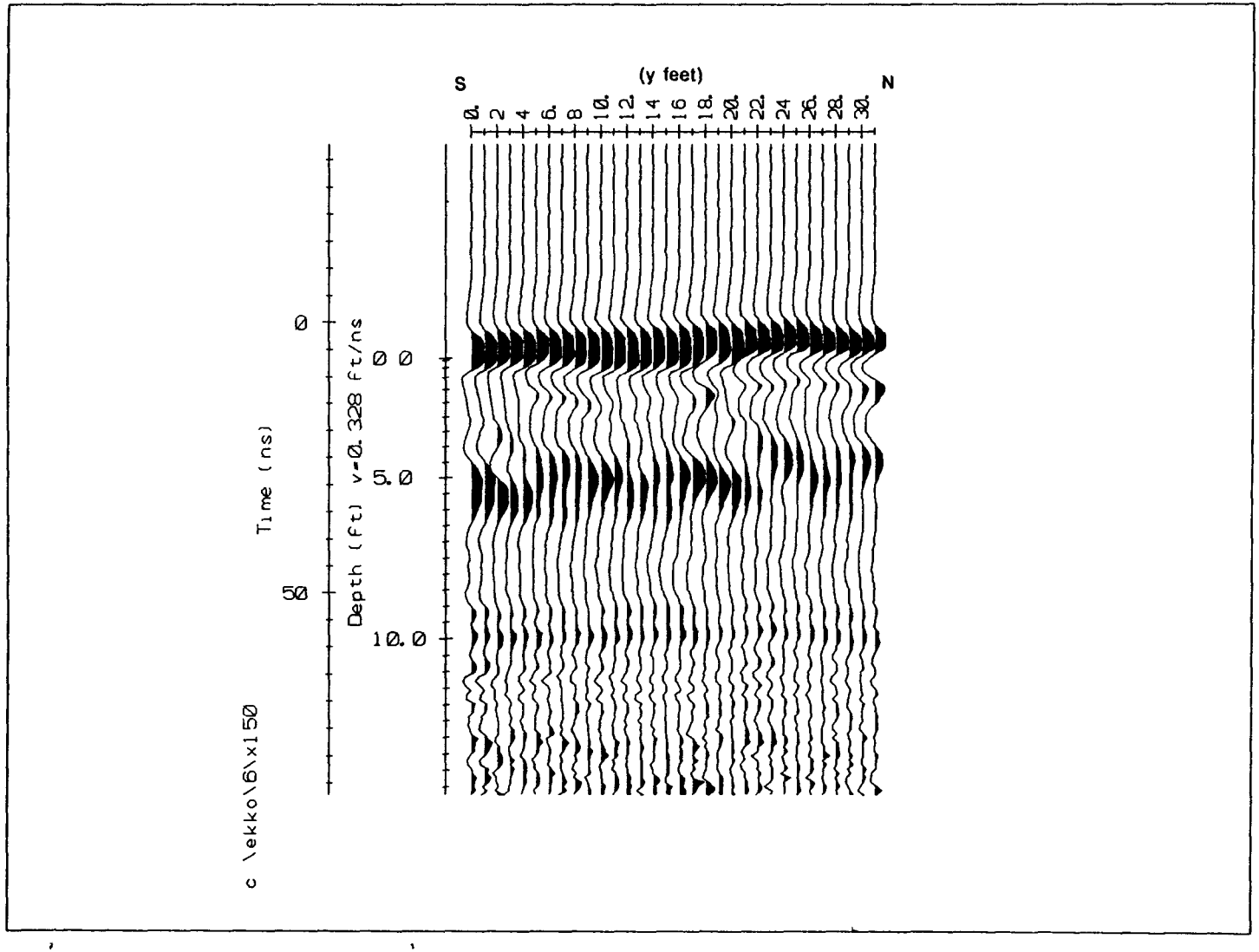
263

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-6
SOUTH TO NORTH ORIENTATION AT X=130 FEET
JUNE 1995



264

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-6
SOUTH TO NORTH ORIENTATION AT X=150 FEET
JUNE 1995



265

Exhibit 3.5.D
Trench T-6 Borehole Logs

266

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT) 5947 80	PROJECT NUMBER OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749638	AREA IHSS 111 3	CASING DIAMETER (IN)	GEOLOGIST JP GIROD	11695
EAST	2087914	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED 04/27/95	
REMARKS OU2 TRENCHES					

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0 00 /1 00	5947	0				0 0-1 0' No sample collected, push directly to 1 0' for soil sample for ID
				0 50 /2 00	5946	1			GP	1 0-1 5' Sandy Gravel with silt and caliche poorly graded, f-c grained, gravel consists of broken up cobbles, quartzite, quartz, dry, orange brown, FeOx stained No recovery (1 5-3 0')
					5945	2				
				1 00 /2 00	5944	3			CP	3 0-4 0' Sandy Gravel with abundant silt and trace clay caliche present, poorly graded, f-c grained, quartzite, quartz, gravel consists of broken up cobbles, orange brown, dry, FeOx stained No recovery (4 0-5 0')
					5943	4				
	BH20740UC			1 00 /2 00	5942	5			SM	5 0-6 0' Gravelly Sand with abundant silt and trace clay caliche present, poorly graded, f-c grained, quartzite, quartz, orange brown, dry, FeOx staining No recovery (6 0-7 0')
					5941	6				
				0 00 /1 00	5940	7				7 0-8 0' No sample collected, push directly to 8 0'
	BH20741UC			2 00 /2 00	5939	8			SC	8 0-10 0' Clayey Sand with abundant silt orange brown, f g to m g, quartzite, quartz, dry, FeOx staining
					5938	9				
						10				Total Depth Drilled 10 00

267

STATE PLANE COORDINATE	TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT) 5946 40	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH 749643	AREA IHSS 111 3	CASING DIAMETER (IN)	GEOLOGIST	JP GIROD	11795
EAST 2088012	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED	04/27/95	
REMARKS OU2 TRENCHES					

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH / SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION

Recovery/Interval	Datum (FT)	Unified Soils Classification or Rock Type	Description
0 00 /1 00	5946		0 0-1 0' No sample collected
1 00 /2 00	5945, 5944	SM	1 0-2 0' Silty Sand with abundant clay and some gravel f-c grained, quartzite, quartz, orange brown to white to dark yellow brown, dry, poorly graded, FeOx staining No recovery (2 0-3 0')
1 50 /2 00	5943, 5942	GP	3 0- 4 5' Sandy Gravel with some silt f-c grained, quartzite, quartz, orange brown to white, CaCO3 present, poorly graded, gravel consists of broken up cobbles, FeOx stained No recovery (4 5-5 0')
2 00 /2 00	5941, 5940	GP	5 0-7 0' Sandy Gravel with trace silt f-c grained, quartzite, quartz, orange brown, gravel consists of broken up cobbl fragments, poorly graded, dry, FeOx staining
0 00 /1 00	5939		7 0-8 0' No sample collected
2 00 /2 00	5938, 5937	SM	8 0-10 0' Silty Sand with some clay CaCO3 present, f-c grained, poorly graded, orange brown, FeOx staining, dry
			Total Depth Drilled 10 00

BH20742WC

268

3 6 Trench T-7 (111 4)

Trench T-7 was investigated using the following methodologies

- Historical data were compile to identify potential contaminants, trench location, and size
- Aerial photographs were examined to identify disturbed areas verify trench dimensions, and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- Two EM surveys were conducted to locate buried metallic objects and define trench boundaries
- GPR surveys were conducted to better determine trench depth and dimensions
- Soil gas surveys were conducted to identify and delineate contaminant plumes
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the trench

As shown in Figure 3 6-1 Trench T-7 is located approximately 290 feet south of the East Access Road and is essentially an extension of Trench T-9 (IHSS 111 6) The dimensions of the trench are approximately 115 feet long, 15 feet wide, and 10 feet deep The trench was reportedly used for disposal of sanitary sewage sludge potentially contaminated with uranium and plutonium and flattened empty drums contaminated with uranium Activities of the sewage sludge were reported between 382 pCi/g and 3 590 pCi/g Older sludge had mostly uranium with an increasing plutonium fraction in later sludge placed in the trenches Total alpha radioactivity in the trench is estimated to be 100 to 150 millicurie (0 1 Ci to 0 15 Ci) Trench T-7 may also contain some asphalt planking from the Solar Evaporation Ponds contaminated with plutonium and uranium The pertinent section of the HRR is included in Exhibit 3 6 A (PAC Reference Number NE111 1-NE111 8)

Although the general location of Trench T-7 was known, the location of the trench had not been physically identified prior to the Trenches Area and Mound Site Characterization Program of 1995 Aerial photographs dating from 1954 through 1970 were examined to ascertain the period of operation approximate the length and width identify staging areas, and gather information which might confirm the contents of the trench (Colorado Aerial Photo Service, 1993)

Most of the history of Trench T-7 can be reconstructed from the photographs taken in 1962 and 1963 In August 1962 the photo shows activity at this location By May 1963 the trench was completely backfilled and leveled off Photographs after 1963 show vegetation slowly reclaiming the area indicating closure and abandonment of the area From the photos the trench dimensions are approximately 20 feet wide by 125 feet long which correlates with information from the HRR

3 6 1 Geology

The surficial deposits at the Trench T-7 area consists of the Rocky Flats Alluvium which ranges in thickness between 14 and 37 feet. The underlying Arapahoe Formation is predominantly claystone (EG&G 1995c) The depth to groundwater seasonally fluctuates between 12 feet bgs to below the alluvium/bedrock contact

3 6.2 Site Visual Survey and Geophysical Surveys

Initially, a visual survey of the Trench T-7 area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division The purpose of this visual survey was to physically determine and/or verify the trench location for the layout of the geophysical grid Landmarks from the aerial photographs were used as reference points to locate the general area of Trench T-7 Soil disturbances such as mounding and subsidence was identified and recent geologic characterization information was used to delineate between Rocky Flats Alluvium and soil disturbance caused by construction related activities In addition, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material. The area did not show any evidence of surficial water or seeps

Upon completion of the visual survey, a geophysical grid was laid out using pin flags The total grid dimensions were 45 wide (north-south) by 220 feet long (east-west) with flags placed at five foot increments

EM-31 Survey

After establishing the geophysical grid, the EM-31 survey was performed. The EM-31 survey shows similar anomalies in both the horizontal and vertical dipole modes that vary from 8 to 20 feet in width and extend over a length of 220 feet. These anomalies strongly support the presence of buried metallic objects and/or conductive liquid or solid materials in the trench EM-31 survey results are presented in Exhibit 3 6 B

EM-61 Survey

To further define the physical characteristics of the grid area, an EM-61 survey was also performed. The EM-61 survey located the same anomalies as the EM-31 did. The dimensions are slightly smaller, but the locations are the same These anomalies indicate the presence of buried metallic objects The EM-61 survey results are presented in Exhibit 3 6 C

Ground Penetrating Radar

GPR allows for a more definitive determination of the walls and horizontal extent of Trench T-7 Results from the GPR survey indicate the trench bottom varies between 9 and 10 feet bgs The width of the trench varies between 14 and 16 feet but is difficult to confirm on all north-south transects The radar also indicates the presence of dense material within the trench at three different locations These areas are between five and eight feet bgs and correlate with the findings of the EM surveys The GPR survey results are presented in Exhibit 3 6 D

3 6 3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995, the vadose zone within Trench T-7 area was highly saturated The increased moisture content of the tended to attenuate soil gas readings, making sample collection difficult However, 48 samples were collected during this phase of the characterization and analyzed for total volatile organic content using field instrumentation Fourteen confirmatory samples were analyzed using general chemistry method 8010

Based on the trench boundaries determined by the geophysical surveys, soil gas sampling locations were placed along two horizontal lines located 10 feet on either side of the centerline of the trench Soil gas samples were collected every 10 feet along these lines at depths of five and nine feet bgs If a sample had a field measurement above 100 ppm, the field crew stepped off 10 feet from that location and collected an additional sample This procedure was repeated until readings less than 100 ppm were obtained This methodology was employed to identify whether a VOC contaminant plume existed and/or extended outside of the trench boundaries

Results of the soil gas survey identified a VOC contaminant plume which emanates from the western half of the trench and migrates south approximately 20 feet beyond the southern trench boundary At five feet bgs the maximum concentration of total VOCs (1925 ppm) was detected at location SG2T07007 (eight feet east of the west trench boundary) At 10 foot bgs the maximum concentration for total VOCs (469 ppm) was detected at location SG2T07008 (28 feet east of the west trench boundary) The majority of the higher VOC concentrations were detected at the five foot bgs level Results of the soil gas investigation are presented in Figure 3 6-2

3 6 4 Subsurface Soil Sampling

Three borehole locations, 11895, 11995 and 12095, were drilled within the trench based on the findings of the aerial photograph search, the geophysical surveys and the soil gas survey results Lithologic descriptions of each borehole are presented in Exhibit 3 6.E. An additional four boreholes, 08291, 08391, B218689 and BH5087 were drilled and sampled during the OU 2 Phase II RFI/RI investigation Data from both characterization efforts indicate elevated levels of one organic compound, metals and radionuclides Figure 3 6-3 identifies the boreholes and wells that characterize Trench T-7

Organic Compounds

Only one organic compound was found to have a concentration exceeding the established RFCA Subsurface Soil Action Level, tetrachloroethene was detected at 14 mg/kg at borehole 11995 (see Table 3 6-1) The detected concentration was less than the PPRG for subsurface soils, construction worker scenario

Metals

Cadmium (range 1 6-6 2 mg/kg), calcium (range 65,000-200,000 mg/kg), chromium (92 1 mg/kg), nickel (145 mg/kg), silver (range. 34.5-63 8 mg/kg), sodium (2,370 mg/K), and strontium (167 mg/kg) had detected concentrations greater than the background $UTL_{99/99}$ as presented in Table 3 6-2 Detected concentrations were less than the PPRGs for subsurface soils, construction worker scenario

Radionuclides

Gross alpha (1,323 pCi/L), americium-241 (range 0 05-208 7 pCi/L), cesium-137 (range 0 11-0 16 pCi/g), plutonium-239/240 (03-1744 pCi/g), uranium-235 (range 0 31-0.55 pCi/g), and uranium-238 (range 2 23-2 27 pCi/g) had detected activities greater than the background $UTL_{99/99}$ as presented in Table 3 6-3 Americium-241 (208 7 pCi/g), plutonium-239/240 (1,744 pCi/g), radium-226 (range 0 50-1 7 pCi/g), radium-228 (range 1 2-1 7 pCi/g), and uranium-233/234 (13 89 pCi/g) had detected activities greater that the subsurface soils PPRGs, construction worker scenario as presented in Table 3 6-4

272

3 6 5 Groundwater

There are several wells in the Trench T-7 area Elevated levels of organic compounds were detected in the groundwater as follows

Organic Compounds

Carbon tetrachloride (9 µg/L) tetrachloroethene (320 µg/L), and trichloroethene (22 µg/L) were detected at concentrations greater than the RFCA Tier II Groundwater Action Levels as presented in Table 3 6-5 These concentrations were less than the RFCA Tier I Groundwater Action Levels and the PPRGs for surface water, open-space receptor

3 6 6 Summary

Based on the results the electromagnetic and geophysical surveys, Trench T-7 is approximately 125 feet long, 8 to 20 feet wide, and 9 to 10 feet deep which corresponds to an approximate volume of 330 to 930 cy of buried material The surveys also indicated the presence of buried metallic objects and possibly other conductive liquids or solids which corresponds with the information in the HRR

The EM-31 survey does not indicate a conductive plume The soil gas surveys indicate a low level VOC plume migrating 20 feet to the south

The data collected was combined with data from previous investigations for comparison to background concentrations, negotiated cleanup levels and PPRGs One detected tetrachloroethane concentration was greater than the RFCA Subsurface Soil Action Level but less than the PPRG for subsurface soils construction worker scenario Six metals were detected at concentrations greater than the background $UTL_{99/99}$ values but less than the PPRGs for subsurface soils, construction worker scenario Six radionuclides were detected with activities greater than the background $UTL_{99/99}$ values Five radionuclides were detected with activities greater than PPRGs for subsurface soils, construction worker scenario However radium-226 and radium-288 background concentrations are greater than PPRGs Three organic compounds were detected at concentrations greater than the RFCA Tier II Groundwater Action Levels These concentrations were less than the RFCA Tier I Groundwater Action Levels and PPRGs for surface water, open-space receptor Based on the available information, Trench T-7 does not require remedial action

Summary information for Trench T-7 is presented in Table 3 6-6

273

Table 3 6-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
[redacted]										
[redacted]										
Trench T 7	11995	BH20734WC	8-10	4/26/95	Tetrachloroethene	14	0 005		11 5	Y

LABORATORY QUALIFIERS
J = Positively identified below sample quantitation limit, result is estimated

NOTES
RFCA Action Levels for Benzoic Acid and 2 Butanone have not been determined

VALIDATION CODES
Y = Analytical results in validation process

274

Table 3 6-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 7	9291	BH00456WCU2	2-6	1/22/92	Calcium	87700	1000		JA	53250
Trench T 7	11995	BH20729WC	3-5	4/25/95	Cadmium	8.2	1		Y	1.33
Trench T 7	11995	BH20729WC	3-5	4/25/95	Calcium	89000	1000		Y	53250
Trench T 7	11995	BH20729WC	3-5	4/25/95	Chromium	92.1	2		Y	66.1
Trench T-7	11995	BH20729WC	3-5	4/25/95	Silver	63.6	2		Y	33.1
Trench T 7	11995	BH20733WC	3-5	4/25/95	Cadmium	1.7	1		Y	1.33
Trench T 7	11995	BH20734WC	8-10	4/25/95	Calcium	3.3	1		Y	53250
Trench T 7	11995	BH20763WC	3-5	4/26/95	Calcium	92900	1		Y	66.1
Trench T 7	11995	BH20734WC	8-10	4/26/95	Silver	186000	1000		Y	33.1
Trench T-7	11995	BH20734WC	8-10	4/26/95	Sodium	34.6	1000		Y	1.33
Trench T-7	11995	BH20734WC	8-10	4/26/95	Calcium	8370	9		Y	1.33
Trench T 7	12095	BH20736WC	8-10	4/26/95	Nickel	116000	1000		Y	53250
Trench T 7	12095	BH20736WC	8-10	4/26/95	Calcium	145	1000		Y	53250
Trench T 7	B218999	BH20736WC	8-10	4/26/95	Calcium	200000	8		Y	53.1
Trench T 7	B218999	B218990003	0-9	4/26/95	Arsenic	109000	11500		Y	2000
Trench T 7	BH8087	BH8087307	3-7	11/13/89	Calcium	16.2	2000		Y	53250
Trench T 7	BH8087	BH8087178R	17 19.5	11/13/89	Cadmium	2.7				78.7
Trench T 7	BH8087	BH8087712UC	12-12.4	8/17/87	Cadmium	1.8			V	7050
Trench T 7	BH8087	BH8087715CT	14.5-17	8/17/87	Cadmium	1.6			N	53250
Trench T 7	BH8087	BH8087178R	17 19.5	8/17/87					N	16.2
									N	1.33
									N	1.33
									N	1.33

LABORATORY QUALIFIER

VALIDATION CODES
JA = Result accepted, but was estimated
N = Will not be validated
V = Valid result
Y = Analytical results in validation process

275

Table 3 6-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND UTL 99/99
Trench T 7	8291	BH00463WCU2	14-20	1/22/92	Plutonium-239 240	0 03	0 007	0 018	A	0 025
Trench T 7	8291	BH00460WCU2	8 14	1/22/92	Plutonium 239 240	0 03	0 003	0 02	A	0 025
Trench T 7	8291	BH00458WCU2	2 8	1/22/92	Plutonium 239 240	0 03	0 008	0 02	A	0 025
Trench T 7	8291	BH00460WCU2	8-14	1/22/92	Radium 226	0 51	0 17	0 21	A	1 42
Trench T 7	8291	BH00460WCU2	8 14	1/22/92	Radium 228	1 1	0 33	0 42	A	2 33
Trench T 7	8291	BH00458WCU2	2 8	1/22/92	Tritium	510	560	220	V	504
Trench T 7	8391	BH00294WCU2	28-34	1/20/92	Radium 226	0 5	0 26	0 19	A	1 42
Trench T 7	8391	BH00287WCU2	10-16	1/20/92	Radium 226	0 54	0 17	0 21	A	1 42
Trench T 7	8391	BH00289WCU2	16-22	1/20/92	Radium-226	0 59	0 17	0 19	A	1 42
Trench T 7	8391	BH00292WCU2	22-28	1/20/92	Radium-226	0 6	0 19	0 23	A	1 42
Trench T 7	8391	BH00299WCU2	34-40	1/21/92	Radium-226	0 61	0 13	0 17	A	1 42
Trench T 7	8391	BH00298WCU2	34-40	1/21/92	Radium-226	0 69	0 17	0 2	A	1 42
Trench T 7	8391	BH00301WCU2	40-44	1/21/92	Radium-226	0 94	0 14	0 19	A	1 42
Trench T 7	8391	BH00287WCU2	10-16	1/20/92	Radium-228	1 3	0 28	0 4	A	2 33
Trench T 7	8391	BH00294WCU2	28-34	1/20/92	Radium-228	1 55	0 59	0 47	A	2 33
Trench T 7	8391	BH00289WCU2	34-40	1/20/92	Radium 228	1 6	0 36	0 45	A	2 33
Trench T 7	8391	BH00292WCU2	22 28	1/20/92	Radium-228	1 7	0 38	0 48	A	2 33
Trench T 7	8391	BH00298WCU2	34-40	1/21/92	Radium-228	1 2	0 31	0 4	A	2 33
Trench T 7	8391	BH00299WCU2	34-40	1/21/92	Radium-228	1 4	0 31	0 42	A	2 33
Trench T 7	8391	BH00301WCU2	40-44	1/21/92	Radium 228	1 6	0 29	0 39	A	2 33
Trench T 7	8391	BH00301WCU2	40-44	1/21/92	Tritium	620	390	270	V	504
Trench T 7	8391	BH00301WCU2	40-44	1/21/92	Tritium	620	390	270	V	504
Trench T 7	11895	BH20729WC	3-5	4/25/95	Americium-241	208 7	0 138	23 1	Y	0 022
Trench T 7	11895	BH20729WC	3-5	4/25/95	Gross Alpha	1323	3 53	151	Y	51 4
Trench T 7	11895	BH20729WC	3-5	4/25/95	Plutonium 239 240	1744	0 933	183	Y	0 025
Trench T 7	11895	BH20730WC	8-10	4/25/95	Uranium-233 234	7 43	0 238	1 43	Y	3 441
Trench T 7	11895	BH20729WC	3-5	4/25/95	Uranium-233 234	13 89	0 562	2.67	Y	3 441
Trench T 7	11895	BH20730WC	8-10	4/25/95	Uranium-235	0 34	0 114	0 242	Y	0 153
Trench T 7	11895	BH20729WC	3-5	4/25/95	Uranium-235	0 55	0 524	0 441	Y	0 153
Trench T 7	11895	BH20730WC	8-10	4/25/95	Uranium-238	2 77	0 202	0 76	Y	1 807
Trench T 7	11995	BH20733WC	3-8	4/26/95	Plutonium-239 240	0 04	0 003	0 015	Y	0 025
Trench T 7	12095	BH20736WC	8-10	4/26/95	Americium-241	0 05	0 006	0 015	Y	0 022
Trench T 7	12095	BH20736WC	8-10	4/26/95	Plutonium-239 240	0 45	0 008	0 064	Y	0 025
Trench T 7	12095	BH20736WC	8-10	4/26/95	Uranium-233 234	8 96	0 016	1 15	Y	3 441
Trench T 7	12095	BH20736WC	8-10	4/26/95	Uranium-235	0 31	0 02	0 067	Y	0 153
Trench T 7	12095	BH20736WC	8-10	4/26/95	Uranium-238	2 23	0 023	0 313	Y	1 807
Trench T 7	B218689	B2186890003	0-3	11/13/89	Americium-241	0 86	0 007	0 11	V	0 022
Trench T 7	B218689	B2186891619	16-19	11/13/89	Cesium-137	0 16	0 18	0 2		0 129
Trench T 7	B218689	B2186891619	16-19	11/13/89	Cesium-137	0 16	0 18	0 2		0 129
Trench T 7	B218689	B2186890307	3-7	11/13/89	Plutonium-239 240	0 11	0	0 032	A	0 025
Trench T 7	B218689	B2186890003	0-3	11/13/89	Plutonium-239 240	2.86	0 006	0.285	A	0 025
Trench T 7	B218689	B2186890307	3-7	11/13/89	Radium-226	0 5	0 3	0 2		1 42

Table 3 6-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{95/95}$ Values (continued)

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 7	B218689	B2186890717	7 17	11/13/89	Radium-226	0.5	0.3	0 2		1 42
Trench T 7	B218689	B2186891113	12-13	11/13/89	Radium-226	0 55	0.33	0.31	V	1.42
Trench T 7	B218689	B2186890003	0-3	11/13/89	Radium-226	0.7	0.3	0.3		1 42
Trench T 7	B218689	B2186891619	18-19	11/13/89	Radium-226	0 7	0.2	0.2		1.42
Trench T 7	B218689	B2186891316	13-16	11/13/89	Radium-226	1	0.4	0.4		1 42
Trench T 7	B218689	B2186891113	12-13	11/13/89	Radium-226	1 15	0.4	0.22	V	2.33
Trench T 7	B218689	B2186890003	0-3	11/13/89	Radium-226	1 3	0.6	0.7		2.33
Trench T 7	B218689	B2186890717	7 17	11/13/89	Radium-226	1 4	0.2	0.3		2.33
Trench T 7	B218689	B2186891316	13-16	11/13/89	Radium-226	1.6	0.4	0.5		2.33
Trench T 7	B218689	B2186891619	18-19	11/13/89	Radium-226	1.6	0 4	0.5		2.33
Trench T 7	BH5067	BH5067I5CT	14.5-17	9/17/87	Plutonium-239,240	0 13		0 14		2.33
Trench T 7	BH5067	BH5067I5CT	14.5-17	9/17/87	Plutonium-239,240	0.13		0.14		0.025
										0.025

VALIDATION CODES
A = Result accepted with qualifications
V = Valid results
Y = Analytical results in validation process

Table 3 6-4 Subsurface Soil Radionuclide Activities Exceeding PPRGs

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	PPRG (pCi/g)
Trench T 7	8291	BH00460WCU2	8 14	1/22/92	Radium 226	0 51	0 17	0 21	A	0 494
Trench T 7	8291	BH00460WCU2	8-14	1/22/92	Radium 228	1 1	0 33	0 42	A	1 01
Trench T 7	8391	BH00294WCU2	28-34	1/20/92	Radium 226	0 5	0 26	0 19	A	0 494
Trench T 7	8391	BH00287WCU2	10-16	1/20/92	Radium-226	0 54	0 17	0 21	A	0 494
Trench T 7	8391	BH00289WCU2	16-22	1/20/92	Radium-226	0 59	0 17	0 19	A	0 494
Trench T 7	8391	BH00292WCU2	22 28	1/20/92	Radium-226	0 6	0 19	0 23	A	0 494
Trench T 7	8391	BH00299WCU2	34-40	1/21/92	Radium-226	0 61	0 13	0 17	A	0 494
Trench T 7	8391	BH00298WCU2	34-40	1/21/92	Radium-226	0 69	0 17	0 2	A	0 494
Trench T 7	8391	BH00301WCU2	40-44	1/21/92	Radium-226	0 94	0 14	0 19	A	0 494
Trench T 7	8391	BH00287WCU2	10-16	1/20/92	Radium-228	1 3	0 28	0 4	A	1 01
Trench T 7	8391	BH00294WCU2	28-34	1/20/92	Radium-228	1 55	0 59	0 47	A	1 01
Trench T 7	8391	BH00289WCU2	16-22	1/20/92	Radium-228	1 6	0 36	0 45	A	1 01
Trench T 7	8391	BH00292WCU2	22 20	1/20/92	Radium-228	1 7	0 38	0 48	A	1 01
Trench T 7	8391	BH00298WCU2	34-40	1/21/92	Radium-228	1 2	0 31	0 4	A	1 01
Trench T 7	8391	BH00299WCU2	34-40	1/21/92	Radium-228	1 4	0 31	0 42	A	1 01
Trench T 7	8391	BH00301WCU2	40-44	1/21/92	Radium-228	1 6	0 29	0 39	A	1 01
Trench T 7	11895	BH20729WC	3-5	4/25/95	Americium-241	208 7	0 138	23 1	Y	164
Trench T 7	11895	BH20729WC	3-5	4/25/95	Plutonium-239 240	1744	0 933	183	Y	219
Trench T 7	11895	BH20729WC	3-5	4/25/95	Uranium-233 234	13 89	0 562	2 67	Y	12 5
Trench T 7	B218689	B2186890307	3-7	11/13/89	Radium-226	0 5	0 3	0 2		0 75
Trench T 7	B218689	B2186890717	7 11	11/13/89	Radium-226	0 5	0 3	0 2		0 75
Trench T 7	B218689	B2186891113	12 13	11/13/89	Radium-226	0 55	0 33	0 31	V	0 494
Trench T 7	B218689	B2186890003	0-3	11/13/89	Radium-226	0 7	0 3	0 3		0 75
Trench T 7	B218689	B2186891619	16-19	11/13/89	Radium-226	0 7	0 2	0 2		0 75
Trench T 7	B218689	B2186891316	13-16	11/13/89	Radium-226	1	0 4	0 4		0 75
Trench T 7	B218689	B2186891113	12 13	11/13/89	Radium-228	1 15	0 4	0 22	V	1 01
Trench T 7	B218689	B2186890003	0-3	11/13/89	Radium-228	1 3	0 6	0 7		1 4
Trench T 7	B218689	B2186890717	7 11	11/13/89	Radium-228	1 4	0 2	0 3		1 4
Trench T 7	B218689	B2186891316	13-16	11/13/89	Radium-228	1 6	0 4	0 5		1 4
Trench T 7	B218689	B2186891619	16-19	11/13/89	Radium-228	1 6	0 4	0 5		1 4

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result
Y = Analytical results in validation process

278

Table 3 6-5 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T 7	8391	GW03478IT	9/3/92	Carbon Tetrachloride	0 009	0.0001		0 005	V
Trench T 7	8391	GW03478IT	9/3/92	Tetrachloroethene	0 32	0.00014	E	0.005	
Trench T 7	8391	GW03478IT	9/3/92	Trichloroethene	0.022	0.00028		0 005	A

LABORATORY QUALIFIERS
E = Chemical exceeds calibration range of the instrument

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result

TABLE 3.6-6 TRENCH T-7 SUMMARY INFORMATION

CONTAMINANTS		
Media: Subsurface Soils		
Greater than $UTL_{99/99}$	Greater than RFCA Standards	Greater than PPRGs
	Tetrachloroethene	
Arsenic Cadmium Calcium Chromium Copper Nickel Silver Sodium		
Gross alpha Americium-241 Cesium-137 Plutonium-239/240 Uranium-233/234 Uranium-235 Uranium-238		Americium-241 Plutonium-239/240 Radium-226 Radium-228 Uranium-233/234

Media: Groundwater			
Greater than $UTL_{99/99}$	Greater than RFCA Tier II Standards	Greater than RFCA Tier I Standards	Greater than PPRGs
	Carbon tetrachloride Tetrachloroethene Trichloroethene		

PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
125	8-20	9-10	330-930	Yes	No

Note

A RFCA subsurface soil action level has not been determined for benzoic acid

Exhibit 3.6.A
Trench T-7 Historical Release Report Information

284

PAC REFERENCE NUMBER N 111 1 NE 111 9

[illegible] Reference Number 111 1 111 8 Operable Unit 2

Unit Name Trenches T-4 through T-11

Best Available Copy

Approximate Location N750 000 E2 087,500

Date(s) of Operation or Occurrence

The exact dates of operation are unknown except for the period of July 29 1954 through August 14 1968[1] Trenches T 9 T 10 and T 11 were differentiated from the other trenches and added to the disposal trench inventory in 1977 See the "Comments" section below for additional discussion of this point

Description of Operation or Occurrence

Trenches T-4 through T 11 along with Trench T 2 (PAC 900 109) and Trench T 3 (PAC NE 110) were used primarily for the disposal of sanitary wastewater treatment plant sludge The sludge removed from the wastewater treatment plant was placed on sludge drying beds The dried material removed from the sludge drying beds was placed in the disposal trenches The sanitary sludge disposal trenches are reported to be approximately 10 feet deep and are provided with two feet of soil cover[3] The trenches are variable in length with the average length being approximately 250 feet.[4] The total amount of sludge disposed in Trenches T 2 through T 11 is estimated at 125 000 kilograms[5] Some amounts of additional materials were also disposed in Trenches T-4 T 9 and T 11 These other materials consisted of asphalt planking (approximately 130 000 square feet of asphalt planking) in T-4 and T 11 from the re design of Solar Pond 207A (PAC 000-101) in 1963 and scrap metal and junk in T 9[5]

[illegible] the same time that Trenches T 9 T 10 and T 11 were identified ([illegible]) it appears that the numbering system for the trenches was slightly modified Whereas earlier documents had presented a consistent numbering system [illegible] 1983 document a trench that had previously been referred to as [illegible] T-4 became T [illegible] This 1983 document [illegible] the T-4 trench essentially as an addition to Trench [illegible] [illegible] designated Trench T 9 [illegible] an extension of Trench T 7[5] but in earlier documents [illegible] had been referred to as Trench T 5 [illegible] had not been identified or named prior to 1983 [illegible] identified as Trench T 5 in the 1983 document was a trench not previously identified (comparison of maps in references 1 and 5)

[illegible] Chemical Description of Constituents Released

[illegible] and plutonium contamination is present in this [illegible] sludge would have [illegible] uranium contamination with newer sludge [illegible] contamination[1] [illegible] alpha activity present in the sludge [illegible] August 1964 [illegible] of 3 591 pCi/g in June 1960 Uranium contamination [illegible] drums that [illegible] been disposed in any of trenches T 2 through T [illegible] oils that had [illegible] the drum[6] The burning of the contaminated oils [illegible] (PAC 900-153) [illegible] March 1957 to mid 1965[6] not in the trenches [illegible] total number [illegible] be present in any of Trenches T 3 through T [illegible] that Trench T-4 [illegible] designated Trench T 11 as discussed above) [illegible]

[illegible] one occasion it is believed that 2 [illegible]00 gallons of [illegible] Building 444 was [illegible] one of the East Trenches [illegible] is believed that [illegible] alpha activity The [illegible] of this material [illegible] approximately 1 3 [illegible] of depleted uranium present in the waste[5] [illegible] was in drums

[illegible] Operation or Occurrence

[illegible] were collected from the three new trenches [illegible] and T 11) during [illegible] time frame So from [illegible] uranium activity and from [illegible] to [illegible] pCi/g uranium activity [illegible] contain from 0 [illegible] pCi/g plutonium

285

activity and from 40 to 126 pCi/g uranium activity. Trench T 11 was found to contain 4.5 to 50 pCi/g [illegible] activity and 0.9 to 158 pCi/g in uranium activity.[5]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents disposed in Trenches T-4 through T 11. This IHSS is being studied in accordance with the IAG schedule for OU2. The IAG activities will include site investigations, site characterizations, and possible remediation. The Final Phase II RFI/RI Report is to be completed by March 12, 1993.

Comments

Trench T-3, along with these trenches, are also called the East Trenches.

Trenches T-4 through T 11 (PAC NE 111) have few operational differences from Trenches T 2 (PAC 900-109) and T-3 (PAC NE 110).

The sludge disposed of in these trenches should consist primarily of concentrated organic matter typically present in sanitary wastewater treatment plant sludge.

From August 1968 until February 1970 sanitary wastewater treatment plant sludge was disposed in [illegible] landfill.[1] After February 1970, sanitary wastewater treatment plant sludge was shipped offsite for disposal.[8]

To date no documentation has been found that records the time frame during which any particular [illegible] receiving waste. Similarly, none of the HRR interviewees were knowledgeable on dates of operation of [illegible] trenches.

The locations of the [illegible] on Plate 2 differ from the IAG map but are taken from the OU2 Phase [illegible] Work Plan [illegible]

References	Other references of interest	
1500793	1500296	1501097
1501719	1600430	1500399
[3] 1500898	1500340	1500460
[4] 1502713	1500287	1500[illegible]
[5] 1500890	1500901	1500[illegible]
[6] 1500656	1500[illegible]	1500[illegible]
1500579	1500458	1500921
[8] 1700445	1500888	

286

Exhibit 3.6.B
Trench T-7 EM-31 Surveys

287

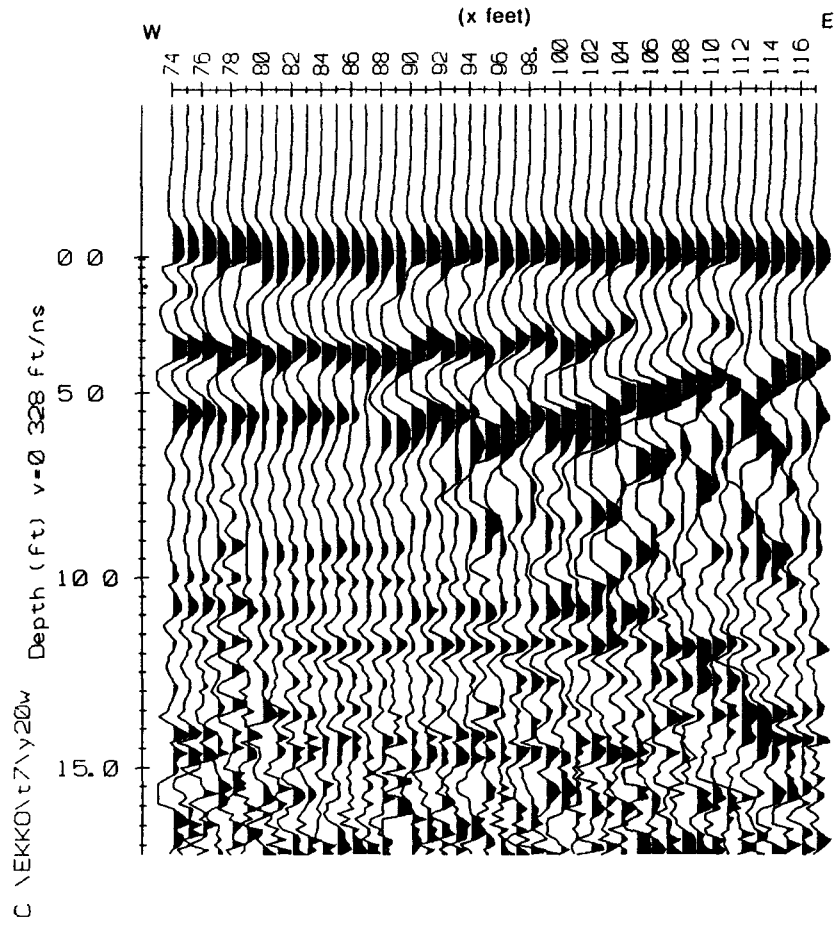
Exhibit 3.6.C
Trench T-7 EM-61 Surveys

293

Exhibit 3.6.D
Trench T-7 Ground Penetrating Radar Surveys

294

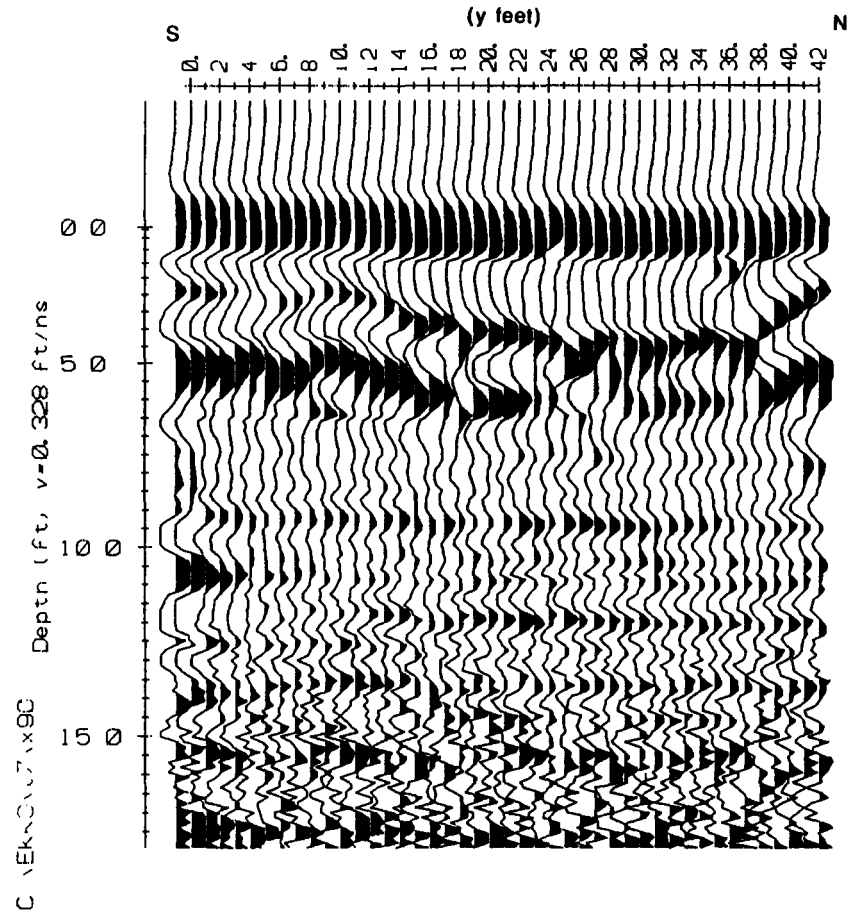
RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-7
WEST TO EAST ORIENTATION AT Y=20 FEET(WESTERN END)
JUNE 1995



Dense materials corresponding to area of high conductivity in EM surveys

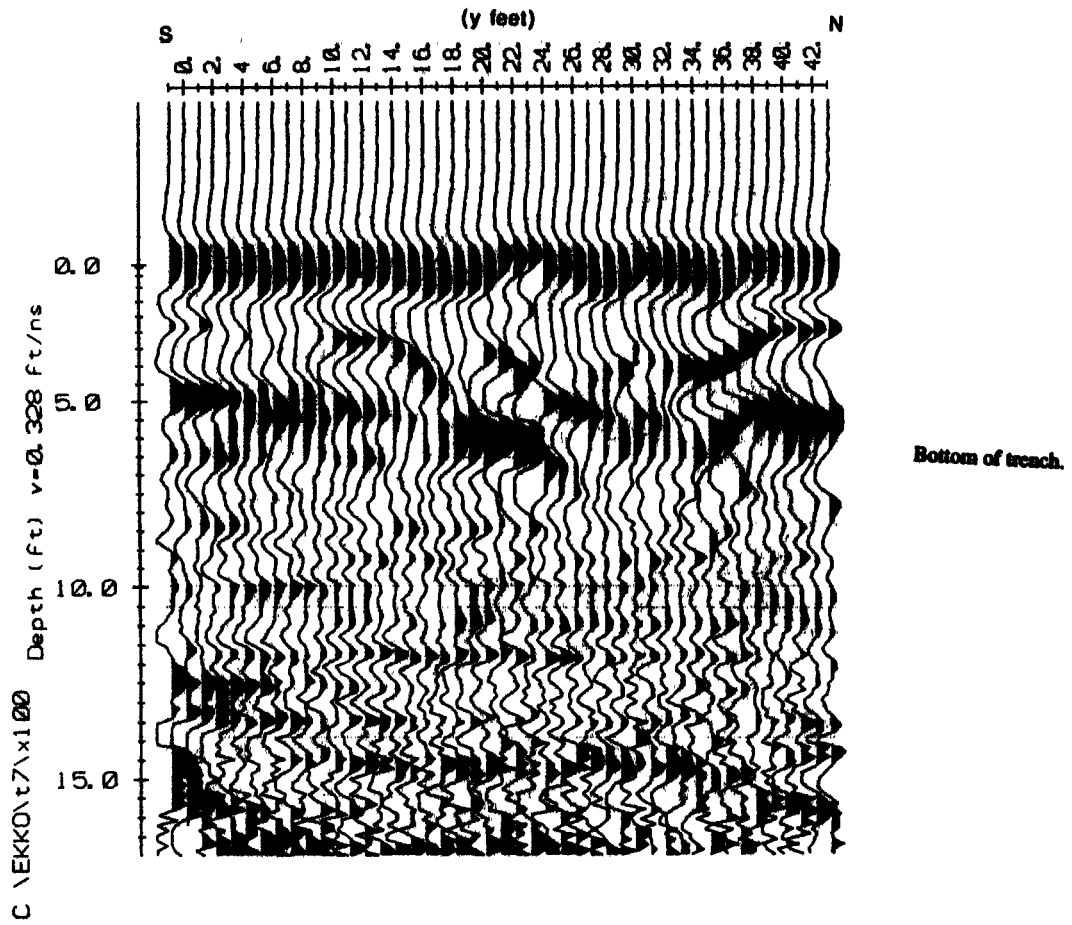
295

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-7
SOUTH TO NORTH ORIENTATION AT X=90 FEET
JUNE 1995



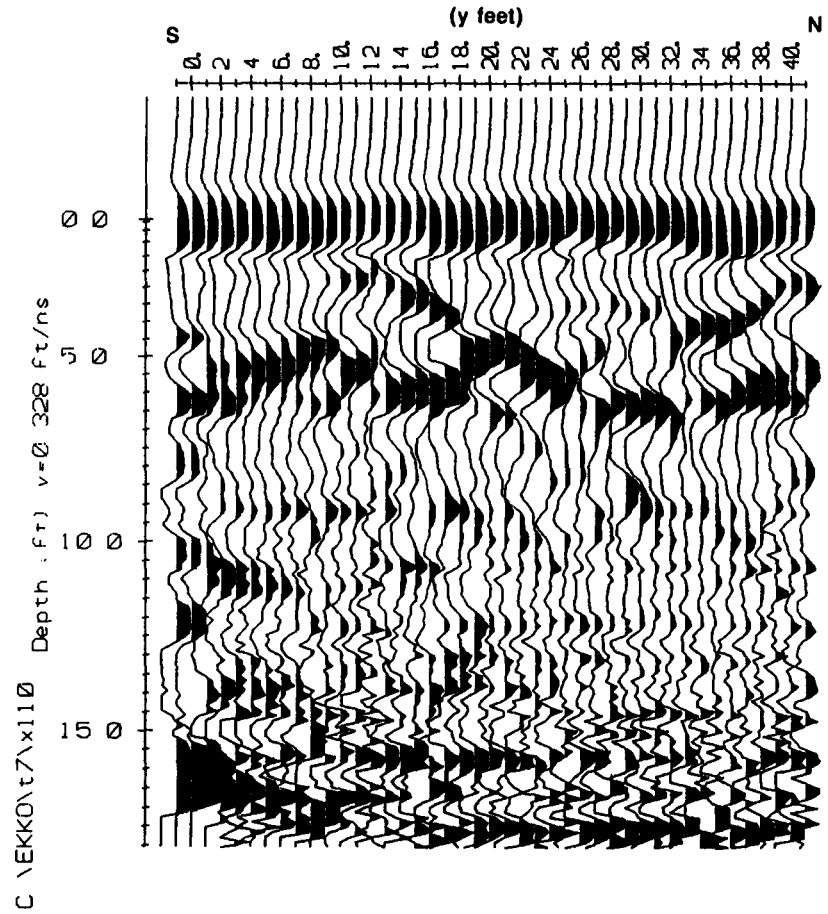
962

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-7
SOUTH TO NORTH ORIENTATION AT X=100 FEET
JUNE 1995



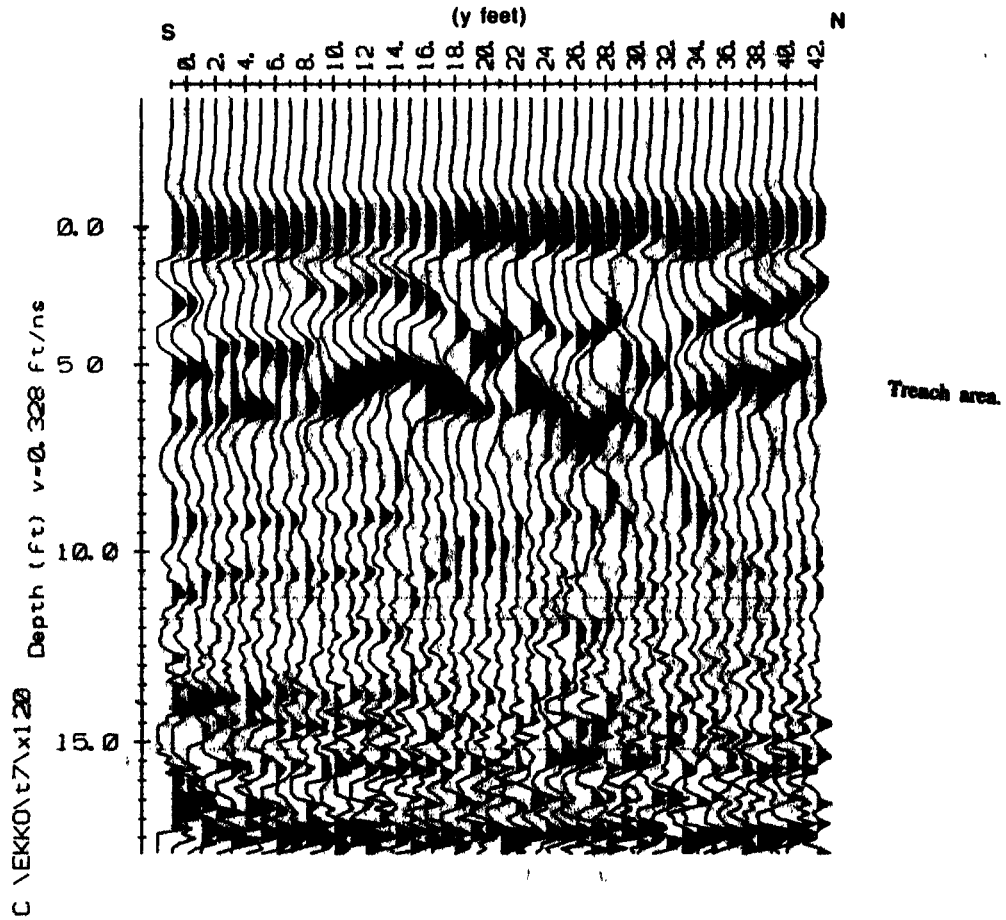
297

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 7
SOUTH TO NORTH ORIENTATION AT X=110 FEET
JUNE 1995



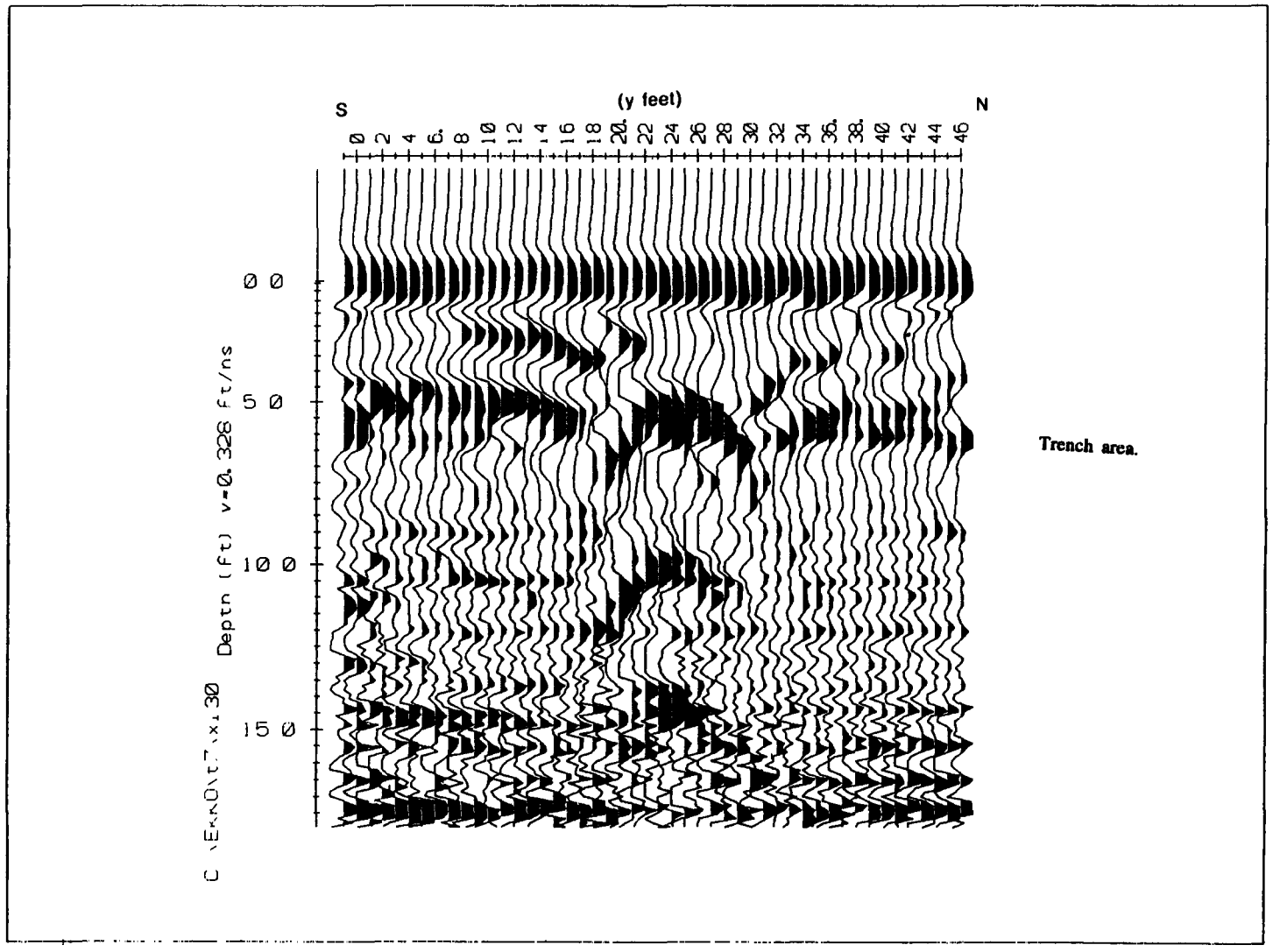
252

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-7
SOUTH TO NORTH ORIENTATION AT X=120 FEET
JUNE 1995



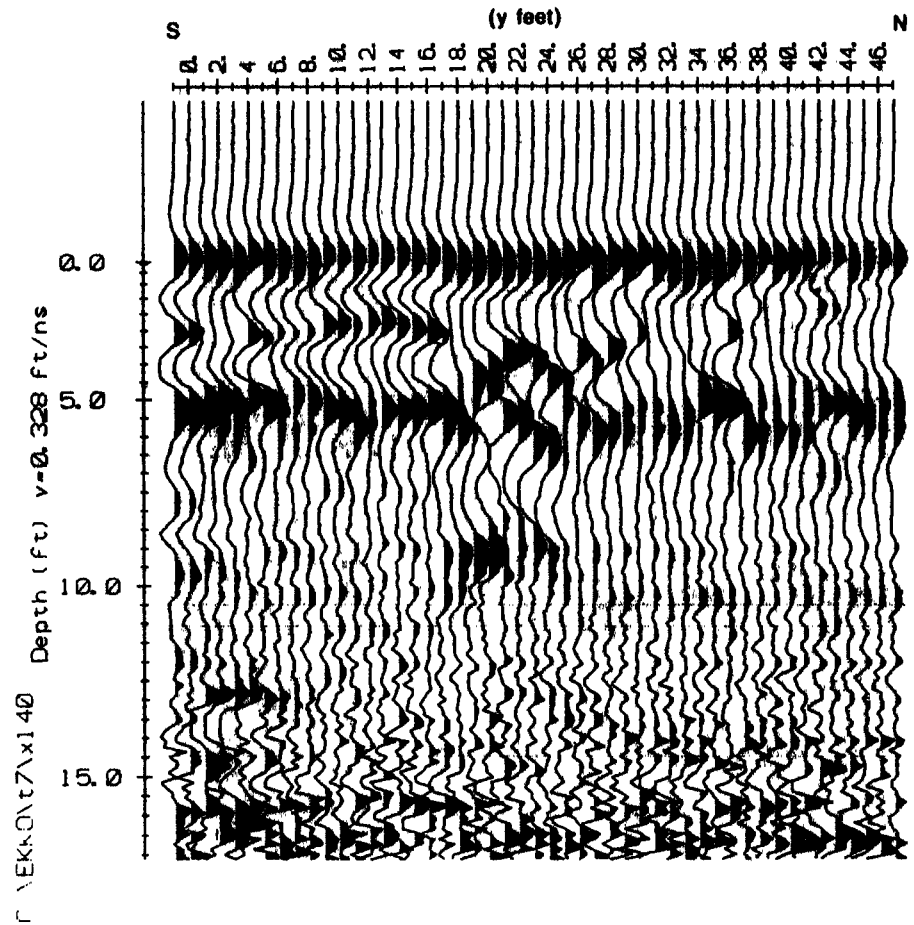
299

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 7
SOUTH TO NORTH ORIENTATION AT X=130 FEET
JUNE 1995



300

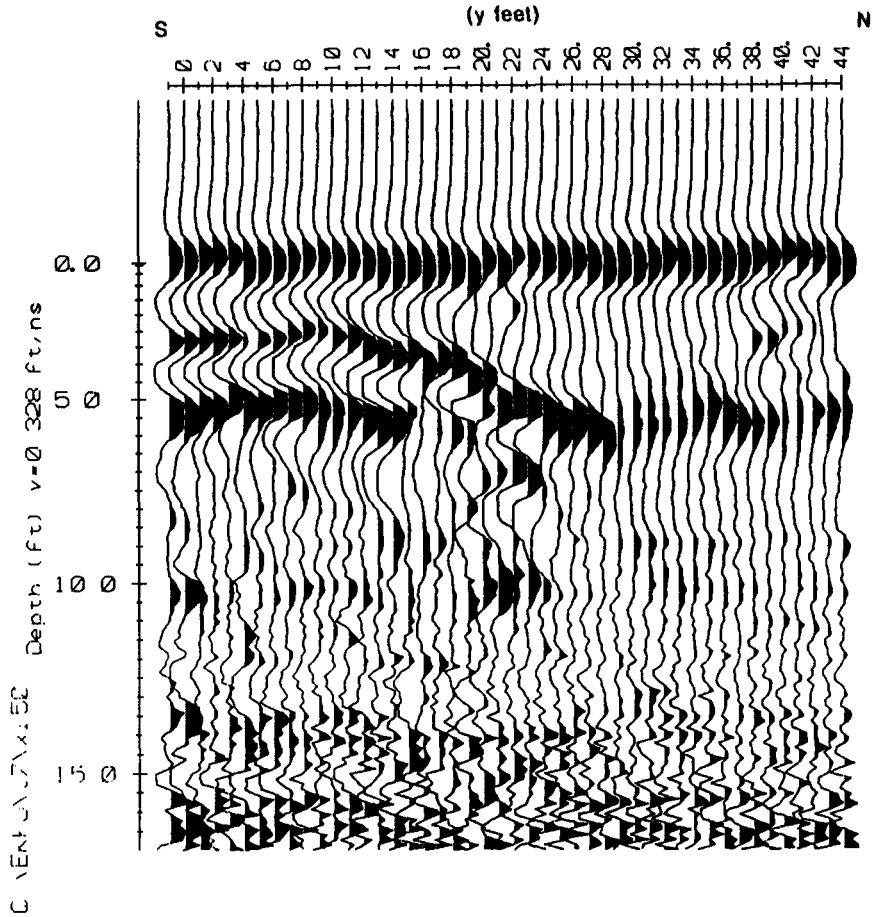
RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-7
SOUTH TO NORTH ORIENTATION AT X=140 FEET
JUNE 1995



Dense materials corresponding to area of high conductivity in EM surveys.

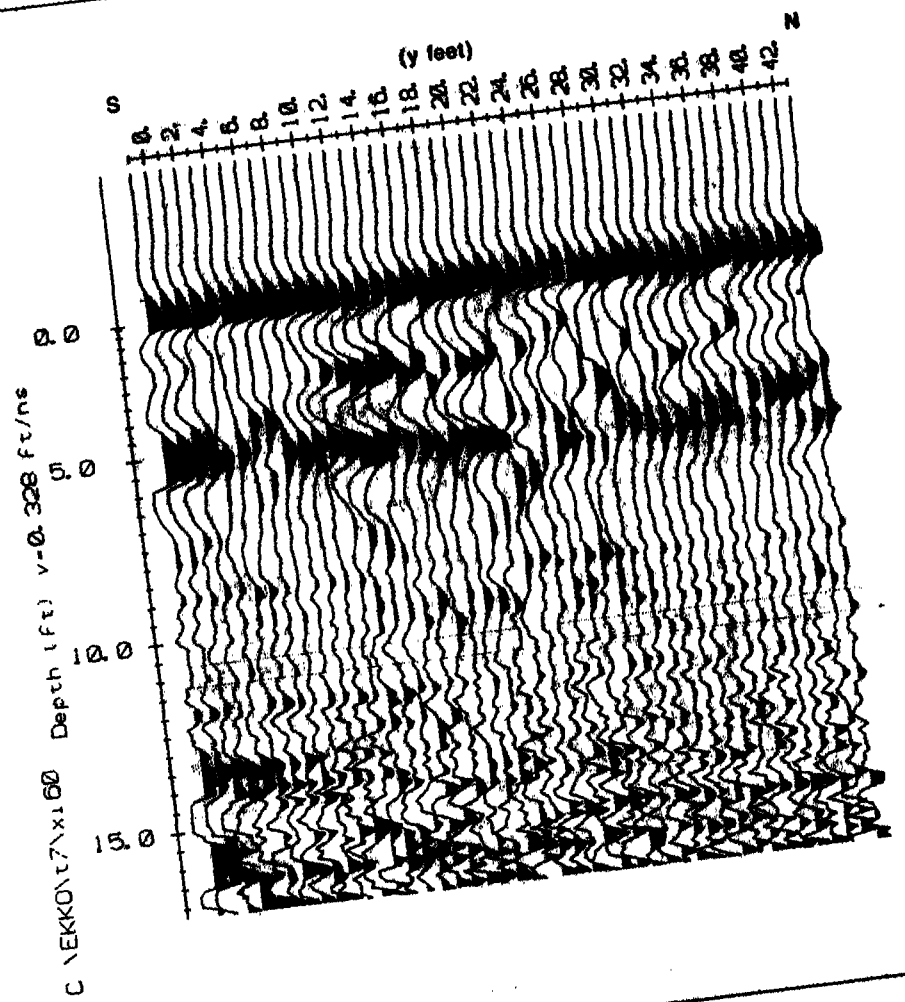
301

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 7
SOUTH TO NORTH ORIENTATION AT X=150 FEET
JUNE 1995

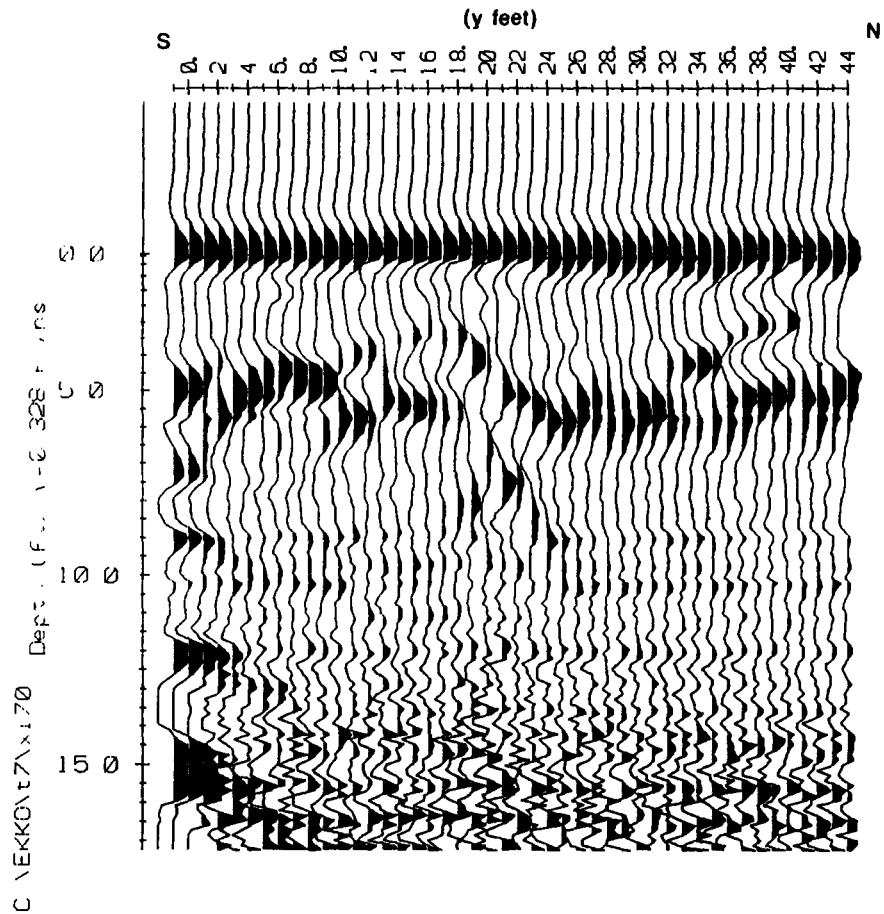


302

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-7
SOUTH TO NORTH ORIENTATION AT X=160 FEET
JUNE 1995

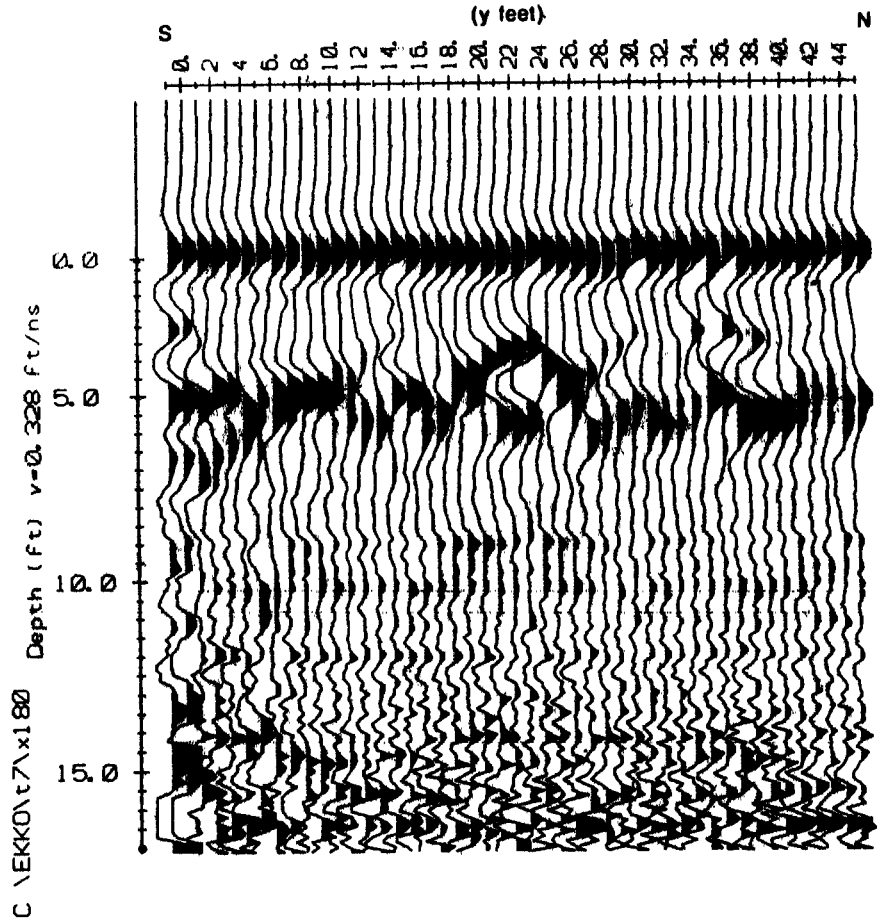


RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 7
SOUTH TO NORTH ORIENTATION AT X=170 FEET
JUNE 1995



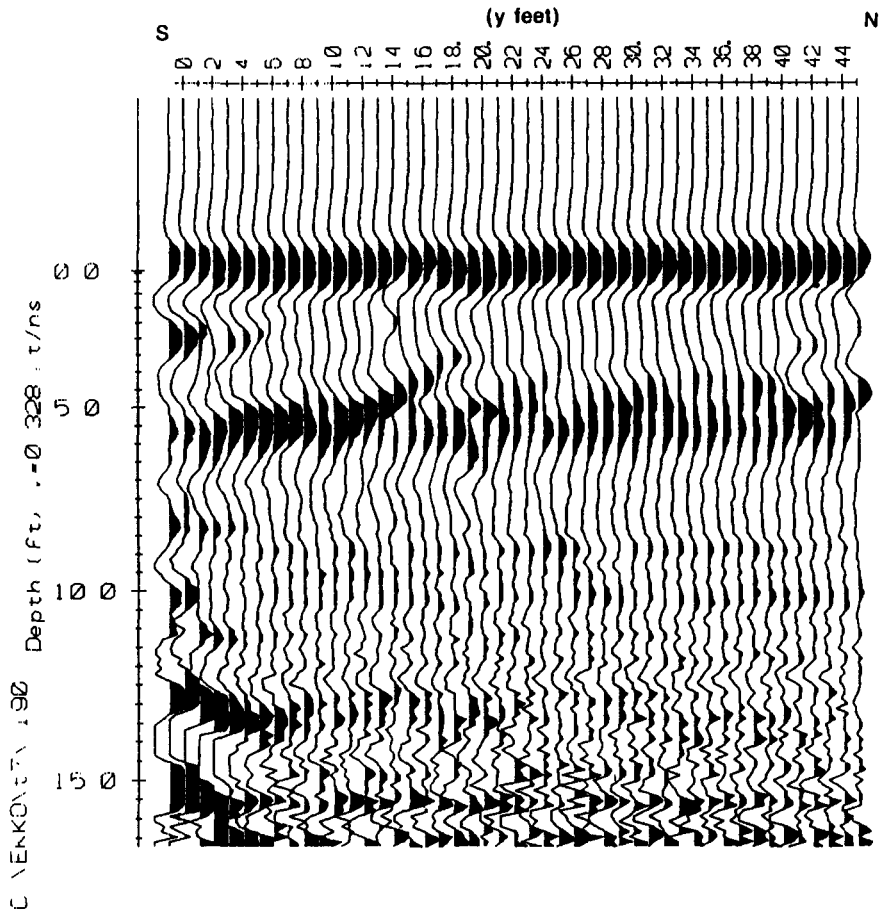
304

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-7
SOUTH TO NORTH ORIENTATION AT X=180 FEET
JUNE 1995



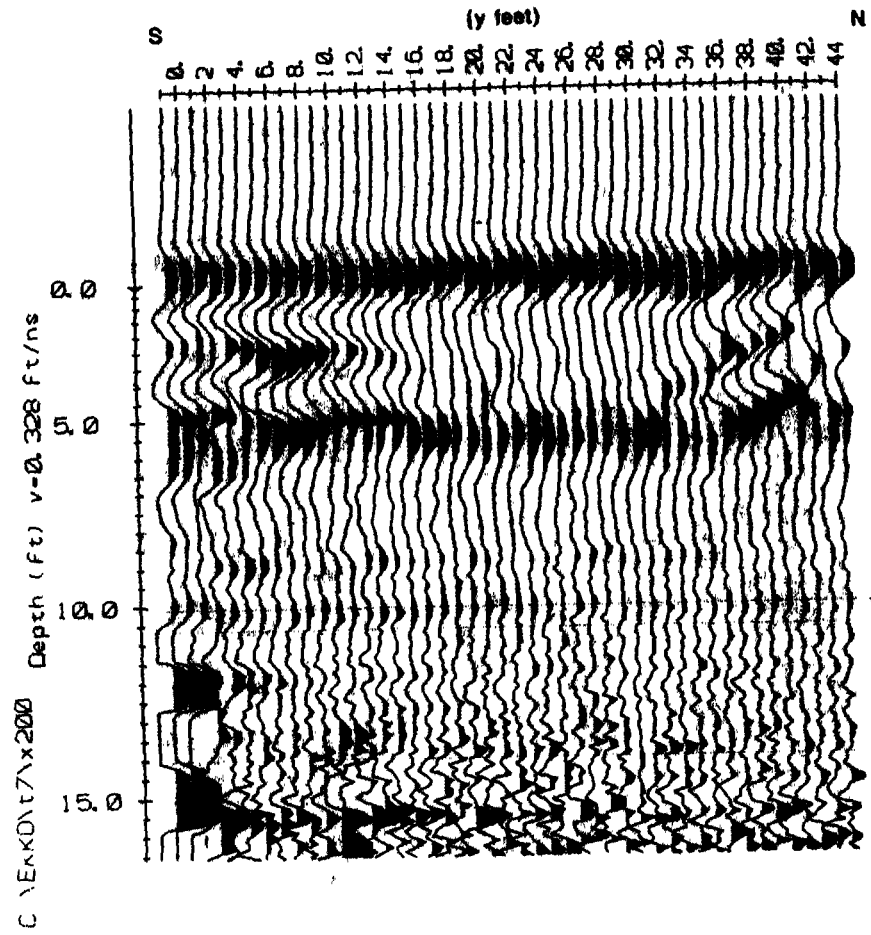
305

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 7
SOUTH TO NORTH ORIENTATION AT X=190 FEET
JUNE 1995

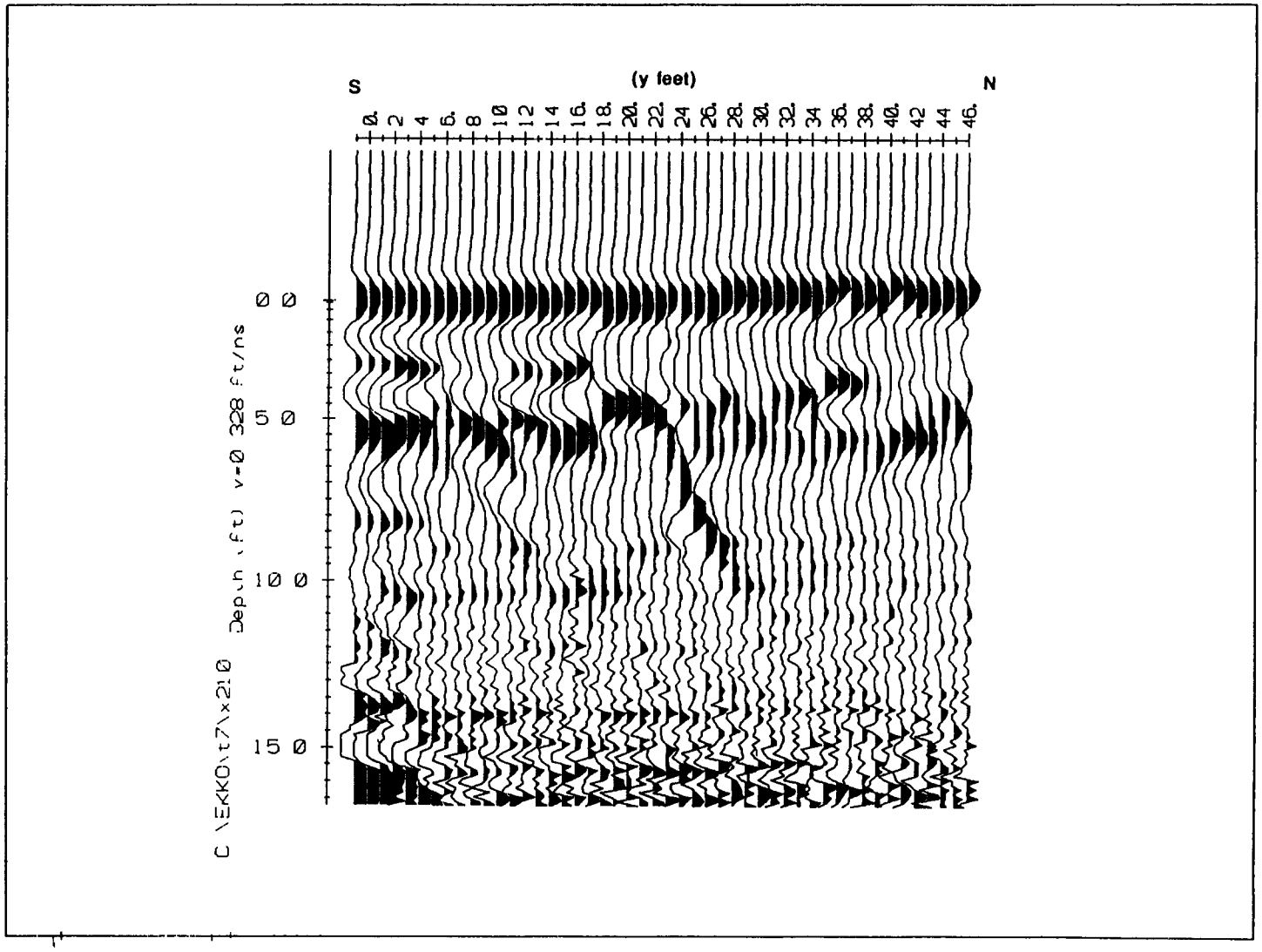


306

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-7
SOUTH TO NORTH ORIENTATION AT X=200 FEET
JUNE 1995

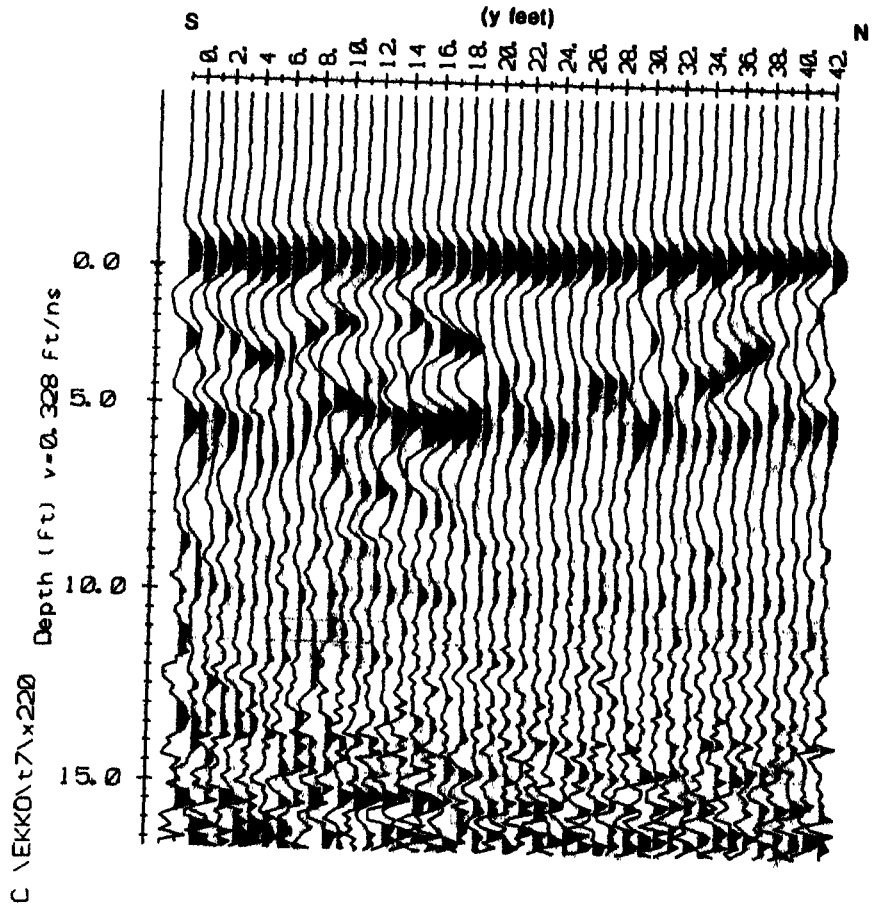


RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 7
SOUTH TO NORTH ORIENTATION AT X=210 FEET
JUNE 1995



308

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-7
SOUTH TO NORTH ORIENTATION AT X=220 FEET
JUNE 1995



309

Exhibit 3.6.E
Trench T-7 Borehole Logs

PRELIMINARY WELL-SITE FIELD LOG

Date 4/25/95 Borehole Number 11895

Rig Geologist JP Girod Company Woodward-Clyde

FEET

0.0 – 1.0' No soil sample taken

1.0' – 2.0' Sandy GRAVEL with silt (GP)
Gravel consists of pulverized cobbles
Grayish brown, caliché prensent
fine to coarse grained sand, dry

2.0' – 3.0' No recovery

3.0' – 7.0' All material used for VOA samples
Voids are present through out this
interval, especially at 4.0' Sandy Gravel w/ silt (GP) caliché, f-c gr dry

7.0' – 8.0' No ~~recov~~ GPS Soil sample taken

8.0' – 10.0' VOA taken
Sandy GRAVEL w/ silt (GP)
Grayish brown with lenses of sandy clay (CL) 2"-3" thick
fine to coarse grained sand, dry

Total Depth 10.0'

1 2 3 VOA VOA 4 VOA VOA 5 VOA VOA 6 VOA VOA 7 8 VOA VOA 9 VOA VOA 10

NOTES

Several intervals from 3.0'-5.0' and 5.0'-7.0' on four holes were sampled in order to obtain enough material for the 3'-5' sample interval

311

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT 075/154 FORM GT 1A (REV 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 1

Borehole Number 11885
Location - North ~~2087726.9~~ East ~~2087726.9~~ 6/27/95
Date 4/25/95 ~~449584.4~~ 6/27/95
Geologist JP Girod
Drilling Equip GEO Probe 4200

Surface Elevation
Area IHSS 111.4
Total Depth 10 0 feet
Company WCFS Project No OUZ
Sample Type

EG&G LOGGING SUPERVISOR
APPROVAL DATE

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
BOX 1 of 1	Run 1 3 0	1 0'					GP	1, 2, 3	X	See reverse side for soil description
	Run 2 5.0'	1 0	BH20729WC					4		
	Run 3 7.0'	1.0'						5, 6	VOA	
	Run 4 8 0'	0'						7, 8	X	
	Run 5 10.0'	2 0'	BH20730WC					9, 10	VOA	Total Depth = 10 0'

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

312

(4011 930-0134 930)(Form GT 1A)(03/01/92)

U S DEPARTMENT OF ENERGY ROCKY FLATS PLANT 084/154 FORM GT 1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 1

Borehole Number 11995
Location - North ~~749599.3~~ East ~~2087752.1~~ 6/27/95
Date 4/26/95 6/27/95
Geologist JPG/ROP
Drilling Equip EFO Probe 4200

Surface Elevation
Area IHSS 111.4
Total Depth 10.0
Company WCFS Project No OU2
Sample Type

EG&G LOGGING SUPERVISOR
APPROVAL DATE

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
Box 1 of 1								1		See other side for soil Description
	Run 1	0.5					GC	2		
	3.0							3		
	Run 2	2.0'	BH20733WC				GC	JPG 4 VOA 4 VOA 5 VOA 6 VOA 7 VOA 8	VOA's	3'-7' Voids prominent metal, wood in sample
	8.0'									
	Run 3	2.0'	BH20734WC				CL	VOA VOA 9 VOA VOA 10	VOA's	
	10'									Total Depth = 10.0'

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

313

6/12/95

(4011 930-0134 930)(Form GT 1A)(03/01/92)

PRELIMINARY WELL-SITE FIELD LOG

Date 4/26/95 Borehole Number 11995

Rig Geologist JP Gilod Company Woodward-Clyde

FEET

0'-1' No sampling

1.0'-3.0' olive brown Clayey Gravel w/ silt and sand (GC)
fine to coarse grained
Gravel consists of cobble fragments

3.0'-8.0' olive brown Moist Clayey Gravel w/ silt and sand and caliché
fine to coarse grained
Gravel consists of broken up cobble fragments

8.0'-10' olive brown to white Silty clay w/ abundant caliché Moist VOA

Total Depth = 10.0'

NOTES Borehole log is a composite of two holes, it was necessary to offset and resample due to lack of recovery and need to collect enough material for samples

ROCKY FLATS PLANT BOREHOLE LOG

PAGE 1 OF 1

Borehole Number 120095
Location - North ~~749587.9~~ East ~~2087564.4~~ 6/27/95
Date 4/26/95
Geologist SP Girod
Drilling Equip GGO Probe 4200

Surface Elevation
Area IHSS 111.4
Total Depth 10'
Company WCFS Project No OU2
Sample Type

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
BOX 1 of 1		00						1		0.0'-1.0' No sample taken
	Run 1	05			JPG 4/26/95 GC		GC	2		1.0'-3.0' Geotechnical Sample taken, No recovery 2.0'-6.0' Geotechical sample from offset 2' recovery
	3.0 Run	JPG						3		
	Run 2	2.0'	BH20735WC		4/26/95 JPG GC		GC	4 5 6 7	VOA's	
	8.0'							8		
	Run 3	2.0'	BH20736WC			CL		9	VOA's	
	10.0'							10		Total Depth 10.0'

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

QC'd 6/12/95

PRELIMINARY WELL-SITE FIELD LOG

Date 4/26/95 Borehole Number 12095

Rig Geologist JP Girod Company Woodward-Clyde

FEET

0.0'-1.0' No sample taken

1.0'-3.0' (GC) Clayey GRAVEL w/ some silt and sand
f-c grained sand
Poorly graded
Gravel consists of broken up cobbles
Olive brown, moist

3.0'-8.0' (GC) Clayey GRAVEL w/ some silt and sand
f-c grained sand
Poorly graded
Gravel consists of broken up cobbles
Olive brown, moist
Plant stems, decayed wood abundant

VOA's

8.0'-10.0' Silty Clay w/ abundant caliche
Olive brown to white
Moist

VOA's

Total Depth 10.0'

NOTES

3 7 TRENCH T-8 (IHSS 111 5)

Trench T-8 was investigated using the following methodologies

- Historical data were compiled to identify potential contaminants, trench location, and size
- Aerial photographs were examined to identify disturbed areas verify trench dimensions and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- One EM surveys were conducted to locate buried metallic objects and define trench boundaries
- GPR surveys were conducted to better determine trench depth and dimensions
- Soil gas surveys were conducted to identify and delineate contaminant plumes
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the trench

As shown in Figure 3 7-1, Trench T-8, is located south of Trench T-7 (IHSS 111 4), south of the East Access Road and east of Trench T-9 (IHSS 111 6) The dimensions of the trench are approximately 120 feet long 10 feet wide and 10 feet deep The trench was reportedly used for disposal of sanitary sewage sludge potentially contaminated with uranium and plutonium and flattened empty drums contaminated with uranium Activities of the sewage sludge were reported between 382 pCi/g and 3 590 pCi/g Older sludge had mostly uranium with an increasing plutonium fraction in later sludge placed in the trenches Total alpha radioactivity in the trench is estimated to be 100 to 150 millicurie (0 1 Ci to 0 15 Ci) Trench T-8 may also contain some asphalt planking from the Solar Evaporation Ponds contaminated with plutonium and uranium The pertinent section of the HRR is included in Exhibit 3 7 A (PAC Reference Number NE111 1-NE111 8)

To pinpoint the location of the trench and timing of activities, aerial photographs dating from 1954 through 1967 were examined (Colorado Aerial Photo Service 1993) Photographs reveal that the first apparent use of the trench was prior to August 11, 1962 and the trench closed prior to May 5, 1963

3 7 1 Geology

Trench T-8 is underlain by the Rocky Flats Alluvium, which ranges in thickness from 16 to 41 feet The Rocky Flats Alluvium is thinner on the west end and thicker on the east end (EG&G 1995c) The hydrograph from monitoring well 08091 located north of Trench T-8 indicates that groundwater fluctuates between 12 feet bgs to below the alluvium/bedrock contact

3 7.2 Site Visual Survey and Geophysical Surveys

Prior to the beginning of fieldwork, a visual survey of the Trench T-8 area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division The purpose of this visual survey was to determine the trench location for the layout of the geophysical grid Landmarks from the aerial photographs were used as reference points to locate the Trench T-8 Soil disturbances such as mounding and subsidence was identified and recent geologic characterization information was used to delineate between unconsolidated Rocky Flats Alluvium and soil disturbance caused by construction related activities In addition, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material. The area did not show any evidence of surficial water or seeps

A geophysical grid was the laid out using pin flags Grid dimensions were 50 feet wide (north-south) by 200 feet long (east-west) with flags placed at five foot increments

EM-31 Survey

After establishing the geophysical grid, the EM-31 survey was performed The EM-31 survey showed the presence a large anomaly, approximately 100 feet long by 30 feet wide, located centrally in the grid This anomaly represents Trench T-8 The quadrature response, horizontal dipole survey also indicates some migration of conductive materials to the southeast. The quadrature response, vertical dipole also showed the presence of the central anomaly The large anomaly is not present in the inphase response, horizontal or vertical dipole modes of the survey indicating the lack of presence of metallic or conductive material For this reason, EM-61 surveys were not performed. The EM-31 survey results support the information provided in the HRR The EM-31 survey results are presented in Exhibit 3 7 B

Ground Penetrating Radar

The information obtained from the GPR indicates that the trench is approximately 5 feet deep and 15 to 24 feet wide which correlates with the EM surveys and HRR information The GPR surveys are presented in Exhibit 3 7 C

318

3 7 3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995, the vadose zone within the Trench T-8 area was highly saturated The increased soil moisture content tended to attenuate soil gas readings, making sample collection difficult However, 24 were collected during this phase of the characterization and analyzed for total volatile organic content using field instrumentation To verify readings of total VOCs, 12 samples were collected and sent to an onsite laboratory for general chemistry analysis using method 8010

Based on the trench boundaries determined by the geophysical surveys soil gas sampling locations were placed along two horizontal lines located 10 feet on either side of the centerline of the trench Soil gas samples were collected every 10 feet along these lines at depths of five and nine feet bgs If a sample had a field measurement above 100 ppm the field crew stepped off 10 feet from that location and collected an additional sample This procedure was repeated until readings less than 100 ppm were obtained This methodology was employed to identify whether a VOC contaminant plume existed within or extends outside of the trench boundaries

Total VOC concentrations varied from zero to 1,051 ppm The highest concentrations were found at the 5 foot depth Soil gas survey information is presented in Figure 3 7-2 and does not indicate the presence of a volatile organic plume

3 7 4 Subsurface Soil Sampling

Subsurface soil sampling from the Trench T-8 area was the final step of the characterization activities Two boreholes, 12795 and 12895 were drilled and sampled at Trench T-8 to characterize the vertical extent of potential contamination in the subsurface soil Geologic borehole logs indicate the presence of wood and debris Lithologic descriptions of each borehole are presented in Exhibit 3 7 D Additionally six boreholes, (08491, 08591 B218989 BH5187, BH5287, and BH5487) were drilled and sampled previously Data from both characterization efforts indicate elevated levels of metals and radionuclides Figure 3 7-3 identifies the boreholes and wells that characterize Trench T-8

Organic Compounds

There were no organic compounds detected at concentrations greater the RFCA Subsurface Soil Action Levels as shown in Table 3 7-1

Metals

Arsenic (range 18 4-30 8 mg/kg), barium (589 mg/kg), cadmium (range: 1 2-5.5 mg/kg), calcium (range 51,000-225,000 mg/kg), chromium (193 mg/kg), copper (46 4 mg/kg), lead (45 6 mg/kg), molybdenum (74.2 mg/kg), nickel (450 mg/kg), potassium (10,500 mg/kg), strontium (196 mg/kg), and sodium (range 2,160-3,700 mg/kg) were detected at concentrations greater than the background $UTL_{99/99}$ as presented in Table 3 7-2

Radionuclides

Gross alpha (range 0.5-718 6 pCi/g), gross beta (137 5 pCi/g), americium-241 (range 0 03-104 9 pCi/g), cesium-137 (range. 0.13-0.20), plutonium-239/240 (range 0.04-642 4 pCi/g), uranium-233/234 (range 3 74-9 38 pCi/g), and uranium-235 (range· 0 16-0 37 pCi/g) activities exceeded the background $UTL_{99/99}$ as presented in Table 3 7-3 Radium-226 (range 1 1-1 7 pCi/g), radium-228 (1 1-3 1 pCi/g), and plutonium-239,240 (642 4 pCi/g) activities exceeded the PPRGs for subsurface soils, construction worker scenario as shown in Table 3 7-4

3 7.5 Groundwater

There are several wells in the Trench T-8 area. An elevated level of one organic compound was observed The detected tetrachloroethene concentration (44 µg/L) at well 08591 exceeded the RFCA Tier II Groundwater Action Level as presented in Table 3.7-5

3 7 6 Summary

The geophysical data indicate the trench is approximately 120 feet long, 15 to 24 feet wide, and 5 feet deep which corresponds to approximately 330 to 530 cy of buried material This representation is consistent with the HRR

The soil gas survey did not indicate the presence of a VOC plume The EM surveys indicate the presence of a conductive plume moving east-northeast. The inphase response of the EM-31 survey did not indicate the presence of buried metallic objects

The data collected was combined with data from previous investigations for comparison to background concentrations, negotiated cleanup levels, and PPRGs There were no organic compounds detected at concentrations greater than the RFCA Subsurface Soil Action Level or PPRGs for subsurface soils construction worker scenario There were nine metals detected at concentrations greater than the background $UTL_{99/99}$ but less than the PPRGs for subsurface soils Seven

320

radionuclides had observed activities greater than the background $UTL_{99/99}$ However, the background $UTL_{99/99}$ values for radium-226 and radium-228 exceed the PPRGs for subsurface soils construction worker scenario One organic compound, tetrachloroethene, exceeded the RFCA Tier II Groundwater Action Level but not the RFCA Tier I Groundwater Action Level or the PPRG for surface water open-space receptor Therefore, remedial action at Trench T-6 is not required

Trench T-8 summary information is provided in Table 3 7-6

Table 3 7-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

LABORATORY QUALIFIERS
J = Positively identified below sample quantitation limit result is estimated

NOTES
RFCA Action Levels for Benzoic Acid and 2 Butanone have not been determined

VALIDATION CODES
Y = Analytical results in validation process

Table 3 7-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T-8	8491	BH00448WCU2	2-8	1/20/92	Calcium	140000	1000		JA	53250
Trench T-8	8591	BH00440WCU2	38-44	1/15/92	Arsenic	18.4	2		V	18.2
Trench T-8	8591	BH00440WCU2	38-44	1/15/92	Barium	569	40		V	372
Trench T-8	12795	BH20752WC	8-10	4/28/95	Cadmium	2.9	1		Y	1.33
Trench T-8	12795	BH20751WC	3-8	4/28/95	Chromium	193	2		Y	89.1
Trench T-8	12795	BH20751WC	3-8	4/28/95	Molybdenum	74.2	40		Y	41.1
Trench T-8	12795	BH20752WC	8-10	4/28/95	Potassium	10500	1000		Y	7276
Trench T-8	12795	BH20751WC	3-8	4/28/95	Sodium	2180	1000		Y	2000
Trench T-8	12795	BH20752WC	8-10	4/28/95	Sodium	3700	1000		Y	2000
Trench T-8	12895	BH20753WC	3-8	4/28/95	Calcium	225000	1000		Y	53250
Trench T-8	12895	BH20754WC	8-10	4/28/95	Calcium	88100	1000		Y	53250
Trench T-8	12895	BH20754WC	8-10	4/28/95	Nickel	400	8		Y	79.7
Trench T-8	BH5187	BH51870009	0-9	9/18/87	Arsenic	29.4			N	18.2
Trench T-8	BH5187	BH51870009	0-9	9/18/87	Cadmium	5.8			N	1.33
Trench T-8	BH5187	BH51870009	0-9	9/18/87	Lead	45.6			N	31
Trench T-8	BH5267	BH526724SR	24-25	9/22/87	Cadmium	1.6			N	1.33
Trench T-8	BH5267	BH52670010	0-9.5	9/22/87	Calcium	175000			N	53250
Trench T-8	BH5467	BH546708DH	6-7.5	9/18/87	Arsenic	29.8			N	18.2
Trench T-8	BH5467	BH54671424	14.2-22.8	9/18/87	Arsenic	30.8			N	18.2
Trench T-8	BH5467	BH546708DH	6-7.5	9/18/87	Cadmium	2.1			N	1.33
Trench T-8	BH5467	BH546710DH	10-11.5	9/18/87	Cadmium	1.8			N	1.33
Trench T-8	BH5467	BH546712DH	12.2-14.2	9/18/87	Cadmium	2			N	1.33
Trench T-8	BH5467	BH54671424	14.2-22.8	9/18/87	Cadmium	5.5			N	1.33
Trench T-8	BH5467	BH54672334	23.5-32.8	9/21/87	Cadmium	1.9			N	1.33
Trench T-8	BH5467	BH546702WT	2-4	9/15/87	Calcium	169000			N	53250
Trench T-8	BH5467	BH546708DH	6-7.5	9/18/87	Calcium	56500			N	53250
Trench T-8	BH5467	BH546702WT	2-4	9/15/87	Strontium	198			N	159

LABORATORY QUALIFIER

VALIDATION CODES
JA = Result accepted, but was estimated
N = Will not be validated
V = Valid result
Y = Analytical results in validation process

Table 3 7-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T 8	8491	BH00448WCU2	2 8	1/20/92	Plutonium 239 240	0 08	0 002	0 028	V	0 025
Trench T 8	8491	BH00450WCU2	8-14	1/20/92	Plutonium-239 240	0 24	0 009	0 054	V	0 025
Trench T 8	8491	BH00453WCU2	14-20	1/20/92	Radium 226	0 58	0 14	0 17	A	1 42
Trench T 8	8491	BH00450WCU2	8 14	1/20/92	Radium 226	0 61	0 19	0 2	A	1 42
Trench T 8	8491	BH00454WCU2	20-22	1/20/92	Radium 226	0 74	0 16	0 19	A	1 42
Trench T 8	8491	BH00453WCU2	14-20	1/20/92	Radium 228	1 2	0 2	0 34	A	2 33
Trench T 8	8491	BH00454WCU2	20-22	1/20/92	Radium-228	1 5	0 37	0 47	A	2 33
Trench T 8	8591	BH00434WCU2	14-20	1/15/92	Cesium 137	0 13	0 13		JA	0 129
Trench T 8	8591	BH00440WCU2	38-44	1/15/92	Cesium 137	0 14	0 13	0 15	A	0 129
Trench T 8	8591	BH00440WCU2	38-44	1/15/92	Cesium-137	0 14	0 13	0 15	A	0 129
Trench T 8	8591	BH00436WCU2	20-26	1/15/92	Cesium-137	0 2	0 2		JA	0 129
Trench T 8	8591	BH00440WCU2	38-44	1/15/92	Radium-226	0 55	0 26	0 27	A	1 42
Trench T 8	8591	BH00431WCU2	8-14	1/15/92	Radium-226	0 65	0 23	0 31	A	1 42
Trench T 8	8591	BH00438WCU2	32 38	1/15/92	Radium 226	0 65	0 23	0 25	A	1 42
Trench T-8	8591	BH00434WCU2	14-20	1/15/92	Radium-226	0 66	0 23	0 26	A	1 42
Trench T 8	8591	BH00444WCU2	38-44	1/16/92	Radium 226	0 85	0 16	0 2	V	1 42
Trench T 8	8591	BH00434WCU2	14-20	1/15/92	Radium 228	1 1	0 57	0 63	A	2 33
Trench T 8	8591	BH00431WCU2	8-14	1/15/92	Radium-228	1 2	0 6	0 73	A	2 33
Trench T 8	8591	BH00438WCU2	32 38	1/15/92	Radium-228	1 4	0 43	0 52	A	2 33
Trench T 8	8591	BH00440WCU2	38-44	1/15/92	Radium 228	1 6	0 35	0 49	A	2 33
Trench T 8	8591	BH00436WCU2	20-26	1/15/92	Radium-228	1 9	0 81	1 1	A	2 33
Trench T-8	8591	BH00444WCU2	44-48	1/16/92	Radium 228	1 8	0 3	0 44	V	2 33
Trench T 8	12795	BH20752WC	8-10	4/28/95	Americium-241	4 56	0 192	0 714	Y	0 022
Trench T 8	12795	BH20751WC	3-8	4/28/95	Americium-241	104 9	0 812	23 2	Y	0 022
Trench T-8	12795	BH20752WC	8-10	4/28/95	Gross Alpha	125 5	5 94	20 4	Y	51 4
Trench T-8	12795	BH20751WC	3-8	4/28/95	Gross Alpha	718 6	6 21	85 7	Y	51 4
Trench T-8	12795	BH20751WC	3-8	4/28/95	Gross Beta	137 5	3 72	11 9	Y	42
Trench T-8	12795	BH20752WC	8-10	4/28/95	Plutonium-239 240	131 4	0 156	13 9	Y	0 025
Trench T 8	12795	BH20751WC	3-8	4/28/95	Plutonium-239 240	642 4	0 561	129	Y	0 025
Trench T-8	12795	BH20752WC	8-10	4/28/95	Uranium-233 234	3 93	0 022	0 536	Y	3 441
Trench T 8	12795	BH20751WC	3-8	4/28/95	Uranium-233 234	9 38	0 015	1 23	Y	3 441
Trench T-8	12795	BH20752WC	8-10	4/28/95	Uranium-235	0 16	0 018	0 045	Y	0 153
Trench T 8	12795	BH20751WC	3-8	4/28/95	Uranium-235	0 37	0 007	0 079	Y	0 153
Trench T 8	12895	BH20753WC	3-8	4/28/95	Plutonium-239 240	0 07	0 013	0 039	Y	0 025
Trench T-8	12895	BH20754WC	8-10	4/28/95	Uranium-233 234	3 74	0 016	0 516	Y	3 441
Trench T-8	B218989	B2189890307	3-7 1	11/27/89	Radium-226	0 6	0 3	0 3		1 42
Trench T-8	B218989	B2189890711	7 1 10 6	11/27/89	Radium-226	0 6	0 3	0 3		1 42
Trench T 8	B218989	B2189891820	17 4-20	11/27/89	Radium-226	0 6	0 3	0 3		1 42
Trench T-8	B218989	B2189891115	12 13	11/27/89	Radium 226	0 7	0 2	0 2		1 42
Trench T 8	B218989	B2189891518	14-14 2	11/27/89	Radium-226	1 7	0 9	1 1		1 42
Trench T 8	B218989	B2189891518	14-14 2	11/27/89	Radium-226	1 7	0 9	1 1		1 42
Trench T-8	B218989	B2189890307	3-7 1	11/27/89	Radium-228	1 1	0 5	0 5		2 33

325

Table 3 7-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{95/95}$ Values (continued)

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T-8	B218969	B2189690711	7 1 10 6	11/27/89	Radium-226	1 1	0 5	0.5		2.33
Trench T-8	B218969	B2189691115	12-13	11/27/89	Radium-226	1 4	0.5	0 6		2.33
Trench T-8	B218969	B2189691820	17 4-20	11/27/89	Radium-226	1 5	0 4	0.5		2.33
Trench T-8	B218969	B2189691518	14-14 2	11/27/89	Radium-226	3 1	1.2	1.8		2 33
Trench T-8	B218969	B2189691518	14-14 2	11/27/89	Radium-226	3.1	1.2	1.8		2.33
Trench T-8	B218969	B2189690307	3-7 1	11/27/89	Tritium	860	360	260		504
Trench T-8	B218969	B2189690711	7 1 10.6	11/27/89	Tritium	1040	570	360		504
Trench T-8	B218969	B2189690711	7 1 10 6	11/27/89	Tritium	1040	570	360		504
Trench T-8	BH5187	BH516712WT	12-14.4	9/22/87	Americium-241	0.05		0.1	N	0.022
Trench T-8	BH5187	BH516717BR	17 19.5	9/22/87	Plutonium-239,240	0.04		0.12		0 025
Trench T-8	BH5187	BH516717BR	17 19.5	9/22/87	Plutonium-239,240	0.04		0 12		0 025
Trench T-8	BH5287	BH528722CT	22-24	9/22/87	Americium-241	0.03		0 07	N	0 022
Trench T-8	BH5287	BH528712DH	12-13	9/22/87	Americium-241	0 1		0.09	N	0.022
Trench T-8	BH5287	BH528700010	0-0.5	9/22/87	Americium-241	0.14		0 1	N	0 022
Trench T-8	BH5287	BH528700010	0-0 5	9/22/87	Plutonium-239,240	0 58		0.17		0.025
Trench T-8	BH5487	BH548702WT	2-4	9/15/87	Americium-241	0.05		0.09	N	0.022
Trench T-8	BH5487	BH548706DH	6-9.65	9/16/87	Americium-241	0 03		0.07	N	0 022
Trench T-8	BH5487	BH548706DH	6-9 65	9/16/87	Americium-241	0.03		0.07	N	0.022
Trench T-8	BH5487	BH548740CT	40 5-41	9/21/87	Americium-241	0 04		0 08	N	0.022
Trench T-8	BH5487	BH548740CT	40.5-41	9/21/87	Americium-241	0 04		0.08	N	0.022
Trench T-8	BH5487	BH548732SH	28.5-32.8	9/21/87	Americium-241	0.06		0.08	N	0.022
Trench T-8	BH5487	BH548739WT	38.5-39	9/21/87	Americium-241	0.08		0.08	N	0.022
Trench T-8	BH5487	BH548702WT	2-4	9/15/87	Plutonium-239,240	0.31		0.14		0 025
Trench T-8	BH5487	BH548710DH	10-11 5	9/16/87	Plutonium-239,240	0.11		0.13		0.025
Trench T-8	BH5487	BH548712DH	12.2-14.2	9/16/87	Plutonium-239,240	0 11		0.13		0.025
Trench T-8	BH5487	BH548710DH	10-11 5	9/16/87	Plutonium-239,240	0.11		0.13		0.025
Trench T-8	BH5487	BH548712DH	12.2-14.2	9/16/87	Plutonium-239,240	0 11		0.13		0.025
Trench T-8	BH5487	BH548742BR	42.5-44	9/21/87	Plutonium-239,240	0.04		0.1		0.025
Trench T-8	BH5487	BH548742BR	42.5-44	9/21/87	Plutonium-239,240	0.04		0.1		0.025

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted, but was estimated
N = Will not be validated
V = Valid result
Y = Analytical results in validation process

Table 3 7-4 Subsurface Soil Radionuclide Activities Exceeding PPRGs

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	PPRG (pCi/g)
Trench T 8	8491	BH00453WCU2	14-20	1/20/92	Radium 226	0 58	0 14	0 17	A	0 494
Trench T 8	8491	BH00450WCU2	8 14	1/20/92	Radium 226	0 61	0 19	0 2	A	0 494
Trench T 8	8491	BH00454WCU2	20-22	1/20/92	Radium 226	0 74	0 16	0 19	A	0 494
Trench T 8	8491	BH00453WCU2	14-20	1/20/92	Radium 228	1 2	0 2	0 34	A	1 01
Trench T 8	8491	BH00454WCU2	20-22	1/20/92	Radium-228	1 5	0 37	0 47	A	1 01
Trench T 8	8591	BH00440WCU2	38-44	1/15/92	Radium 226	0 55	0 26	0 27	A	0 494
Trench T 8	8591	BH00431WCU2	8-14	1/15/92	Radium 226	0 65	0 23	0 31	A	0 494
Trench T 8	8591	BH00438WCU2	32 38	1/15/92	Radium 226	0 65	0 23	0 25	A	0 494
Trench T 8	8591	BH00434WCU2	14-20	1/15/92	Radium 226	0 66	0 23	0 26	A	0 494
Trench T 8	8591	BH00444WCU2	44-48	1/16/92	Radium 226	0 85	0 16	0 2	V	0 494
Trench T 8	8591	BH00434WCU2	14-20	1/15/92	Radium 228	1 1	0 57	0 63	A	1 01
Trench T 8	8591	BH00431WCU2	8-14	1/15/92	Radium-228	1 2	0 6	0 73	A	1 01
Trench T 8	8591	BH00438WCU2	332 38	1/15/92	Radium 228	1 4	0 43	0 52	A	1 01
Trench T 8	8591	BH00440WCU2	38-44	1/15/92	Radium-228	1 6	0 35	0 49	A	1 01
Trench T 8	8591	BH00436WCU2	20-26	1/15/92	Radium 228	1 9	0 81	1 1	A	1 01
Trench T 8	8591	BH00444WCU2	44-48	1/16/92	Radium-228	1 8	0 3	0 44	V	1 01
Trench T 8	12795	BH20751WC	3-8	4/28/95	Plutonium 239 240	642 4	0 561	129	Y	219
Trench T 8	B218989	B2189890307	3 7 1	11/27/89	Radium 226	0 6	0 3	0 3		0 75
Trench T 8	B218989	B2189890711	7 1 10 6	11/27/89	Radium-226	0 6	0 3	0 3		0 75
Trench T-8	B218989	B2189891820		11/27/89	Radium 226	0 6	0 3	0 3		0 75
Trench T 8	B218989	B2189891115	12 13	11/27/89	Radium-226	0 7	0 2	0 2		0 75
Trench T 8	B218989	B2189891518	14-14 2	11/27/89	Radium 226	1 7	0 9	1 1		0 75
Trench T 8	B218989	B2189891518	14-14 2	11/27/89	Radium 226	1 7	0 9	1 1		0 75
Trench T 8	B218989	B2189890307	3-7 1	11/27/89	Radium-228	1 1	0 5	0 5		1 4
Trench T 8	B218989	B2189890711	7 1 10 6	11/27/89	Radium 228	1 1	0 5	0 5		1 4
Trench T 8	B218989	B2189891115	12 13	11/27/89	Radium-228	1 4	0 5	0 6		1 4
Trench T 8	B218989	B2189891820	17 4-20	11/27/89	Radium-228	1 5	0 4	0 5		1 4
Trench T 8	B218989	B2189891518	14-14 2	11/27/89	Radium-228	3 1	1 2	1 8		1 4
Trench T 8	B218989	B2189891518	14-14 2	11/27/89	Radium-228	3 1	1 2	1 8		1 4

VALIDATION CODES
A = Result accepted with qualifications
V = Valid Result
Y = Analytical results in validation process

Table 3 7-5 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T-8	8591	GW02577IT	3/12/92	Tetrachloroethene	0 044	0 00002	E	0 005	

LABORATORY QUALIFIERS
E = Chemical exceeds calibration range of the instrument

TABLE 3.7-6 TRENCH T-8 SUMMARY INFORMATION

CONTAMINANTS		
Media: Subsurface Soils		
Greater than $UTL_{99/99}$	Greater than RFCA Standards	Greater than PPRGs
Arsenic Barium Cadmium Calcium Chromium Copper Lead Molybdenum Nickel Potassium Strontium Sodium		
Gross alpha Gross beta Americium-241 Cesium-137 Plutonium-239/240 Uranium-233/234 Uranium-235		Radium-226 Radium-228 Plutonium-239,240

Media Groundwater			
Greater than $UTL_{99/99}$	Greater than RFCA Tier II Standards	Greater than RFCA Tier I Standards	Greater than PPRGs
	Tetrachloroethene		

PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
120	15-24	5	330-530	No	Yes conductive plume moving east-northeast

Note

A RFCA subsurface soil action level has not been determined for benzoic acid

328

Exhibit 3.7.A
Trench T-8 Historical Release Report Information

332

PAC REFERENCE NUMBER NE 111 1 NE 111 3

SS Reference Number 111 1 111 8 Operable Unit 2

Best Available Copy

Unit Name Trenches T-4 through T-11

Approximate Location N750 000 E2 087,500

Date(s) of Operation or Occurrence

The exact dates of operation are unknown except for the period of July 29 1954 through August 14 1968[1] Trenches T 9 T 10 and T 11 were differentiated from the other trenches and added to the disposal trench inventory in 1977[2] See the "Comments" section below for additional discussion of this point

Description of Operation or Occurrence

Trenches T-4 through T 11 along with Trench T 2 (PAC 900 109) and Trench T 3 (PAC NE 110) were used primarily for the disposal of sanitary wastewater treatment plant sludge The sludge removed from the wastewater treatment plant was placed on sludge drying beds The dried material removed from the sludge drying beds was placed in the disposal trenches The sanitary sludge disposal trenches are reported to be approximately 10 feet deep and are provided with two feet of soil cover[3] The trenches are variable in length with the average length being approximately 250 feet[4] The total amount of sludge disposed in Trenches T 2 through T 11 is estimated at 125 000 kilograms[5] Some amounts of additional materials were also disposed in Trenches T 4 T 9 and T 11 These other materials consisted of asphalt planking (approximately 130 000 square feet of asphalt planking) in T-4 and T 11 from the re design of Solar Pond 207A (PAC 000-101) in 1963 and scrap metal and junk in T 9[5]

At the same time that Trenches T 9 T 10 and T 11 were identified (1977) it appears that the numbering system for the trenches was slightly modified Whereas earlier documents had presented a consistent numbering system [illegible] 1983 document a trench that had previously been referred to as [illegible] T 11[5] This 1983 document [illegible] the T-4 trench essentially as an addition to Trench [illegible] designated Trench T 9 [illegible] essentially an extension of Trench T 7[5] but in earlier documents [illegible] had been referred to as Trench T 5[1] Trench T 10 had not been identified or named prior to 1983 [illegible] as Trench T 5 in the 1983 document was a trench not previously identified (comparison of maps [illegible] and 5)

[illegible] Chemical Description of Constituents Released

[illegible] and plutonium contamination is present in this sludge [illegible] sludge would have [illegible] primarily uranium contamination with newer sludge [illegible] plutonium contamination [illegible] lived alpha activity present in the sludge was reported [illegible] pCi/g in August 1964 [illegible] of 3 591 pCi/g in June 1960 Uranium contamination [illegible] in flattened drums that [illegible] been disposed in any of trenches T 2 through T [illegible] contaminated oils that had [illegible] the drum[6] The burning of the contaminated oil [illegible] Burn Pit No-2 (PAC 900-153) from March 1957 to mid 1965[6] not in the trenches [illegible] up to 200 in total number [illegible] in any of Trenches T 3 through T [illegible] 1973 document that Trench T-4 [illegible] designated Trench T 11 as discussed above) contained [illegible] 2 5

On at least one occasion it is believed that 2 400 gallons of [illegible] generated in Building [illegible] was [illegible] one of the East Trenches [illegible] It is believed that [illegible] total alpha activity The [illegible] with approximately 1 3 [illegible] depleted uranium present in the [illegible] this material was in drums

Response to Operation or Occurrence

[illegible] were collected from the [illegible] 197[illegible] Trenches T 9 T 10 and T 11) during [illegible] Soil from [illegible] 0 40 to [illegible] pCi/g in plutonium activity and from [illegible] to [illegible] pCi/g uranium activity Trench T [illegible] was [illegible] to contain from 0 18 to 14 pCi/g plutonium

333

activity and from 40 to 126 pCi/g uranium activity Trench T-11 was found to contain 4.5 to 50 pCi/g plutonium activity and 0.9 to 158 pCi/g in uranium activity[5]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents disposed in Trenches T-4 through T-11 This IHSS is being studied in accordance with the IAG schedule for OU2 The IAG activities will include site investigations site characterizations and possible remediation The Final Phase II RFI/RI Report is to be completed by March 12 1993

Comments

Trench T-3 along with these trenches are also called the East Trenches

Trenches T-4 through T-11 (PAC NE 111) have few operational differences from Trenches T-2 (PAC 900 109) and T-3 (PAC NE 110)

The sludge disposed of in these trenches should consist primarily of concentrated organic matter typically present in sanitary wastewater treatment plant sludge

From August 1968 until February 1970 sanitary wastewater treatment plant sludge was disposed in the [illegible] landfill[1] After February 1970 sanitary wastewater treatment plant sludge was shipped offsite for disposal

To date no documentation has been found that records the time frame during which any particular [illegible] receiving waste Similarly none of the HRR interviewees were knowledgeable on dates of operation of [illegible] trenches

The locations of [illegible] on Plate 2 differ from the IAG map but are taken from the OU2 [illegible] Work Plan [illegible]

References	Other references of interest	
[1] 1500793	1500296	1501097
1501719	1600430	1500[illegible]
[3] 1500898	1500340	1500460
[4] 1502713	[illegible]	[illegible]
[5] 1500890	1500901	1500[illegible]
[6] 1500656	1500304	1500[illegible]
1500579	1500458	1500921
[8] 1700445	1500888	

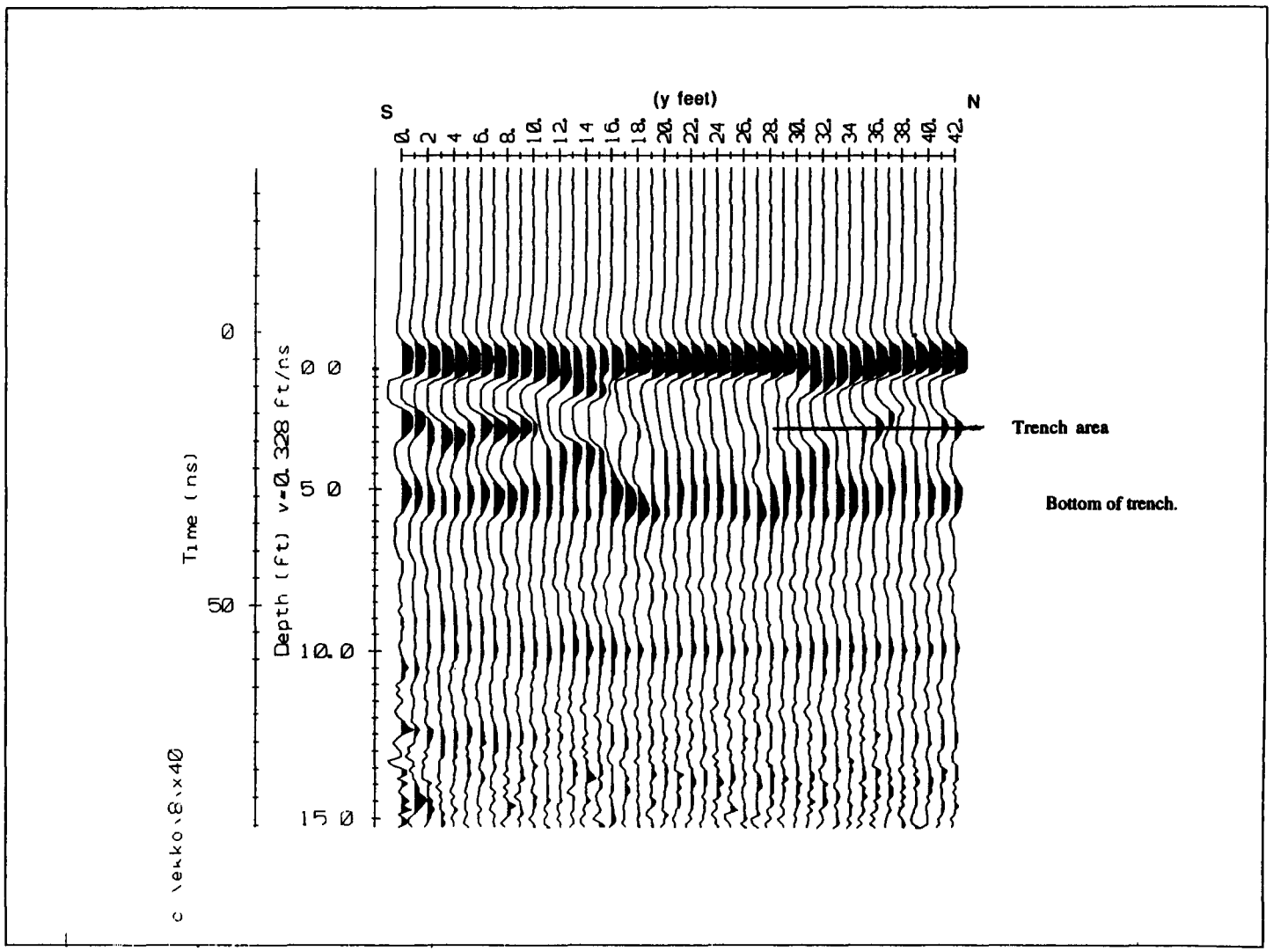
334

Exhibit 3.7.B
Trench T-8 EM-31 Surveys

Exhibit 3.7.C
Trench T-8 Ground Penetrating Radar Surveys

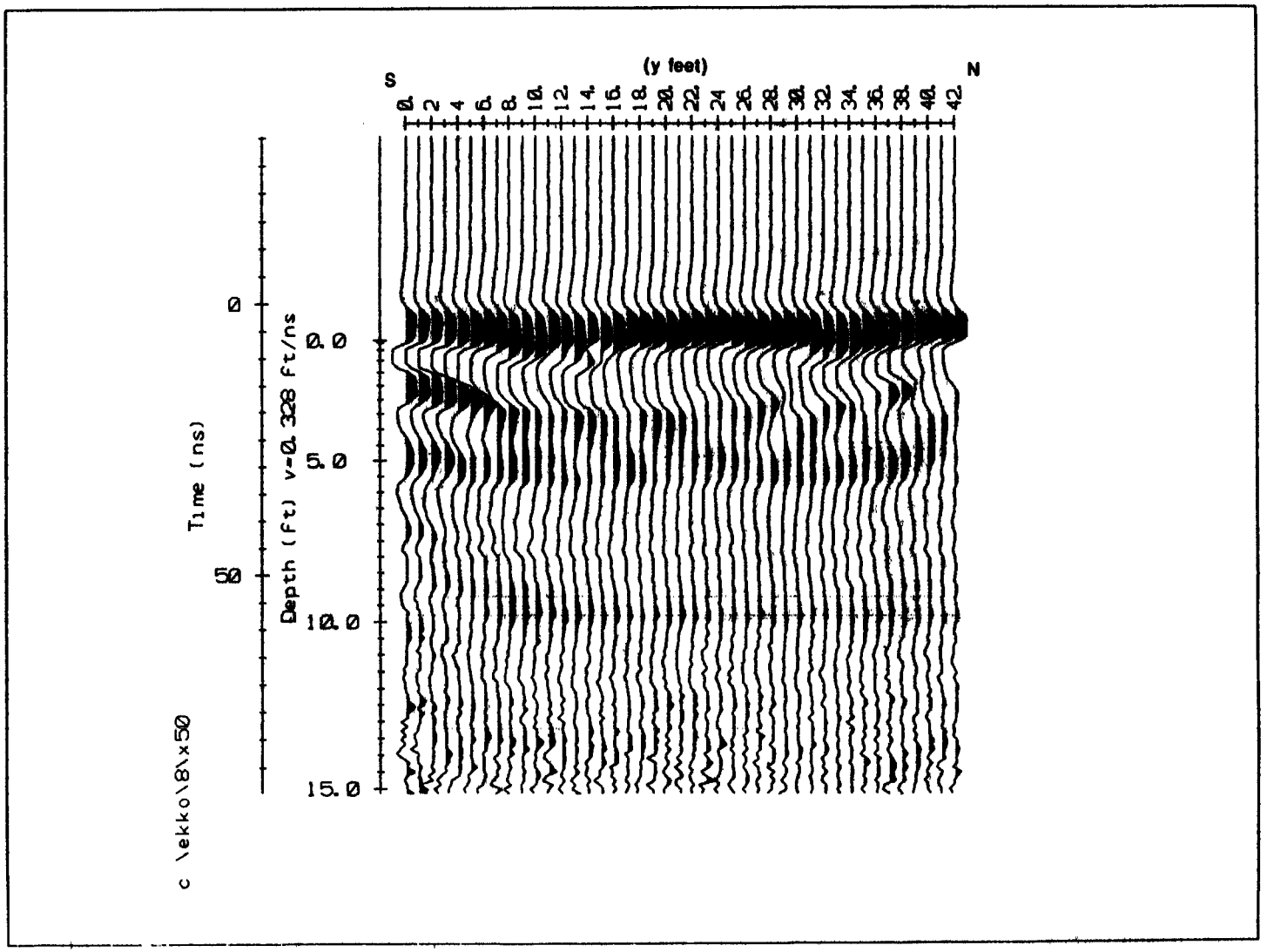
340

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 8
SOUTH TO NORTH ORIENTATION AT X=40 FEET
JUNE 1995



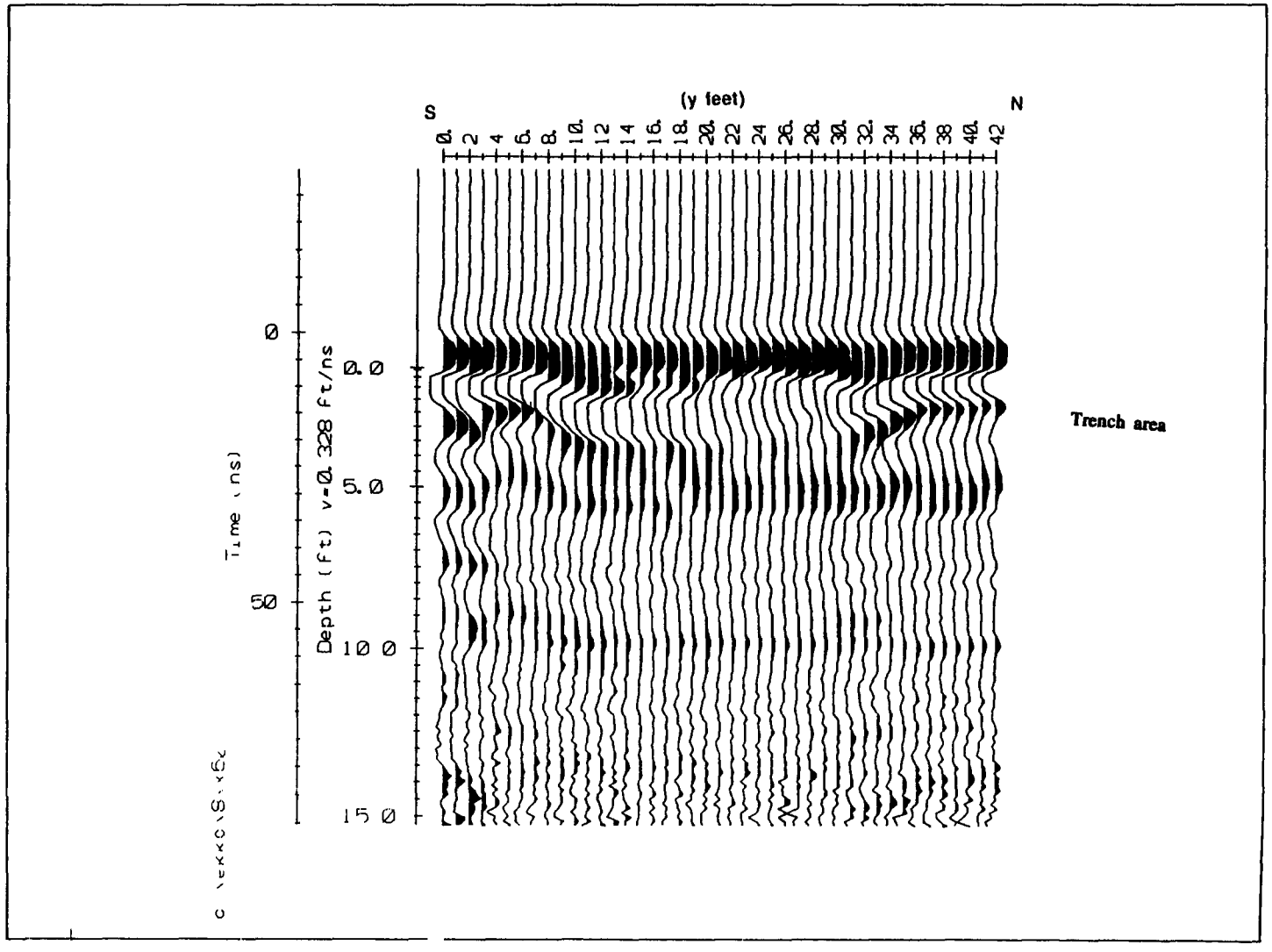
341

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-8
SOUTH TO NORTH ORIENTATION AT X=50 FEET
JUNE 1995

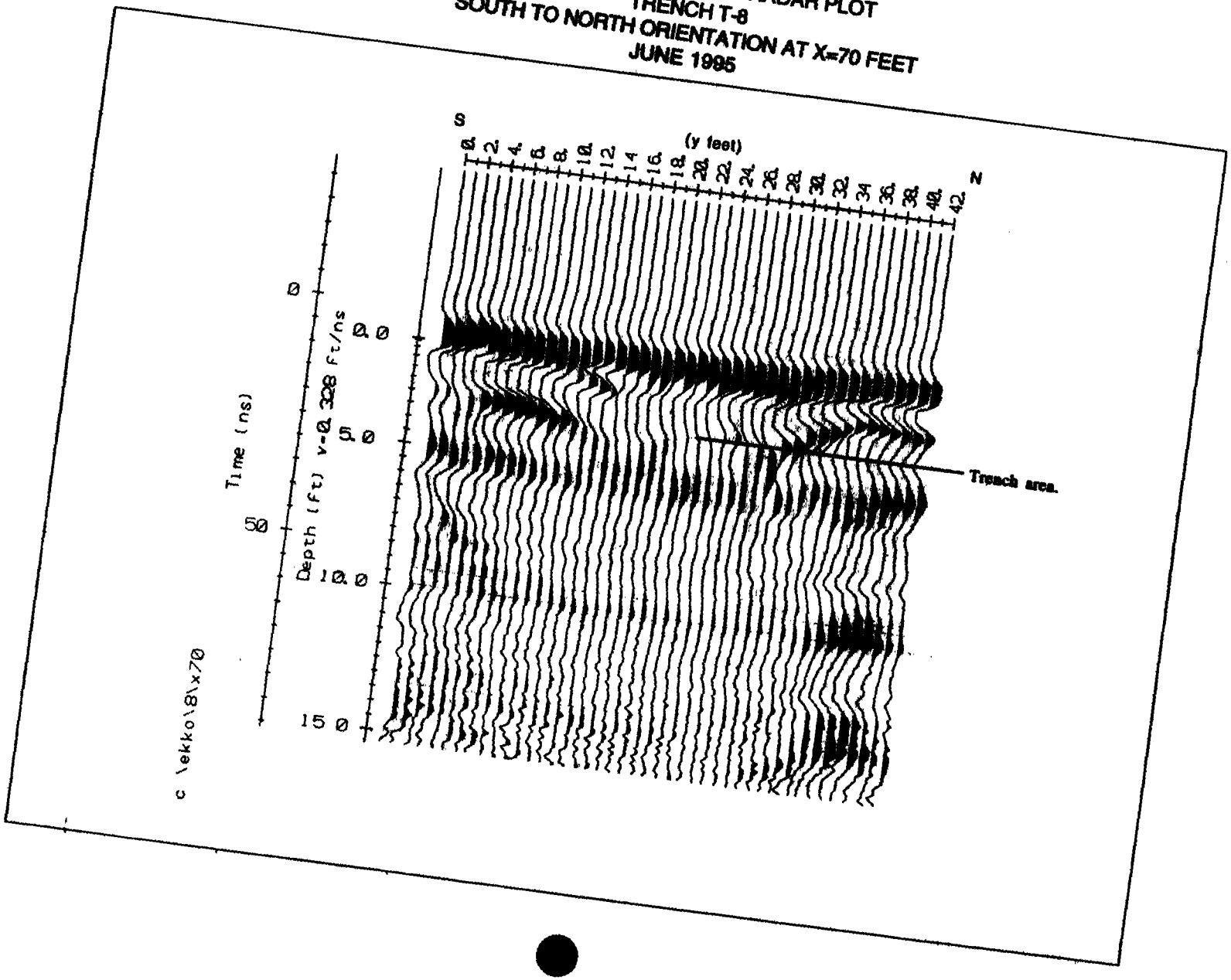


342

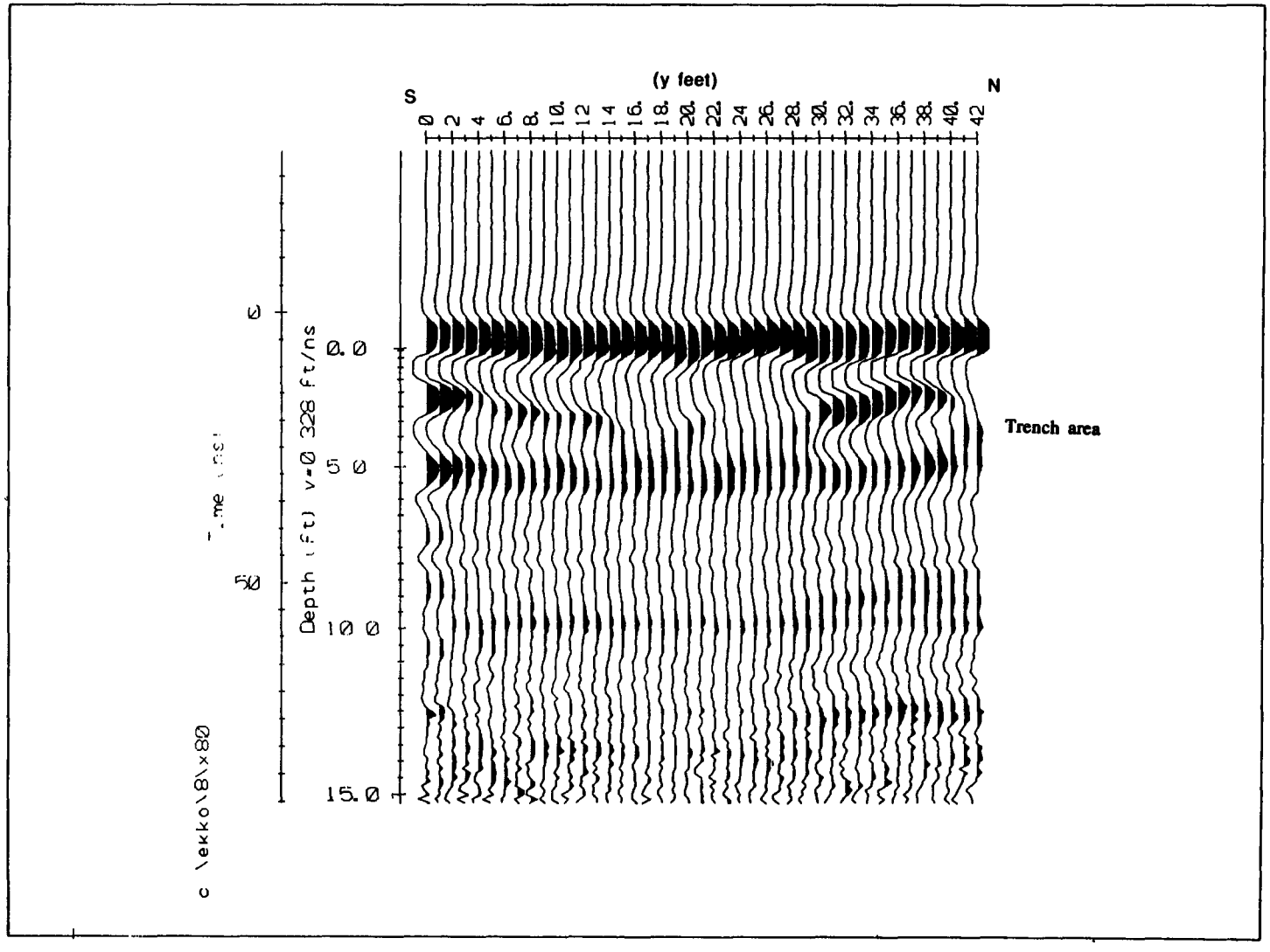
RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 8
SOUTH TO NORTH ORIENTATION AT X=60 FEET
JUNE 1995



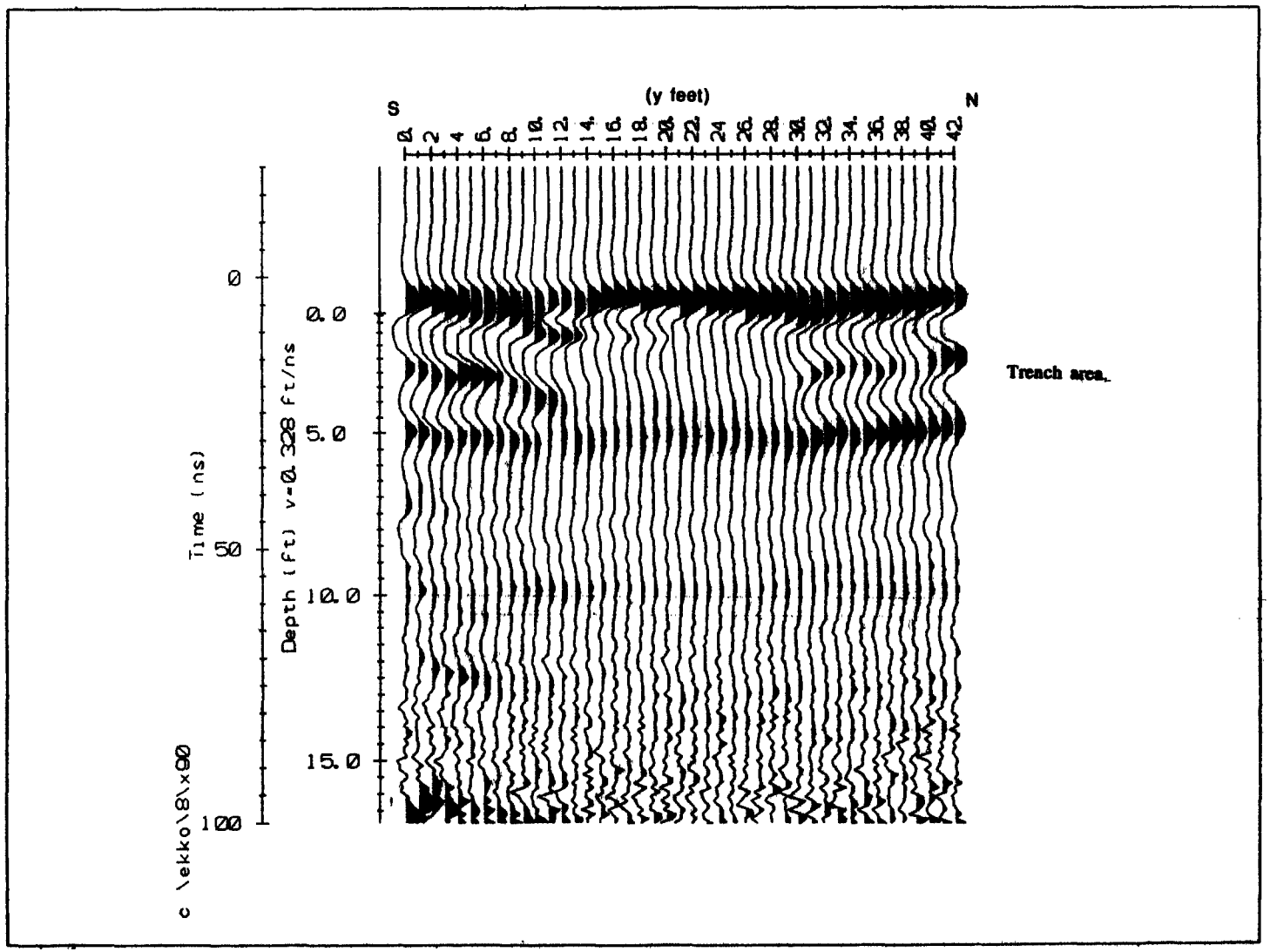
RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-8
SOUTH TO NORTH ORIENTATION AT X=70 FEET
JUNE 1995



RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 8
SOUTH TO NORTH ORIENTATION AT X=80 FEET
JUNE 1995

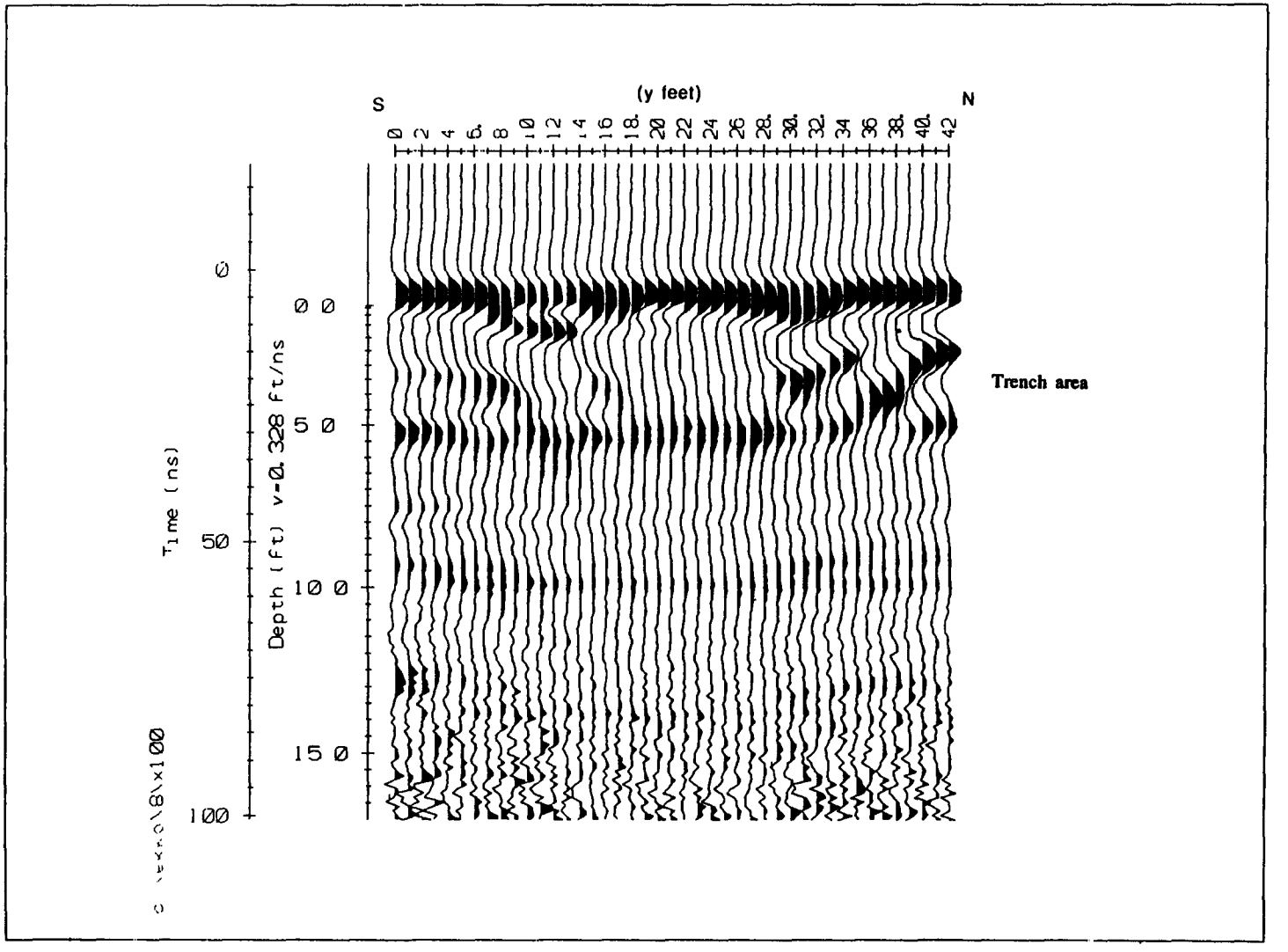


RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-8
SOUTH TO NORTH ORIENTATION AT X=90 FEET
JUNE 1995

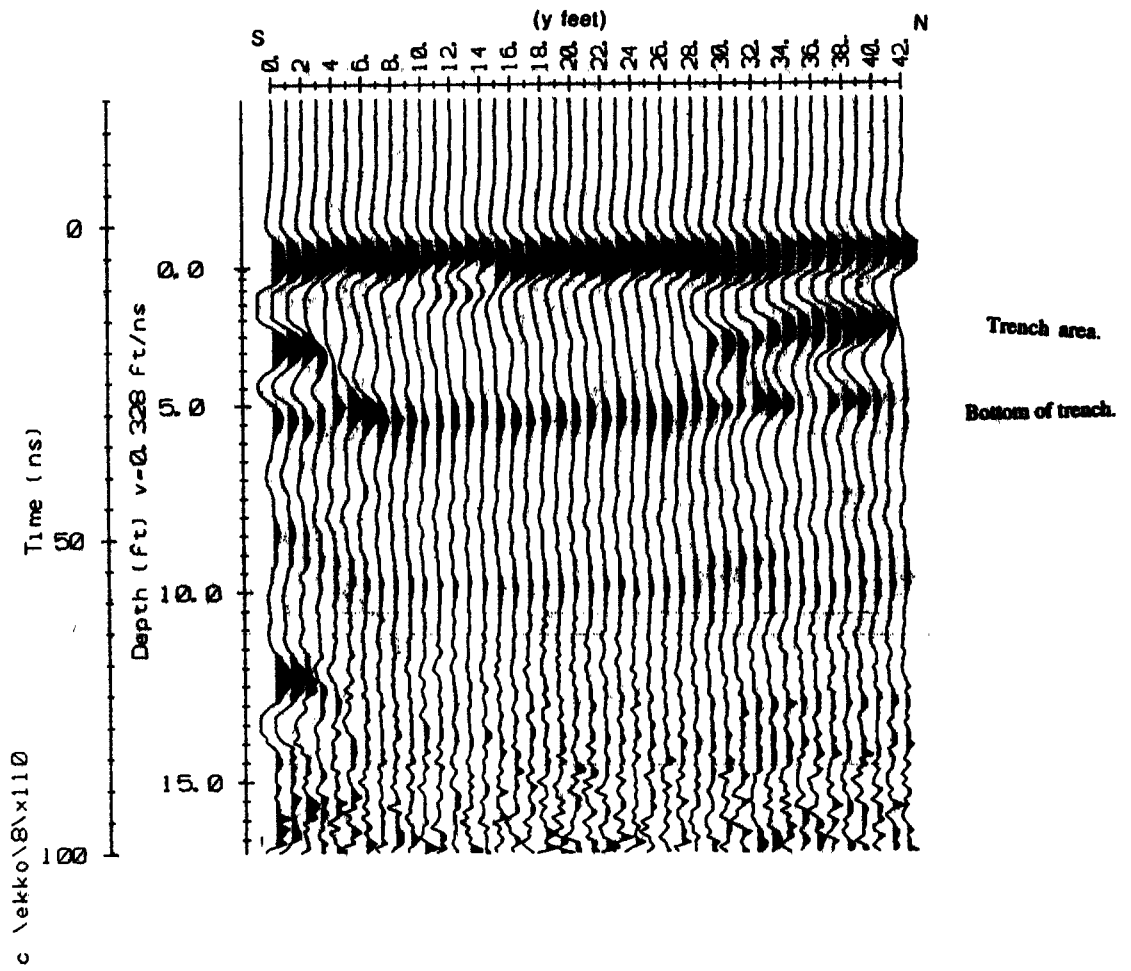


346

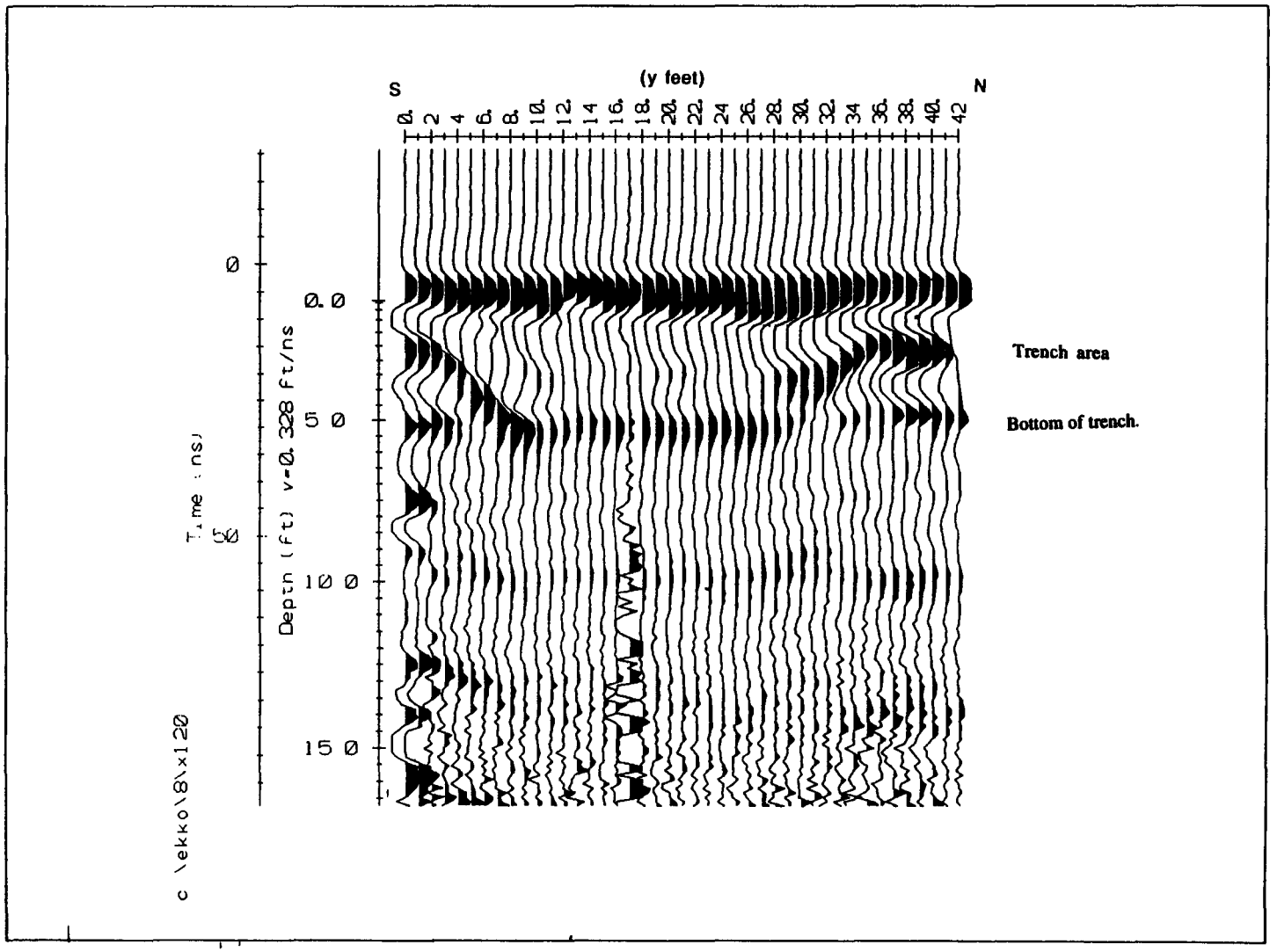
RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-8
SOUTH TO NORTH ORIENTATION AT X=100 FEET
JUNE 1995



RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-8
SOUTH TO NORTH ORIENTATION AT X=110 FEET
JUNE 1995

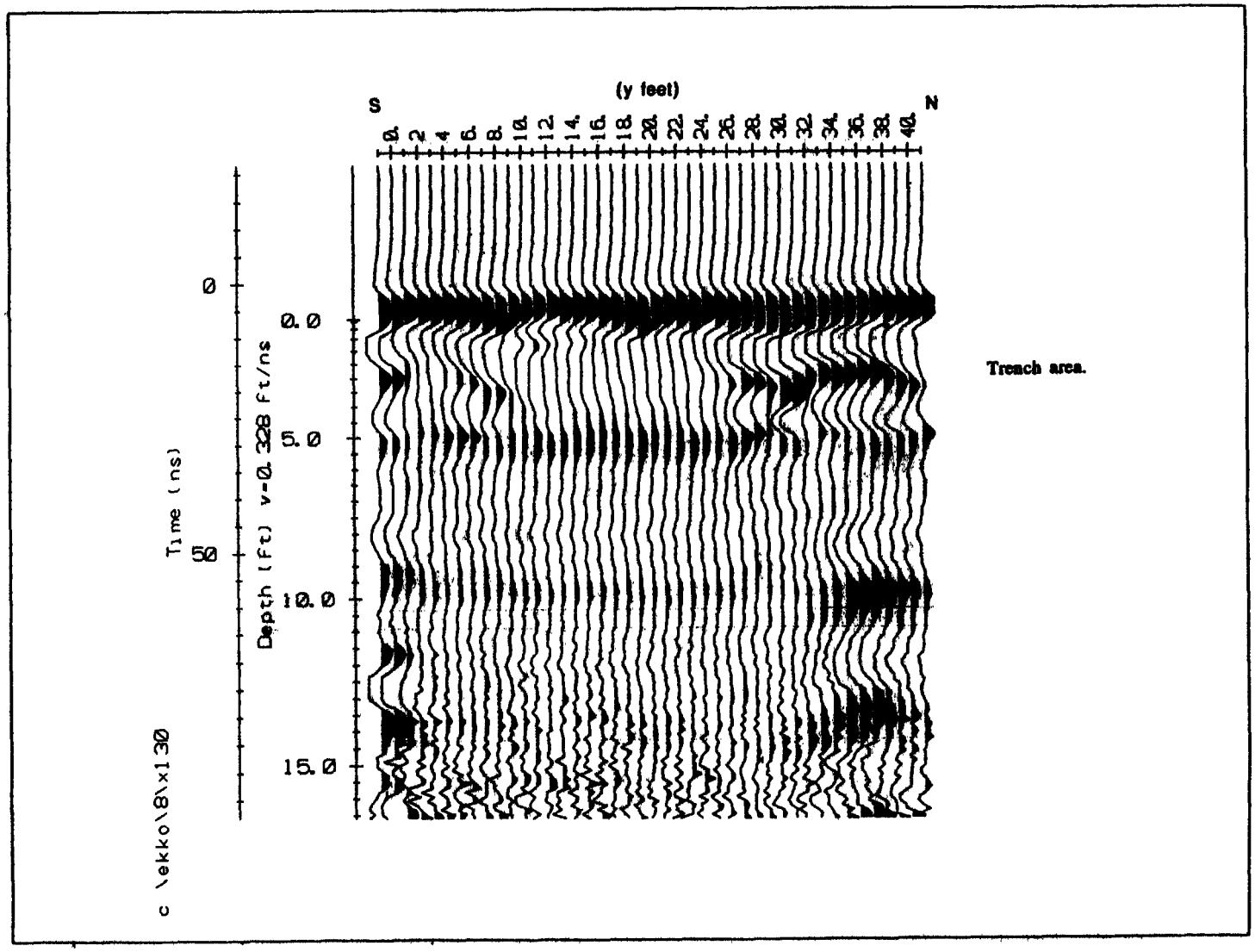


RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 8
SOUTH TO NORTH ORIENTATION AT X=120 FEET
JUNE 1995

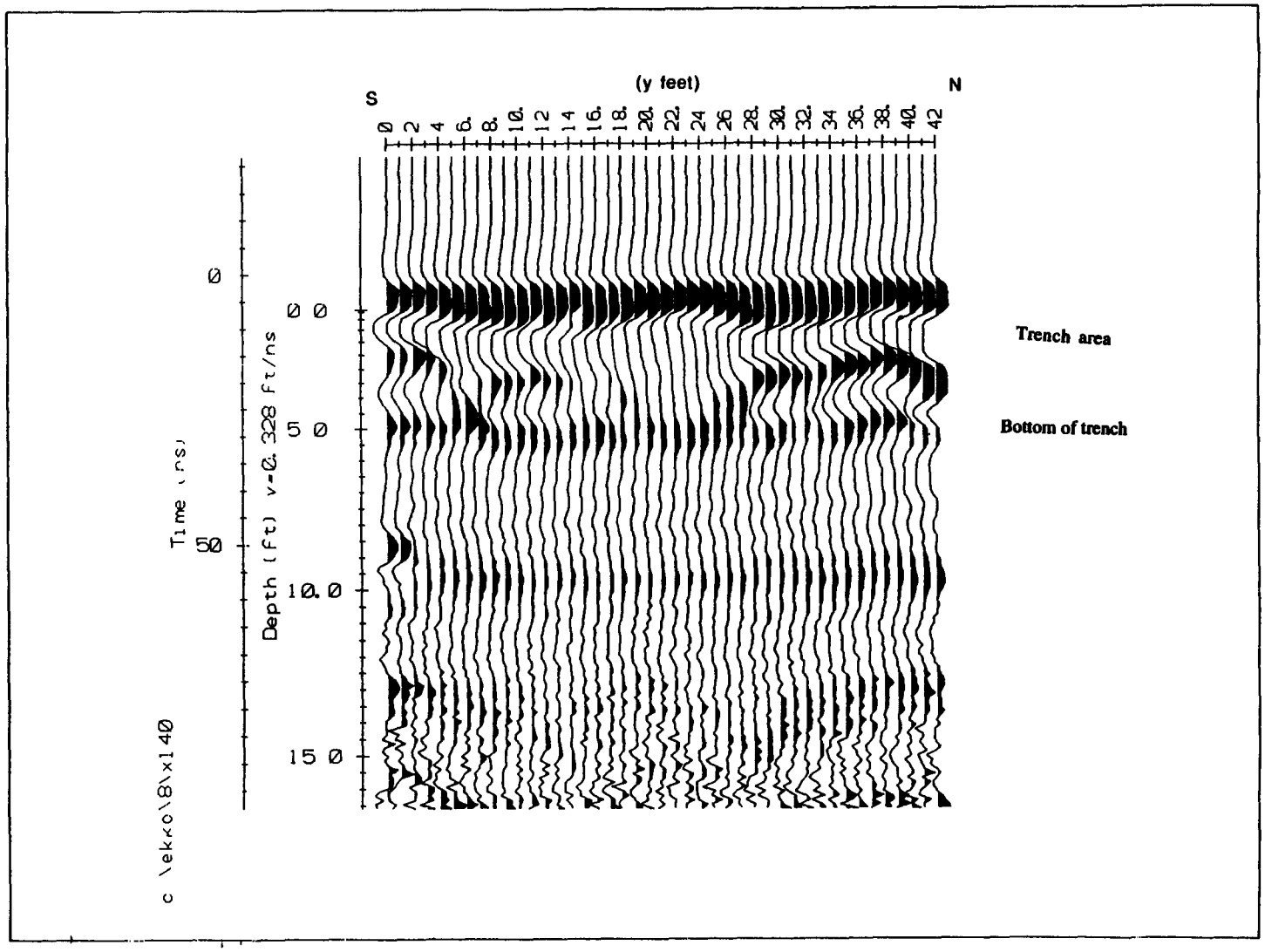


349

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-8
SOUTH TO NORTH ORIENTATION AT X=130 FEET
JUNE 1995

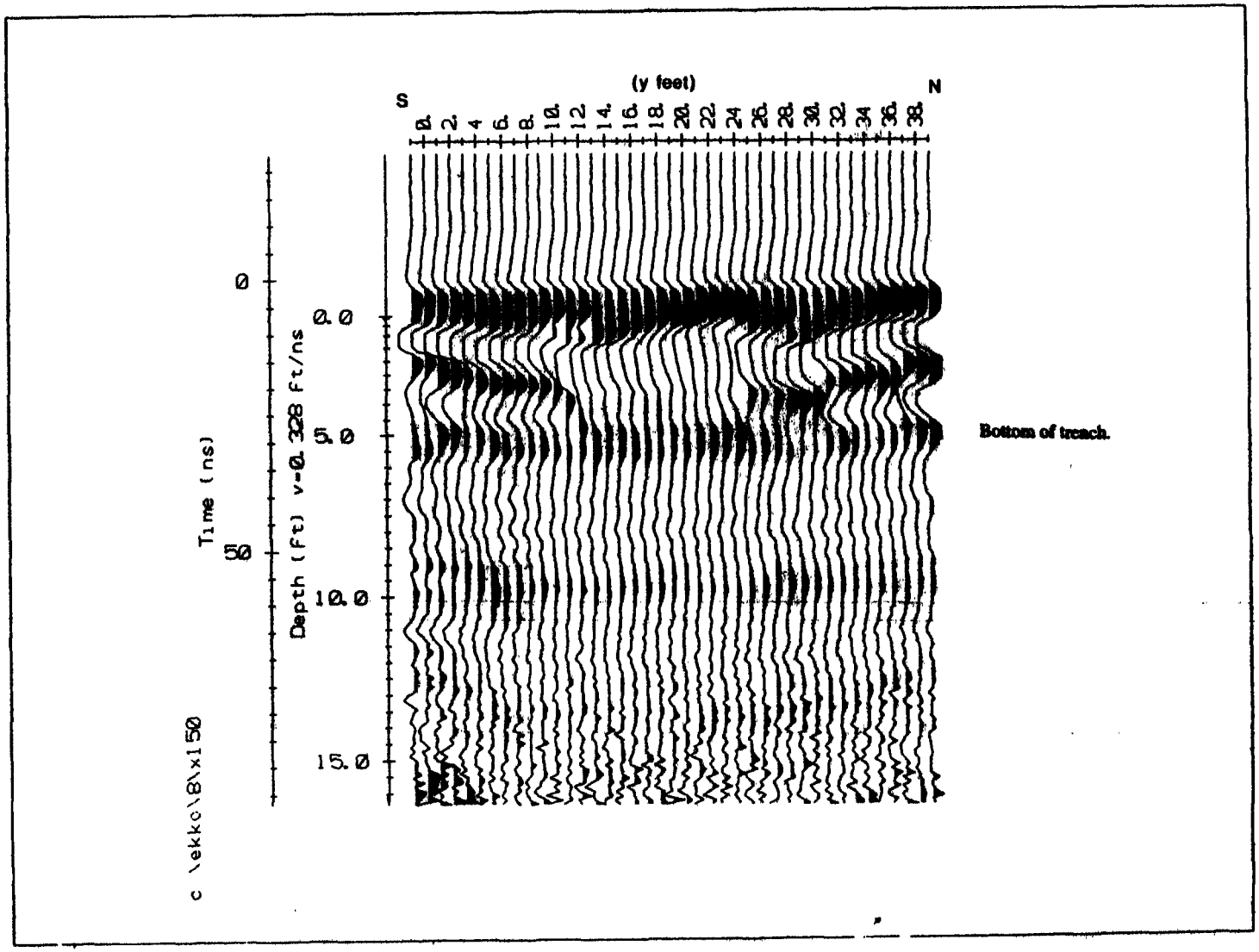


RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 8
SOUTH TO NORTH ORIENTATION AT X=140 FEET
JUNE 1995

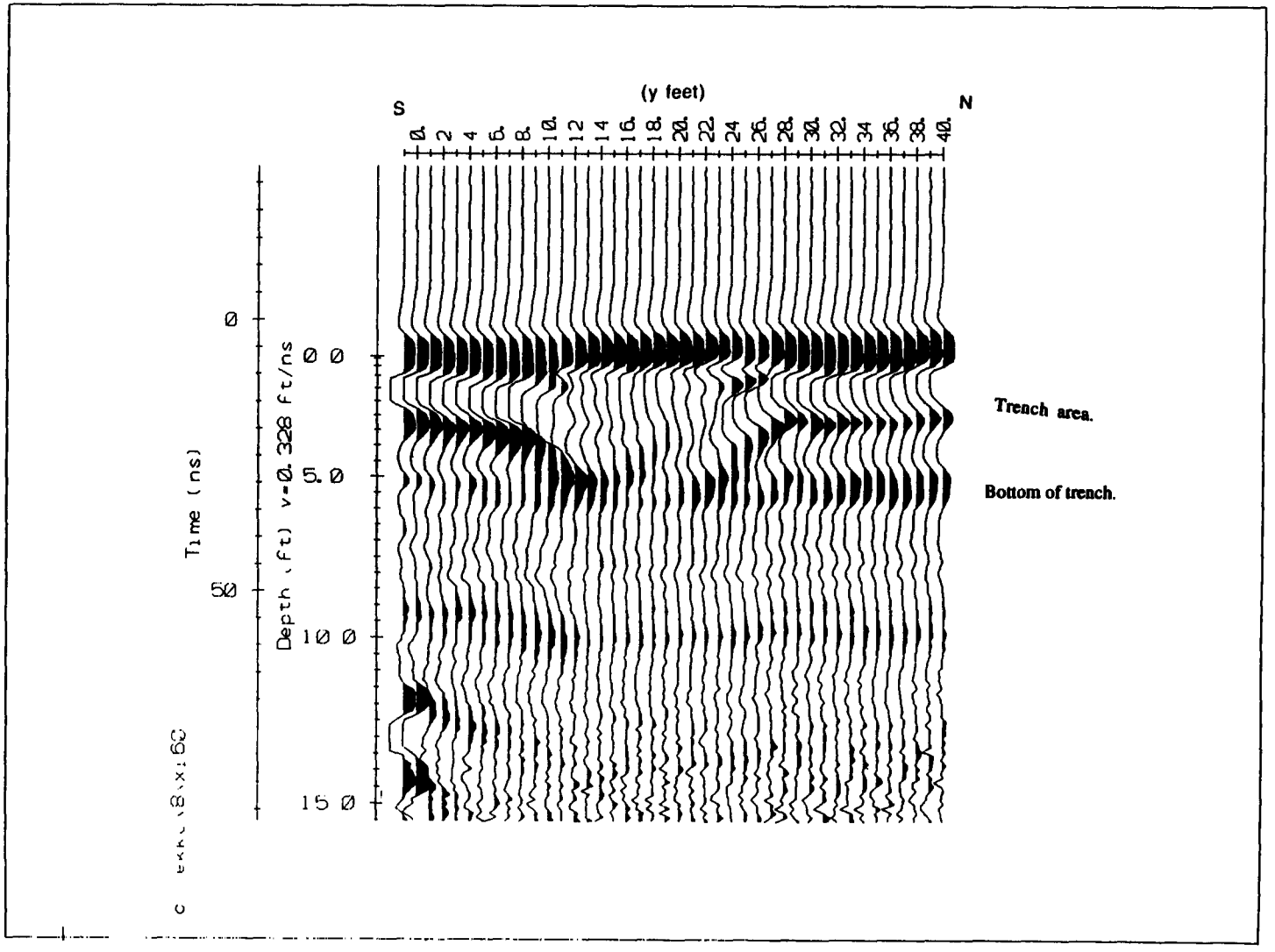


357

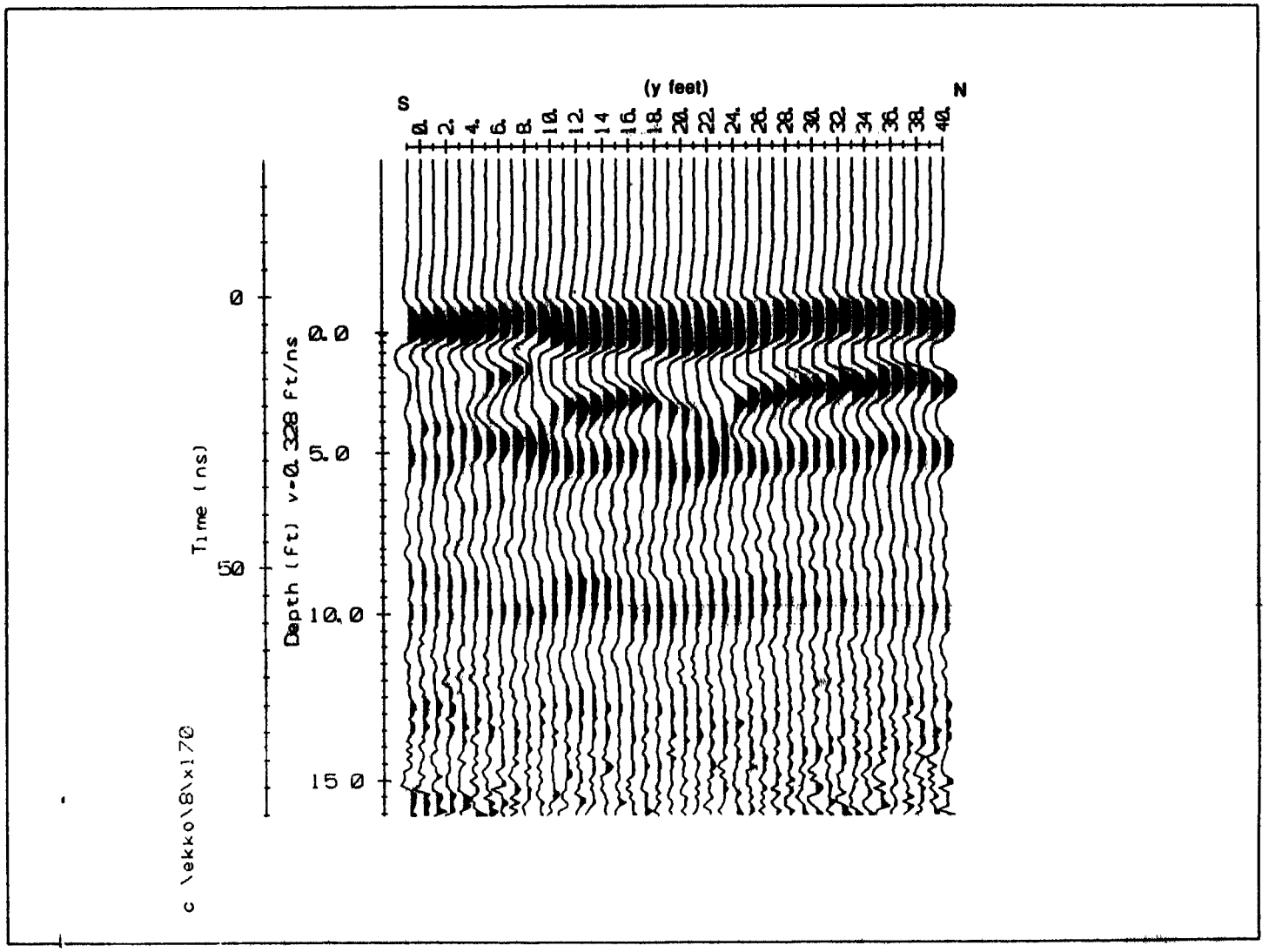
RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-8
SOUTH TO NORTH ORIENTATION AT X=150 FEET
JUNE 1995



RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-8
SOUTH TO NORTH ORIENTATION AT X=160 FEET
JUNE 1995



RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-8
SOUTH TO NORTH ORIENTATION AT X=170 FEET
JUNE 1995



354

Exhibit 3.7.D
Trench T-8 Borehole Logs

555

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT)	5949 50	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749515	AREA T 8 THSS 111 5	CASING DIAMETER (IN)		GEOLOGIST	JP GIROD	12795
EAST	2087948	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	1 00	DATE DRILLED	04/28/95	
REMARKS	OU2 TRENCHES						

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5949	0				0 0-1 0' No sample collected
				0 50 /3 00	5948	1			GC	1 0-1 5' Clayey Gravel with some sand and silt dark yellow brown, poorly graded, f-c grained, qtzite, quartz, gravel consists of crushed cobbles, FeOx staining on sand grains and gravel, dry No recovery (1 5-3 0')
					5947	2				
					5946	3			GP	3 0-5 0' Sandy Gravel with some clay and silt White to yellow-orange, poorly graded, f-c grained, quartzite, quartz, gravel consists of crushed cobbles, Fe Ox staining, dry Hole offset twice for 3 0-8 0' sample recovery No recovery (5 0-8 0')
					5945	4				
	BH2075UC			2 00 /5 00	5944	5				
					5943	6				
					5942	7				
					5941	8			GP	8 0-10 0' Sandy Gravel with some clay and silt poorly graded, f-c grained quartzite, quartz, gravel consists of broken up cobbles, FeOx staining, dry, olive brown to yellow orange
				2 00 /2 00	5940	9				
						10				Total Depth Drilled 10 00

376

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT) 5949 10	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749527	AREA T 8, IHSS 111 5	CASING DIAMETER (IN)	GEOLOGIST	JP GIROD	12895
EAST	2087982	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED	04/28/95	
REMARKS	OU2 TRENCHES					

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%		5949	0				0 0-1 0' No sample collected Push directly to 1 0'
				0 50 /3 00	5948	1			GC	1 0-1 5' Clayey Gravel with some sand and silt poorly graded, f-c grained, dry yellow orange to dark yellow brown Started sampling at 1 0' depth of run #1 No recovery (1 5 3 0')
					5947	2				
					5946	3			GC	3 0-4 0 Clayey Gravel with abundant sand and some silt poorly graded, f c grained, FeOx staining, orange yellow to dark yellow brown, gravel (broken up cobbles), dry No recovery (4 0-6 0)
				1 00 /3 00	5945	4				
	BH20753AC				5944	5				
					5943	6			GC	6 0-7 0' Same as 3 0-4 0' above No recovery (7 0-8 0')
				1 00 /2 00	5942	7				
					5941	8			GP	8 0-10 0' Sandy Gravel with some clay and silt poorly graded, f-c grained, yellow-orange FeOx staining, gravel (broken up cobbles), dry Hole offset 1 0' to west to recover sample from 8 0-10 0'
	[illegible]AC			2 00 /2 00	5940	9				
						10				Total Depth Drilled 10 00

357

3 8 Trench T-9 (IHSS 111 6)

Trench T-9 was investigated using the following methodologies

- Historical data were compiled to identify potential contaminants, trench location, and size
- Aerial photographs were examined to identify disturbed areas verify trench dimensions, and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- Two EM surveys were conducted to locate buried metallic objects and define trench boundaries
- GPR surveys were conducted to better determine trench depth and dimensions
- Soil gas surveys were conducted to identify and delineate contaminant plumes
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the trench

As shown in Figure 3 8-1, Trench T-9 is located approximately 1,500 feet east of the 903 Pad and south of the East Access Road The dimensions of the trench are approximately 210 feet long, 20 feet wide and 10 feet deep The trench was reportedly used for disposal of sanitary sewage sludge potentially contaminated with uranium and plutonium and flattened empty drums contaminated with uranium Activities of the sewage sludge were reported between 382 pCi/g and 3,590 pCi/g Older sludge had mostly uranium with an increasing plutonium fraction in later sludge placed in the trenches Total alpha radioactivity in the trench is estimated to be 100 to 150 millicurie (0 1 Ci to 0 15 Ci) Trench T-9 may also contain some asphalt planking from the Solar Evaporation Ponds contaminated with plutonium and uranium The pertinent section of HRR is presented in Exhibit 3 8 A (PAC Reference Number NE111 1-NE111 8)

Although the general location of Trench T-9 was known, the exact location of the trench had not been physically identified prior to the Trenches Area and Mound Site Characterization Program of 1995 Aerial photographs dating from 1954 through 1974 were examined to ascertain the period of operation, approximate the length and width, identify staging areas, and gather information which might confirm the contents of the trench (Colorado Aerial Photo Service, 1993) Photographs from 1962 through 1970 reveal an area approximately 20 feet wide by 210 feet long of dark staining and disturbed soil The location and dimensions of this staining and soil disturbance are consistent with information from the Historical Release Report

3 8 1 Geology

The stratigraphy in the Trench T-9 area consists of Rocky Flats Alluvium overlying claystone of the Arapahoe Formation Alluvial deposits are approximately 17 to 26 feet thick Artificial fill deposits correspond with the area identified as Trench T-9 The claystone bedrock in the area of IHSS 111 6 is approximately 26 feet bgs (EG&G 1995c) The hydrograph from monitoring well 07991, located within the IHSS boundary, indicates that groundwater fluctuates between 16 feet bgs to below the alluvium/bedrock contact

3 8.2 Site Visual Survey and Geophysical Surveys

After aerial photographs were examined, a visual survey of the Trench T-9 area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general area of Trench T-9 Again, soil disturbances such as mounding and subsidence were identified and recent geologic characterization information were used to delineate between unconsolidated Rocky Flats Alluvium and soil disturbance caused by construction related activities Evidence of fill material deposits were also noted In addition to the geologic characteristics of the area, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material. The area did not show any evidence of surficial water or seeps

Upon completion of the visual survey, a geophysical grid was laid out using pin flags. The total grid dimensions are 45 feet wide (north-south) by 210 feet long (east-west) with flags placed at five foot increments

EM-31 Survey

After establishing the geophysical grid, an EM-31 survey was performed The initial data collected from the survey depicts the general area of the trench which is 10 to 17 feet wide and extends lengthwise for approximately 200 feet Anomalies are present that represent metallic or conductive materials within the trench Anomalies north and south of the trench are probably related to saturated soil conditions EM-31 survey results are presented in Exhibit 3 8.B

EM-61 Survey

To further define the physical characteristics of the grid area, an EM-61 survey was also performed. As seen in the EM-31 survey results, the EM-61 survey located several isolated anomalies, some corresponding with high conductivity areas on the EM-31 surveys These anomalies depict the area

within the trench most likely to contain buried metallic objects The small isolated anomalies south of the trench are fence posts EM-61 survey results are presented in Exhibit 3 8 C

Ground Penetrating Radar

GPR was used in conjunction with the EM-31 and EM-61 surveys This information allows for a more definitive determination of the walls and horizontal extent of Trench T-9 Results from the GPR survey indicate the trench bottom to be approximately 10 to 14 feet bgs The width of the trench appears to vary between 16 and 20 feet and the trench length appears to be approximately 200 feet The GPR also indicates the presence of dense material located in the east and west ends of the trench These areas are between 2 and 12 feet bgs This data is consistent with the findings of the EM surveys and is presented in Exhibit 3 8 D

3 8 3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995 the vadose zone within Trench T-9 area was highly saturated The increased soil moisture content tended attenuate soil gas readings, making sample collection difficult However 50 samples were collected and analyzed for total volatile organic content using field instrumentation Seventeen confirmatory samples were analyzed using general chemistry method 8010

Based on the trench boundaries determined by the geophysical surveys, soil gas sampling locations were placed along two horizontal lines located four feet on either side of the centerline of the trench Soil gas samples were collected every 15 feet along these lines at depths of five and 10 feet bgs

Results of the soil gas survey were inconclusive due to the moisture in the soil and the methodologies used Concentration ranged from 0-1765 ppm The analyses indicated spotty VOC contamination over the entire trench with no indication of a VOC plume Results of the soil gas investigation are presented in Figure 3 8-2

3 8 4 Subsurface Soil Sampling

Subsurface soil sampling from the Trench T-9 area was the final step of the characterization activities Three borehole locations (12295, 12395 and 12495) within the trench were selected for soil sampling based up the findings of the aerial photograph search the geophysical surveys and the soil gas survey results Lithologic descriptions of each boreholes is presented in Exhibit 3 8 E Four boreholes and wells (04291 BH4887 BH4987 and BH4787) were drilled and sampled previously

The data from these two investigations indicate elevated levels of one organic compound, metals, and radionuclides Figure 3 8-3 identifies those boreholes that characterize Trench T-9

Organic Compounds

Results from the subsurface soil sampling within Trench T-9 showed one value of trichloroethene (16 mg/kg) detected at a concentration above the RFCA Subsurface Soil Action Levels as shown in Table 3 8-1

Metals

Arsenic (range 18 5-22 8 mg/kg), cadmium (range 1 6-3 6 mg/kg), calcium (range 72,800-109,000 mg/kg), copper (79 7 mg/kg), lead (range 33 6-39 5 mg/kg), mercury (1 4 mg/kg), and silver (219 mg/kg) concentrations exceeded the background $UTL_{99/99}$ as presented in Table 3 8-2

Radionuclides

Gross beta (54 48 pCi/g), americium-241 (range 0 02-0 04 pCi/g), cesium-137 (0 10 pCi/g), plutonium-239/240 (range 0 06-0 15 pCi/g), uranium-233/234 (11 4 pCi/g), uranium-235 (0 53 pCi/g), and uranium-238 (11 95 pCi/g) activities exceeded the background $UTL_{99/99}$ as presented in Table 3 8-3

3 8 5 Groundwater

Gross beta (7 289 pCi/L), uranium-233,234 (4 0766 pCi/L), and uranium-238 (3 065 pCi/L) activities exceeded the RFCA Tier II Groundwater Action Levels in well 4291 as presented in Table 3 8-4

3.8.6 Summary

Geophysical data indicates that trench is 16 to 20 feet wide, 200 feet long, and approximately 10 to 14 feet deep which corresponds to 1,180 to 2,070 cy of buried material The survey indicates the presence of buried metallic objects in the east and west ends of the trench The GPR confirms the presence of dense material in these area.

There is no indication of a VOC plume or a conductive plume

Trichloroethene was detected at one concentration that exceeded the RFCA Subsurface Soil Action Level but less then the PPRG for subsurface soil, construction worker scenario There were seven

361

metals detected at concentrations exceeding the background $UTL_{99/99}$ values but less than the PPRGs for subsurface soils, construction worker scenario There were seven radionuclides with observed activities exceeding the background $UTL_{99/99}$ values but less than the PPRGs for subsurface soils, construction worker scenario Three radionuclide activities exceeded the RFCA Tier II Groundwater Action Levels Based on sporadic and low-level detections of contaminants, Trench T-9 does not require remedial action

Trench T-9 summary information is presented in Table 3 8-5

Table 3 8-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
Trench T 9	12395	BH20759WC	3-8	5/1/95	Tetrachloroethene	16	0 005		11 5	Y

LABORATORY QUALIFIERS

VALIDATION CODES
Y = Analytical results in validation process

Table 3 8-2 Subsurface Soil Metal Concentrations Exceeding UTL_{BKG} Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND UTL_{BKG}
Trench T-9	12295	BH20757WC	3-6	5/1/95	Calcium	72600	1000		Y	53250
Trench T-9	12295	BH20759WC	3-6	5/1/95	Calcium	108000	1000		Y	53250
Trench T-9	12495	BH20763WC	3-6	5/1/95	Cadmium	2.4	1		Y	1.33
Trench T-9	12495	BH20763WC	3-6	5/1/95	Copper	79.7	8		Y	49.1
Trench T-9	12495	BH20763WC	3-6	5/1/95	Lead	39.5	0.6		Y	31
Trench T-9	12495	BH20763WC	3-6	5/1/95	Mercury	1.4	0.1		Y	1.18
Trench T-9	12495	BH20763WC	3-6	5/1/95	Silver	219	2		N	33.1
Trench T-9	BH4987	BH20763WC	3-6	5/1/95	Arsenic	22.6			N	16.2
Trench T-9	BH4987	BH48670006	6-7.14	9/1/95	Cadmium	2.4			N	1.33
Trench T-9	BH4987	BH48670006	6-7.14	9/19/97	Cadmium	1.6			N	1.33
Trench T-9	BH4987	BH48671313CT	132, 15.11	9/18/97	Cadmium	1.9			N	1.33
Trench T-9	BH4987	BH48671159R	15.2-18.7	9/17/97	Arsenic	108000			N	53250
Trench T-9	BH4987	BH48670006	6-7.14	9/17/97	Cadmium	18.5			N	16.2
Trench T-9	BH4987	BH48672419R	24.14-25.64	9/19/97	Cadmium	2.4			N	1.33
Trench T-9	BH4987	BH48670006	6-7.3	9/21/97	Cadmium	3.6			N	1.33
Trench T-9	BH4987	BH48670619	6-15.54	9/18/97	Lead	33.6			N	31
Trench T-9	BH4987	BH48672419R	24.14-25.64	9/21/97						

LABORATORY QUALIFIER

VALIDATION CODES
N = Will not be validated
Y = Analytical results in validation process

Table 3 8-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{90/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{90/99}$
Trench T 9	12295	BH20757WC	3-8	5/1/95	Gross Beta	52 48	3 62	6 01	Y	42
Trench T 9	12295	BH20757WC	3-8	5/1/95	Plutonium 239 240	0 09	0 006	0 022	Y	0 025
Trench T 9	12295	BH20757WC	3-8	5/1/95	Uranium-233 234	11 14	0 014	1 38	Y	3 441
Trench T 9	12295	BH20757WC	3-8	5/1/95	Uranium 235	0 53	0 006	0 093	Y	0 153
Trench T 9	12295	BH20757WC	3-8	5/1/95	Uranium 238	11 95	0 011	1 48	Y	1 807
Trench T 9	12395	BH20760WC	8 10	5/1/95	Plutonium 239 240	0 1	0 01	0 025	Y	0 025
Trench T 9	12495	BH20763WC	3-6	5/1/95	Plutonium 239 240	0 06	0 004	0 02	Y	0 025
Trench T 9	BH4887	BH488710UC	6-7 14	9/17/87	Americium-241	0 03		0 07	N	0 022
Trench T 9	BH4887	BH48870006	6-7 14	9/16/87	Plutonium 239 240	0 15		0 14		0 025
Trench T 9	BH4887	BH488710UC	6-7 14	9/17/87	Plutonium 239 240	0 03		0 1		0 025
Trench T 9	BH4987	BH498720UC	20-22	9/21/87	Americium 241	0 04		0 07	N	0 022
Trench T 9	BH4987	BH49870008	6-7 3	9/18/87	Plutonium-239 240	0 1		0 13		0 025

VALIDATION CODES
N = Will not be validated
Y = Analytical results in validation process

365

Table 3 8-4 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T 9	4291	GW02924IT	5/19/92	Gross Beta	7 289	1 8	1 57	A	5
Trench T 9	4291	GW02924IT	5/19/92	Uranium-233,234	4 066	0 108	1 05	A	1 07
Trench T-9	4291	GW02924IT	5/19/92	Uranium-238	3 065	0 304	0 898	A	0 768

VALIDATION CODES
A = Result accepted with qualifications

TABLE 3.8-5 TRENCH T-9 SUMMARY INFORMATION

CONTAMINANTS		
Media· Subsurface Soils		
Greater than $UTL_{99/99}$	Greater than RFCA Standards	Greater than PPRGs
	Trichloroethene	
Arsenic Cadmium Calcium Copper Lead Mercury Silver		
Gross beta Americium-241 Cesium-137 Plutonium-239/240 Uranium-233/234 Uranium-235 Uranium-238		

Media. Groundwater			
Greater than $UTL_{99/99}$	Greater than RFCA Tier II Standards	Greater than RFCA Tier I Standards	Greater than PPRGs
	Gross beta Uranium-233,234 Uranium-238		

PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
200	16-20	10-14	1,180-2,070	Yes	No

Exhibit 3.8.A
Trench T-9 Historical Release Report Information

Best Available Copy

PAC REFERENCE NUMBER NE 111 1 NE 111 8

CASS Reference Number 111 1 111 8 Operable Unit 2

Unit Name Trenches T-4 through T-11

Approximate Location N750 000 E2 087,500

Date(s) of Operation or Occurrence

The exact dates of operation are unknown except for the period of July 29 1954 through August 14 1968[1] Trenches T 9 T-10 and T 11 were differentiated from the other trenches and added to the disposal trench inventory in 1977[2] See the "Comments" section below for additional discussion of this point

Description of Operation or Occurrence

Trenches T-4 through T 11 along with Trench T 2 (PAC 900 109) and Trench T 3 (PAC NE 110) were used primarily for the disposal of sanitary wastewater treatment plant sludge The sludge removed from the wastewater treatment plant was placed on sludge drying beds The dried material removed from the sludge drying beds was placed in the disposal trenches The sanitary sludge disposal trenches are reported to be approximately 10 feet deep and are provided with two feet of soil cover[3] The trenches are variable in length with the average length being approximately 250 feet.[4] The total amount of sludge disposed in Trenches T 2 through T 11 is estimated at 125 000 kilograms[5] Some amounts of additional materials were also disposed in Trenches T-4 T 9 and T 11 These other materials consisted of asphalt planking (approximately 130 000 square feet of asphalt planking) in T-4 and T 11 from the re-design of Solar Pond 207A (PAC 000-101) in 1963 and scrap metal and junk in T 9[5]

At the same time that Trenches T 9 T 10 and T 11 were identified [illegible] it appears that the numbering system for the trenches was slightly modified Whereas earlier documents had presented a consistent numbering system in a 1983 document a trench that had previously been referred to as [illegible] became T 11[5] This 1983 document placed the T-4 trench essentially as an addition to Trench T 3[5] [illegible] 1983 document designated Trench T 9 as essentially an extension of Trench T 7[5] but in earlier documents [illegible] referred to as Trench T 5[1] Trench T 10 had not been identified or named prior to 1983 [illegible] as Trench T 5 in the 1983 document was a trench not previously identified (comparison of maps [illegible] and 5)

Physical Chemical Description of Constituents Released

Some uranium and plutonium contamination is present [illegible] the older sludge would have [illegible] uranium contamination with newer sludge [illegible] plutonium contamination[1] [illegible] alpha activity present in the sludge was [illegible] of 382 pCi/g in August 1964 [illegible] of 3 591 pCi/g in June 1960[1] Uranium contamination [illegible] in flattened drums that may have been disposed in any of trenches T 2 through T [illegible] contaminated oils that had been held in the drum[6] The burning of the contaminated oil [illegible] in Oil Burn Pit No 2 (PAC 900-153) from March 1957 to mid 1965[6] not in the trenches These [illegible] up to 200 in total number could be present in any of Trenches T 3 through T [illegible] in a 1973 document that Trench T-4 [illegible] designated Trench T 11 as discussed above) contain [illegible] 235

On at least one occasion it is believed that 2 [illegible] gallons [illegible] generated in Building [illegible] was also disposed in one of the East Trenches [illegible] is believed that this is total alpha activity The activity of this material [illegible] approximately 1 3 [illegible] depleted uranium present in the waste [illegible] this material was in drums

Response to Operation or Occurrence

Soil [illegible] were collected from the three [illegible] trenches [illegible] in 1977 Trenches T 9 T 10 and T 11) during [illegible] time frame Soil from [illegible] 0 [illegible] pCi/g [illegible] activity and from [illegible] to [illegible] pCi/g uranium activity [illegible] to contain from 0 18 to 14 pCi/g plutonium

372

activity and from 40 to 126 pCi/g uranium activity. Trench T-11 was found to contain 4.5 to 50 pCi/g plutonium activity and 0.9 to 158 pCi/g in uranium activity.[5]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents disposed in Trenches T-4 through T-11. This IHSS is being studied in accordance with the IAG schedule for OU2. The IAG activities will include site investigations, site characterizations, and possible remediation. The Final Phase II RFI/RI Report is to be completed by March 12, 1995.

Comments

Trench T-3, along with these trenches, are also called the East Trenches.

Trenches T-4 through T-11 (PAC NE 111) have few operational differences from Trenches T-2 (PAC 900-109) and T-3 (PAC NE 110).

The sludge disposed of in these trenches should consist primarily of concentrated organic matter typically present in sanitary wastewater treatment plant sludge.

From August 1965 until February 1970 sanitary wastewater treatment plant sludge was disposed in the [illegible] landfill.[1] After February 1970, sanitary wastewater treatment plant sludge was shipped offsite for disposal.[9]

To date no documentation has been found that records the time frame during which any particular [illegible] receiving waste. Similarly, none of the HRR interviewees were knowledgeable on dates of operation of individual trenches.

The locations of these trenches on Plate 2 differ from the IAG map but are taken from the O[illegible] Work Plan [illegible]

References

[1] 1500793
1501719
[3] 1500898
[4] 1500[illegible]
[5] 1500899
[6] 1500656
[7] 1500579
[8] 1700445

Other references of interest

1500296
1600430
1500340
500287
500301
500304
1500458
1500888

1501097
1500769
1500[illegible]60
1500[illegible]
1500[illegible]37
1500[illegible]
1500921

373

Exhibit 3.8.B
Trench T-9 EM-31 Surveys

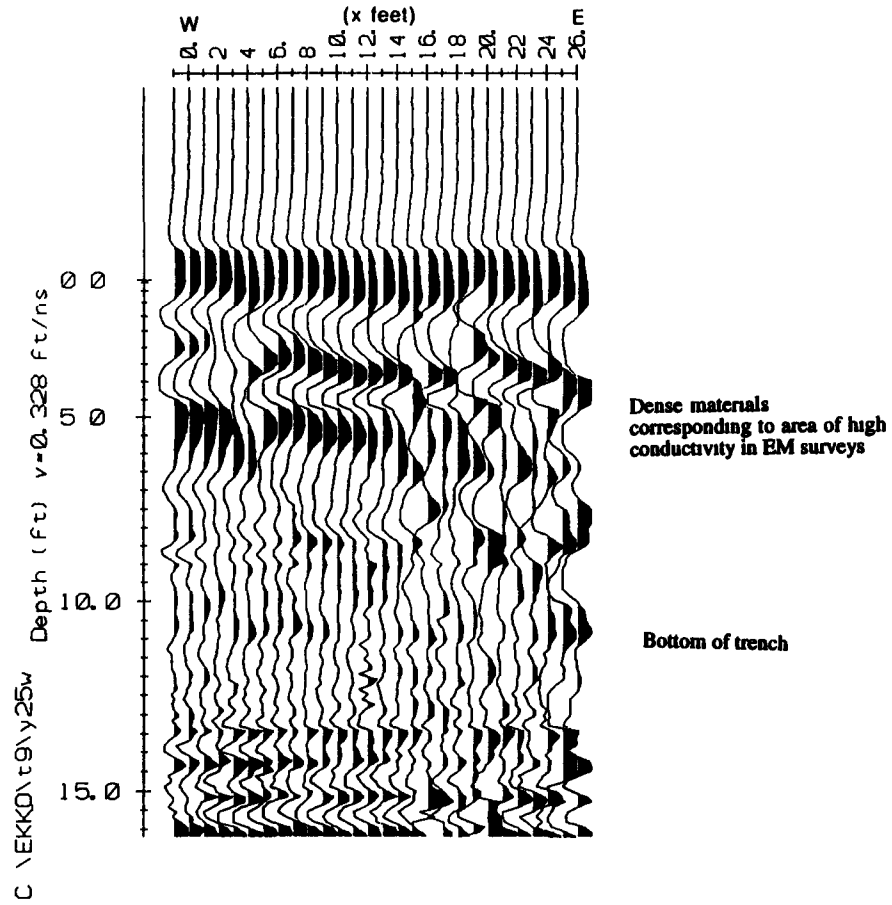
374

Exhibit 3.8.C
Trench T-9 EM-61 Surveys

379

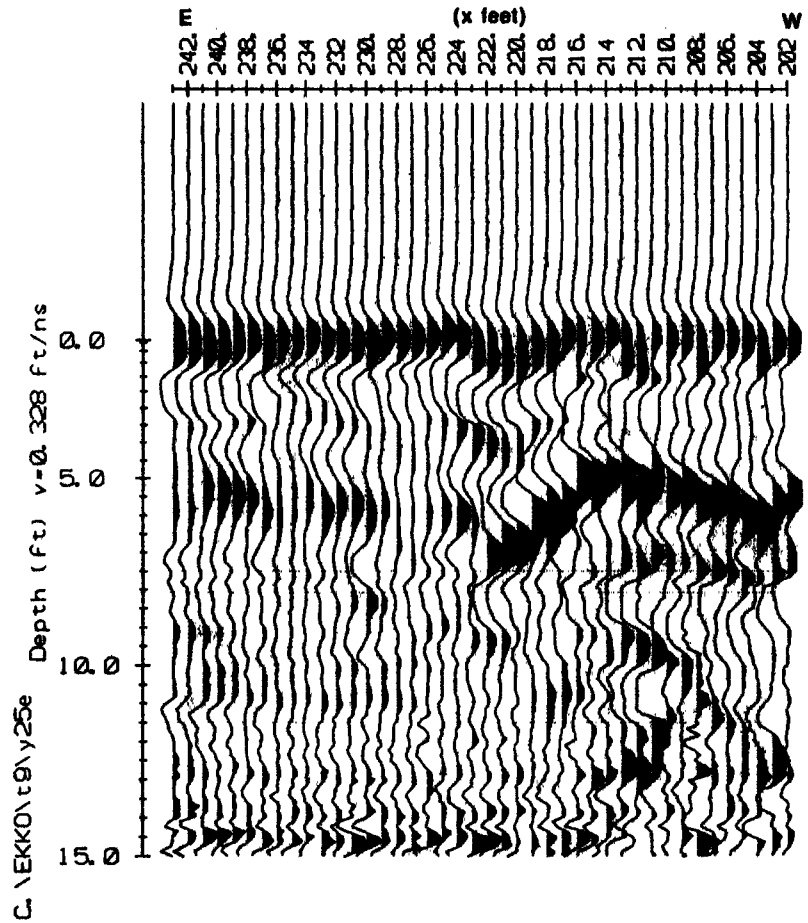
Exhibit 3.8.D
Trench T-9 Ground Penetrating Radar Surveys

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 9
WEST TO EAST ORIENTATION AT Y=25 FEET (WESTERN END)
JUNE 1995

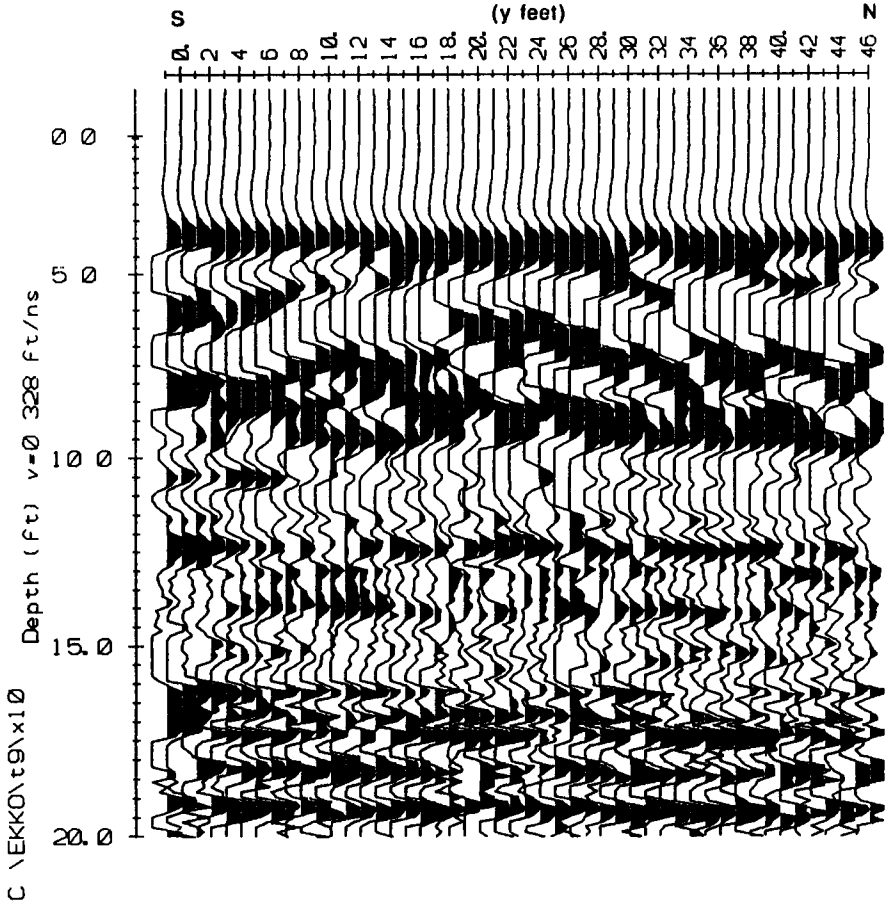


382

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-9
EAST TO WEST ORIENTATION AT Y = 25 FEET (EASTERN END)
JUNE 1995

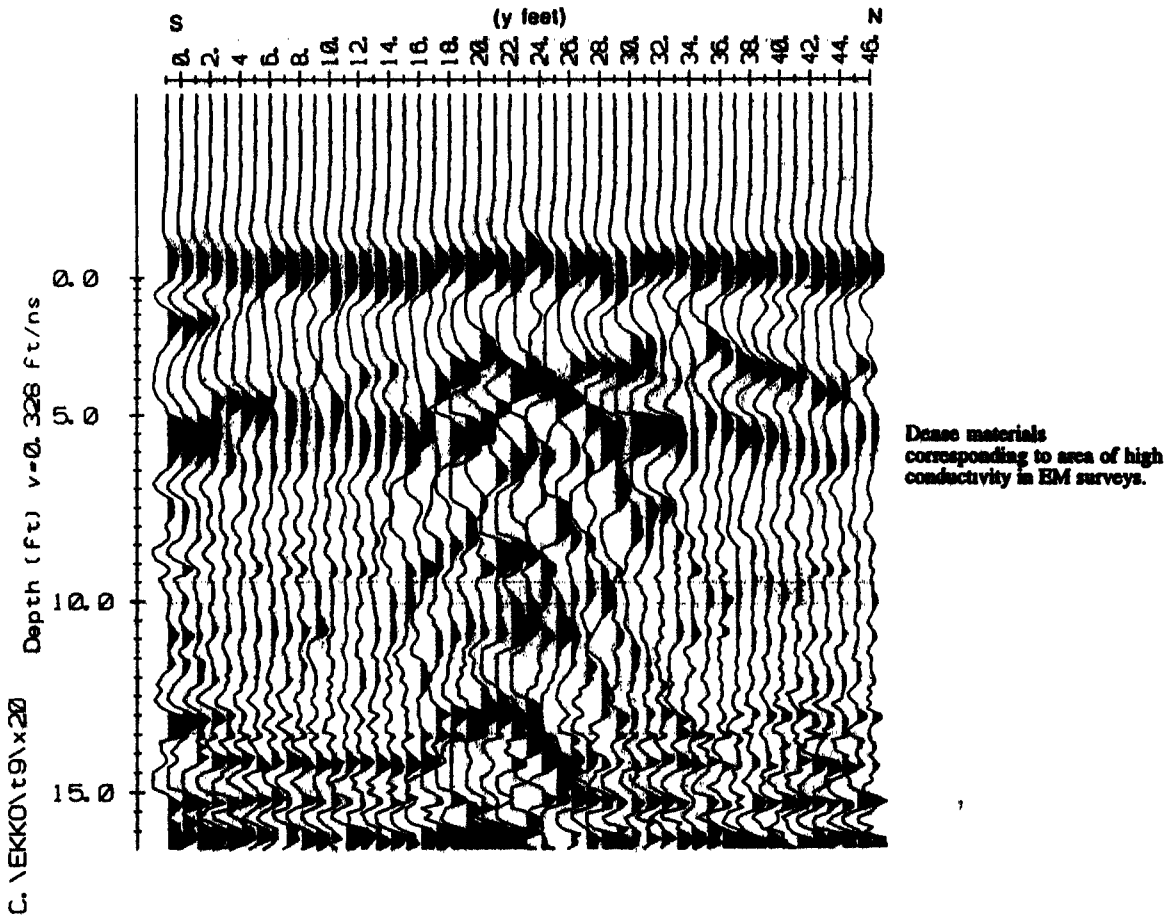


RFETS OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 9
SOUTH TO NORTH ORIENTATION AT X=10 FEET
JUNE 1995



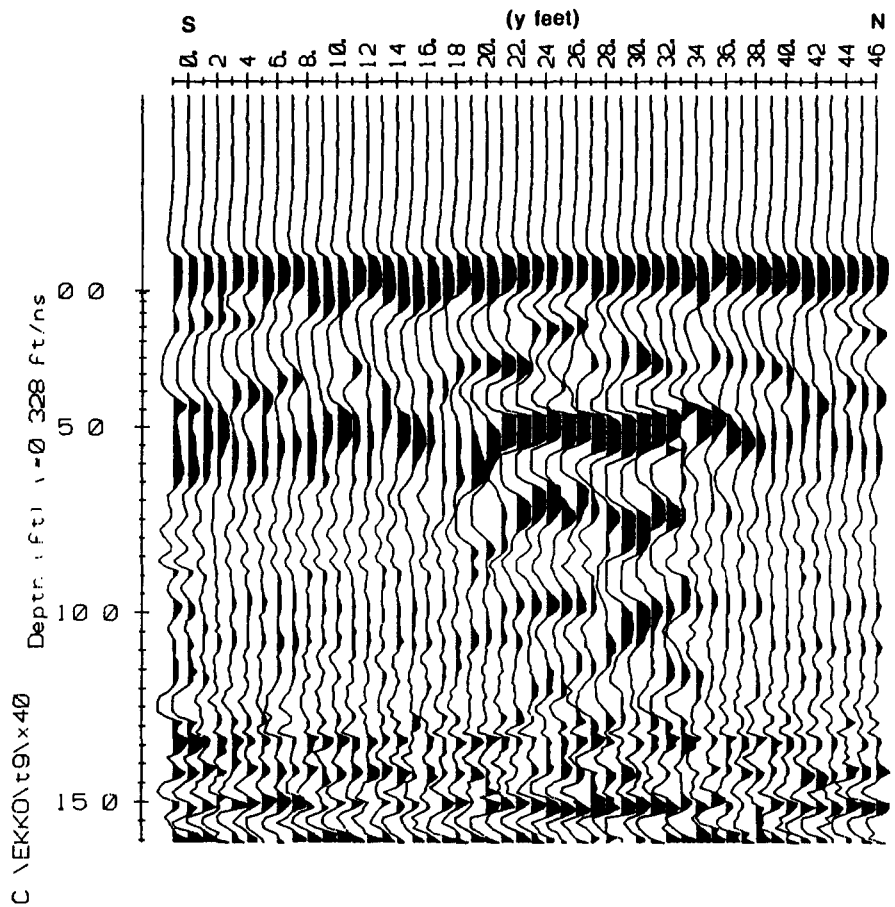
384

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-9
SOUTH TO NORTH ORIENTATION AT X=20 FEET
JUNE 1995



385

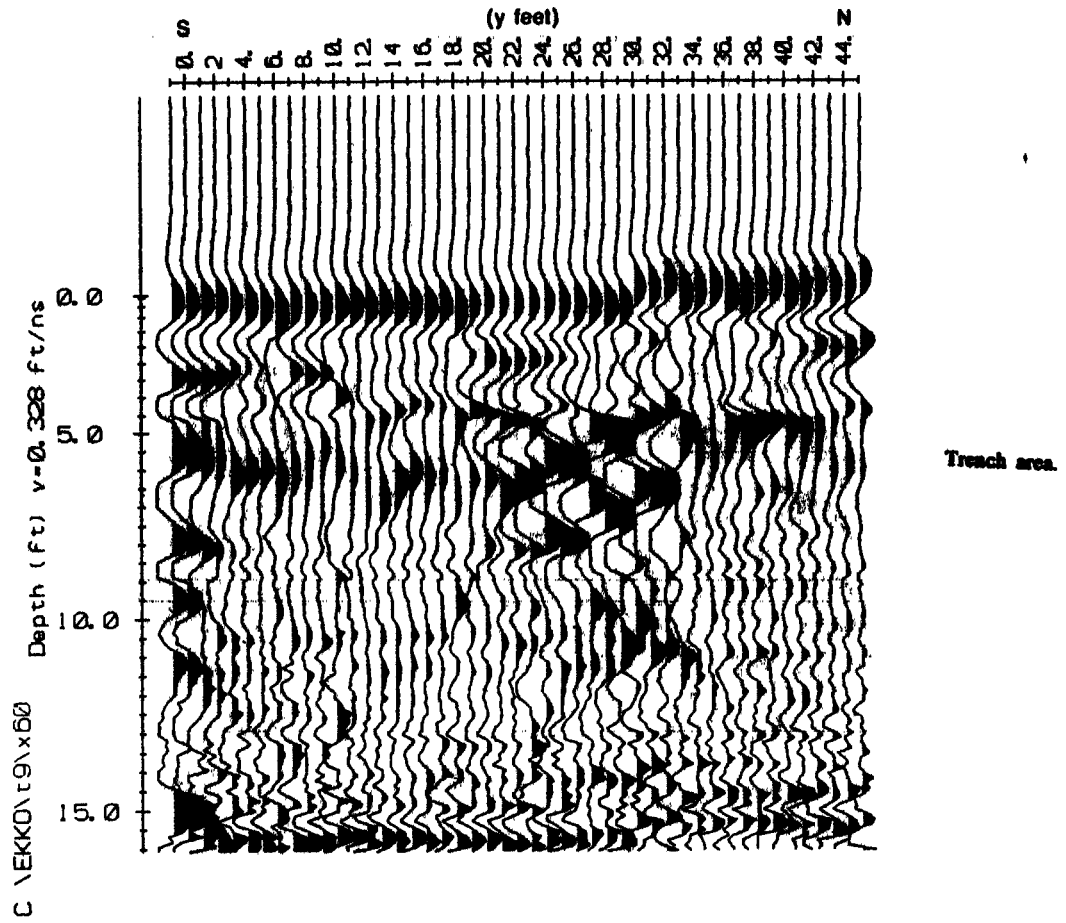
RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 9
SOUTH TO NORTH ORIENTATION AT X=40 FEET
JUNE 1995



Trench area.

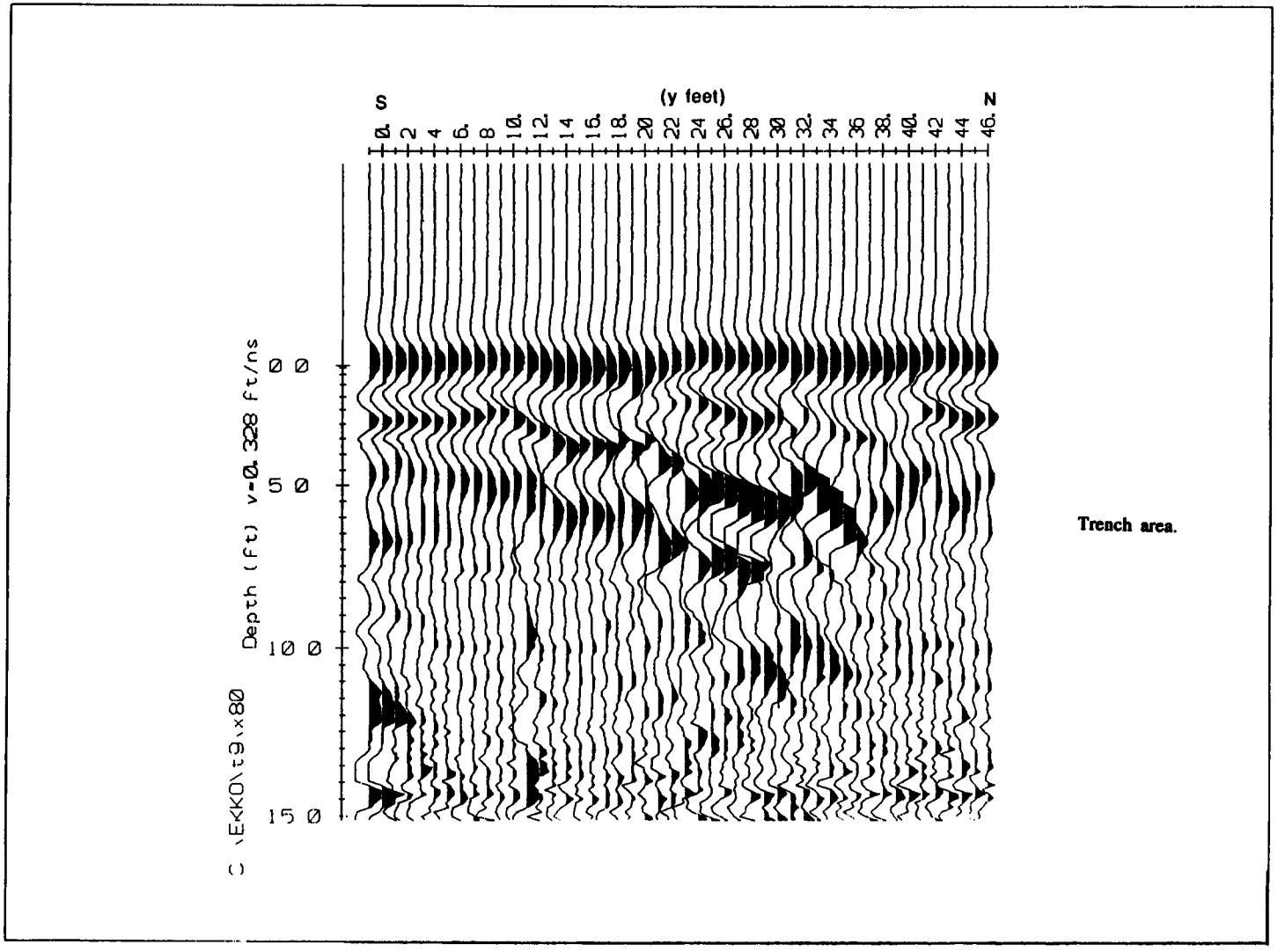
386

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-9
SOUTH TO NORTH ORIENTATION AT X=60 FEET
JUNE 1995



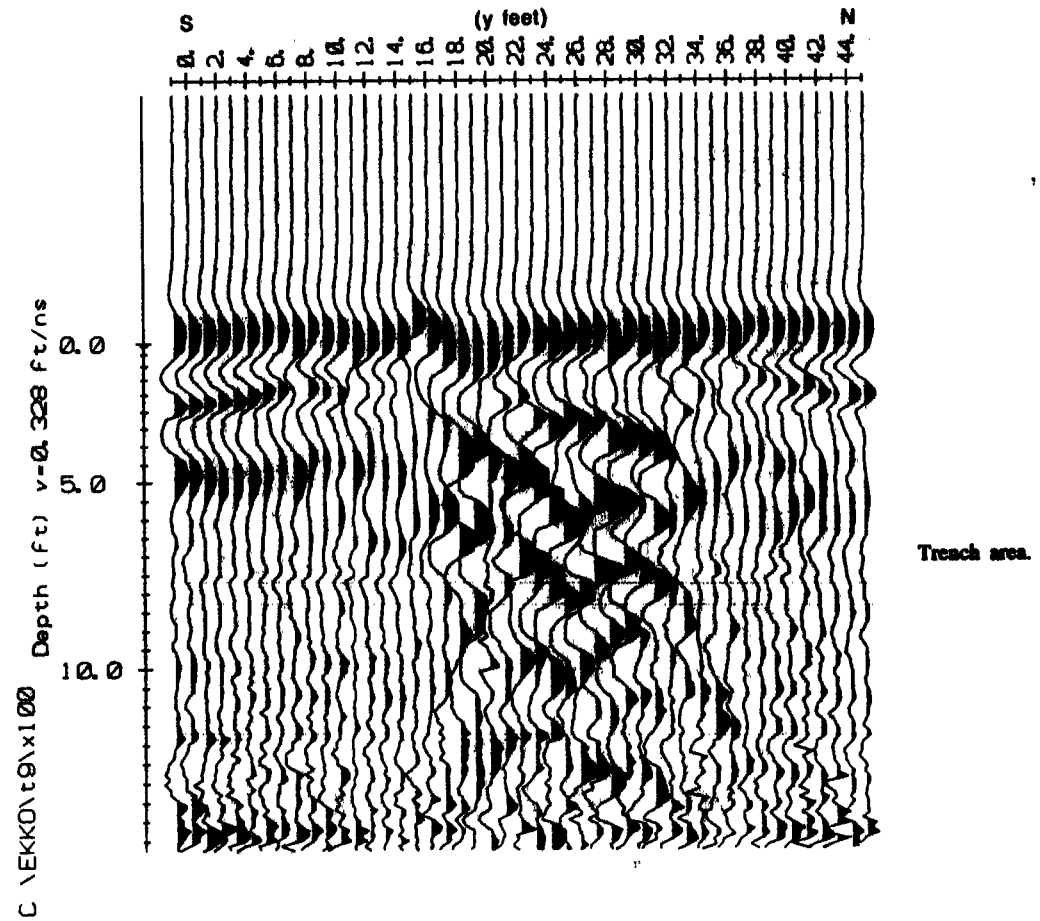
387

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-9
SOUTH TO NORTH ORIENTATION AT X=80 FEET
JUNE 1995



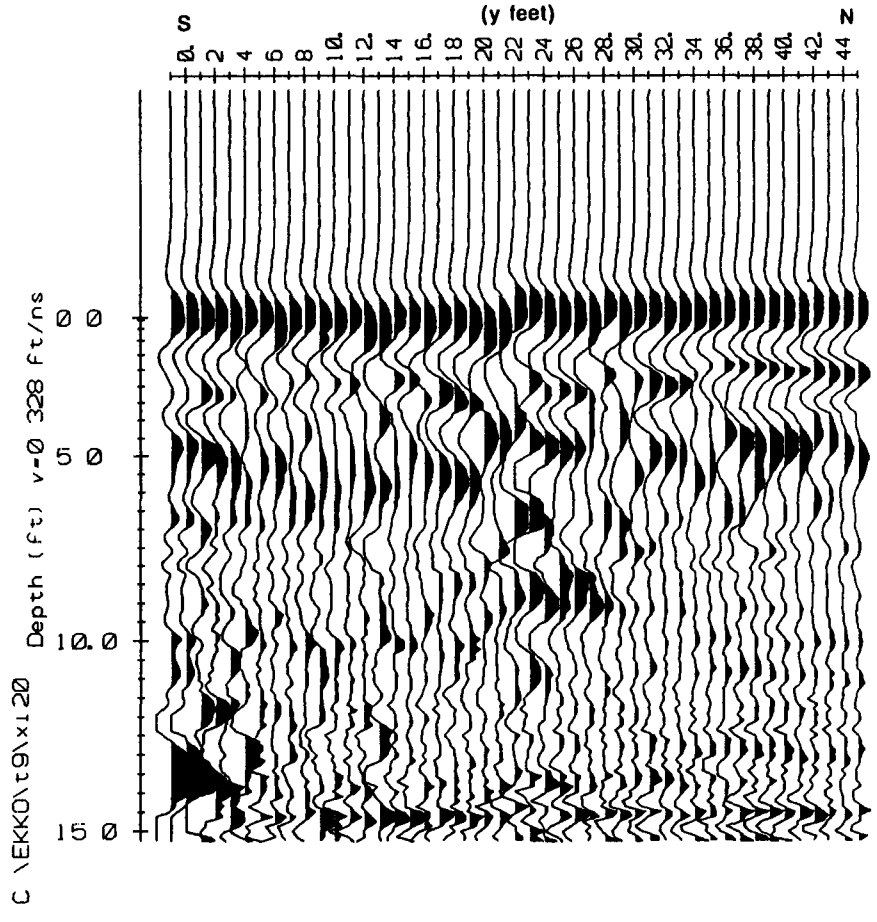
388

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-9
SOUTH TO NORTH ORIENTATION AT X=100 FEET
JUNE 1995



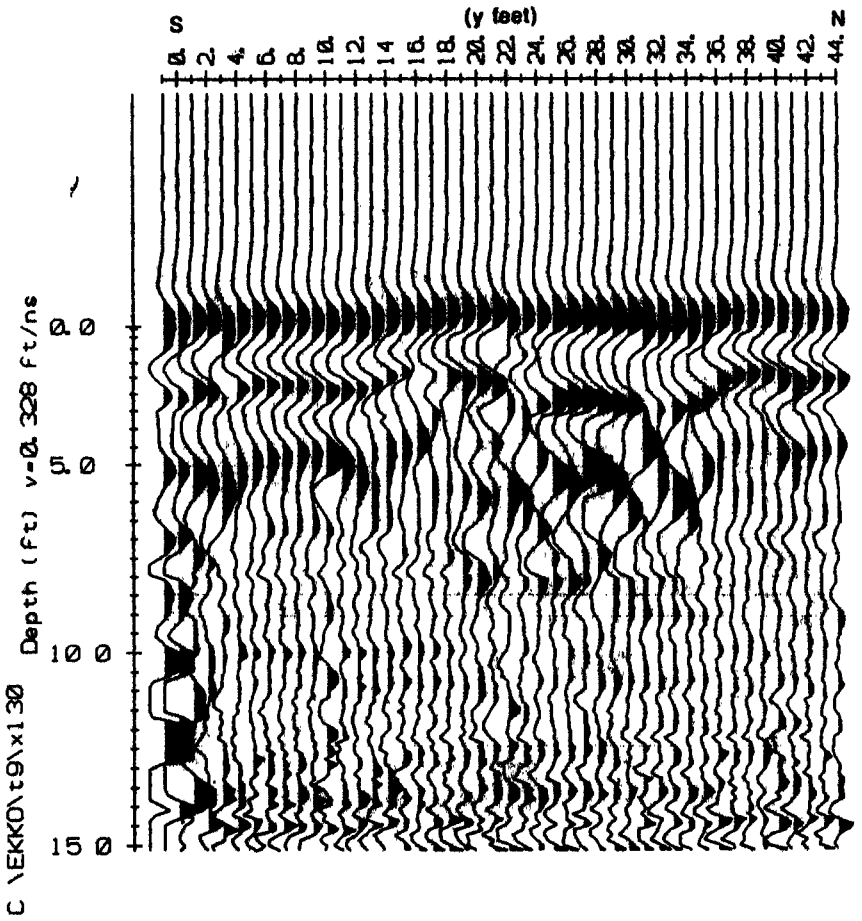
Trench area.

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 9
SOUTH TO NORTH ORIENTATION AT X=120 FEET
JUNE 1995



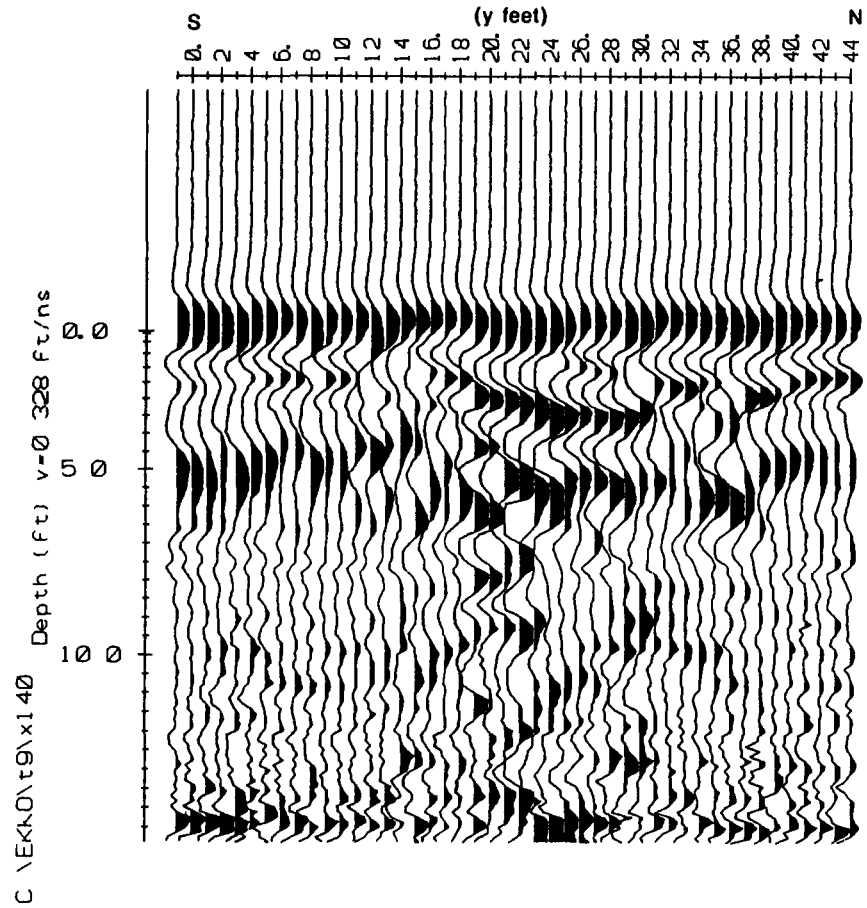
390

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-9
SOUTH TO NORTH ORIENTATION AT X=130 FEET
JUNE 1995



Trench area.

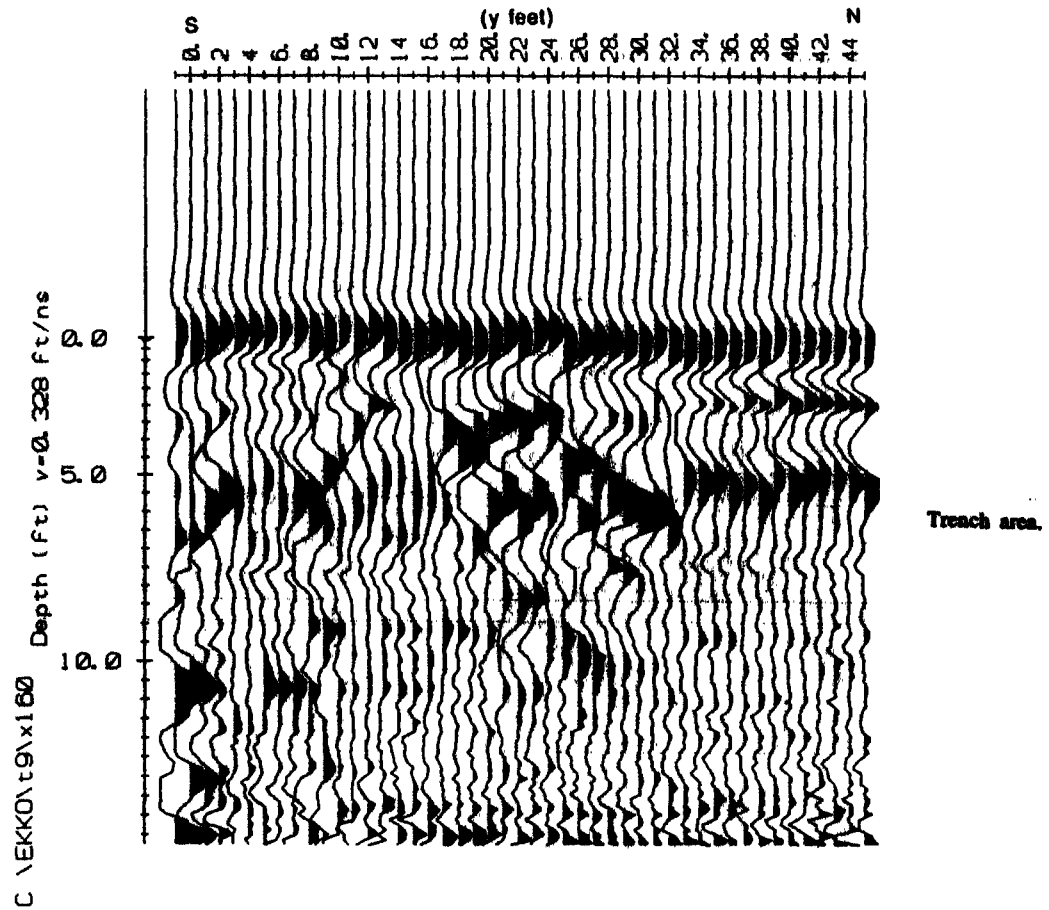
RFETS OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 9
SOUTH TO NORTH ORIENTATION AT X=140 FEET
JUNE 1995



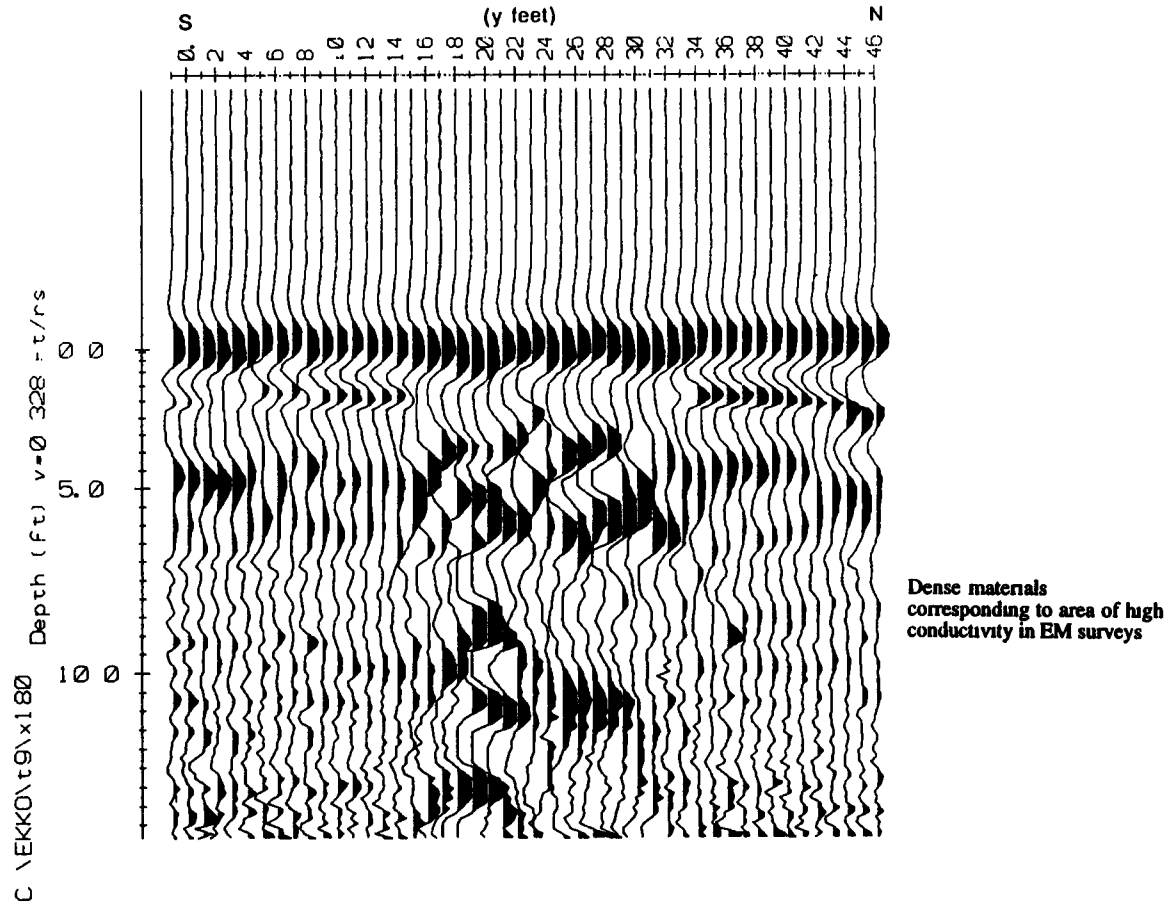
Trench area.

382

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-9
SOUTH TO NORTH ORIENTATION AT X=160 FEET
JUNE 1995

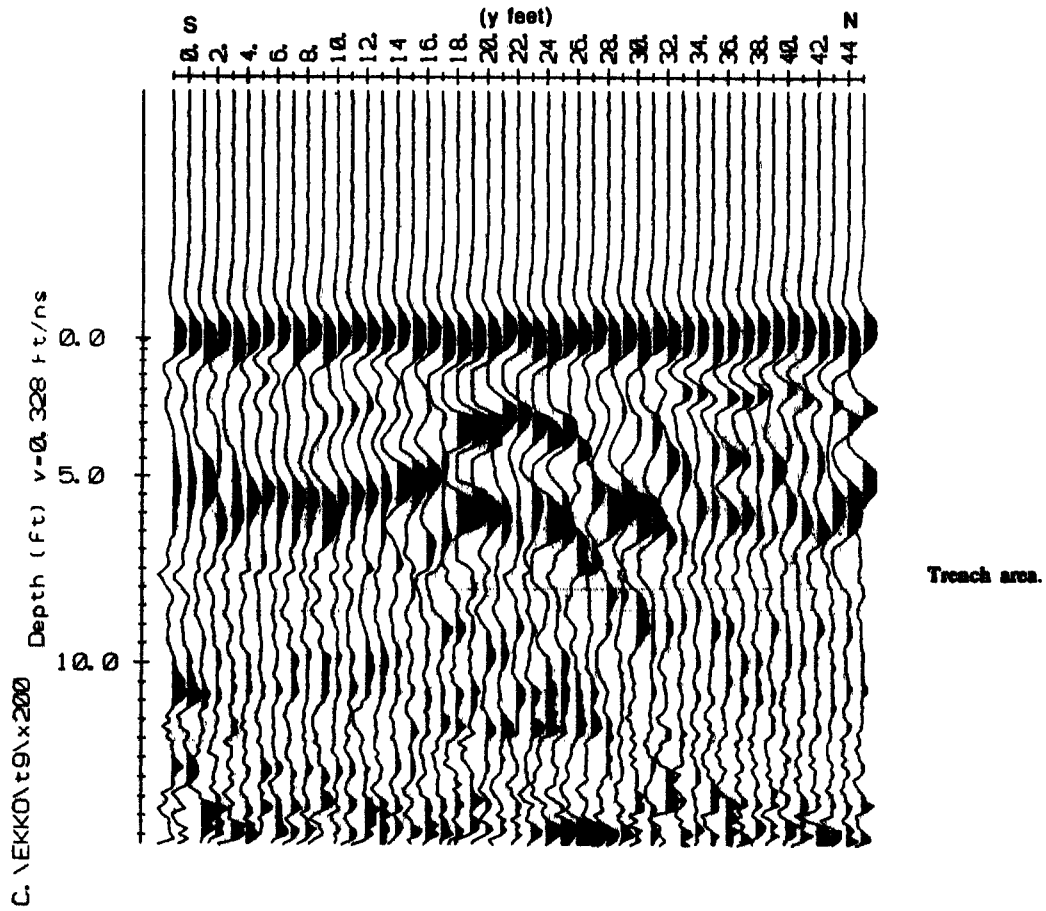


RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 9
SOUTH TO NORTH ORIENTATION AT X=180 FEET
JUNE 1995



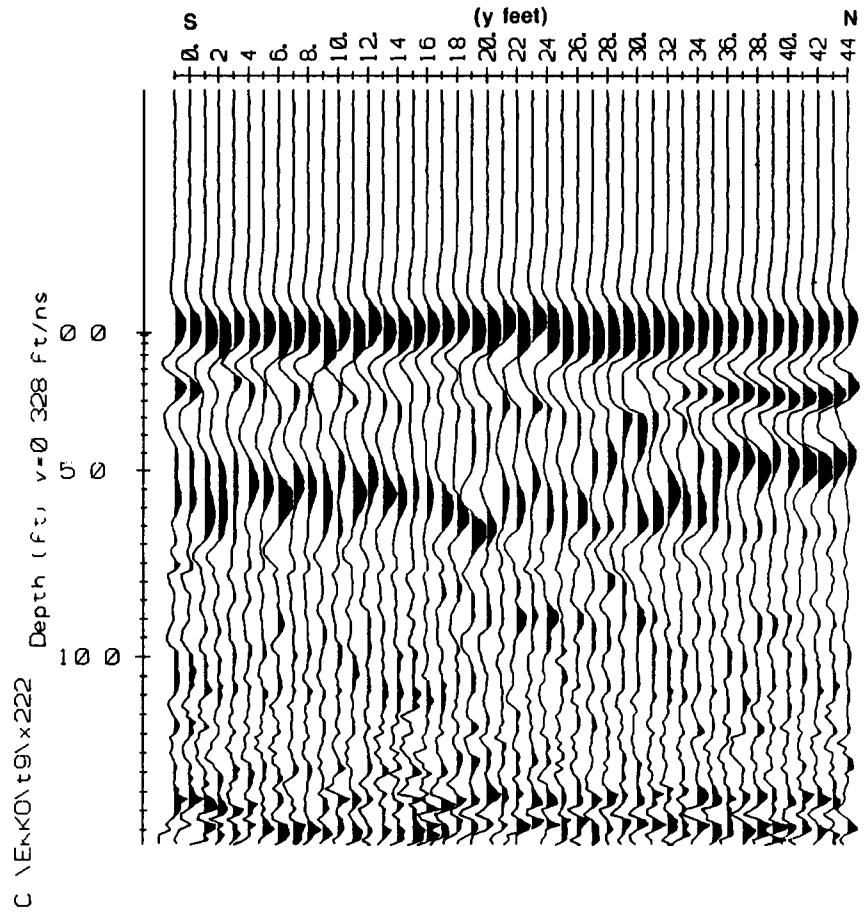
384

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-9
SOUTH TO NORTH ORIENTATION AT X=200 FEET
JUNE 1995



Trench area.

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 9
SOUTH TO NORTH ORIENTATION AT X=222 FEET
JUNE 1995



RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-9
SOUTH TO NORTH ORIENTATION AT X=232 FEET
JUNE 1995

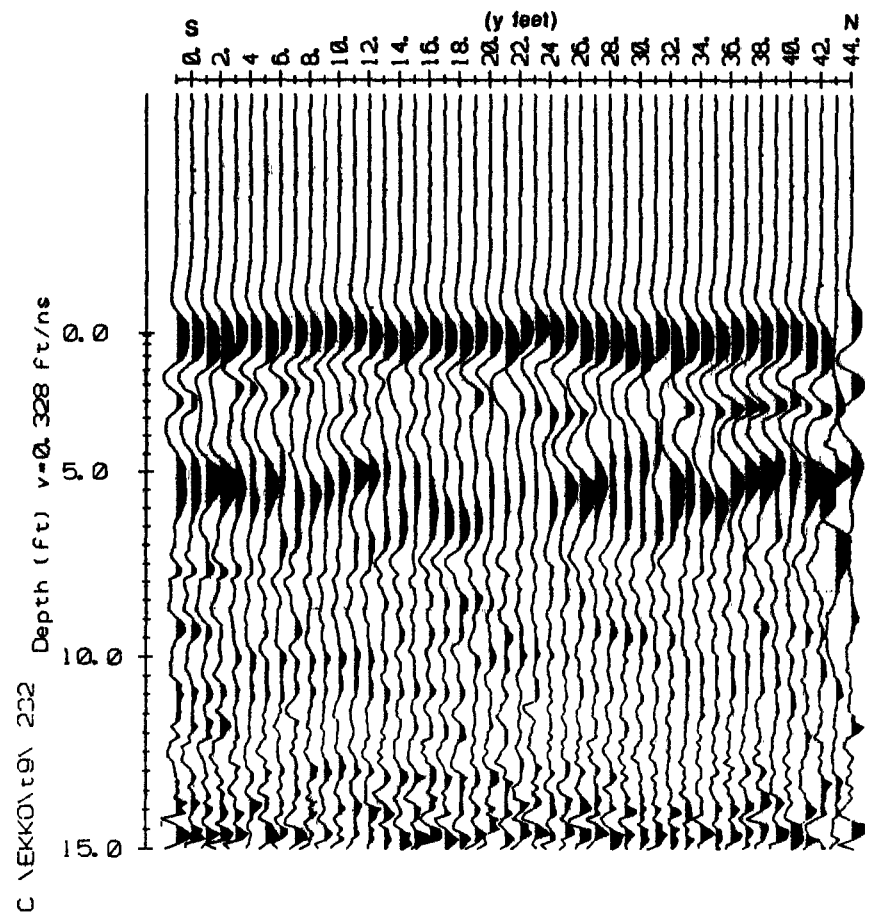
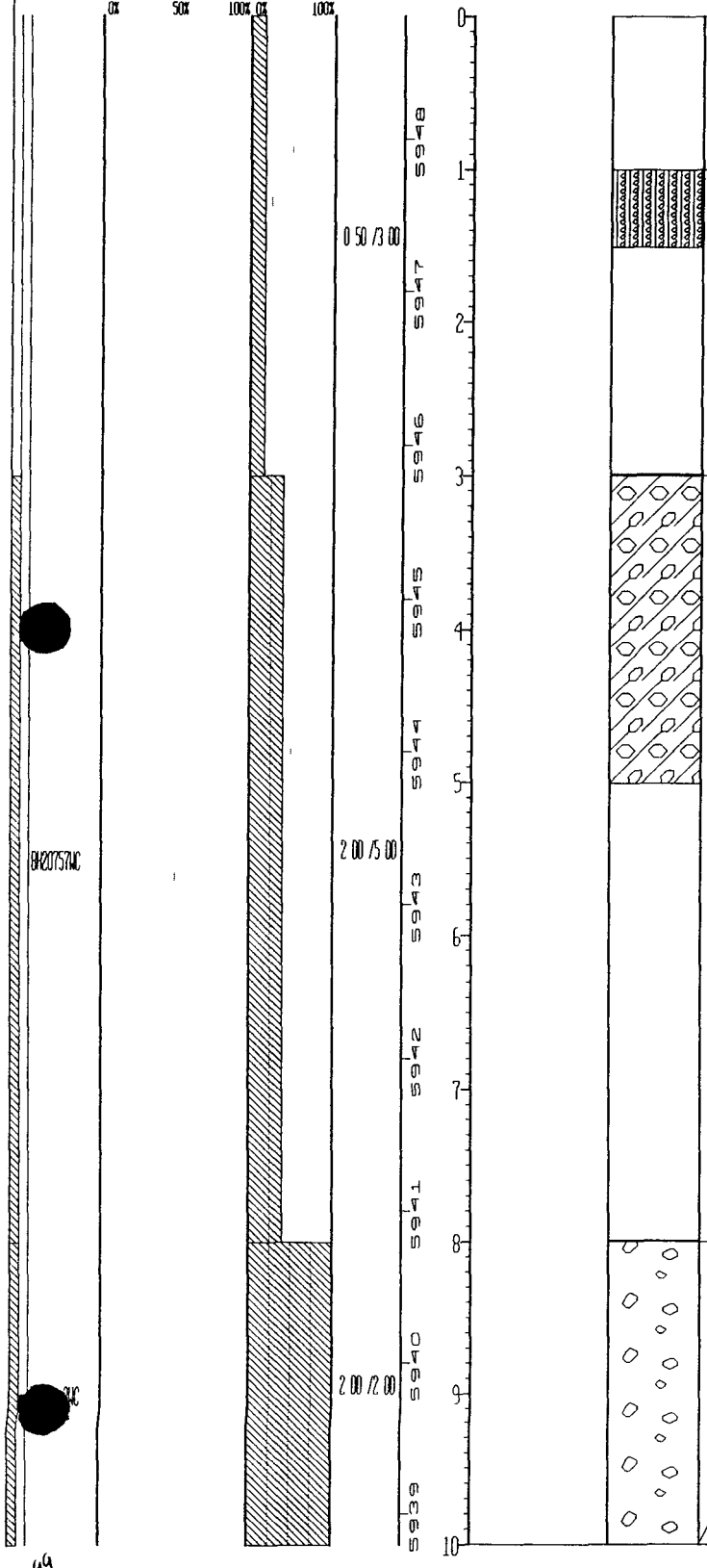


Exhibit 3.8.E
Trench T-9 Borehole Logs

398

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT)	5948 80	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749578	AREA T-9, IHSS 111 6	CASING DIAMETER (IN)		GEOLOGIST	JP GIROD	12295
EAST	2087749	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	1 00	DATE DRILLED	05/01/95	
REMARKS	OU2 TRENCHES						

CHEMICAL SAMP DEPTH
GRADATIONAL DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE 0% 50% 100%
PERCENT RECOVERY 0% 100%
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



0 0-1 0'
No sample collected

SM
1 0-1 5'
Gravelly Sand with some silt and trace clay moderate yellowish brown, fine to coarse grained, poorly graded, quartz, quartzite Gravel consists of broken up cobbles, FeOx staining on sand grains and gravel, dry, paper and wood fragments present

No recovery (1 5-3 0')

GC
3 0-5 0'
Clayey Gravel with some sand and silt olive brown, fine to coarse grained sand, poorly graded, quartzite, quartz, gravel is broken up cobbles, FeOx staining on sand grain and gravel, paper and wood fragments, moist, wet

No recovery (5 0-8 0')

GP
8 0-10 0'
Sandy Gravel with trace silt and clay orange yellow, fine to coarse grained, poorly graded, quartzite, quartz, gravel is broken up cobble fragments, FeOx stain abundant, wet

Total Depth Drilled 10 00

399

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT) 5948 60	PROJECT NUMBER 002 RFI/RI	LOG OF BORING NUMBER
NORTH	749563	AREA T-9, IHSS 111 6	CASING DIAMETER (IN)	GEOLOGIST JP GIROD	12395
EAST	2087681	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED 05/01/95	
REMARKS 002 TRENCHES					

CHEMICAL SAMPLE DEPTH / GRADATIONAL DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%		5948	0				0 0-1 0' No sample collected
				0 50 /3 00	5947	1			SC	1 0-1 5' Clayey Sand with gravel and silt dark yellowish brown, fine to medium grained, quartz, poorly graded, FeOx staining, moist, voids No recovery (1 5-3 0')
					5946	2				
					5945	3			SC	3 0-5 0' Clayey Sand with gravel and silt dark yellowish brown, fine to medium grained, quartzite, quartz, poorly graded, FeOx staining, voids, moist, wet No recovery (5 0-8 0')
					5944	4				
				2 00 /5 00	5943	5				
	1B20759MC				5942	6				
					5941	7				
					5940	8			GP	8 0-10 0' Sandy Gravel with silt fine to coarse grained, poorly graded, quartzite, quartz, FeOx stained, gravel is broken up cobble fragments, moist
	[illegible]MC			2 00 /2 00	5939	9				
						10				Total Depth Drilled 10 00

1/00

STATE PLANE COORDINATE	TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT)	5950 80	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH 749549	AREA T-9 IHSS 111 6	CASING DIAMETER (IN)		GEOLOGIST	JP GIROD	12495
EAST 2087581	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	1 00	DATE DRILLED	05/01/95	
REMARKS OU2 TRENCHES						

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5950	0				0 0-1 0' No sample collected Push directly to 1 0'
				0 40 /3 00	5949	1			SW	1 0-1 4' Sand with trace silt, fine to coarse grained, well graded, quartzite, quartz, dark yellow brown to yellow orange, FeOx staining, moist No recovery (1 4-3 0')
					5948	2				
					5947	3			SW	3 0-5 0' Sand with trace silt fine to coarse grained, well-graded, quartzite, quartz, olive green, yellow orange, red FeOx, MnOx staining, moist No recovery (5 0-6 0')
	BH20763AC			2 00 /3 00	5946	4				
					5945	5				
				2 00 /2 00	5944	6			SC	6 0-8 0' Clayey Sand with gravel and silt fine to coarse grained, well graded, quartz, quartzite, olive green, yellow orange, red FeOx, MnOx staining, moist
					5943	7				
				2 00 /2 00	5942	8			SC	8 0-10 0' Clayey Sand with gravel and silt fine to coarse grained, well graded, quartz, quartzite, yellow orange, red FeOx and MnOx staining, moist
	BH20764AC				5941	9				
						10				Total Depth Drilled 10 00

3 9 TRENCH T-10 (IHSS 111 7)

Trench T-10 was investigated using the following methodologies

- Historical data were compiled to identify potential contaminants, trench location, and size
- Aerial photographs were examined to identify disturbed areas verify trench dimensions, and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- Two EM surveys were conducted to locate buried metallic objects and define trench boundaries
- GPR surveys were conducted to better determine trench depth and dimensions
- Soil gas surveys were conducted to identify and delineate contaminant plumes
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the trench

As shown in Figure 3 9-1 Trench T-10, is located 60 feet north of the East Access Road and approximately 700 feet east of the former inner east gate area Trench T-10 trends nearly east-west for approximately 110 feet It is approximately 20 wide and 10 feet deep Though all the trenches were excavated and filled with waste during the period between 1960 and 1968, Trench T-10 was not identified as an individual trench until 1983 The trench was reportedly used for disposal of sanitary sewage sludge potentially contaminated with uranium and plutonium and flattened empty drums contaminated with uranium Activities of the sewage sludge were reported between 382 pCi/g and 3 590 pCi/g Older sludge had mostly uranium with an increasing plutonium fraction in later sludge placed in the trenches Total alpha radioactivity in the trench is estimated to be 100 to 150 millicurie (0 1 Ci to 0 15 Ci) Trench T-10 may also contain some asphalt planking from the Solar Evaporation Ponds contaminated with plutonium and uranium Up to 300 drums that had contained contaminated oil and were burned and flattened in the Oil Burn Pit No-2, were also disposed of in one of the Northeast trenches Uranium contamination may have been present in these drums The pertinent section of the HRR is included in Exhibit 3 9 A (PAC Reference Number NE111 1-NE111 8)

Although the general location of Trench T-10 was known, the exact location of the trench had not been physically identified prior to the Trenches Area and Mound Site Characterization Program of 1995 Aerial photographs dating from 1954 through 1970 were examined to ascertain the period of operation approximate the length and width identify staging areas, and gather information which might confirm the contents of the trench (Colorado Aerial Photo Service 1993) Photographs from 1963 show no disturbance in the area of Trench T-10 The next sequence of aerial photos was taken in 1967 and shows the trench had already been excavated and filled

3 9 1 Geology

The stratigraphy of the Trench T-10 area consists of the Rocky Flats Alluvium overlying claystone and sandstone of the Arapahoe Formation Trench T-10 has been filled by unconsolidated artificial fill consisting of clayey and silty gravel The thickness of the alluvium in the Trench T-10 area ranges from 20 to 27 feet (EG&G 1995c) The hydrograph of monitoring well 078191, located west of Trench T-10, indicates that groundwater occurs between 13 feet bgs to below the bedrock/alluvium contact

3 9.2 Site Visual Survey and Geophysical Surveys

After aerial photographs were examined, a visual survey of the Trench T-10 area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general area of Trench T-10 Soil disturbances such as mounding and subsidence were identified and recent geologic characterization information was used to delineate between Rocky Flats Alluvium and soil disturbance caused by construction related activities Evidence of fill material deposits was also noted In addition to the geologic characteristics of the area, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material The area did not show any evidence of surficial water or seeps

Upon completion of the visual survey, a geophysical grid was laid out over the area of Trench T-10 using pin flags The flags were spaced every five feet for 50 feet north-south and 220 feet east-west

EM-31 Survey

After establishing the geophysical grid, the EM-31 survey was performed. The EM-31 reveals the trench area as 10 to 15 feet wide and approximately 130 feet long Anomalies are present which indicate the presence of buried metallic objects and/or other conductive liquid or solid materials in the trench EM-31 survey results are presented in Appendix B

EM-61 Survey

To further define the physical characteristics of the trench area, and EM-61 was also performed The pattern displayed by EM-61 at Trench T-10 is nearly identical EM-31 survey results The EM-61 results indicate the presence of buried metallic objects in the east end of the trench which may

403

correspond to the flattened drums described in the HRR Survey results are presented in Exhibit 3 8 B

Ground Penetrating Radar

GPR was used in conjunction with the EM-31 and EM-61 surveys to try and obtain a more definitive determination of the walls and extent of Trench T-10 However the unprecedented heavy precipitation during the spring of 1995 created pools of surface water and saturated the alluvium so that the radar patterns were diffuse and provided no clear indications of the shape of the trench The trench appears to vary from 8 to 12 feet deep and 14 to 18 feet wide There are indications of dense materials in the vicinity of where it would be expected from the EM-31 and EM-61 surveys, but again the patterns are diffuse and unclear Results of the GPR surveys are shown in Exhibit 3 8 C

3 9 3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995, the vadose zone within the Northeast Trenches area was highly saturated The increased soil moisture content tended to attenuate soil gas readings, making sample collection difficult However, 36 samples were collected and analyzed for total volatile organic content using field instrumentation

Based on the trench boundaries determined by the geophysical surveys, soil gas sampling locations were placed along two horizontal lines located 10 feet on either side of the centerline of the trench Soil gas samples were taken every 20 feet along the x-axis (east-west) and 10 feet along the y-axis (north-south) at depths of five and 10 feet bgs If a sample had a field measurement above 100 ppm, the field crew stepped off 10 feet in the north-south direction from that location and collected an additional sample This procedure was repeated until readings less than 100 ppm were obtained

Results of the soil gas survey identified two zones of elevated soil gas within Trench T-10 and indications of possible migration outside the trench to the southeast At the five feet bgs, the maximum concentration of total VOCs (481 ppm) was detected near the western anomaly indicated from the geophysical survey At the 10 feet bgs the maximum concentration detected was 220 ppm total VOCs Higher concentrations within the trench were mostly at the five feet bgs while outside the trench most higher concentrations were at the 10 feet bgs The higher concentrations found in the eastern half of the trench are separated from the higher concentrations found in the western half by a zone of near zero concentration which does reflect the likelihood of two source zones within the trench The higher soil gas concentrations correspond to the areas identified by the geophysical surveys as containing conductive and or buried metallic objects Results of the soil gas investigations are presented in Figure 3 9-2

3 9 4 Subsurface Soil Sampling

Subsurface soil sampling from the Trench T-10 area was the final step of the characterization activities Four borehole locations (10195, 10295, 10395, and 10495) within the trench were selected for sampling based upon the findings of the aerial photograph search, the geophysical surveys, and the soil gas survey results Lithologic descriptions of each borehole are presented in Exhibit 3 8.E In addition, two boreholes (BH4587 and BH4687) were drilled and sampled previously Data from both characterization efforts indicated elevated levels of one metal and radionuclides Figure 3 9-3 identifies those boreholes and wells that characterize Trench T-10

Organic Compounds

There were no organic compounds detected at concentrations greater than the RFCA Subsurface Soil Action Levels as presented in Table 3 9-1

Metals

Cadmium (range· 2.2-6 1 mg/kg) and manganese (3,540 mg/kg) concentrations exceeded the background $UTL_{99/99}$ as presented in Table 3 9-2

Radionuclides

Americium-241 (range 0 03-7 67 pCi/g) and plutonium-239/240 (0 04-34 79 pCi/g) activities exceeded the background $UTL_{99/99}$ as shown in Table 3 9-3

3.9.5 Groundwater

There is no upper hydrostratigraphic groundwater in the vicinity of Trench T-10

3 9 7 Summary

Trench T-10 appears to be 130 feet long, 15 to 20 feet wide, and 8 to 12 feet deep which corresponds to an approximate volume of 580 to 1,160 cy of buried materials There appears to be two separate sources of buried metallic objects and possibly other conductive solid or liquid material in Trench T-10

The soil gas survey did not indicated the presence of a VOC plume migrating to the southeast. The EM-31 survey indicated the presence of a conductive plume moving east-southeast

405

The data collected from the boreholes were combined with data from previous investigations for comparison to background concentrations, negotiated cleanup levels, and PPRGs All detected concentration of organic compounds and metals and activities of radionuclides were less than the RFCA Subsurface Soil action levels and PPRGs for subsurface soils, construction worker scenario The concentrations of two metals and the activities of two isotopes exceeded background $UTL_{99/99}$ values Therefore Trench T-10 does not require remedial action

Trench T-10 summary information is presented in Table 3 9-4

Table 3 9-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
[redacted]										

LABORATORY QUALIFIERS
J = Positively identified below sample quantitation limit result is estimated

NOTES
RFCA Action Levels for Benzoic Acid and 2 Butanone have not been determined

VALIDATION CODES
Y = Analytical results in validation process

Table 3 9-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 10	BH4587	BH45870009	0-9.5	9/31/87	Cadmium	3.4			N	1.33
Trench T 10	BH4587	BH45870917	9.5-17	9/31/87	Cadmium	2.9			N	1.33
Trench T 10	BH4587	BH4587717UC	17.5-19.9	9/31/87	Cadmium	4.1			N	1.33
Trench T 10	BH4587	BH4587720CT	20-22.3	9/31/87	Cadmium	2.8			N	1.33
Trench T 10	BH4587	BH4587722BR	22.5-25	9/31/87	Cadmium	3			N	1.33
Trench T 10	BH4587	BH4587727DH	27.5-30	9/31/87	Cadmium	6.1			N	1.33
Trench T 10	BH4587	BH4587730DH	30-32.5	9/31/87	Cadmium	4.5			N	53250
Trench T 10	BH4587	BH45870009	0-9.5	9/31/87	Calcium	58900			N	1190
Trench T 10	BH4587	BH4587727DH	27.5-30	9/31/87	Manganese	3540			N	1.33
Trench T 10	BH4587	BH45870009	0-9	9/3/87	Cadmium	2.3			N	1.33
Trench T 10	BH4587	BH45870917	9.5-17.5	9/3/87	Cadmium	2.3			N	1.33
Trench T 10	BH4587	BH4587726CT	27-29.5	9/3/87	Cadmium	6.2			N	1.33
Trench T 10	BH4587	BH4587729BR	29.5-32	9/3/87	Cadmium	2.2			N	1.33

LABORATORY QUALIFIER

VALIDATION CODES
N = Will not be validated

Table 3 9-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T 10	10195	BH20709WC	5 7	4/17/95	Amencium 241	7 67	0 02	0 827	Y	0 022
Trench T 10	10195	BH20709WC	5 7	4/17/95	Plutonium-239 240	34 79	0 029	3 76	Y	0 025
Trench T 10	10195	BH20709WC	5-7	4/17/95	Uranium 238	2 67	0 081	0 46	Y	1 807
Trench T 10	10295	BH20716WC	3-5	4/19/95	Plutonium-239 240	0 12	0 003	0 024	Y	0 025
Trench T 10	10395	BH20705WC	7 9	4/20/95	Plutonium 239 240	0 09	0 006	0 03	Y	0 025
Trench T 10	10495	BH20818WC	17 18	5/8/95	Plutonium 239 240	0 04	0 041	0 034	Y	0 025
Trench T 10	BH4587	BH45870009	0-9 5	8/31/87	Americium 241	0 03		0 11	N	0 022
Trench T 10	BH4587	BH458722BR	22 5-25	8/31/87	Americium-241	0 08		0 13	N	0 022
Trench T 10	BH4587	BH458722BR	22 5-14	8/31/87	Americium 241	0 08		0 13	N	0 022
Trench T 10	BH4587	BH458720CT	20-22.3	8/31/87	Plutonium-239 240	0 04		0 09		0 025
Trench T 10	BH4587	BH458722BR	22 5-25	8/31/87	Plutonium-239 240	0 04		0 08		0 025
Trench T 10	BH4587	BH458720CT	30-22.3	8/31/87	Plutonium-239 240	0 04		0 09		0 025
Trench T 10	BH4587	BH458722BR	22 5-25	8/31/87	Plutonium-239 240	0 04		0 08		0 025
Trench T 10	BH4587	BH45870009	0-9 5	8/31/87	Plutonium-239 240	0 09		0 11		0 025
Trench T 10	BH4687	BH468724UC	24 5-25 1	9/3/87	Americium 241	0 03		0 1	N	0 022
Trench T 10	BH4687	BH46870009	0-9	9/2/87	Plutonium-239 240	0 06		0 17		0 025
Trench T 10	BH4687	BH46870919	9 5-17 8	9/2/87	Plutonium 239 240	0 28		0 14		0 025
Trench T 10	BH4687	BH468726CT	27 29 5	9/3/87	Plutonium-239 240	0 05		0 08		0 025
Trench T 10	BH4687	BH468724UC	24 5-25 1	9/3/87	Plutonium 239 240	0 09		0 12		0 025

VALIDATION CODES
N = Will not be validated
Y = Analytical results in validation process

409

TABLE 3.9-4 TRENCH T-10 SUMMARY INFORMATION

CONTAMINANTS					
Media: Subsurface Soils					
Greater than UTL_{9090}		Greater than RFCA Standards		Greater than PPRGs	
Cadmium Manganese					
Americium-241 Plutonium-239/240					
PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
130	15-20	8-12	580-1,160	Yes	Yes conductive plume migrating east-southeast

Note.

There is no upper hydrostratigraphic groundwater at Trench T-10

A RFCA subsurface soil action level has not been determined for benzoic acid

Exhibit 3.9.A
Trench T-10 Historical Release Report Information

Best Available Copy

PAC REFERENCE NUMBER NE 111.1 NE 111.8

[illegible] Reference Number 111.1 111.8 Operable Unit 2

Unit Name Trenches T-4 through T-11

Approximate Location N750 000 E2 087,500

Date(s) of Operation or Occurrence

The exact dates of operation are unknown except for the period of July 29 1954 through August 14 1968[1] Trenches T 9 T 10 and T 11 were differentiated from the other trenches and added to the disposal trench inventory in 1977[2] See the "Comments" section below for additional discussion of this point

Description of Operation or Occurrence

Trenches T-4 through T 11 along with Trench T 2 (PAC 900 109) and Trench T 3 (PAC NE 110) were used primarily for the disposal of sanitary wastewater treatment plant sludge The sludge removed from the wastewater treatment plant was placed on sludge drying beds The dried material removed from the sludge drying beds was placed in the disposal trenches The sanitary sludge disposal trenches are reported to be approximately 10 feet deep and are provided with two feet of soil cover[3] The trenches are variable in length with the average length being approximately 250 feet[4] The total amount of sludge disposed in Trenches T 2 through T 11 is estimated at 125 000 kilograms[5] Some amounts of additional materials were also disposed in Trenches T-4 T 9 and T 11 These other materials consisted of asphalt planking (approximately 130 000 square feet of asphalt planking) in T-4 and T-11 from the re-design of Solar Pond 207A (PAC 000-101) in 1963 and scrap metal and junk in T 9[5]

At the same time that Trenches T 9 T 10 and T 11 were identified (19[illegible]) it appears that the numbering system for the trenches was slightly modified Whereas earlier documents had presented a consistent numbering system [illegible] 1983 document a trench that had previously been [illegible] became T [illegible] This 1983 document [illegible] the T-[illegible] trench essentially as an addition to [illegible] 1983 document designated Trench T 9 [illegible] essentially an extension of Trench T 7[illegible] but in earlier doc[illegible] had [illegible] referred to as Trench T 5[1] Trench T 10 had not been identified or named prior to 198[illegible] The [illegible] identified as Trench T 5 in the 1983 document was a trench not previously identified (comparison of map[illegible] 1 and 5)

Physical/Chemical Description of Constituents Released

[illegible] and plutonium contamination is present [illegible] the older sludge would have [illegible] uranium contamination with newer sludge [illegible] amount of plutonium contamination[1] [illegible] lived alpha activity present in the sludge was [illegible] of 382 pCi/g in August 1964 [illegible] maximum of 3 591 pCi/g in June 1960[1] Uranium [illegible] also be present in flattened drums that may have been disposed in any of trenches T 2 through [illegible] the contaminated oils that had been held in the drum[6] The burning of the contamin[illegible] Oil Burn Pit No 2 (PAC 900-153) from March 1957 to mid 1965[6] not in the trenches The [illegible] estimated at up to 200 in total number [illegible] be present in any of Trenches T 3 through T 11 [illegible] 1983 document that Trench T-4 [illegible] designated Trench T 11 as discussed above) [illegible] 225

[illegible] at least one occasion it is believed that 2 400 gallons [illegible] coolant generated in Building [illegible] was [illegible] disposed in one of the East Trenches [illegible] of 150 000 dpm [illegible] it is believed that [illegible] total alpha activity The [illegible] approximately 1 3 [illegible] depleted uranium present in the waste [illegible] or not this material was in drums

Purposes to Operation or Occurrence

[illegible] were collected from the [illegible] trenches [illegible] 197[illegible] (Trenches T 9 T 10 and T 11) during [illegible] Soil fro[illegible] from 0 40 to 58 pCi/g in plutonium activity [illegible] to 450 pCi/g uranium activity Trench [illegible] to contain from 0 18 to [illegible] pCi/g plutonium

415

activity and from 40 to 126 pCi/g uranium activity Trench T-11 was found to contain 4.5 to 50 pCi/g plutonium activity and 0.9 to 158 pCi/g in uranium activity[5]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents disposed in Trenches T-4 through T 11 This IHSS is being studied in accordance with the IAG schedule for OU2 The IAG activities will include site investigations site characterizations and possible remediation The Final Phase II RFI/RI Report is to be completed by March 12 1993

Comments

Trench T-3 along with these trenches are also called the East Trenches

Trenches T-4 through T 11 (PAC NE 111) have few operational differences from Trenches T 2 (PAC 900-109) and T-3 (PAC NE 110)

The sludge disposed of in these trenches should consist primarily of concentrated organic matter typically present in sanitary wastewater treatment plant sludge

From August 1968 until February 1970 sanitary wastewater treatment plant sludge was disposed in the RFP sanitary landfill[1] After February 1970 sanitary wastewater treatment plant sludge was shipped offsite for disposal[9]

To date no documentation has been found that records the time frame during which any particular trench was receiving waste Similarly none of the HRR interviewees were knowledgeable on dates of operation of individual trenches

The locations of these trenches on Plate 2 differ from the IAG map but are taken from the O[illegible] Work Plan [illegible]

References	Other references of interest	
[1] 1500793	1500296	1501097
1501719	600430	1500399
[3] 500895	500340	1500460
[4] 1507713	[illegible]287	1500[illegible]
[5] 1500890	500901	1500887
[6] 1500656	500304	1500766
[7] 1500579	500458	1500921
[8] 1700445	500888	

416

Exhibit 3.9.B
Trench T-10 EM-31 Surveys

417

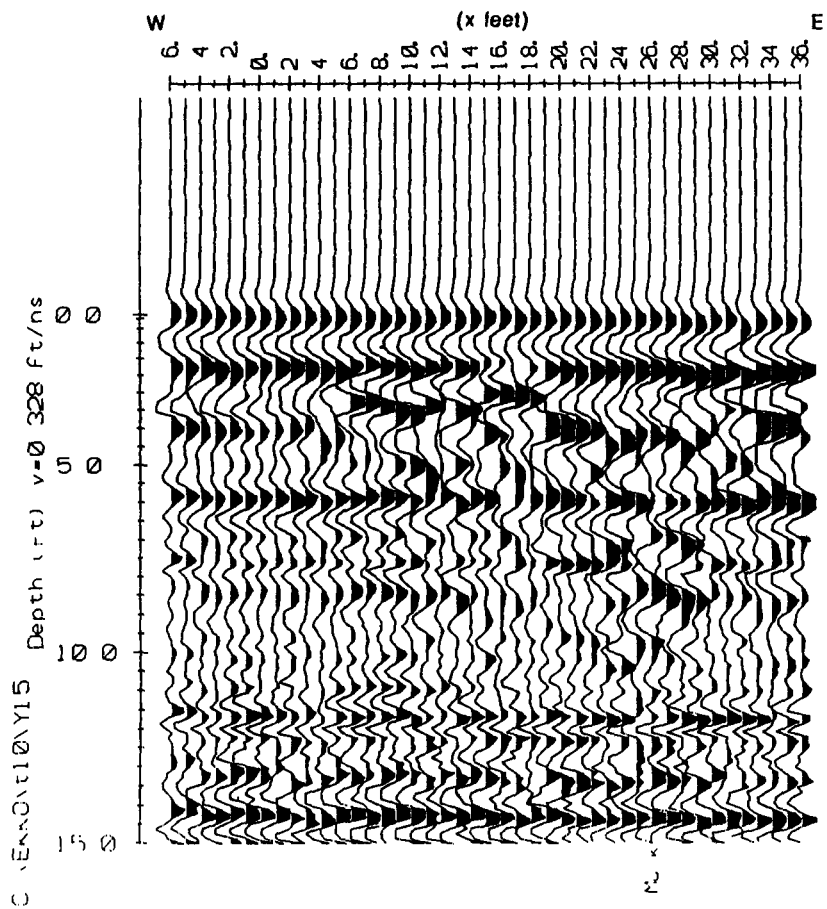
Exhibit 3.9.C
Trench T-10 EM-61 Surveys

422

Exhibit 3.9.D
Trench T-10 Ground Penetrating Radar Surveys

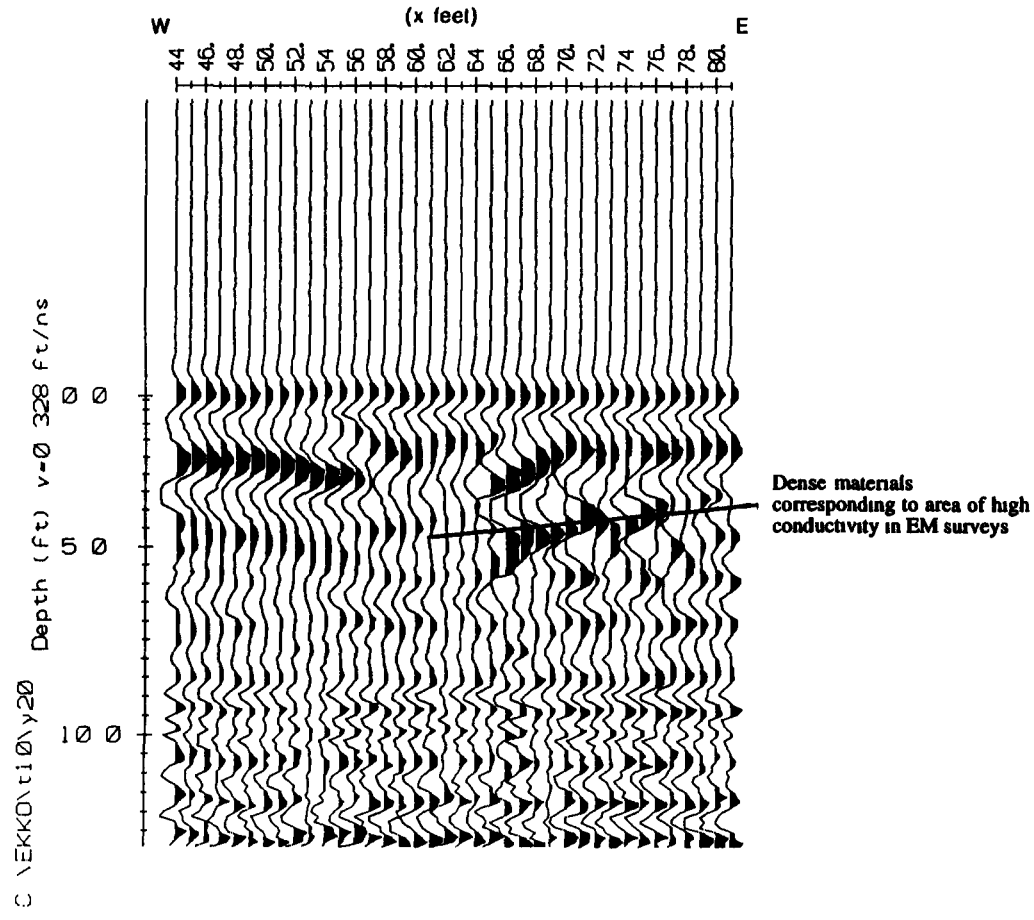
424

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 10
WEST TO EAST ORIENTATION AT Y=15 FEET (WESTERN END)
JUNE 1995

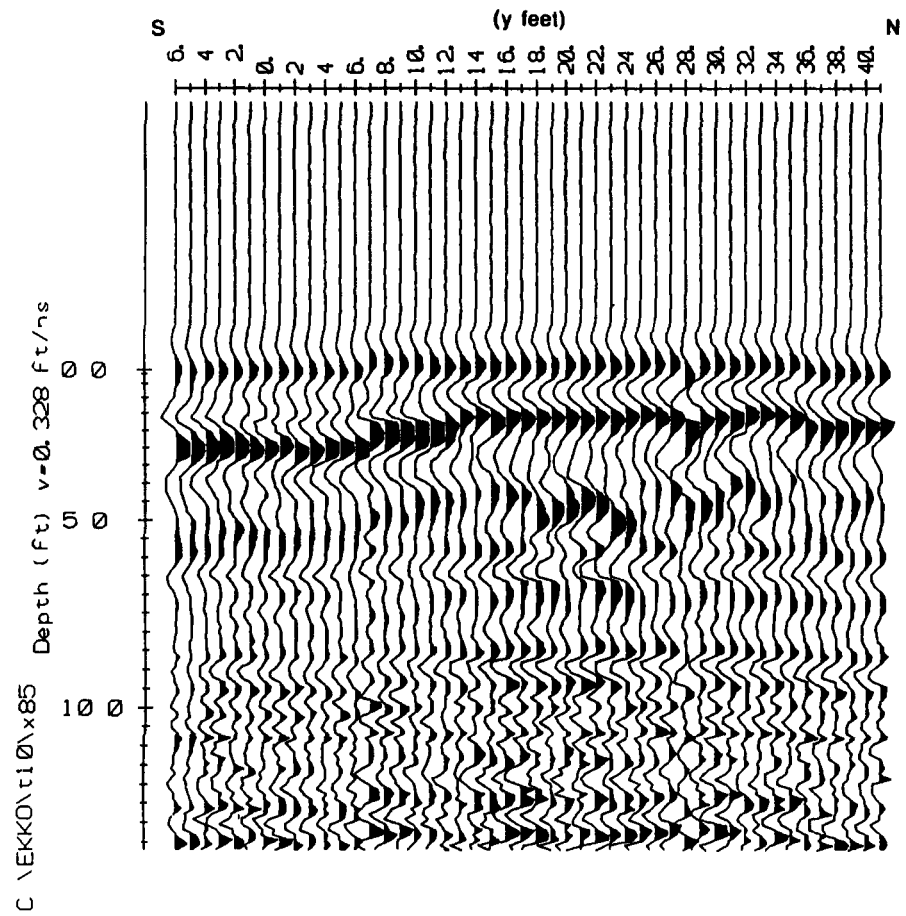


425

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 10
WEST TO EAST ORIENTATION AT Y=20 FEET
JUNE 1995

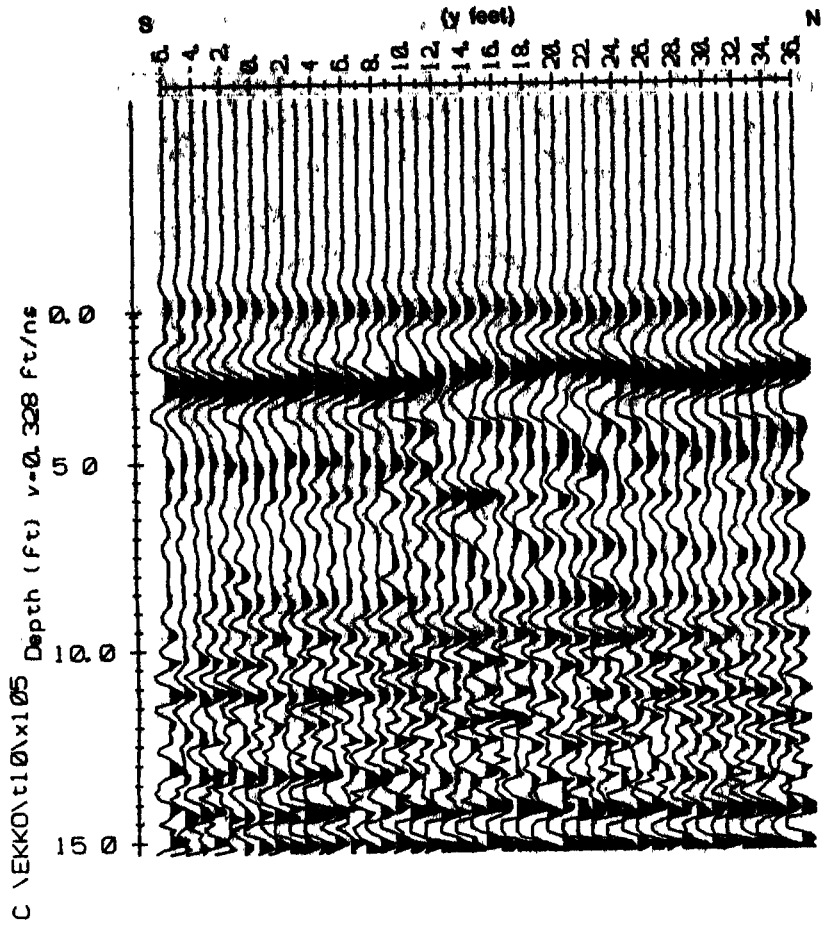


RFETS OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 10
SOUTH TO NORTH ORIENTATION AT X=85 FEET
JUNE 1995



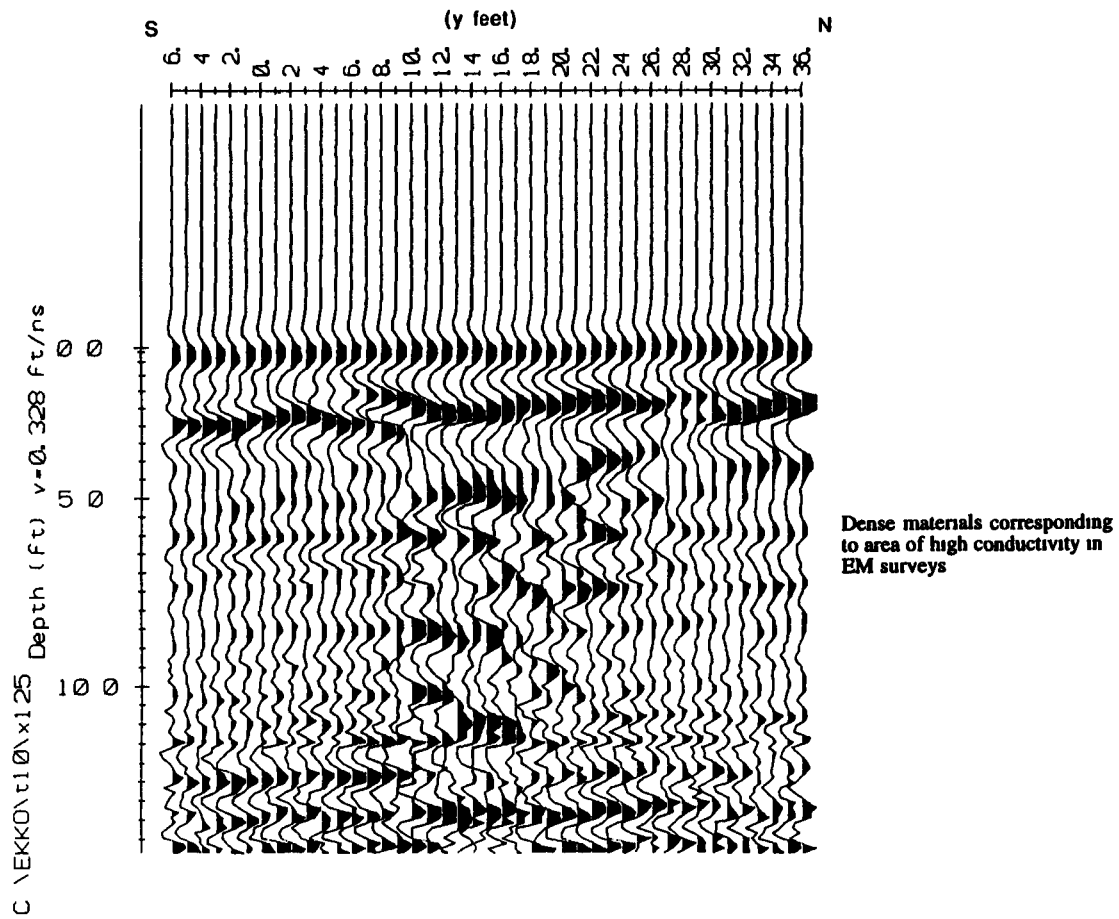
427

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-10
SOUTH TO NORTH ORIENTATION AT X=105 FEET
JUNE 1995



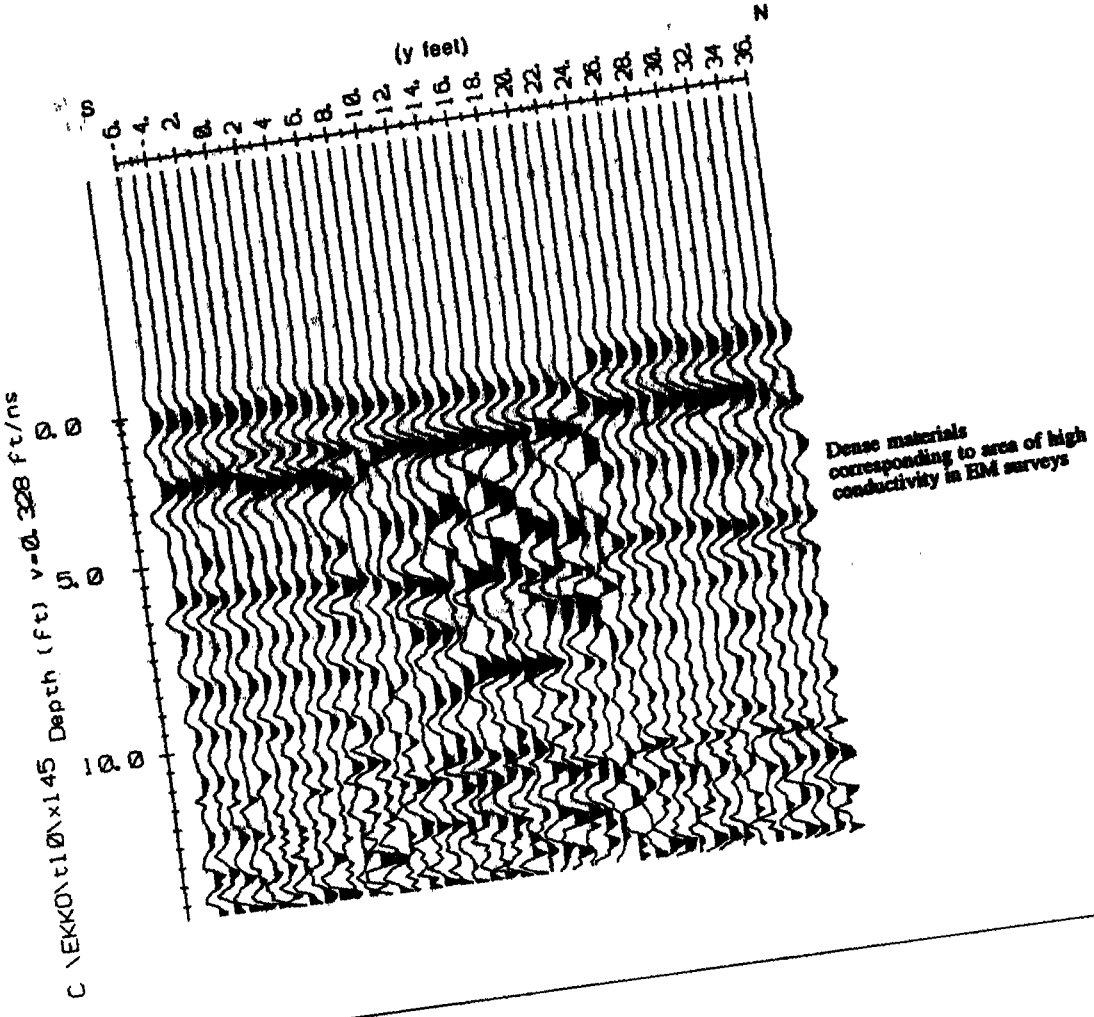
428

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-10
SOUTH TO NORTH ORIENTATION AT X=125 FEET
JUNE 1995

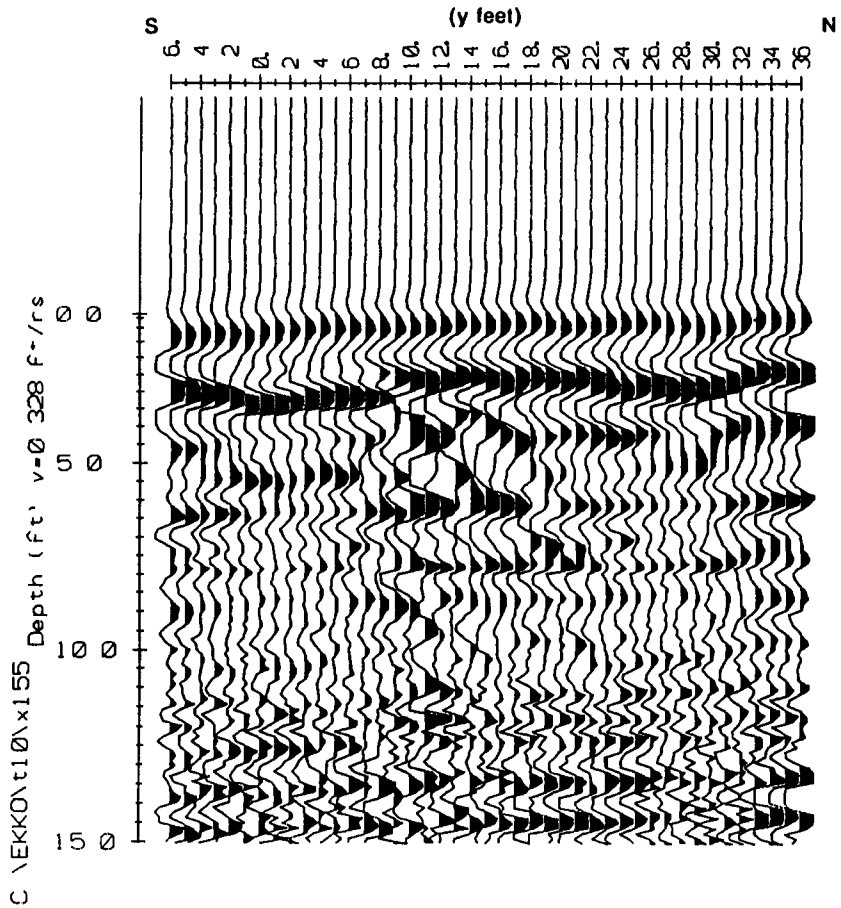


429

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-10
SOUTH TO NORTH ORIENTATION AT X=145 FEET
JUNE 1995

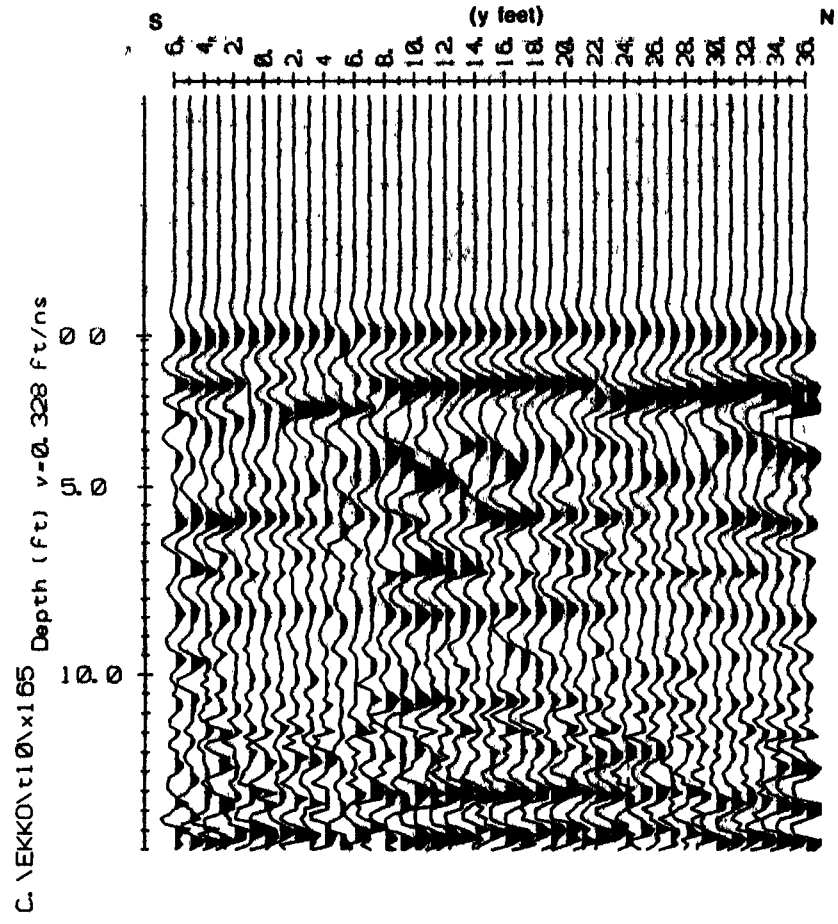


RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 10
SOUTH TO NORTH ORIENTATION AT X=155 FEET
JUNE 1995



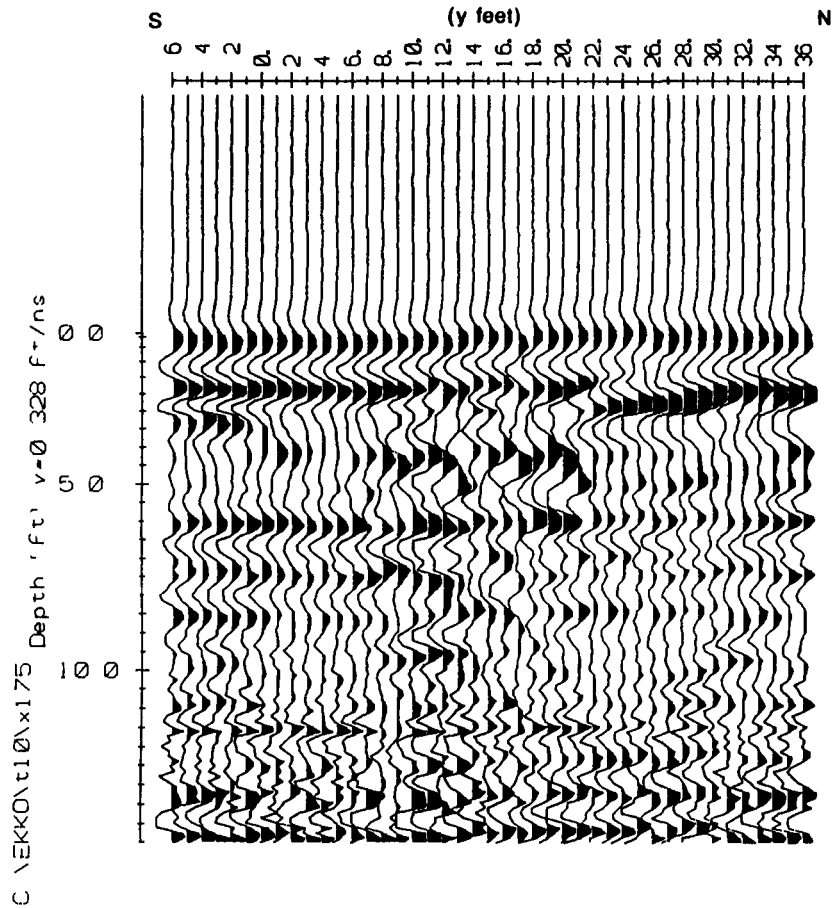
431

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-10
SOUTH TO NORTH ORIENTATION AT X=165 FEET
JUNE 1995



432

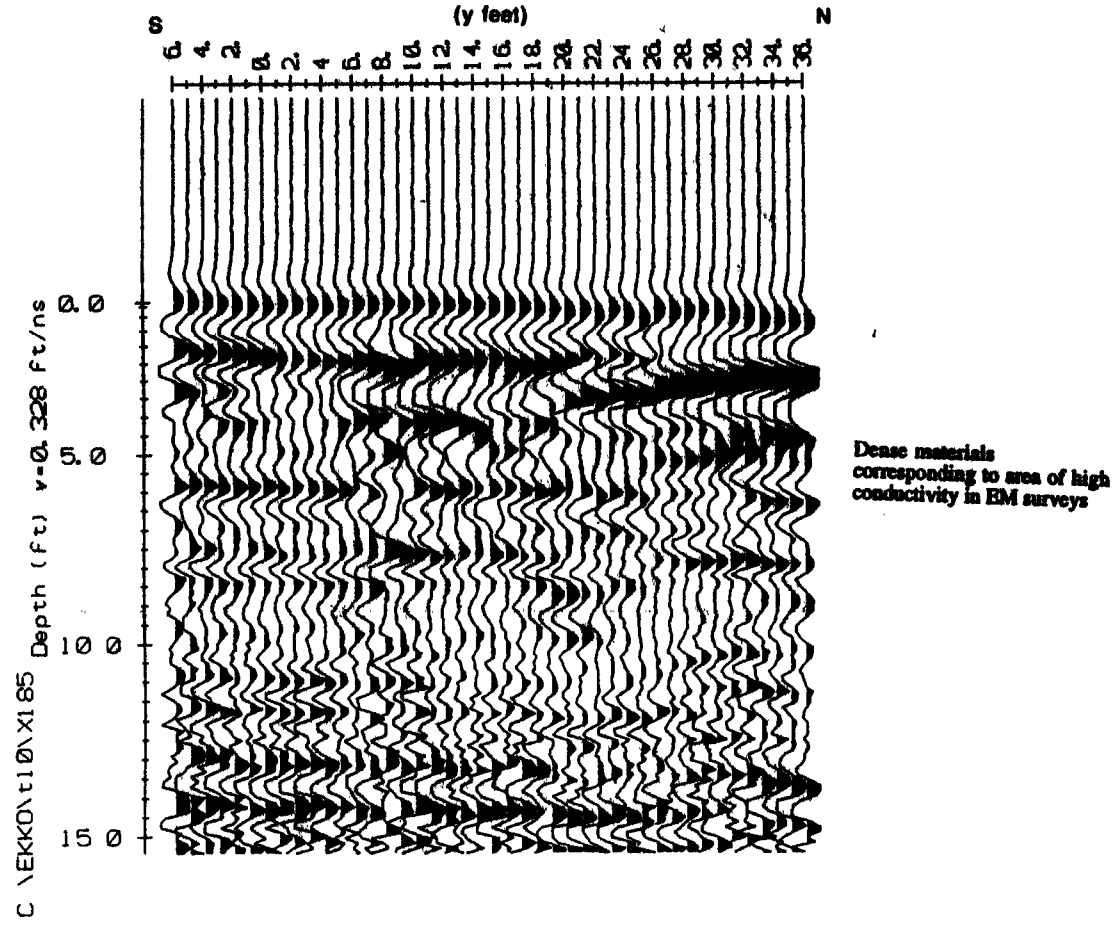
RFETS OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-10
SOUTH TO NORTH ORIENTATION AT X=175 FEET
JUNE 1995



Dense materials corresponding to area of high conductivity in EM surveys

433

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-10
SOUTH TO NORTH ORIENTATION AT X=185 FEET
JUNE 1995



434

Exhibit 3.9.E
Trench T-10 Borehole Logs

435

U S DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT 1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG 066/159

PAGE 1 OF 1

Borehole Number 10195
Location - North ~~749715.8~~ East ~~2087189.6~~
Date 4-17-95 6/21/95
Geologist L L Gardiner
Drilling Equip Geoprobe

Surface Elevation
Area T-10
Total Depth 9.0 ft
Company WCFS Project No 4040A
Sample Type Soil

EG&G LOGGING SUPERVISOR
APPROVAL DATE

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0	0							0		
1		1/2						1		
~~2~~ ~~2~~	2 2	0/1						2		
								3		
~~3.5~~ ~~3.5~~	3.5 3.	0/1.5						4		
~~5~~	5	1.0 ~~0.5~~ 2/3 4-17-95						5		
~~6~~ 6		2						6		
7	7 7							7		
		2/2						8		
	9							9		
	TD-9.0 ft							10		

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

Sold by 6/14/95

436

(4011 930-0134-930)(Form GT 1A)(03/01/92)

U.S DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT 1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG

067/159

PAGE 1 OF 1

Date 4-7-95 Borehole Number 10195

Rig Geologist LL Gardiner Company WCFS

FEET

Silt, sandy dry brown

SAND, gravelly, very fine to course grained, Light brown, subangular to subrounded - very fine grained sand is lightly cemented w/ calcite, Dry

No Recovery 2-3.5'
a few granite cobbles in bottom of core

No Recovery 3.5-5

SAND and gravel, w/ quartzite cobbles, Sand is very fine to medium grained yellowish brown slightly cemented, Dry

SAND, gravelly Light brown to reddish brown dry, very fine to fine grained, calcareous granite fragments Dry

TD = 9'

NOTES

437

(4011 930-0135 930)(Form GT 1B)(03/01/92)

U.S DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT 1A (REV 2)

ROCKY FLATS PLANT BOREHOLE LOG 074/159

PAGE 1 OF 1

Borehole Number 6/27/95 0295
Location - North ~~749718.3~~ East ~~2087143.6~~ 6/27/95
Date 4-19-95
Geologist LL Gardiner
Drilling Equip Geoprobe

Surface Elevation
Area T-10 (IHSS 111.7
Total Depth
Company WCFS Project No 4040A
Sample Type Soil

EG&G LOGGING SUPERVISOR
APPROVAL DATE

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0	0	1.5/2						0		
1.5	2							1		
2 2.5	2 3	1/2						2		
		10						3		
	5.0							4		
		0.0						5		
	7.0							6		
	8.0	0.0						7		
		15						8		
10	10.0							9		
								10		

Qc'd by [signature] 6/14/95

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

438

(4011 930-0134 930)(Form GT 1A)(03/01/92)

U S DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG 075/159

PAGE ___ OF ___

Date 4-19-95 Borehole Number 10295

Rig Geologist L L Gardiner Company WCFS

FEET

Sand, silty clayey, gravelly, olive brown slightly moist

SAND, silty, gravelly, cobbly, medium brown fine grained, calcareous

BH20716WC 3-5'

refusal @ 5' - 1" diameter rock in core barrel will try to push it out of the way

Push from 7 8' → no recovery from 5-7'

Sample BH20713WC from 8-10'

RNS BH20714WC

TB BH20715WC

Clay Gravel, reddish brown dry,

0 1 2 3 4 5 6 7 8 9 10

NOTES

439

(4011 930-0135 930)(Form GT 1B)(03/01/92)

U S DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT 1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

081 / 159

PAGE 1 OF 1

Borehole Number 6/27/95 10395
Location - North ~~[illegible]~~ East ~~[illegible]~~ 6/27/95
Date 4/19/95
Geologist LA Gust
Drilling Equip Geoprobe

Surface Elevation
Area T-10 (IHSS 111.7)
Total Depth 9.0 ft.
Company WCFS Project No 4040
Sample Type Continuous Core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
00	00									
	Run 1	05						1		
	20							2		
	Run 2	00						3		
	40							4		
Box 1 of 1	Run 3	10						5		
								6		
	70							7		
	Run 3	2						8		
	9							9		

QC'd by [illegible] 6/14/95

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

440

(4011 930-0134-930)(Form GT 1A)(03/01/92)

U S DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT 1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG 082/159

PAGE 1 OF ___

Date 4/19/95 Borehole Number 10395

Rig Geologist LH Gast Company WCFS

			FEET
0-2' 0 5' recovery		Sandy Clay (CL) brown, moist some roots, small	1
2-4' No recovery			2
4-7' 1' recovery		void space 3-4'	3
	455	Clay (asphalt), black, dry, some metal scraps	4
	BH20717WC collected from 4-		5
		Clayey Gravel (GC) reddish brown, dry, some caliche	6
7-9' 2' Recov	BH20705WC	SAND, clayey, gravelly cobbly, pale brown to reddish brown, w/caliche	7
			8
			9

Total Depth = 9'

NOTES

441

(4011 930-0135 930)(Form GT 1B)(03/01/92)

U.S DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV 2)

ROCKY FLATS PLANT BOREHOLE LOG 095 / 159

PAGE 2 OF 2

Borehole Number 10495
Location - North NA East NA
Date 5/5/95
Geologist LL Gardiner
Drilling Equip Mobile B-57 HSA

Surface Elevation
Area T-10
Total Depth 20
Company WCFS Project No 5040A
Sample Type Soil

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
	10							10		
	Run 7	2"						11		
	12							12		
	Run 8	0						13		
	14							14		
	Run 9	0								
	15							15		
	Run 10	4"						16		
	17							17		
	Run 11	0.5'								
	18							18		
	Run 12	4"						19		
	20							20		

6/14/95

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

442

U.S DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG

096 / 159

PAGE 2 OF 2

Date 5/5/95 Borehole Number 10495

Rig Geologist LL Gardiner Company WCFS

Depth	Description	Feet
10	Recovery - 0' SAND, silty, fine grained, reddish brown, dry.	10
11		11
12	Recovery - 0' SAND, silty gravelly fine grained, reddish brown Dry.	12
13		13
14	No Recovery	14
15	Recovery 4" SAND, very fine to coarse grained, dry well graded, gravelly driller Large cobbles, reddish brown	15
16		16
17	VOA sample BH20818WC Recovery - 0.5' RAD SVOC Metals BH20818WC	17
18	Recovery - 4" SAND, reddish brown gravelly, very fine to coarse grained well graded, Dry (Driller Large Cobbles)	18
19		19
20		20

NOTES Total Depth = 20'

443

(4011 930-0135-930)(Form GT 1B)(03/01/92)

3 10 TRENCH T-11 (IHSS 111 8)

Trench T-11 was investigated using the following methodologies

- Historical data were compiled to identify potential contaminants trench location and size
- Aerial photographs were examined to identify disturbed areas, verify trench dimensions, and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- One EM survey was conducted to locate buried metallic objects and define trench boundaries
- Soil gas surveys were conducted to identify and delineate contaminant plumes
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the trench

As shown in Figure 3 10-1, Trench T-11 is located north of the East Access Road west of Trench T-10 (IHSS 111 7), and south of Trench T-3 (IHSS 110) The dimensions of the trench are approximately 120 feet long, 10 feet wide, and 10 feet deep The trench was reportedly used for disposal of sanitary sewage sludge potentially contaminated with uranium and plutonium and flattened empty drums contaminated with uranium Activities of the sewage sludge were reported between 382 pCi/g and 3,590 pCi/g Older sludge had mostly uranium with an increasing plutonium fraction in later sludge placed in the trenches Total alpha radioactivity in the trench is estimated to be 100 to 150 millicurie (0 1 Ci to 0 15 Ci) Trench T-11 may also contain some asphalt planking from the Solar Evaporation Ponds contaminated with plutonium and uranium The pertinent section of HRR is presented in Exhibit 3 10 A (PAC Reference Number NE111 1-NE111 8)

Aerial photographs dating from 1954 through 1970 were examined to ascertain the period of operation, approximate the length and width identify staging areas, and gather information which might confirm the contents of the trench (Colorado Aerial Photo Service) Photographs from 1962 show no disturbance in the area of Trench T-10 A photograph from 1964 shows the trench open The next sequence of aerial photos was taken in 1967 and shows the trench had already been excavated filled with waste material, and abandoned

3 10 1 Geology

Trench T-11 is underlain by approximately 28 feet of Rocky Flats Alluvium The Rocky Flats Alluvium is underlain by the Arapahoe Formation Number 1 Sandstone (EG&G 1995c) The hydrograph from monitoring well 07891 located within the IHSS boundary indicates that groundwater occurs between 13 feet and below the bedrock/alluvium contact

3 10.2 Site Visual Survey and Geophysical Surveys

After aerial photographs were examined, a visual survey of the Trench T-11 area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general area of Trench T-11 Soil disturbances such as mounding and subsidence were identified and recent geologic characterization information was used to delineate between undisturbed Rocky Flats Alluvium and soil disturbance caused by construction related activities Evidence of fill material deposits was also noted In addition to the geologic characteristics of the area, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material

Upon completion of the visual survey, a geophysical grid was laid out over the area of Trench T-11 using pin flags Grid dimensions were 50 feet wide (north-south) by 200 feet long (east-west) with flags placed at five foot increments

EM-31 Survey

After establishing the geophysical grid, the EM-31 survey was performed. The EM-31 survey revealed the presence of two small centrally located anomalies which corresponds to two piezometers Another highly conductive area corresponds to the location of an underground utility cable. The survey reveals an area of low conductivity approximately 10-15 feet wide and approximately 150 feet long which correlates to the Trench T-11 outline The EM-31 survey did not indicate the presence of buried metallic objects or other conductive solid or liquid materials in Trench T-11 EM-31 survey results are presented as Exhibit 3 10 B

Ground Penetrating Radar

Due to the saturated conditions, GPR surveys were not performed

3 10 3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995, the vadose zone within the Trench T-11 area was highly saturated. The increased soil moisture content tended attenuate soil gas readings, making sample collection difficult However, 36 samples were collected during this phase of the characterization and analyzed for total volatile organic content using field instrumentation Thirteen samples were analyzed by an onsite laboratory using method 8010

Based on the trench boundaries determined by the geophysical surveys, soil gas sampling locations were placed along two horizontal lines located 10 feet on either side of the centerline of the trench Soil gas samples were taken every 20 feet along the x-axis (east-west) and 10 feet along the y-axis (north-south) at depths of five and 10 bgs If a sample had a field measurement above 100 ppm, the field crew stepped off 10 feet in the north-south direction and collected an additional sample This procedure was repeated until readings less than 100 ppm were obtained This methodology was employed to identify whether a VOC contaminant plume existed within or extends outside of the trench boundaries

There was no VOC plume identified by the survey, although it appears that the organic compounds may be concentrated in the center of the trench Results of the soil gas investigation are presented in Figure 3 10-2

3 10 4 Subsurface Soil Sampling

Subsurface soil sampling from the area identified as Trench T-11 was the final step of the Trenches and Mound Site Characterization activities Two boreholes (11095 and 11195) were drilled and sampled to determine the extent of vertical migration of contaminants Lithologic descriptions of each boreholes is presented in Exhibit 3 10 C In addition four boreholes (07891, 10491, BH4387, and BH4487) were drilled and sampled previously Data from both investigations indicate elevated levels of organic compounds, metals and radionuclides Figure 3 10-3 identifies those boreholes and wells that characterize Trench T-11

Organic Compounds

There were no organic compounds detected at concentrations exceeding the RFCA Subsurface Soil Action Levels as shown in Table 3 10-1

Metals

Cadmium (range 1 4-3 6 mg/kg), calcium (79,300 mg/kg) and nickel (range 105-163 mg/kg) concentrations exceeded the background $UTL_{99/99}$ as presented in Table 3 10-2

Radionuclides

Americium-241 (range 0 03-0 07 pCi/g) and plutonium-239/240 (range 0 02-0 25 pCi/g) activities exceeded the background $UTL_{99/99}$ as shown in Table 3 10-3 Radium-226 (range 0 56-0 62 pCi/g)

and radium-228 (range 1 14-2.04 pCi/g) activities exceeded the subsurface soils PPRGs, construction worker scenario as presented in Table 3 10-4

3 10.5 Groundwater

There are several wells in the Trench T-11 area. Organic compounds, metals and radionuclides were detected at elevated levels in the groundwater as follows

Organic Compounds

Carbon tetrachloride (range 63-330 µg/L), tetrachloroethene (range 44-86 µg/L), and trichloroethene (range 20-39 µg/L) concentrations exceeded the RFCA Tier II Groundwater Action Levels as presented in Table 3.10-5

Metals

Dissolved barium (range 187-199 µg/L), total barium (range 406-420 µg/L), dissolved cadmium (5 1 µg/L), dissolved calcium (range 143,000-159,000 µg/L), total calcium (143,000 µg/L), dissolved lead (13 8 µg/L), total lead (range 24 6-25 4 µg/L), dissolved manganese (range 616-618 µg/L), total manganese (range 242-996 µg/L), total mercury (0.22 µg/L), and total potassium (4,540-10,900 µg/L) concentrations exceeded the background $UTL_{99/99}$ values as shown in Table 3 10-6 Dissolved cadmium (5 µg/L), dissolved manganese and total manganese (range 242-996 µg/L) concentrations exceeded the RFCA Tier II Groundwater Action Levels as presented in Table 3 10-7

Radionuclides

Dissolved gross alpha (range 7 17-9 409 pCi/L), dissolved gross beta (5 23-12 83 pCi/L), dissolved uranium-233/234 (range 3 39-5 90 pCi/L), and dissolved uranium-238 (range 1 59-5 40 pCi/L) activities exceeded the background $UTL_{99/99}$ but were less than RFCA Tier II and RFCA Tier I Groundwater Action Levels and PPRGs for surface water, open-space receptor (see Table 3 10-8)

3.10 6 Summary

The geophysical data indicates the trench is 10 to 15 feet wide and 120 to 150 feet long, and assuming a 5 or 10 foot depth, corresponds to a buried waste volume of approximately 220 to 830 cy Neither a VOC or conductive plume were identified from the surveys

447

The data collected from the boreholes were combined with data from previous investigations for comparison to background concentrations negotiated cleanup levels, and PPRGs Two metals were detected at concentrations greater than the background $UTL_{99/99}$ values but less than PPRGs for subsurface soils construction worker scenario Two radionuclide activities exceeded the background $UTL_{99/99}$ values but were less than the PPRGs for subsurface soils, construction worker scenario Radium-226 and radium-228 activities exceeded the PPRGs for subsurface soils, construction worker scenario However, the background $UTL_{99/99}$ values for these radionuclides exceed the PPRGs

The concentrations of three organic compounds and one metal exceeded the RFCA Tier II Groundwater Action Levels There were no detected concentrations of organic compounds or metals greater than the RFCA Tier I Groundwater Action Levels or the PPRGs for surface water, open-space receptor For these reasons, remedial action at Trench T-11 is not recommended

Trench T-11 summary information is presented in Table 3 10-9

448

Table 3 10-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
[redacted]										

LABORATORY QUALIFIERS
J = Positively identified below sample quantitation limit, result is estimated

NOTES
RFCA Action Levels for Benzoic Acid and 2 Butanone have not been determined

VALIDATION CODES
Y = Analytical results in validation process

Best Available Copy

445

Table 3 10-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 11	11095	BH207188WC	7 10	4/24/95	Nickel	163	8		Y	78.7
Trench T 11	11195	BH207701WC	4-7	4/12/95	Cadmium	2.9	1		Y	1.33
Trench T-11	11195	BH207709WC	4-7	4/12/95	Nickel	105	8		N	78.7
Trench T 11	BH4367	BH4367004DH	4-5.3	9/4/87	Cadmium	2.2			N	1.33
Trench T 11	BH4367	BH4367009DH	9.5-10.3	9/4/87	Cadmium	2.5			N	1.33
Trench T 11	BH4367	BH4367120DH	12-12.9	9/4/87	Cadmium	1.7			N	1.33
Trench T 11	BH4367	BH4367114DH	14.5-15.8	9/4/87	Cadmium	3.2			N	1.33
Trench T 11	BH4367	BH4367117DH	17 18.3	9/4/87	Cadmium	2.1			N	1.33
Trench T 11	BH4367	BH4367122DH	22.2-23.2	9/4/87	Cadmium	2.8			N	1.33
Trench T 11	BH4367	BH4367128UC	24.7-26	9/8/87	Cadmium	2.4			N	1.33
Trench T 11	BH4367	BH4367127CT	27.4-29.7	9/8/87	Cadmium	3.2			N	1.33
Trench T 11	BH4367	BH4367300D	29.7-32	9/8/87	Cadmium	2.8			N	1.33
Trench T 11	BH4367	BH4367308R	29.7-32	9/8/87	Cadmium	3.6			N	1.33
Trench T 11	BH4487	BH4487004DH	4-5.3	9/9/87	Cadmium	78300			N	1.33
Trench T-11	BH4487	BH4487014DH	4-5.3	9/4/87	Calcium	2.1			N	1.33
Trench T 11	BH4487	BH4487118DH	14.5-16.4	9/9/87	Cadmium	1.4			N	1.33
Trench T-11	BH4487	BH4487220DH	19.5-22	9/9/87	Cadmium	3			N	53250
Trench T-11	BH4487	BH4487224DH	22-23.5	9/9/87	Cadmium	2.9			N	1.33
Trench T-11	BH4487	BH4487327DH	24.5-27	9/9/87	Cadmium	2.8			N	1.33
			32-34.5	9/9/87	Cadmium	2.1			N	1.33
									N	1.33
									N	1.33
									N	1.33

LABORATORY QUALIFIER

VALIDATION CODES
N = Will not be validated
Y = Analytical results in validation process

450

Table 3 10-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND UTL 99/99
Trench T 11	7891	BH00395WCU2	2 1 8	12/12/91	Americium 241	0 04	0	0 015	A	0 022
Trench T 11	7891	BH00394WCU2	2 1 8	12/12/91	Americium 241	0 05	0	0 017	A	0 022
Trench T 11	7891	BH00398WCU2	8-14	12/12/91	Plutonium 239 240	0 03	0	0 015	A	0 025
Trench T 11	7891	BH00402WCU2	16 22	12/12/91	Plutonium 239 240	0 03	0	0 017	A	0 025
Trench T 11	7891	BH00395WCU2	2 1 8	12/12/91	Plutonium 239 240	0 21	0 013	0 044	A	0 025
Trench T 11	7891	BH00394WCU2	2 1 8	12/12/91	Plutonium 239 240	0 25	0	0 049	A	0 025
Trench T 11	10491	BH00200WCU2	2 8	12/11/91	Americium 241	0 03	0	0 013	A	0 022
Trench T 11	10491	BH00200WCU2	2 8	12/11/91	Plutonium-239 240	0 03	0 012	0 02	A	0 025
Trench T 11	10491	BH00205WCU2	14-20	12/11/91	Plutonium-239 240	0 03	0 011	0 02	A	0 025
Trench T 11	10491	BH00205WCU2	14-20	12/11/91	Plutonium-239 240	0 03	0 011	0 02	A	0 025
Trench T 11	10491	BH00205WCU2	14-20	12/11/91	Radium 226	0 56	0 5	0 141		1 42
Trench T 11	10491	BH00203WCU2	8-14	12/11/91	Radium-226	0 62	0 5	0 111		1 42
Trench T 11	10491	BH00200WCU2	8-14	12/11/91	Radium-228	1 14	0 5	0 211		2.33
Trench T 11	10491	BH00205WCU2	2 8	12/11/91	Radium 228	1 66	0 5	0 325		2 33
Trench T 11	10491	BH00203WCU2	14-20	12/11/91	Radium-228	2 04	0 5	0 301		2 33
Trench T 11	11095	BH20718WC	8-14	4/24/95	Plutonium 239 240	0 09	0 007	0 022	Y	0 025
Trench T 11	11195	BH20703WC	4-7	4/12/95	Americium 241	0 03	0 007	0 011	Y	0 022
Trench T 11	11195	BH20701WC	4-7	4/12/95	Plutonium-239 240	0 1	0 007	0 037	Y	0 025
Trench T 11	11195	BH20703WC	4-7	4/12/95	Plutonium-239 240	0 26	0 011	0 055	Y	0 025
Trench T 11	BH4387	BH4387407D	4-5 3	9/4/87	Americium-241	0 03		0 09	N	0 022
Trench T 11	BH4387	BH4387407D	4-5 3	9/4/87	Americium-241	0 03		0 09	N	0 022
Trench T 11	BH4387	BH438725UC	24 7 26	9/8/87	Americium-241	0 03		0 09	N	0 022
Trench T 11	BH4387	BH438722DH	22.2 23 2	9/8/87	Americium-241	0 04		0 1	N	0 022
Trench T 11	BH4387	BH4387300D	29 7 32	9/8/87	Americium 241	0 05		0 1	N	0 022
Trench T 11	BH4387	BH4387300D	29 7 32	9/8/87	Americium-241	0 05		0 1	N	0 022
Trench T 11	BH4387	BH438707DH	7 7 9	9/4/87	Plutonium-239 240	0 05		0 09		0 025
Trench T 11	BH4387	BH438704DH	4-5 3	9/4/87	Plutonium-239 240	0 09		0 12		0 025
Trench T 11	BH4387	BH438714DH	14 5-15 8	9/4/87	Plutonium-239 240	0 1		0 1		0 025
Trench T 11	BH4387	BH438714DH	14 5-15 8	9/4/87	Plutonium-239 240	0 1		0 1		0 025
Trench T 11	BH4387	BH438725UC	24 7 26	9/8/87	Plutonium-239 240	0 03		0 09		0 025
Trench T 11	BH4387	BH4387300D	29 7-32	9/8/87	Plutonium-239 240	0 04		0 08		0 025
Trench T 11	BH4387	BH4387300D	29 7-32	9/8/87	Plutonium-239 240	0 04		0 08		0 025
Trench T 11	BH4487	BH448722DH	22 23 5	9/9/87	Americium-241	0 07		0 11	N	0 022
Trench T 11	BH4487	BH448732BR	32-34 5	9/9/87	Americium-241	0 07		0 1	N	0 022
Trench T 11	BH4487	BH448722DH	22 2 23 5	9/9/87	Americium-241	0 07		0 11	N	0 022
Trench T 11	BH4487	BH448732BR	32 34 5	9/9/87	Americium-241	0 07		0 1	N	0 022
Trench T 11	BH4487	BH448704DH	4-6 2	9/9/87	Plutonium-239 240	0 07		0 09		0 025

Table 3 10-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{95/95}$ Values (continued)

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{95/95}$

VALIDATION CODES
A = Result accepted with qualifications
N = Will not be validated
Y = Analytical results in validation process

Table 3 10-4 Subsurface Soil Radionuclide Activities Exceeding PPRGs

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	PPRG (pCi/g)
Trench T 11	10491	BH00205WCU2	14-20	12/11/91	Radium 226	0 56	0 5	0 141		0 75
Trench T 11	10491	BH00203WCU2	8-14	12/11/91	Radium 226	0 62	0 5	0 111		0 75
Trench T 11	10491	BH00200WCU2	2 8	12/11/91	Radium 228	1 14	0 5	0 211		1 4
Trench T 11	10491	BH00205WCU2	14-20	12/11/91	Radium-228	1 66	0 5	0 325		1 4
Trench T 11	10491	BH00203WCU2	8-14	12/11/91	Radium-228	2 04	0 5	0 301		1 4

VALIDATION CODES

Table 3 10-5 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T 11	7891	GW02434IT	3/12/92	Carbon Tetrachloride	0 063	0 00002	E	0 005	
Trench T 11	7891	GW02855IT	5/7/92	Carbon Tetrachloride	0.064	0.00002	E	0 005	
Trench T 11	7891	GW03353IT	8/20/92	Carbon Tetrachloride	0 13	0.00014	E	0.005	
Trench T 11	7891	GW03909IT	10/23/92	Carbon Tetrachloride	0.11	0.0005		0 005	A
Trench T 11	7891	GW01301WC	9/2/93	Carbon Tetrachloride	0 27	0 0002		0.005	V
Trench T 11	7891	GW01668WC	12/9/93	Carbon Tetrachloride	0 16	0.0002		0.005	Y
Trench T 11	7891	GW01149GA	8/21/94	Carbon Tetrachloride	0.33	0 0003		0.005	V
Trench T 11	7891	GW02434IT	3/12/92	Tetrachloroethene	0.044	0.00002	E	0.005	
Trench T 11	7891	GW02855IT	5/7/92	Tetrachloroethene	0.042	0.00002		0.005	
Trench T 11	7891	GW03353IT	8/20/92	Tetrachloroethene	0.084	0.00014	E	0.005	
Trench T 11	7891	GW03909IT	10/23/92	Tetrachloroethene	0.047	0 0005		0 005	A
Trench T 11	7891	GW01301WC	9/2/93	Tetrachloroethene	0.08	0.0001		0.005	V
Trench T-11	7891	GW01668WC	12/9/93	Tetrachloroethene	0.052	0.0001		0.005	Y
Trench T 11	7891	GW01149GA	8/21/94	Tetrachloroethene	0.086	0.0002		0.005	V
Trench T 11	7891	GW02434IT	3/12/92	Trichloroethene	0.033	0.00003		0 005	
Trench T-11	7891	GW02855IT	5/7/92	Trichloroethene	0 032	0.00003	E	0.005	
Trench T 11	7891	GW03353IT	8/20/92	Trichloroethene	0.026	0 00028	E	0 005	
Trench T 11	7891	GW03909IT	10/23/92	Trichloroethene	0 029	0.0005		0 005	A
Trench T 11	7891	GW01301WC	9/2/93	Trichloroethene	0.036	0.0001		0.005	V
Trench T 11	7891	GW01668WC	12/9/93	Trichloroethene	0.02	0.0001		0.005	Y
Trench T 11	7891	GW01149GA	8/21/94	Trichloroethene	0.039	0 0002		0.005	V

LABORATORY QUALIFIERS
E = Chemical exceeds calibration range of the instrument

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result
Y = Analytical results in validation process

Table 3 10-6 Groundwater Dissolved Metal Concentrations Exceeding $UTL_{99/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (μ g/L)	DETECTION LIMIT (μ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T 11	7891	GW02434IT	3/12/92	Banum	194	200	BE	JA	171 2
Trench T 11	7891	GW02855IT	5/7/92	Barium	187	200	BE	JA	171 2
Trench T 11	7891	GW03353IT	8/20/92	Banum	193	5 1		V	171 2
Trench T 11	7891	GW03909IT	10/23/92	Banum	195	2 1		V	171 2
Trench T 11	7891	GW01149GA	8/21/94	Banum	199	200	B	V	171 2
Trench T 11	7891	GW03353IT	8/20/92	Cadmium	5 1	3 1		JA	4 26
Trench T 11	7891	GW02434IT	3/12/92	Calcium	143000	5000		V	141250
Trench T 11	7891	GW01149GA	8/21/94	Calcium	159000	5000		V	141250
Trench T 11	7891	GW03909IT	10/23/92	Lead	13 8	1 3		V	13 3
Trench T 11	7891	GW02434IT	3/12/92	Manganese	616	15		V	263
Trench T 11	7891	GW02855IT	5/7/92	Manganese	618	15		V	263

LABORATORY QUALIFIER
B = Detected concentration was less than the contract required detection limit and above the instrument detection limit
E = Reported value is estimated due to interference

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result

Table 3 10-6 Groundwater Total Metal Concentrations Exceeding UTL_{0000} Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND UTL_{0000}
Trench T 11	7891	GW02855IT	5/7/92	Barium	420	200		V	296
Trench T 11	7891	GW03353IT	8/20/92	Barium	406	5.1		V	296
Trench T 11	7891	GW02434IT	3/12/92	Calcium	143000	5000		V	141900
Trench T 11	7891	GW02855IT	5/7/92	Lead	25 4	3		V	18.4
Trench T 11	7891	GW03353IT	8/20/92	Lead	24 6	0.8		V	18.4
Trench T 11	7891	GW02434IT	3/12/92	Manganese	668	15		V	606
Trench T 11	7891	GW02855IT	5/7/92	Manganese	996	15		V	606
Trench T 11	7891	GW02434IT	3/12/92	Mercury	0.22	0.2		V	0.15
Trench T 11	7891	GW02855IT	5/7/92	Potassium	10900	5060	E	JA	4980
Trench T 11	7891	GW03353IT	8/20/92	Potassium	6850	1030		V	4980

LABORATORY QUALIFIER
E = Reported value is estimated due to interference

VALIDATION CODES
JA = Result accepted, but was estimated
V = Valid result

Table 3 10-7 Groundwater Dissolved Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (µ g/L)
Trench T 11	7891	GW03353IT	8/20/92	Cadmium	5	3		JA	5
Trench T 11	7891	GW02434IT	3/12/92	Manganese	616	15		V	183
Trench T 11	7891	GW02855IT	5/7/92	Manganese	618	15		V	183

LABORATORY QUALIFIER

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result

957

Table 3 10-7 Groundwater Total Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µg/L)	DETECTION LIMIT (µg/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (µg/L)
Trench T 11	7891	GW02434IT	3/12/92	Manganese	668	15		V	183
Trench T 11	7891	GW02855IT	5/7/92	Manganese	996	15		V	183
Trench T 11	7891	GW03353IT	8/20/92	Manganese	554	1 4		V	183
Trench T 11	7891	GW03909IT	10/23/92	Manganese	242	2 1		V	183

LABORATORY QUALIFIER

VALIDATION CODES
V = Valid result

Table 3 10-8 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T 11	7891	GW02434IT	3/12/92	Gross Alpha	7 175	2 4	3 64	A	7
Trench T 11	7891	GW02855IT	5/7/92	Gross Alpha	9 409	1 5	3 46	A	7
Trench T 11	7891	GW01301WC	9/2/93	Gross Alpha	8 5	1 5	1 5	V	7
Trench T 11	7891	GW02434IT	3/12/92	Gross Beta	5 235	3 4	2 16	A	5
Trench T 11	7891	GW02855IT	5/7/92	Gross Beta	11 31	2 6	2 44	A	5
Trench T 11	7891	GW03909IT	10/23/92	Gross Beta	12 83	3 4	2 93	A	5
Trench T 11	7891	GW02434IT	3/12/92	Uranium-233 234	3 39	0 118	0 984	A	1 07
Trench T 11	7891	GW02855IT	5/7/92	Uranium-233 234	5 37	0	0 527	A	1 07
Trench T 11	7891	GW03353IT	8/20/92	Uranium-233 234	4	0 2	0 89	A	1 07
Trench T 11	7891	GW03909IT	10/23/92	Uranium-233 234	3 833	0 151	1 02	A	1 07
Trench T 11	7891	GW01301WC	9/2/93	Uranium-233 234	5 9	0 28	2 3	A	1 07
Trench T 11	7891	GW01149GA	8/21/94	Uranium-233 234	4 6423	0 403	1 2654	V	1 07
Trench T 11	7891	GW02434IT	3/12/92	Uranium-238	3 281	0 118	0 964	A	0 768
Trench T 11	7891	GW02855IT	5/7/92	Uranium-238	3 47	0	0 401	A	0 768
Trench T 11	7891	GW03353IT	8/20/92	Uranium-238	2 5	0 2	0 63	A	0 768
Trench T 11	7891	GW03909IT	10/23/92	Uranium-238	1 844	0	0 66	A	0 768
Trench T 11	7891	GW01301WC	9/2/93	Uranium-238	5 4	0 16	2 1	A	0 768
Trench T 11	7891	GW01149GA	8/21/94	Uranium-238	1 5945	0 403	0 75	V	0 768

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result

958

TABLE 3.10-9 TRENCH T-11 SUMMARY INFORMATION

CONTAMINANTS		
Media: Subsurface Soils		
Greater than $UTL_{95/95}$	Greater than RFCA Standards	Greater [illegible]
	2-butanone	
Cadmium Calcium Nickel		
Americium-241 Plutonium-239/240		Radium-226 Radium-228

Media: Groundwater			
Greater than $UTL_{95/95}$	Greater than RFCA Tier II Standards	Greater than RFCA Tier I Standards	Greater than PPRGs
	Carbon tetrachloride Tetrachloroethene Trichloroethene		
Barium Cadmium Calcium Lead Manganese Mercury Potassium	Cadmium Manganese		
Gross alpha Gross beta Uranium-233/234 Uranium-238			

PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
120-150	10-15	5-10	220-830	Yes	No

Note

RFCA subsurface soil action levels have not been determined for 2-butanone and benzoic acid

Exhibit 3.10.A
Trench T-11 Historical Release Report Information

464

Best Available Copy

PAC REFERENCE NUMBER NE 111 1 NE 11 9

[illegible] Reference Number 111 1 111 8 Operable Unit 2

Unit Name Trenches T-4 through T-11

Approximate Location N750 000 E2 087,500

Date(s) of Operation or Occurrence

The exact dates of operation are unknown except for the period of July 29 1954 through August 14 1968[1] Trenches T 9 T 10 and T-11 were differentiated from the other trenches and added to the disposal trench inventory in 1977[2] See the "Comments" section below for additional discussion of this point

Description of Operation or Occurrence

Trenches T-4 through T 11 along with Trench T 2 (PAC 900 109) and Trench T 3 (PAC NE 110) were used primarily for the disposal of sanitary wastewater treatment plant sludge The sludge removed from the wastewater treatment plant was placed on sludge drying beds The dried material removed from the sludge drying beds was placed in the disposal trenches The sanitary sludge disposal trenches are reported to be approximately 10 feet deep and are provided with two feet of soil cover[3] The trenches are variable in length with the average length being approximately 250 feet[4] The total amount of sludge disposed in Trenches T 2 through T 11 is estimated at 125 000 kilograms[5] Some amounts of additional materials were also disposed in Trenches T-4 T 9 and T 11 These other materials consisted of asphalt planking (approximately 130 000 square feet of asphalt planking) in T-4 and T 11 from the re-design of Solar Pond 207A (PAC 000-101) in 1963 and scrap metal and junk in T 9[5]

At the same time that Trenches T 9 T 10 and T 11 were identified [illegible] appears that the numbering system for the trenches was slightly modified Whereas earlier documents had [illegible] consistent numbering system [illegible] a 1983 document a trench that had previously been [illegible] T 11 This 1983 document [illegible] T-4 trench essentially as an addition to Trench [illegible] 1983 [illegible] designated Trench T 9 [illegible] essentially an extension of Trench T 7[5] but in earlier documents [illegible] referred to as Trench T 5[1] Trench T 10 had not been identified or named prior to 1983 The [illegible] as Trench T 5 in the 1983 document was a trench not previously identified (comparison of [illegible] and 5)

Physical Chemical Description of Constituents Released

[illegible] and plutonium contamination is pres[illegible] sludge would have [illegible] primarily uranium contamination with newer [illegible] contamination [illegible] alpha activity present in the sludge [illegible] 382 pCi/g in August 1964 [illegible] of 3 591 pCi/g in June 1960 [illegible] drums that [illegible] been disposed in any of trenches T 2 through T [illegible] oils that had [illegible] in the drum[6] The burning of the contam[illegible] (PAC 900-153) from March 1957 to mid 1965[6] not in the trenches [illegible] up to [illegible] in total number [illegible] be present in any of Trenches T 3 through [illegible] that Trench T-4 [illegible] designated Trench T 11 as discussed [illegible]

On at least one occasion it is believed that 2 400 gallons [illegible] in Building [illegible] was [illegible] one of the East Trenches This [illegible] is believed that [illegible] alpha activity The [illegible] approximately 1 3 kilograms (kg) of depleted uranium present in the [illegible] this material was in drums

Response to Operation or Occurrence

[illegible] were collected from the [illegible] 1977 Trenches T 9 T 10 and T 11 during [illegible] time frame Soil from [illegible] plutonium activity and from [illegible] pCi/g uranium activity [illegible] 0 18 to [illegible] pCi/g plutonium

465

activity and from 40 to 126 pCi/g uranium activity Trench T-11 was found to contain 4 5 to 50 pCi/g plutonium activity and 0 9 to 158 pCi/g in uranium activity [5]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents disposed in Trenches T-4 through T 11 This IHSS is being studied in accordance with the IAG schedule for OU2 The IAG activities will include site investigations site characterizations and possible remediation The Final Phase II RFI/RI Report is to be completed by March 12 1993

Comments

Trench T-3 along with these trenches are also called the East Trenches

Trenches T-4 through T-11 (PAC NE 111) have few operational differences from Trenches T 2 (PAC 900-109) and T-3 (PAC NE 110)

The sludge disposed of in these trenches should consist primarily of concentrated organic matter typically present in sanitary wastewater treatment plant sludge

From August 1968 until February 1970 sanitary wastewater treatment plant sludge was disposed in the RFP sanitary landfill [1] After February 1970 sanitary wastewater treatment plant sludge was shipped offsite for disposal [9]

To date no documentation has been found that records the time frame during which any particular trench was receiving waste Similarly none of the HRR interviewees were knowledgeable on dates of operation of individual trenches

The locations of the e trenches on Plate 2 differ from the IAG map but are taken from the OU2 Phase [illegible] Work Plan (Alluvial) (Jul [illegible]

References	Other references of interest	
[1] 1500793	1500296	1501097
1501719	500430	1500[illegible]
[3] 1500898	500340	1500460
[4] 150[illegible]	00287	150[illegible]
[5] 1500890	00901	1500[illegible]
[6] 1500656	500304	1500[illegible]
1500[illegible]79	1500458	1500[illegible]
[8] 1700[illegible]	500888	

466

Exhibit 3.10.B
Trench T-11 EM-31 Surveys

Exhibit 3.10.C
Trench T-11 Borehole Logs

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT)	5957 60	PROJECT NUMBER	002 RFI/RI	LOG OF BORING NUMBER
NORTH	749644	AREA TRENCH T-11	CASING DIAMETER (IN)		GEOLOGIST	LL GARDINER	11095
EAST	2086990	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	1 00	DATE DRILLED	04/20/95	

REMARKS SOIL TYPES EXTIMATED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% – 50% – 100%) | PERCENT RECOVERY (0% – 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY

UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CL	0 0-1 0'+/- Silty Clay dark brown, moist 1 0-1 5' Clayey sand cobbles light brown to reddish brown, dry No recovery (1 5-2 0')
SW	2 0-3 0' Sand with some gravel very fine to fine grained, light brown, calcareous cement, dry
SW	3 0-4 5' Sand reddish brown to pale brown, some gravel, some caliche, v f g to m g, subangular, dry No recovery (4 5-5 0')
SM	5 0-6 8' Sand pale pinkish brown to reddish brown, silty, v f g to c g, gravelly, well graded, dry No recovery (6 8-7 0')
SC	7 0-8 4' Clayey Sand reddish brown, gravelly cobbles with large fragments of quartzite and pulverized rock powder, dry No recovery (8 4-9 0')
	9 0-10 0' Clayey Sand silty, reddish brown, gravelly, some cobbles, quartzite fragments, dry
	Total Depth Drilled 10 00

RECOVERY/INTERVAL	DATUM (FT)
1 50 /2 00	5957
	5956
1 00 /1 00	5955
1 50 /2 00	5954
	5953
1 80 /2 00	5952
	5951
1 40 /2 00	5950
	5949
1 00 /1 00	5948

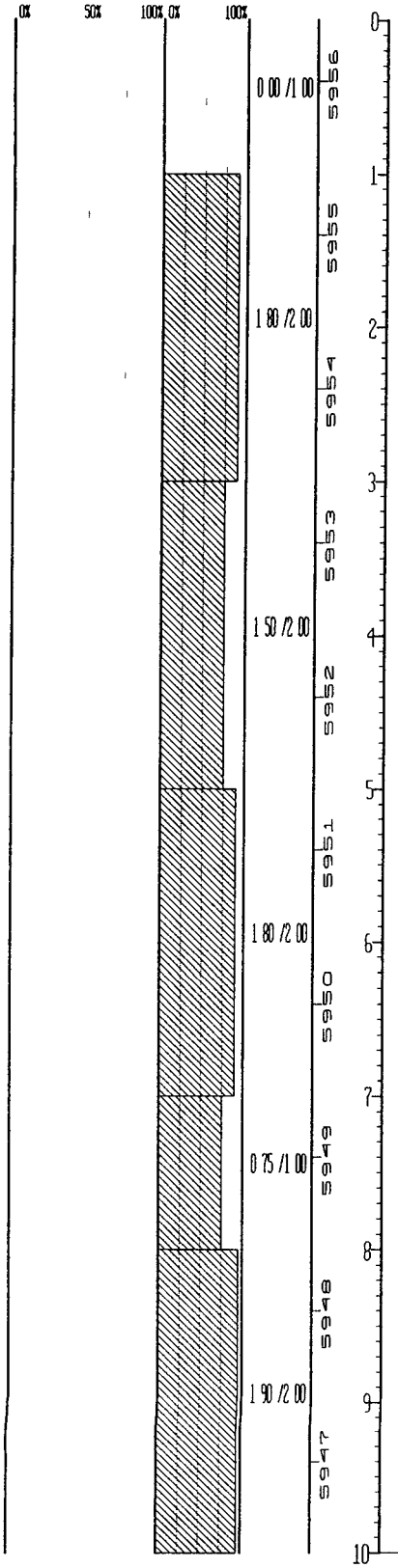
DEPTH (FT): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

473

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT)	5956 40	PROJECT NUMBER	002 RFI/RI	LOG OF BORING NUMBER
NORTH	749661	AREA N/A	CASING DIAMETER (IN)		GEOLOGIST	LL GARDINER	11195
EAST	2087100	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	1 00	DATE DRILLED	04/12/95	

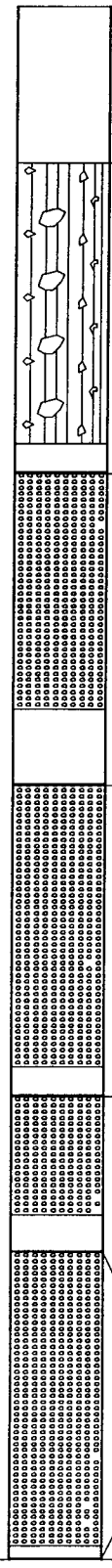
REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER



WELL OR PIEZOMETER CONSTRUCTION

LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
NO RECOVERY	0 0-1 0' No recovery
GM	1 0-2 8' Gravel, sand, with cobbles, silty, pale brown, c to v f g, rounded to subangular, sand and granite, well graded, dry No recovery (2 8-3 0')
SW	3 0-4 5' Sand, gravelly, pinkish brown, v f g to c g, quartz and granite fragments, round to angular, micaceous, dry, well graded No recovery (4 5-5 0')
SW	5 0-6 8' Gravelly Sand med to light brown, silt v f g to c g, well graded, granite, some interbedded, sand and gravelly sand, dry No recovery (6 8-7 0')
SW	7 0-7 75' Sand and gravel same as above caliche nodules with bottom one inch becoming olive gray sandy clay No recovery (7 75-8 0')
SW	8 0-9 9' Sand and gravel granite, pinkish to reddish brown, some with gray clay, mica (<5%) sand is v f g to c g, well graded, dry No recovery (9 9-10 0')
	Total Depth Drilled 10 00

474

3 11 TRENCH T-12 (PAC NE-1412)

Trench T-12 was investigated using the following methodologies

- Historical data were compiled to identify potential contaminants trench location and size
- Aerial photographs were examined to identify disturbed areas verify trench dimensions and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- EM surveys were conducted to locate buried metallic objects and define trench boundaries
- GPR surveys were conducted to better determine trench depth and dimensions
- Soil gas surveys were conducted to identify and delineate contaminant plumes
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the trench

This trench was unknown until the recent aerial photo evaluation and does not have an IHSS designation Trench T-12 is located east of the inner east guard station and south of Trench T-13 and is estimated to be approximately 10 feet wide, 125 feet long and 5 feet deep as shown in Figure 3 11-1 Trench T-12 is an extension of Trench T-9 The HRR states that all of the trenches in the Northeast Trenches Area are thought to be about 10 feet deep and to primarily contain sewage sludge This sewage sludge is believed to contain uranium and plutonium contamination Flattened drums may also be present The HRR indicates that at least 2 400 gallons of water and lathe coolant were disposed in one of the trenches (unspecified) in this area Trench T-12 is now partially covered with asphalt or base material of the East Access Road The pertinent section of HRR is presented in Exhibit 3 11 A (PAC Reference Number NE111 1-NE111 8)

Aerial photographs dating from 1954 through 1970 were examined to ascertain the period of operation, approximate the length and width, identify staging areas, and gather information which might confirm the contents of the trench (Colorado Aerial Photo Service 1993) A photo from 1962 shows Trench T-12 open and containing a dark material which may be sewage sludge Photographs from 1964 show the trench filled and abandoned

3 11 1 Geology

Trench T-12 is underlain by the Rocky Flats Alluvium which ranges in thickness from 17 to 28 feet In this area, the Rocky Flats alluvium is underlain by the Arapahoe Formation Number 1 Sandstone (EG&G 1995c) The hydrograph of monitoring well 44286 located adjacent to Trench

T-12 indicates that groundwater fluctuates between six feet bgs to below the bedrock/alluvium contact

3 11.2 Site Visual Survey and Geophysical Surveys

After aerial photographs were examined, a visual survey of the Trench T-12 area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general Trench T-12 area Soil disturbances such as paving, mounding and subsidence were identified and recent geologic characterization information was used to delineate between Rocky Flats Alluvium and soil disturbance caused by construction related activities Evidence of road and fill material deposits was also noted. In addition to the geologic characteristics of the area, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material

Upon completion of the visual survey, a geophysical grid was laid out over the area of Trench T-12 using pin flags Grid dimensions were 50 feet wide (north-south) by 200 feet long (east-west) with flags placed at five foot increments

EM-31 Survey

After establishing the geophysical grid, the EM-31 survey was performed The EM-31 survey reveals the presence of a large highly conductive anomaly in the northwest quadrant which corresponds to a metal fence The inphase horizontal mode indicates an area of low conductive
15-25 feet wide and of an indeterminate length At a minimum, the trench area appears to be 125 feet long The trench apparently does not contain metallic or conductive materials Therefore, an EM-61 survey was not performed The EM-31 survey results are presented in Exhibit 3 11.B

Ground Penetrating Radar

The information obtained from the GPR indicates that the trench is approximately 10-20 feet wide and five feet deep The exact length is unknown since not all of the GPR transacts were usable because of saturated soil conditions Based on GPR results, it appears to be a minimum of 150 feet long GPR survey results are presented in Exhibit 3 11 C

3 11 3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995, the vadose zone within Trench T-12 area was highly saturated The increased soil moisture content tended to attenuate soil gas readings,

476

making sample collection difficult However, 26 samples were collected and analyzed for total volatile organic content using field instrumentation Six samples were analyzed by on onsite laboratory using method 8010

Based on the trench boundaries determined by the geophysical surveys soil gas sampling points were placed along two horizontal lines located 10 feet on either side of the centerline of the trench Soil gas samples were taken every 20 feet along the x-axis (east-west) and 10 feet along the y-axis (north-south) at depths of five and 10 feet bgs If a sample had a field measurement above 100 ppm, the field crew stepped off 10 feet in the north-south direction and collected an additional sample This procedure was repeated until readings less than 100 ppm were obtained

The highest concentrations of total VOCs were found in the five foot bgs samples Concentrations ranged from 0-1,157 ppm A VOC plume identified was not indicated by the survey although it appears that the organic compounds are concentrated in the western third of the trench Results from the soil gas investigation are presented in Figure 3 11-2

3 11 4 Subsurface Soil Sampling

Subsurface soil sampling from the Trench T-12 area was the final step of the characterization activities Two boreholes (12595 and 12695) were drilled and sampled The lithology of each borehole is presented in Exhibit 3 11 D In addition four boreholes (04191, 07991, B215389, and BH4787) were previously drilled and sampled Data from both characterization efforts indicate elevated levels of organic compounds, metals and radionuclides Figure 3 11-3 identifies those boreholes and wells that characterize Trench T-12

Organic Compounds

There were no organic compounds detected at concentrations exceeding the RFCA Subsurface Soil Action Levels as presented in Table 3 11-1

Metals

Cadmium (range 1 4-2 6 mg/kg) calcium (range 95 800-131 000 mg/kg) and nickel (116 mg/kg) concentrations exceeded the subsurface background $UTL_{99/99}$ values as shown in Table 3 11-2

Radionuclides

Americium-241 (range 0 04-0 16 pCi/g), plutonium-239/240 (0 05-0 13 pCi/g), uranium-235 (range 0 16-0 18 pCi/g), and uranium-238 (2 95 pCi/g) activities exceeded the background $UTL_{99/99}$ values as shown in Table 3 11-3 Radium-226 (range 0 6-0 8 pCi/g) and radium-228 (range 1.3-1 8 pCi/g) activities exceeded the subsurface soil PPRGs construction worker scenario as presented in Table 3 11-4

3 11 5 Groundwater

There are several wells in the Trench T-12 area. Organic compounds, metals and radionuclides were detected in the groundwater at elevated levels as follows

Organic Compounds

Carbon tetrachloride (range 16-180 µg/L), methylene chloride (22 µg/.L), tetrachloroethene (range 9-36 µg/L), and trichloroethene (5-16 µg/L) concentrations exceeded the RFCA Tier II Groundwater Action Levels as shown in Table 3 11-5)

Metals

Dissolved barium (221 µg/L), total barium (412 µg/L), dissolved calcium (180,000 µg/L), dissolved manganese (range 480-726 µg/L), total manganese (955 µg/L), and total potassium (5,470-15,700 µg/L) concentrations exceeded background $UTL_{99/99}$ as presented in Table 3 11-6 Total antimony (23 µg/L) dissolved manganese (range 192-726 µg/L) and total manganese (range 486-955 µg/L) concentrations exceeded the RFCA Tier II Groundwater Action Levels as presented in Table 3 11-7

Radionuclides

The strontium-89/90 (1 34 pCi/L) activity exceeded the background $UTL_{99/99}$ as presented in Table 3 11-8 Dissolved gross alpha (range 16-34 pCi/L), dissolved gross beta (10 4-18 0 pCi/L), dissolved uranium-233/234 (9-20 pCi/L), dissolved uranium-235 (1 21 pCi/L), and dissolved uranium-238 (8 9-16 pCi/L) activities exceeded the RFCA Tier II Groundwater Action Levels as shown in Table 3 11-9

3 11 6 Summary

The data indicate that the trench is 5 feet deep 10 to 15 feet wide and approximately 150 feet long which corresponds to 280 to 420 cy of buried material The electromagnetic survey data does not indicate the presence of buried metallic objects

Soil gas surveys and electromagnetic surveys do not indicate the presence of VOC or conductive plumes

The data collected from the boreholes were combined with data from previous investigations for comparison to negotiated cleanup levels, background concentrations and preliminary remediation goals The concentration of one organic compound exceeded the RFCA Subsurface Soil Action Level Three metal concentrations and four radionuclide activities exceeded background $UTL_{99/99}$ values Radium-226 and radium-288 activities exceeded the PPRGs for subsurface soils construction worker scenario However, the subsurface soil background $UTL_{99/99}$ values for radium-226 and radium-228 exceed the PPRGs Four metal concentrations and one radionuclide activity exceed background $UTL_{99/99}$ values Four organic compound and two metal concentrations, and five radionuclide activities exceed the RFCA Tier II Groundwater Action Levels All detected organic compound and metal concentrations and measured radionuclide activities are less than the RFCA Tier I Groundwater Action Levels and the PPRGs for surface water, open-space receptor Therefore, no remedial action is recommended for this trench

Trench T-12 summary information is presented in Table 3 11-10

Table 3 11-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
[redacted]										

LABORATORY QUALIFIERS
J = Positively identified below sample quantitation limit result is estimated

NOTES
RFCA Action Levels for Benzoic Acid and 2 Butanone have not been determined

VALIDATION CODES
A = Result accepted with qualifications

Best Available Copy

580

Table 3 11-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 12	7991	BH00332WCU2	2.8	2/3/92	Calcium	95800	1000		V	53250
Trench T 12	12895	BH20778WC	8-10	5/2/95	Nickel	116	8		Y	78.7
Trench T 12	B215999	B215999003	0-3	10/31/99	Calcium	131000	2000		V	53250
Trench T 12	BH4787	BH478704DH	4-5.32	9/11/87	Cadmium	1.4			N	1.39
Trench T 12	BH4787	BH478706DH	6-7.15	9/11/87	Cadmium	1.9			N	1.33
Trench T 12	BH4787	BH478706DH	8-9	9/11/87	Cadmium	2.6			N	1.33
Trench T 12	BH4787	BH478727BR	27.2-28.2	9/15/87	Cadmium	1.6			N	1.33
Trench T 12	BH4787	BH478704DH	4-5.32	9/11/87	Calcium	109000			N	53250
Trench T 12	BH4787	BH478706DH	6-7.15	9/11/87	Calcium	58500			N	53250

LABORATORY QUALIFIER

VALIDATION CODES
N = Will not be validated
V = Valid result
Y = Analytical results in validation process

581

Table 3 11-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T 12	7991	BH00332WCU2	2 8	2/3/92	Plutonium 239 240	0 12	0	0 021	A	0 025
Trench T 12	7991	BH00336WCU2	14-20	2/3/92	Uranium 235	0 16	0 006	0 041	A	0 153
Trench T 12	7991	BH00336WCU2	14-20	2/3/92	Uranium-235	0 16	0 006	0 041	A	0 153
Trench T 12	7991	BH00332WCU2	2 8	2/3/92	Uranium-238	2 95	0 005	0 35	A	1 807
Trench T 12	B215389	B2153890003	0-3	10/31/89	Americium 241	0 03	0 007	0 015		0 022
Trench T 12	B215389	B2153890307	3-7	11/1/89	Cesium 137	1 09	0 38	0 4		0 129
Trench T 12	B215389	B2153890003	0-3	10/31/89	Plutonium-239 240	0 13	0 004	0 036		0 025
Trench T 12	B215389	B2153890307	3-7	11/1/89	Plutonium-239 240	0 05	0 008	0 014		0 025
Trench T 12	B215389	B2153890003	0-3	10/31/89	Radium 226	0 8	0 4	0 4		1 42
Trench T 12	B215389	B2153890307	3-7	11/1/89	Radium-226	0 6	0 2	0 2		1 42
Trench T 12	B215389	B2153890711	7 11	11/1/89	Radium 226	0 7	0 4	0 3		1 42
Trench T 12	B215389	B2153891215	12 15	11/1/89	Radium-226	0 7	0 4	0 4		1 42
Trench T 12	B215389	B2153891519	15-19	11/1/89	Radium-226	0 8	0 4	0 4		1 42
Trench T 12	B215389	B2153891923	19-23	11/1/89	Radium-226	0 8	0 3	0 3		1 42
Trench T 12	B215389	B2153892326	23-26	11/1/89	Radium-226	0 8	0 3	0 3		1 42
Trench T 12	B215389	B2153890003	0-3	10/31/89	Radium-228	1 3	0 7	0 7		2 33
Trench T 12	B215389	B2153891215	12 15	11/1/89	Radium-228	1 3	0 6	0 5		2 04
Trench T 12	B215389	B2153890711	7 11	11/1/89	Radium-228	1 5	0 3	0 2		2 04
Trench T 12	B215389	B2153891519	15-19	11/1/89	Radium 228	1 8	0 8	0 8		2 04
Trench T 12	B215389	B2153892326	23-26	11/1/89	Uranium-235	0 18	0	0 21		0 114
Trench T 12	B215389	B2153892326	23-26	11/1/89	Uranium-235	0 18	0	0 21		0 114
Trench T 12	BH4787	BH478709DH	9 5-10 52	9/11/87	Americium-241	0 04		0 06	N	0 012
Trench T 12	BH4787	BH478704DH	4-5 32	9/11/87	Americium-241	0 06		0 09	N	0 012
Trench T 12	BH4787	BH478706DH	6-7 15	9/11/87	Americium-241	0 06		0 08	N	0 012
Trench T 12	BH4787	BH478715DH	15-15 65	9/11/87	Americium-241	0 06		0 07	N	0 012
Trench T 12	BH4787	BH478715DH	15-15 65	9/11/87	Americium-241	0 06		0 07	N	0 012
Trench T 12	BH4787	BH478711DH	11 5-12.66	9/11/87	Americium-241	0 1		0 08	N	0 012
Trench T 12	BH4787	BH478722WT	22.5-24 3	9/14/87	Americium-241	0 05		0 08	N	0 012
Trench T 12	BH4787	BH478720DH	20 5-21	9/14/87	Americium-241	0 09		0 11	N	0 012
Trench T 12	BH4787	BH478727BR	27 2 28 2	9/15/87	Americium-241	0 16		0 12	N	0 012
Trench T 12	BH4787	BH478727BR	27 2 28 2	9/15/87	Americium-241	0 16		0 12	N	0 012
Trench T 12	BH4787	BH478708DH	8-9	9/11/87	Plutonium-239 240	0 06		0 14		0 018
Trench T 12	BH4787	BH478708DH	8-9	9/11/87	Plutonium-239 240	0 06		0 14		0 018
Trench T 12	BH4787	BH478720DH	20 5-21	9/14/87	Plutonium-239 240	0 03		0 1		0 018
Trench T 12	BH4787	BH4787026D	26 2-27 2	9/15/87	Plutonium-239 240	0 04		0 1		0 018
Trench T 12	BH4787	BH478727BR	27 2 28 2	9/15/87	Plutonium-239 240	0 11		0 12		0 018
Trench T 12	BH4787	BH478727BR	27 2 28 2	9/15/87	Plutonium-239 240	0 11		0 12		0 018

482

Table 3 11-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{95/95}$ Values (continued)

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{95/95}$

VALIDATION CODES
A = Result accepted with qualifications
N = Will not be validated

Table 3 11-4 Subsurface Soil Radionuclide Activities Exceeding PPRGs

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	PPRG (pCi/g)
Trench T 12	B215389	B2153890003	0-3	10/31/89	Radium 226	0 8	0 4	0 4		0 75
Trench T 12	B215389	B2153890307	3 7	11/1/89	Radium 226	0 6	0 2	0 2		0 75
Trench T 12	B215389	B2153890711	7 11	11/1/89	Radium 226	0 7	0 4	0 3		0 75
Trench T 12	B215389	B2153891215	12 15	11/1/89	Radium 226	0 7	0 4	0 4		0 75
Trench T 12	B215389	B2153891519	15-19	11/1/89	Radium 226	0 8	0 4	0 4		0 75
Trench T 12	B215389	B2153891923	19-23	11/1/89	Radium-226	0 8	0 3	0 3		0 75
Trench T 12	B215389	B2153892326	23-26	11/1/89	Radium-226	0 8	0 3	0 3		0 75
Trench T 12	B215389	B2153890003	0-3	10/31/89	Radium 228	1 3	0 7	0 7		1 4
Trench T 12	B215389	B2153891215	12 15	11/1/89	Radium-228	1 3	0 6	0 5		1 4
Trench T 12	B215389	B2153890711	7 11	11/1/89	Radium 228	1 5	0 3	0 2		1 4
Trench T 12	B215389	B2153891519	15-19	11/1/89	Radium-228	1 8	0 8	0 8		1 4

VALIDATION CODES

584

Table 3 11-5 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T 12	7991	GW02579IT	3/12/92	Carbon Tetrachloride	0 04	0 00002	E	0.005	
Trench T 12	7991	GW02925IT	5/20/92	Carbon Tetrachloride	0 036	0.00002	E	0.005	Z
Trench T 12	7991	GW03322IT	8/28/92	Carbon Tetrachloride	0 016	0.0007		0 005	V
Trench T 12	7991	GW03874IT	12/4/92	Carbon Tetrachloride	0 049	0 0004		0 005	V
Trench T 12	7991	GW00785WC	5/17/93	Carbon Tetrachloride	0 14	0.0002		0 005	V
Trench T 12	7991	GW01271WC	8/31/93	Carbon Tetrachloride	0 1	0.0002		0.005	V
Trench T 12	7991	GW01639WC	12/2/93	Carbon Tetrachloride	0 13	0 0002	E	0.005	Z
Trench T-12	7991	GW00815GA	5/17/94	Carbon Tetrachloride	0.18	0.0003		0.005	V
Trench T 12	7991	GW01377GA	9/7/94	Carbon Tetrachloride	0.15	0 0003		0.005	V
Trench T 12	7991	GW01782GA	11/14/94	Carbon Tetrachloride	0.18	0.0003	E	0.005	Z
Trench T-12	7991	GW02925IT	5/20/92	Methylene Chloride	0.022	0.00001	E	0.005	A
Trench T 12	7991	GW02579IT	3/12/92	Tetrachloroethene	0 009	0 00002		0.005	
Trench T 12	7991	GW02925IT	5/20/92	Tetrachloroethene	0.033	0.00002	E	0.005	Z
Trench T 12	7991	GW03322IT	8/28/92	Tetrachloroethene	0.017	0.00014		0.005	V
Trench T 12	7991	GW03874IT	12/4/92	Tetrachloroethene	0.012	0.0002		0.005	V
Trench T 12	7991	GW00785WC	5/17/93	Tetrachloroethene	0.026	0 0001		0.005	V
Trench T 12	7991	GW01271WC	8/31/93	Tetrachloroethene	0.026	0.0001		0 005	V
Trench T 12	7991	GW01639WC	12/2/93	Tetrachloroethene	0.027	0 0001		0 005	JA
Trench T 12	7991	GW00815GA	5/17/94	Tetrachloroethene	0.036	0.0002		0.005	V
Trench T 12	7991	GW01377GA	9/7/94	Tetrachloroethene	0.026	0.0002		0.005	V
Trench T 12	7991	GW01782GA	11/14/94	Tetrachloroethene	0.032	0.0002		0 005	V
Trench T 12	7991	GW02925IT	5/20/92	Trichloroethene	0.014	0.00003		0.005	Z
Trench T 12	7991	GW03322IT	8/28/92	Trichloroethene	0.006	0.0003		0.005	V
Trench T 12	7991	GW03874IT	12/4/92	Trichloroethene	0.005	0.0002		0.005	V
Trench T 12	7991	GW00785WC	5/17/93	Trichloroethene	0.011	0.0001		0.005	V
Trench T-12	7991	GW01271WC	8/31/93	Trichloroethene	0.011	0.0001		0.005	V
Trench T 12	7991	GW01639WC	12/2/93	Trichloroethene	0.011	0.0001		0.005	V
Trench T-12	7991	GW00815GA	5/17/94	Trichloroethene	0.016	0.0002		0.005	V
Trench T 12	7991	GW01377GA	9/7/94	Trichloroethene	0 012	0.0002		0.005	V
Trench T 12	7991	GW01782GA	11/14/94	Trichloroethene	0 014	0.0002		0.005	V

LABORATORY QUALIFIERS
E = Chemical exceeds calibration range of the instrument

VALIDATION CODES
A = Result accepted with qualifications
J = Positively identified below the sample quantitation limit. Result is estimated
V = Valid result
Y = Analytical results in validation process
Z = Validation was not requested or performed

485

Table 3 11-6 Groundwater Dissolved Metal Concentrations Exceeding $UTL_{99/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T 12	4191	GW02923IT	5/19/92	Manganese	354	15		V	263
Trench T 12	7991	GW02925IT	5/20/92	Barium	221	200	E	JA	171 2
Trench T 12	7991	GW02665GA	6/13/95	Calcium	180000	5000		Y	141250
Trench T 12	7991	GW02925IT	5/20/92	Manganese	726	15		V	263
Trench T 12	7991	GW03322IT	8/26/92	Manganese	480	1 4		V	263

LABORATORY QUALIFIER
J = Estimated quantification

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result
Y = Analytical results in validation process

5/98

Table 3 11-6 Groundwater Total Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µg/L)	DETECTION LIMIT (µg/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 12	4191	GW02923IT	5/19/92	Potassium	10600	5000		V	4980
Trench T 12	7991	GW02925IT	5/20/92	Barium	412	200		V	298
Trench T 12	7991	GW02925IT	5/20/92	Lead	20 8	3	S	V	18.4
Trench T 12	7991	GW02925IT	5/20/92	Manganese	955	15		V	606
Trench T 12	7991	GW02925IT	5/20/92	Potassium	15700	5000		V	4980
Trench T 12	7991	GW03322IT	8/26/92	Potassium	5470	1030		V	4980

LABORATORY QUALIFIER
S = The reported value was determined by the method of standard addition

VALIDATION CODES
JA = Result accepted, but was estimated
V = Valid result

487

Table 3 11-7 Groundwater Dissolved Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (µ g/L)
Trench T 12	4191	GW02923IT	5/19/92	Manganese	354	15		V	183
Trench T 12	4191	GW03319IT	8/27/92	Manganese	192	1		V	183
Trench T 12	7991	GW02925IT	5/20/92	Manganese	726	15		V	183
Trench T 12	7991	GW03322IT	8/26/92	Manganese	480	1		V	183

LABORATORY QUALIFIER

VALIDATION CODES
V = Valid result

Table 3 11-7 Groundwater Total Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µg/L)	DETECTION LIMIT (µg/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (µg/L)
Trench T 12	4191	GW02923IT	5/19/92	Manganese	543	15		V	183
Trench T 12	7991	GW03322IT	8/26/92	Antimony	23	18.8		JA	6
Trench T 12	7991	GW02925IT	5/20/92	Manganese	955	15		V	183
Trench T 12	7991	GW03322IT	8/26/92	Manganese	486	1 4		V	183

LABORATORY QUALIFIER

VALIDATION CODES
V = Valid result

-189

Table 3 11-8 Groundwater Dissolved Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T 12	7991	GW02925IT	5/20/92	Strontium-89 90	1 348	0 4	0 614	JA	1 164

VALIDATION CODES
JA = Result accepted but was estimated

490

Table 3 11-9 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T 12	4191	GW03319IT	8/27/92	Gross Alpha	8.267	1 5	3.12	A	7
Trench T 12	4191	GW02923IT	5/19/92	Gross Beta	11 69	1 8	1 98	A	5
Trench T 12	4191	GW03319IT	8/27/92	Gross Beta	9.233	2.8	2.3	A	5
Trench T 12	4191	GW02663GA	6/19/95	Gross Beta	5.3	1 4	0.92	Y	5
Trench T 12	4191	GW02923IT	5/19/92	Uranium-233,234	3.761	0	1	A	1 07
Trench T 12	4191	GW02663GA	6/19/95	Uranium-233,234	3.7	0 34	0 97	Y	1 07
Trench T 12	4191	GW02923IT	5/19/92	Uranium-238	2 675	0 107	0 854	A	0.768
Trench T-12	4191	GW02663GA	6/19/95	Uranium-238	3.2	0.24	0.87	Y	0 768
Trench T 12	7991	GW02925IT	5/20/92	Gross Alpha	16 05	1 5	4.4	A	7
Trench T 12	7991	GW03322IT	8/26/92	Gross Alpha	22	4	5.8	V	7
Trench T 12	7991	GW01271WC	8/31/93	Gross Alpha	34	1 5	3.1	V	7
Trench T 12	7991	GW00615GA	5/17/94	Gross Alpha	26.8206	4.829	7.0616	V	7
Trench T 12	7991	GW01377GA	9/7/94	Gross Alpha	25	1 1	2.2	Y	7
Trench T-12	7991	GW02665GA	6/13/95	Gross Alpha	18	1 2	2.3	Y	7
Trench T-12	7991	GW02925IT	5/20/92	Gross Beta	15.35	2.9	2.53	A	5
Trench T 12	7991	GW03322IT	8/26/92	Gross Beta	18	2	2 2	V	5
Trench T 12	7991	GW01271WC	8/31/93	Gross Beta	11	2 5	2.2	V	5
Trench T 12	7991	GW00615GA	5/17/94	Gross Beta	10.4415	5.3324	3.8336	V	5
Trench T 12	7991	GW01377GA	9/7/94	Gross Beta	14	3.1	2.5	Y	5
Trench T 12	7991	GW02665GA	6/13/95	Gross Beta	12	3	2.4	Y	5
Trench T 12	7991	GW02925IT	5/20/92	Strontium-89,90	1.348	0.4	0.614	JA	0 852
Trench T-12	7991	GW02925IT	5/20/92	Uranium-233,234	11 73	0.107	2.15	A	1.07
Trench T 12	7991	GW03322IT	8/26/92	Uranium-233,234	11	0.3	1.7	V	1 07
Trench T 12	7991	GW01271WC	8/31/93	Uranium-233,234	18	0.04	2.9	A	1 07
Trench T 12	7991	GW00615GA	5/17/94	Uranium-233,234	17.5869	0.1944	1.8617	V	1 07
Trench T-12	7991	GW01377GA	9/7/94	Uranium-233,234	20	0.69	4.4	Y	1.07
Trench T-12	7991	GW02665GA	6/13/95	Uranium-233,234	9	0.3	2	Y	1.07
Trench T 12	7991	GW00615GA	5/17/94	Uranium-235	1.218	0.1423	0.4427	V	1.01
Trench T 12	7991	GW02925IT	5/20/92	Uranium-238	8.917	0	1.76	A	0.768
Trench T 12	7991	GW03322IT	8/26/92	Uranium-238	9.1	0.2	1.5	V	0.768
Trench T 12	7991	GW01271WC	8/31/93	Uranium-238	16	0.07	2.6	A	0.768
Trench T 12	7991	GW00615GA	5/17/94	Uranium-238	15.5544	0.1861	1 7469	V	0 768
Trench T-12	7991	GW01377GA	9/7/94	Uranium-238	16	0.6	3.6	Y	0.768
Trench T 12	7991	GW02665GA	6/13/95	Uranium-238	8.9	0 36	1.9	Y	0 768

Table 3 11-9 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted but was estimated
V = Valid result
Y = Analytical results in validation process

TABLE 3.11-10 TRENCH T-12 SUMMARY INFORMATION

CONTAMINANTS		
Media Subsurface Soils		
Greater than $UTL_{95/95}$	Greater than RFCA Standards	Greater than PPRGs
Cadmium Calcium Nickel		
Americium-241 Plutonium-239/240 Uranium-235 Uranium-238		Radium-226 Radium-228

Media Groundwater			
Greater than $UTL_{95/95}$	Greater than RFCA Tier II Standards	Greater than RFCA Tier I Standards	Greater than PPRGs
	Carbon tetrachloride Methylene chloride Tetrachloroethene Trichloroethene		
Barium Calcium Manganese Potassium	Manganese		
Strontium-89/90	Gross alpha Gross beta Uranium-233/234 Uranium-238		

PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
150	10-15	5	280-420	No	No

Note

A RFCA subsurface soil action level had not been determined for 2-butanone

493

Exhibit 3.11.A
Trench T-12 Historical Release Report Information

447

PAC REFERENCE NUMBER NE 1111 NE 1118

HSS Reference Number 1111 1118 Operable Unit 2

Unit Name Trenches T-4 through T 11

Approximate Location N750 000 E2 087,500

Date(s) of Operation or Occurrence

The exact dates of operation are unknown except for the period of July 29 1954 through August 14, 1968[1] Trenches T 9 T 10 and T-11 were differentiated from the other trenches and added to the disposal trench inventory in 1977[2] See the "Comments" section below for additional discussion of this point.

Description of Operation or Occurrence

Trenches T-4 through T 11 along with Trench T 2 (PAC 900 109) and Trench T 3 (PAC NE 110) were used primarily for the disposal of sanitary wastewater treatment plant sludge The sludge removed from the wastewater treatment plant was placed on sludge drying beds The dried material removed from the sludge drying beds was placed in the disposal trenches The sanitary sludge disposal trenches are reported to be approximately 10 feet deep and are provided with two feet of soil cover[3] The trenches are variable in length with the average length being approximately 250 feet.[4] The total amount of sludge disposed in Trenches T 2 through T 11 is estimated at 125 000 kilograms[5] Some amounts of additional materials were also disposed in Trenches T-4 T 9 and T 11 These other materials consisted of asphalt planking (approximately 130 000 square feet of asphalt planking) in T-4 and T 11 from the re-design of Solar Pond 207A (PAC 000-101) in 1963 and scrap metal and junk in T 9[5]

At the same time that Trenches T 9 T 10 and T 11 were identified [illegible] it appears that the numbering system for the trenches was slightly modified Whereas earlier documents had presented a consistent numbering system in a 1983 document a trench that had previously been referred to as [illegible] T 4 became T 11[5] This 1983 document placed the T-4 trench essentially as an [illegible] T [illegible] 1983 document designated Trench T 9 as essentially an extension of Trench T 7 [illegible] in earlier documents [illegible] referred to as Trench T 5[1] Trench T 10 had not been identified or named prior to 1983 [illegible] identified as Trench T 5 in the 1983 document was a trench not previously identified (comparison of map [illegible] References 1 and 5)

Physical/Chemical Description of Constituents [illegible]

[illegible] uranium and plutonium contamination is present in [illegible] noted that the older sludge would have had primarily uranium contamination with newer sludge [illegible] a source of plutonium contamination total long lived alpha activity present in the sludge [illegible] of 382 pCi/g in August 1964 to a maximum of 3 591 pCi/g in June 1980 [illegible] present in flattened drums that may have been disposed in any of the trenches T 2 through T 11 [illegible] the contaminated oils that had been held in the drum[6] The burning of the contaminated oils [illegible] Burn Pit No-2 (PAC 900-153) from March 1957 to mid 1965[6] not in the trenches [illegible] estimated at up to 200 in total number could be present in any of Trenches T 2 through T 11 [illegible] document that Trench T-4 currently designated Trench T 11 as [illegible] of uranium 235[7]

On at least one occasion it is believed [illegible] gallons of water and the coolant generated in Building 444 was also disposed in one of the East Trenches [illegible] of 150 000 dpm/l [illegible] that this is total alpha activity The [illegible] dpm with approximately 1 3 kilograms of depleted uranium [illegible] not this material was in drums

Physical Description of Operation or Occurrence

Soil samples were collected from the [illegible] in 1977 (Trenches T 9 T 10 and T 11) during [illegible] time frame Soil from [illegible] from 0 40 to 68 pCi/g in plutonium activity and from [illegible] to [illegible] 0 pCi/g uranium [illegible] T 11 was found to contain from 0 18 to 14 pCi/g plutonium

Best Available Copy

activity and from 40 to 126 pCi/g uranium activity Trench T-11 was found to contain 4.5 to 50 pCi/g plutonium activity and 0.9 to 158 pCi/g uranium activity[5]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents disposed in Trenches T-4 through T-11 This IHSS is being studied in accordance with the IAG schedule for OU2 The IAG activities will include site investigations site characterizations and possible remediation The Final Phase II RFI/RI Report is to be completed by March 12 1993

Comments

Trench T-3 along with these trenches are also called the East Trenches

Trenches T-4 through T-11 (PAC NE 111) have few operational differences from Trenches T-2 (PAC 900-109) and T-3 (PAC NE 110)

The sludge disposed of in these trenches should consist primarily of concentrated organic matter typically present in sanitary wastewater treatment plant sludge

From August 1968 until February 1970 sanitary wastewater treatment plant sludge was disposed in the RFP sanitary landfill[1] After February 1970 sanitary wastewater treatment plant sludge was shipped offsite for disposal[9]

To date no documentation has been found that records the time frame during which any particular trench was receiving waste Similarly none of the HRR interviewees were knowledgeable on dates of operation of individual trenches

The locations of [illegible] on Plate 2 differ from the IAG map but are taken from the OU2 Phase [illegible] Work Plan [illegible]

References	Other references of interest	
[1] 1500793	1500296	1501097
1501719	1600430	1500393
[3] 1500898	1500340	1500460
[4] 1507[illegible]	1500287	15[illegible]
1500890	1500901	15[illegible]
[6] 1500656	1500304	1500763
[7] 1500579	1500458	1500[illegible]
[8] 1700445	1500888	

499

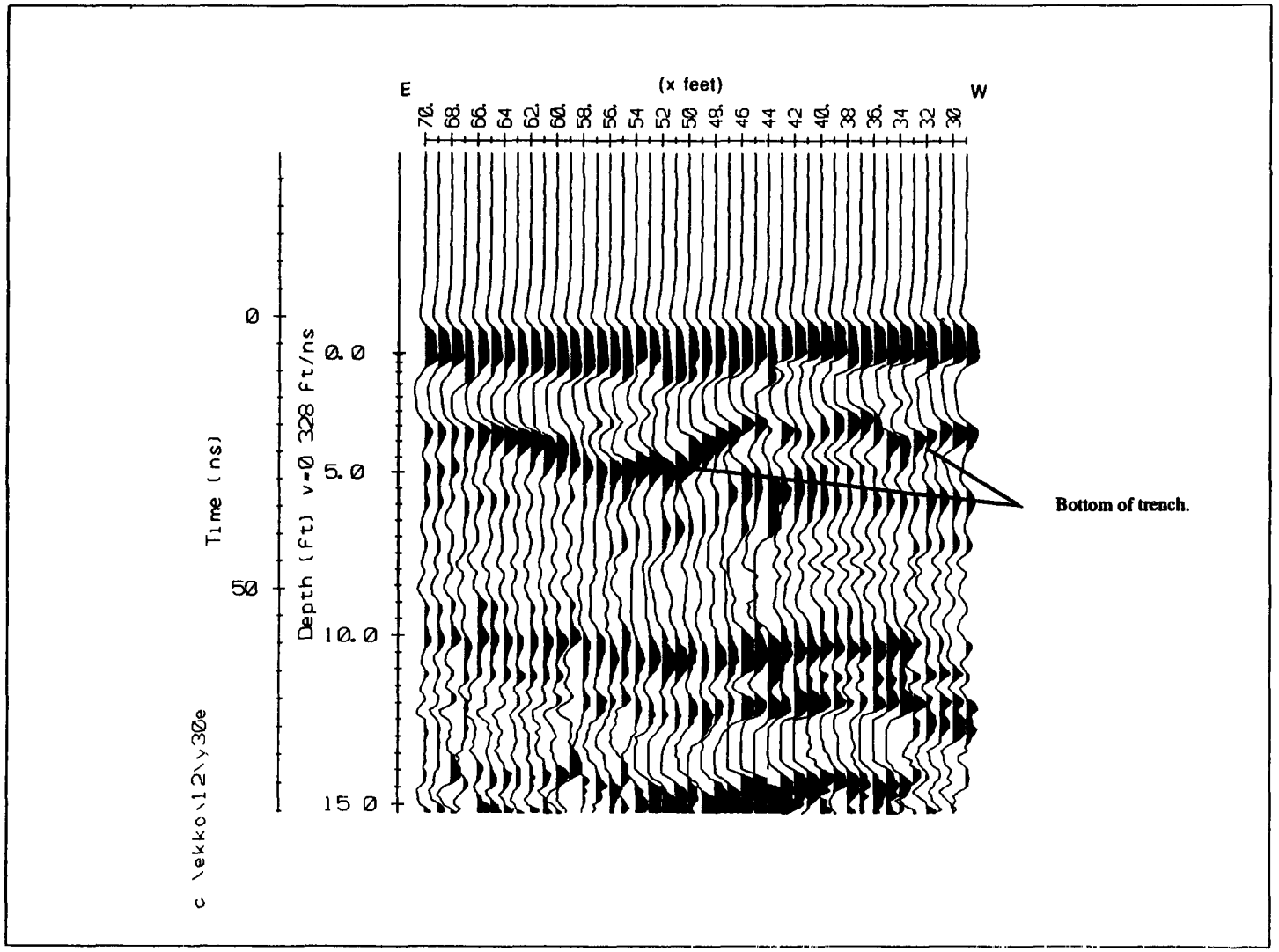
Exhibit 3.11.B
Trench T-12 EM-31 Surveys

300

Exhibit 3.11.C
Trench T-12 Ground Penetrating Radar Surveys

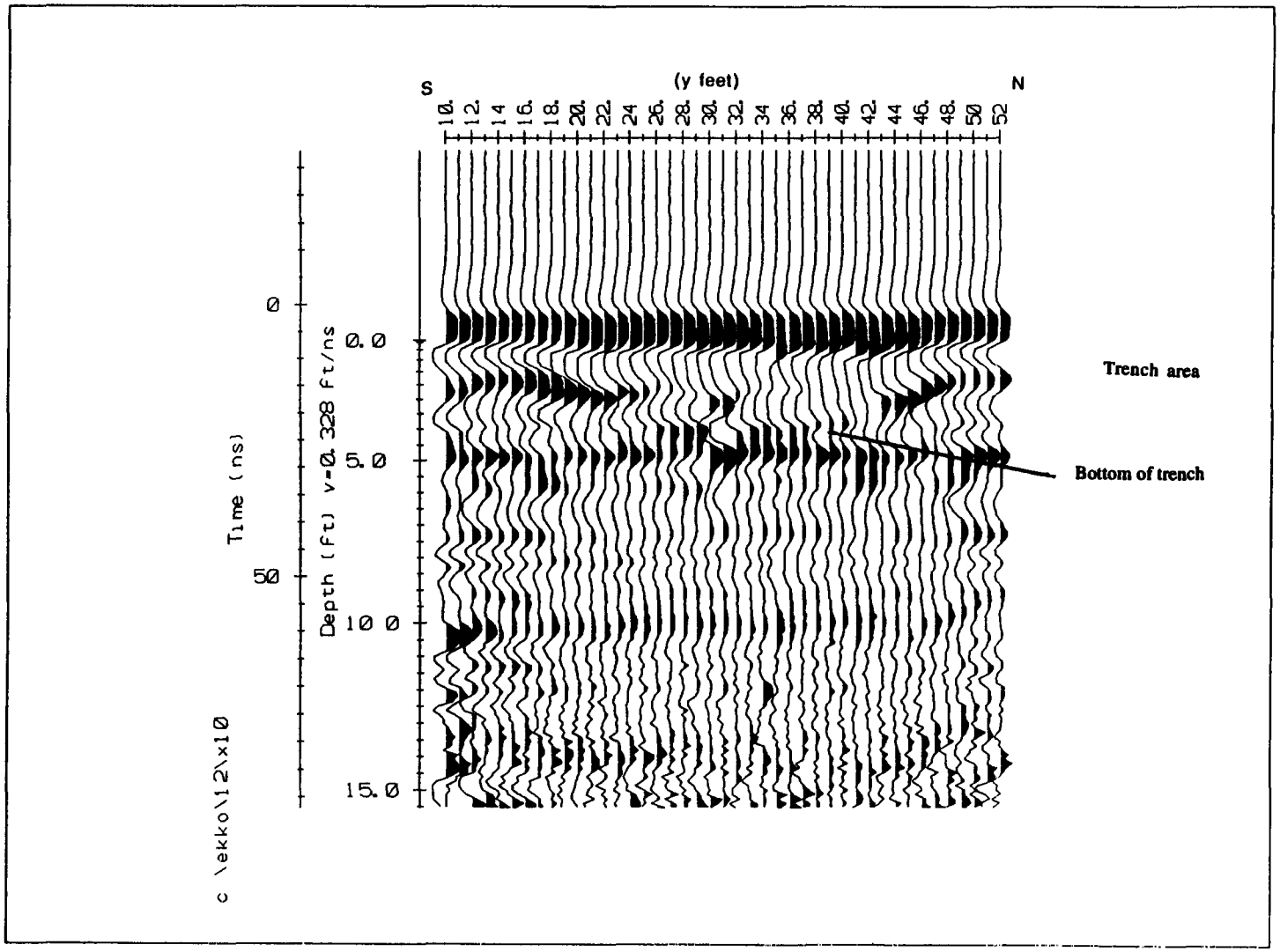
505

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 12
EAST TO WEST ORIENTATION AT Y=30 FEET
JUNE 1995

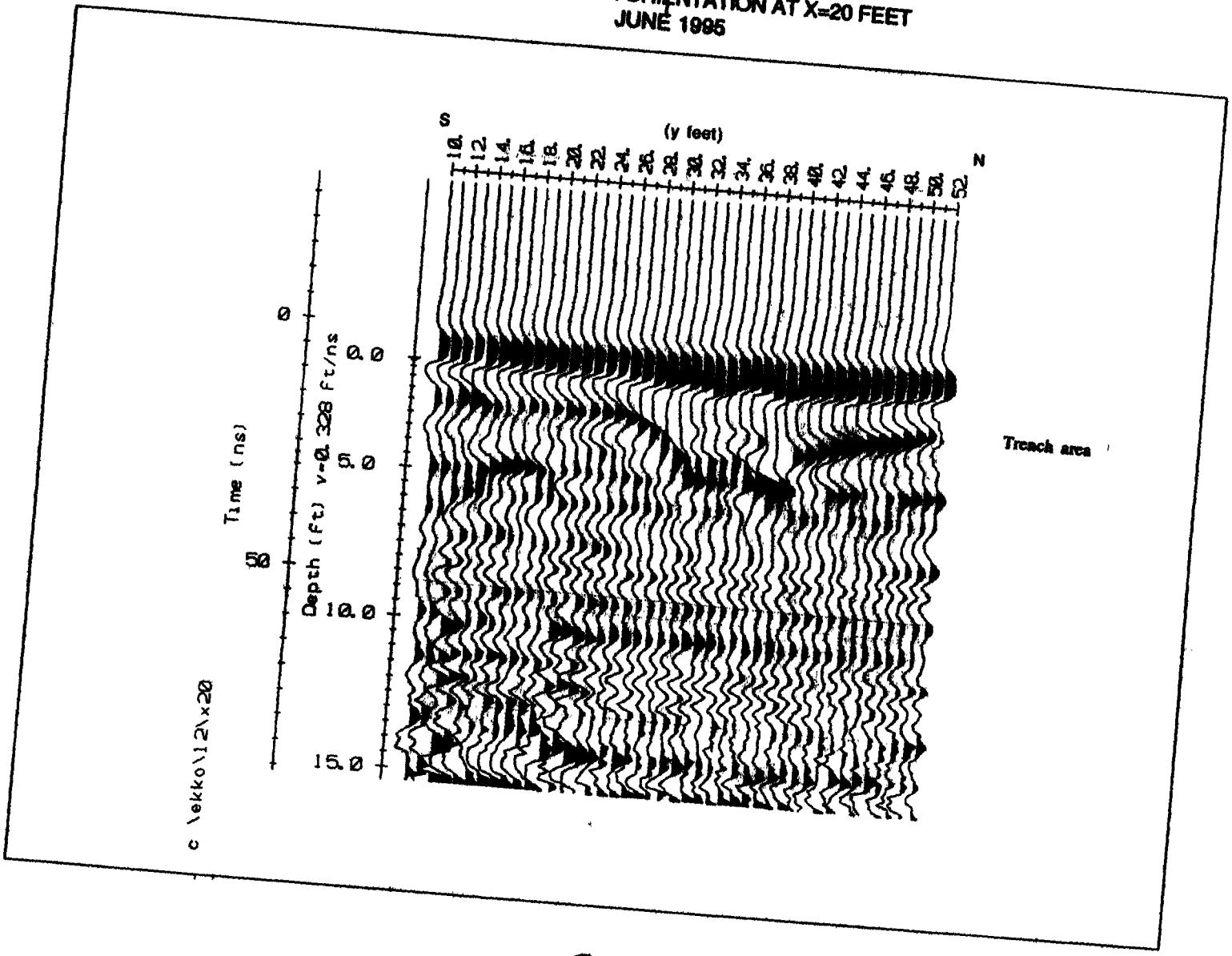


306

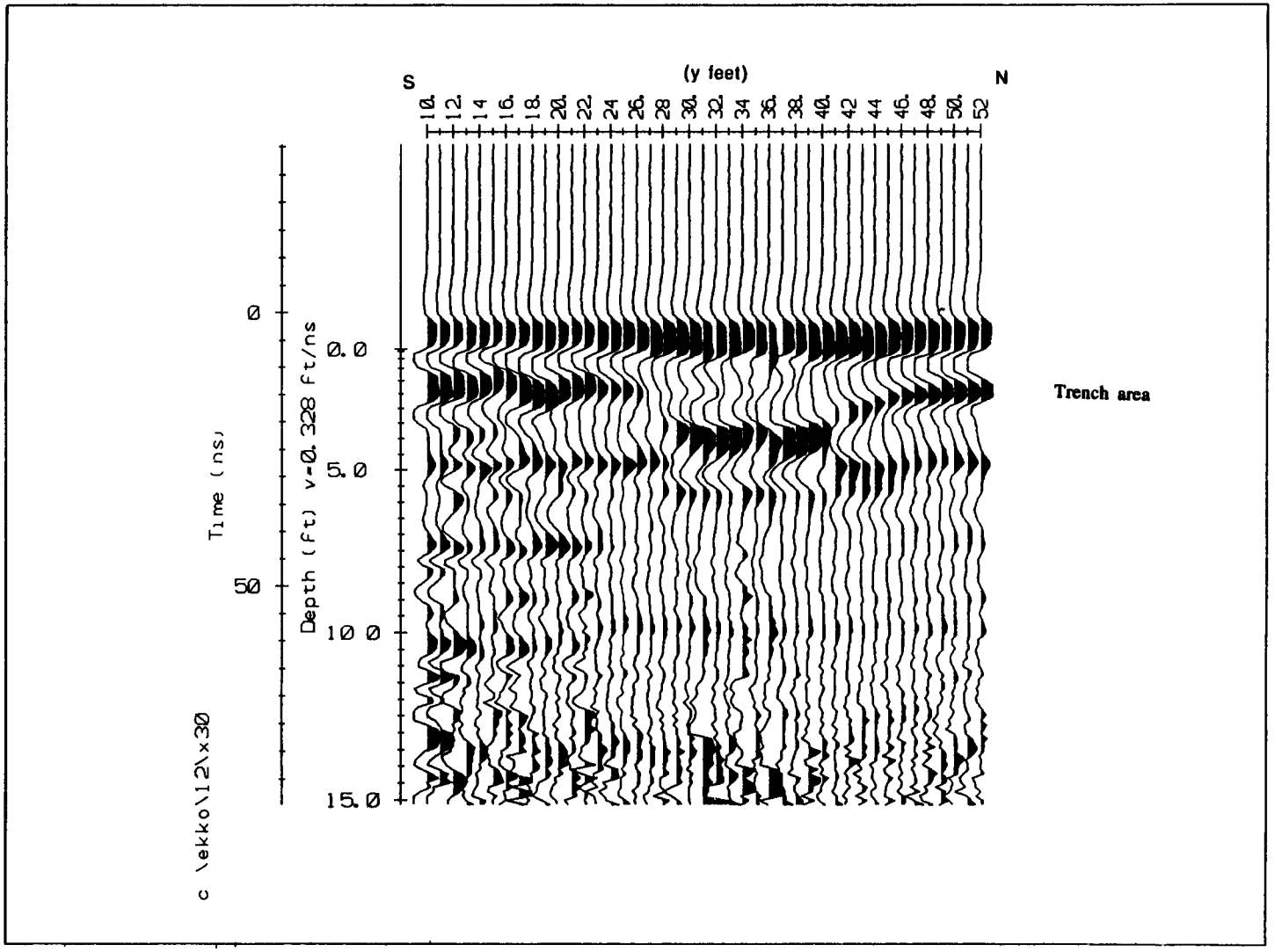
RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 12
SOUTH TO NORTH ORIENTATION AT X=10 FEET
JUNE 1995



RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-12
SOUTH TO NORTH ORIENTATION AT X=20 FEET
JUNE 1995

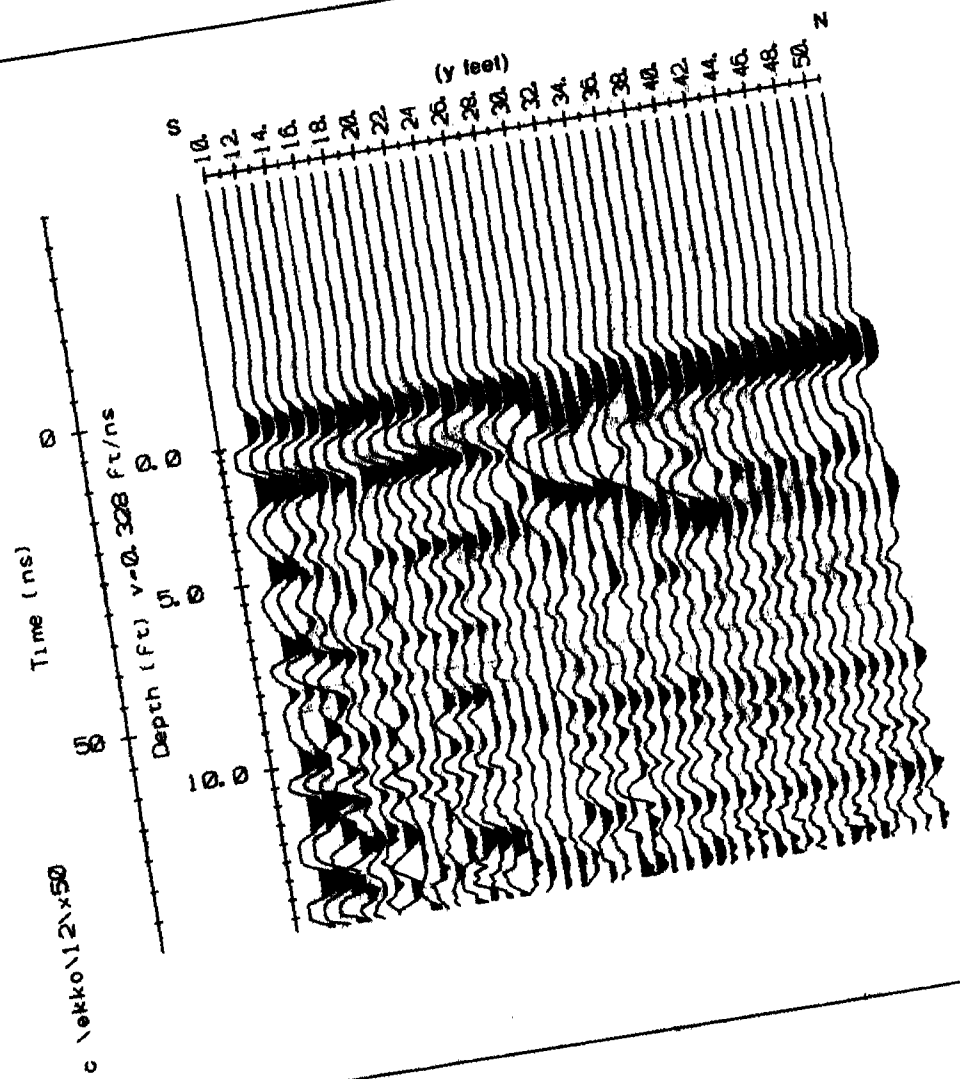


RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 12
SOUTH TO NORTH ORIENTATION AT X=30 FEET
JUNE 1995

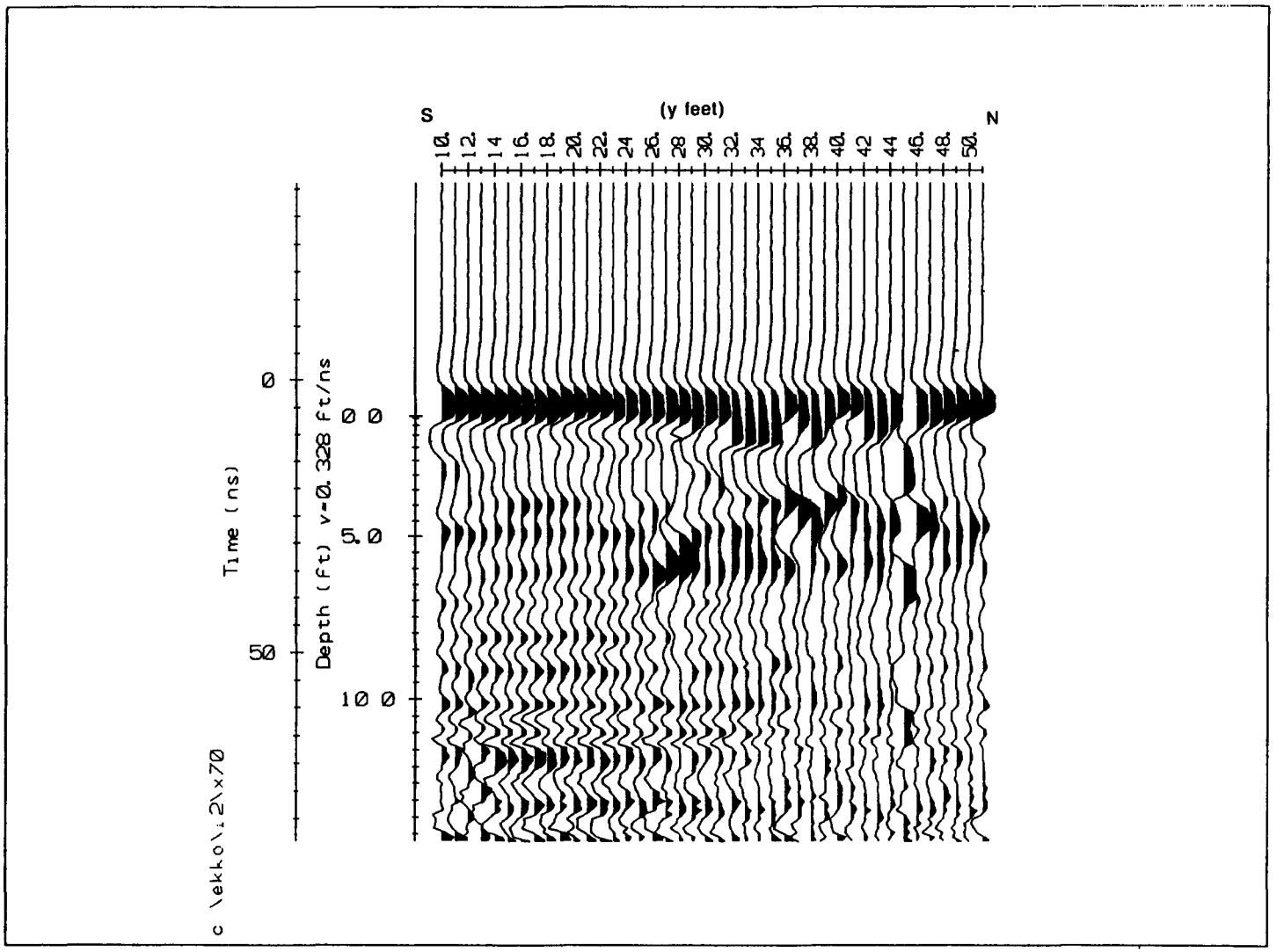


505

RFETS, OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-12
SOUTH TO NORTH ORIENTATION AT X=50 FEET
JUNE 1995

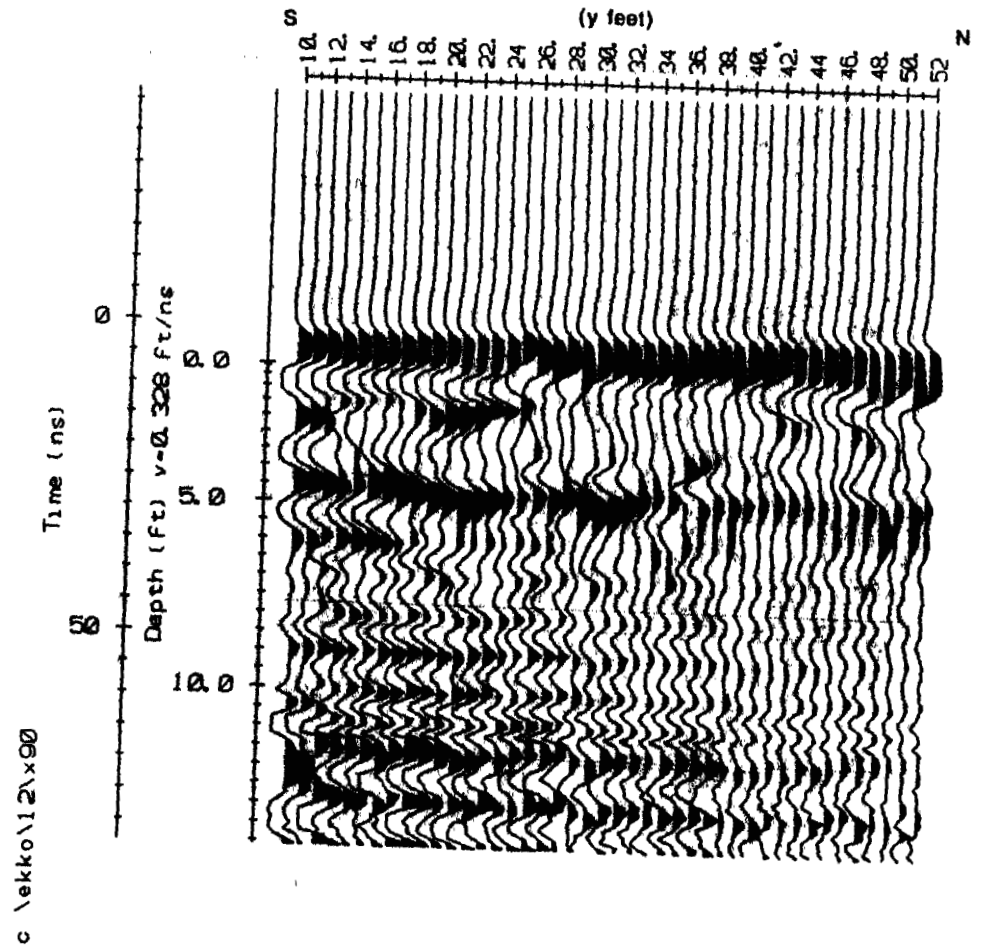


RFETS OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 12
SOUTH TO NORTH ORIENTATION AT X=70 FEET
JUNE 1995



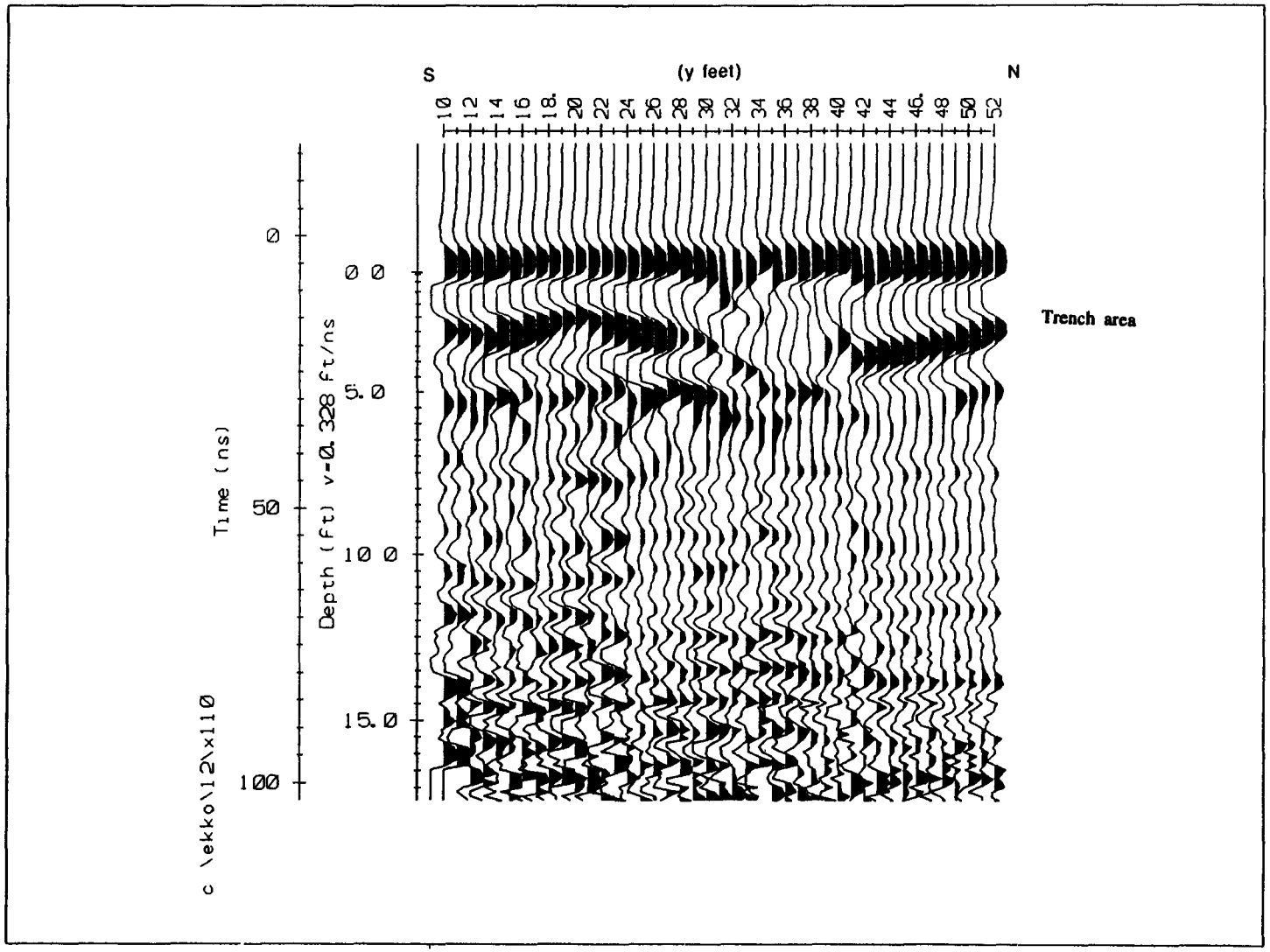
511

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-12
SOUTH TO NORTH ORIENTATION AT X=90 FEET
JUNE 1995



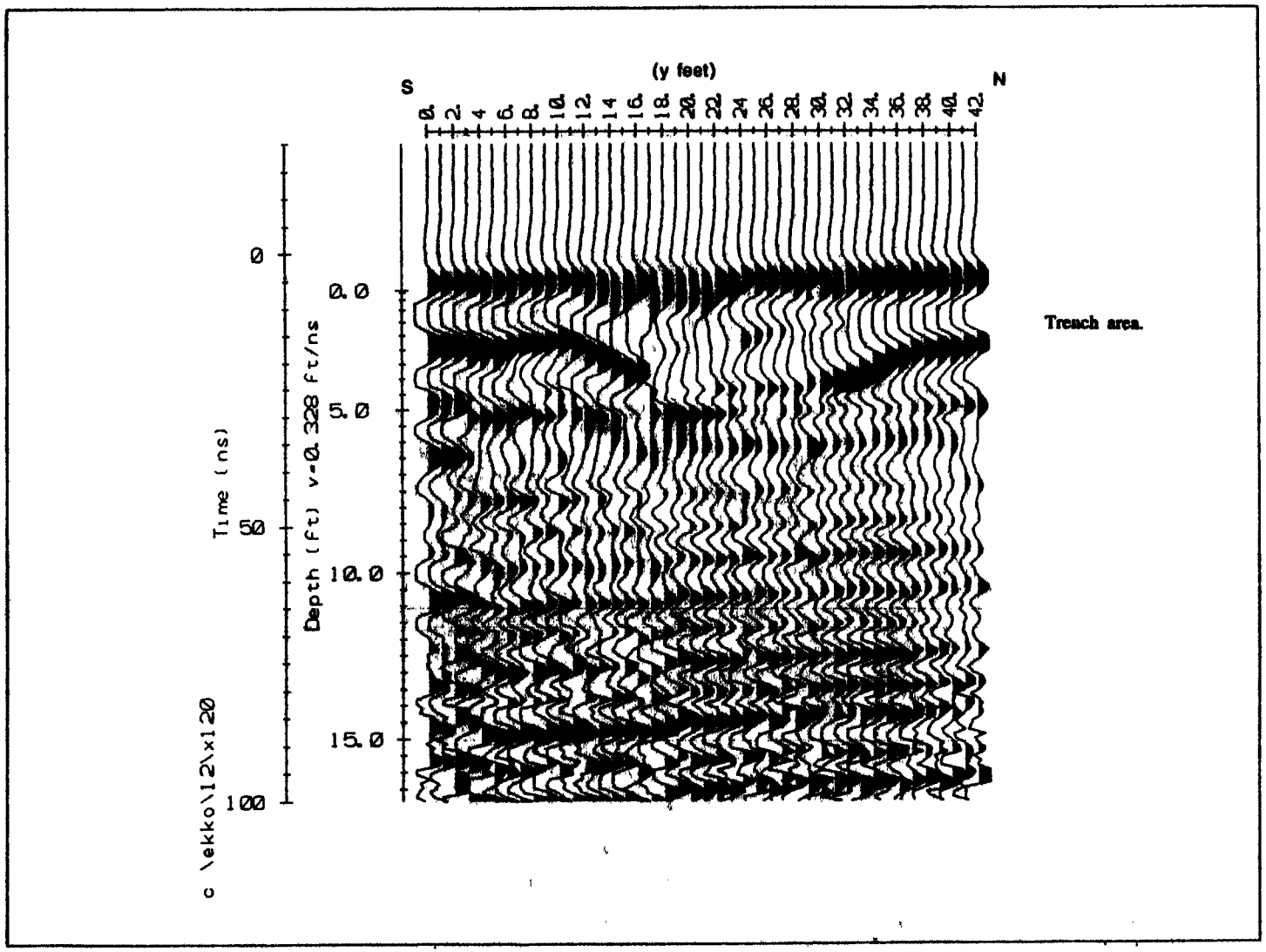
572

RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 12
SOUTH TO NORTH ORIENTATION AT X=110 FEET
JUNE 1995



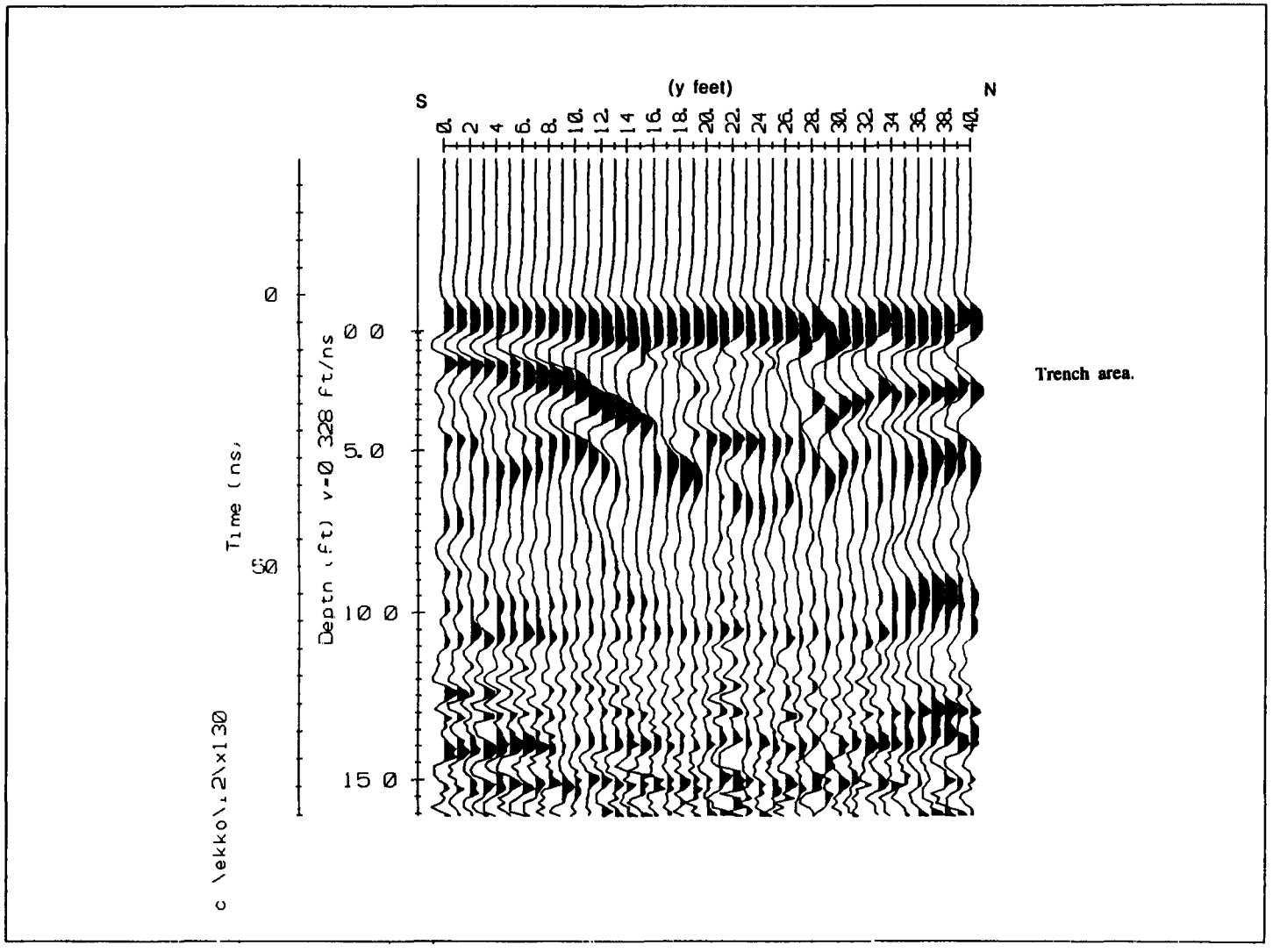
573

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-12
SOUTH TO NORTH ORIENTATION AT X=120 FEET
JUNE 1995



S/Y

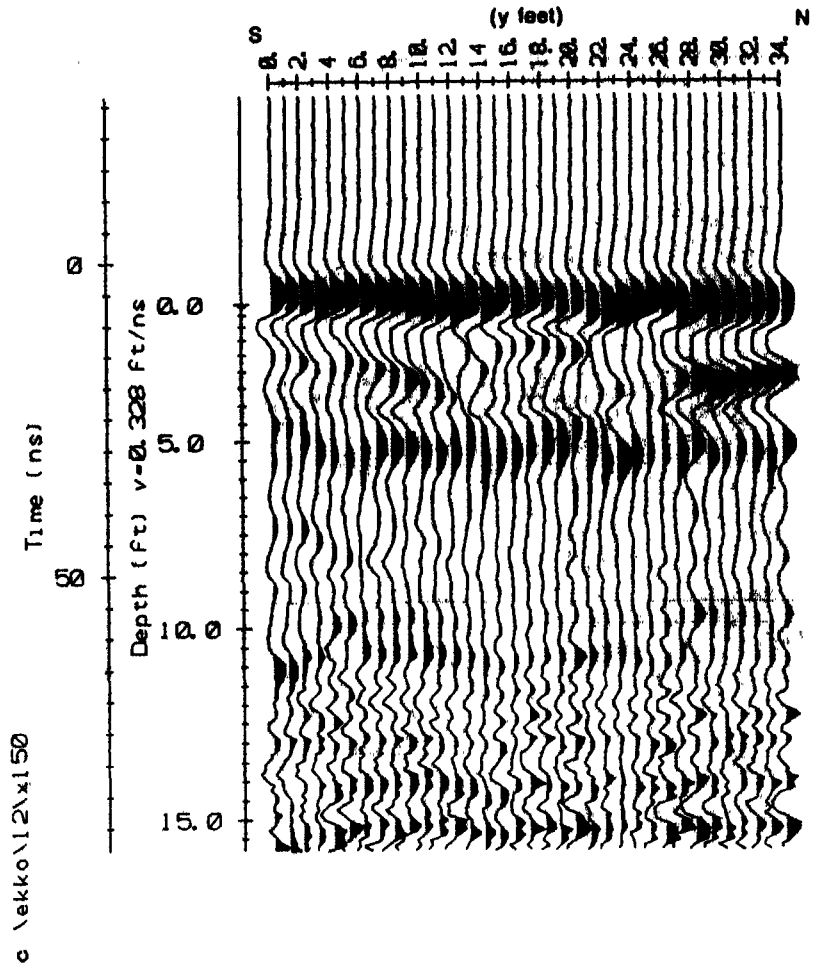
RFETS OU 2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 12
SOUTH TO NORTH ORIENTATION AT X=130 FEET
JUNE 1995



Trench area.

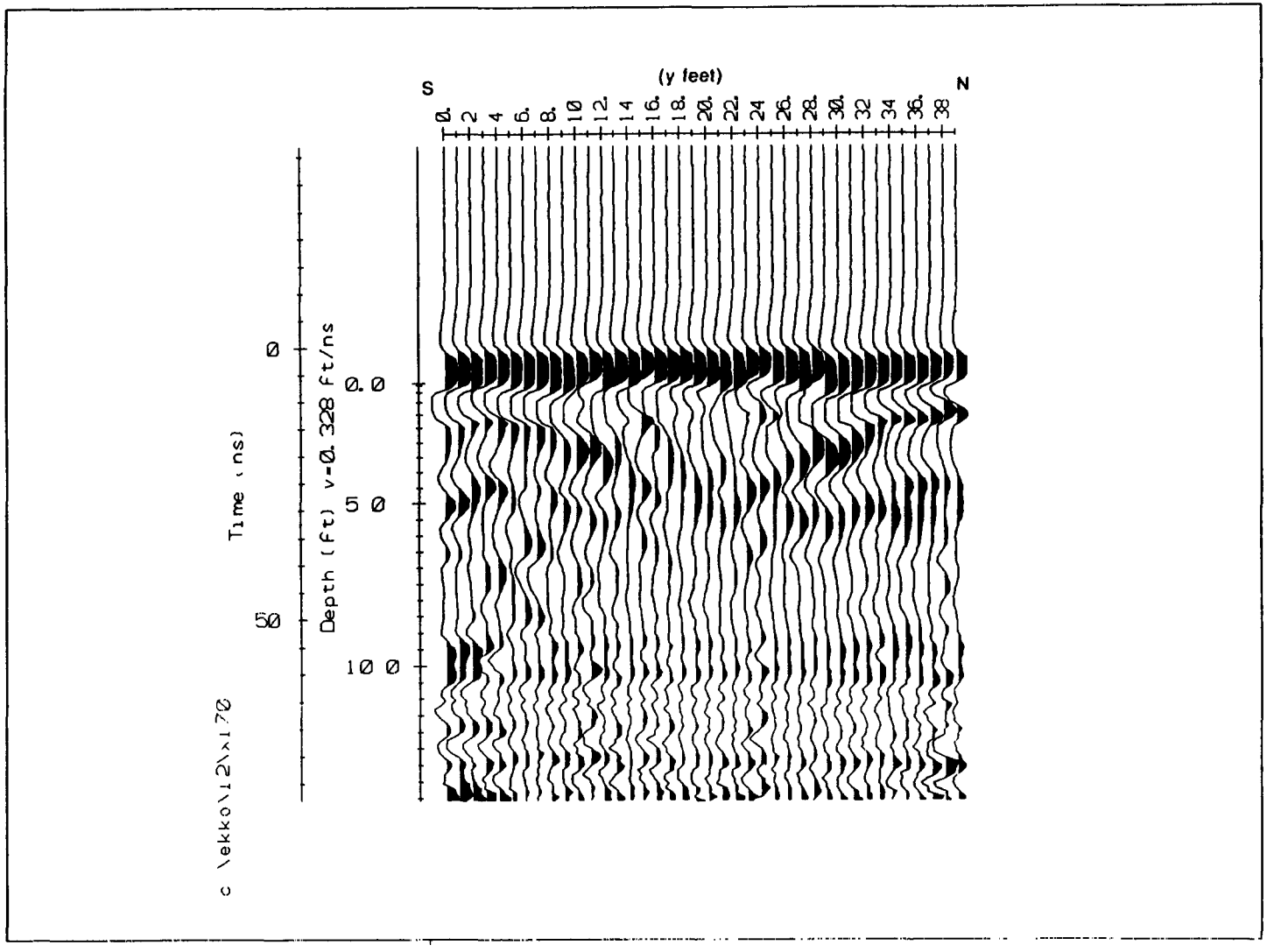
5/5

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-12
SOUTH TO NORTH ORIENTATION AT X=150 FEET
JUNE 1995



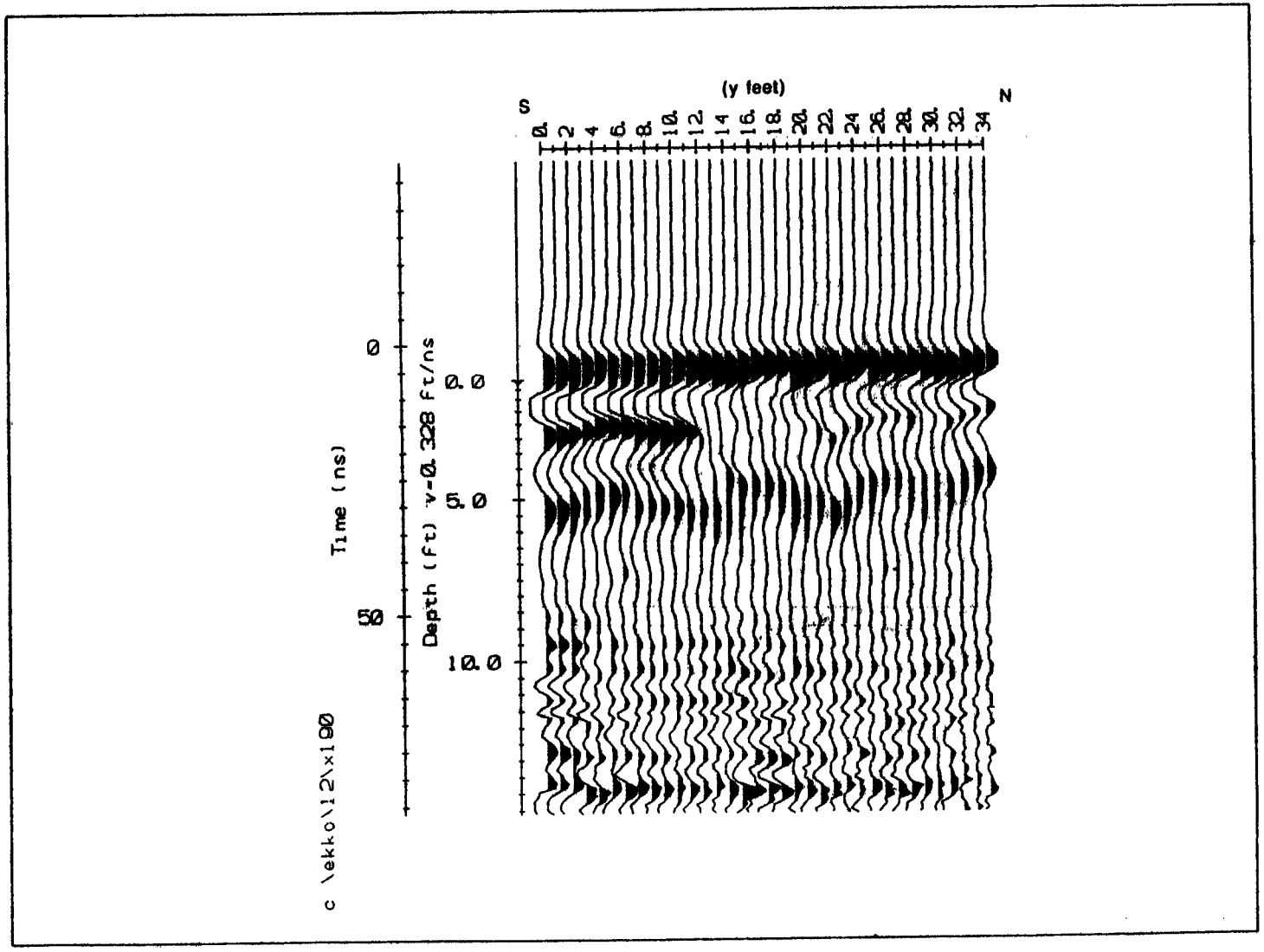
5/6

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T 12
SOUTH TO NORTH ORIENTATION AT X=170 FEET
JUNE 1995



517

RFETS, OU-2 TRENCHES
GROUND PENETRATING RADAR PLOT
TRENCH T-12
SOUTH TO NORTH ORIENTATION AT X=190 FEET
JUNE 1995



578

Exhibit 3.11.D
Trench T-12 Borehole Logs

518 b

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT) 5954 10	PROJECT NUMBER OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749532	AREA T-12, IHSS 111	CASING DIAMETER (IN)	GEOLOGIST JP GIROD	12595
EAST	2087400	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED 05/02/95	
REMARKS OU2 TRENCHES 1					

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5954	0				0 0-1 0' No sample collected Pushed directly to 1 0'
				1 00 /3 00	5953	1			SC	1 0-2 0' Clayey Sand with silt white-pinkish white, f-c grained, poorly graded, quartzite, quartz, FeOx staining, CaCO3 present Started smapling at 1 0' on run #1
					5952	2				No recovery (2 0-3 0')
					5951	3			SM	3 0-5 0' Silty Sand with trace gravel orange-yellow, f-c grained, poorly graded, quartzite, quartz, FeOx staining
	UC			2 00 /2 00	5950	4				
					5949	5			SM	5 0-7 0' Silty Sand with gravel orange yellow to white, f-c grained, poorly graded, quartzite, quartz, FeOx staining
				2 00 /2 00	5948	6				
					5947	7				7 0-8 0' No sample collected
				0 00 /1 00	5946	8			SM	8 0-10 0' Silty Sand with clay and some gravel orange-yellow, f-c grained, poorly graded, quartzite, quartz
	UC			2 00 /2 00	5945	9				
						10				Total Depth Drilled 10 00

514

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT) 5952 80	PROJECT NUMBER OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749551	AREA TRENCH T-12	CASING DIAMETER (IN)	GEOLOGIST JP GIROD	12695
EAST	2087538	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED 05/02/95	
REMARKS OU2 TRENCHES					

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%			0				0 0-1 0' No sample collected Push directly to 1 0'
					5952	1			SM	1 0-2 1' Silty Sand with some clay and trace gravel f-m grained, poorly graded, quartz, CaCO3 present, pinkish white, moist
				1 50 /3 00	5951	2				
	BH20780UC								CL	2 1-2 5' Silty Clay with trace sand moist No recovery (2 5-3 0')
					5950	3			SM	3 0-3 8' Silty Sand with some clay and gravel orange yellow - gray white, f-c grained, poorly graded, quartz, quartzite, CaCO3 present, gravel consists of broken up cobble fragments, moist, FeOx staining No recovery (3 8-5 0')
				0 80 /2 00	5949	4				
					5948	5			SM	5 0-7 0' Silty Sand with some clay and trace gravel orange yellow to tan, f-c grained, poorly graded, quartzite, quartz, CaCO3 present, gravel consists of broken up cobble fragments, FeOx staining, moist No recovery (7 0-8 0')
	BH20772UC				5947	6				
				2 00 /3 00	5946	7				
					5945	8			SM	8 0-10 0' Silty Sand with trace clay and some gravel f-c grained, poorly graded, quartzite, quartz, CaCO3 present Gravel consists of broken up cobble fragments, FeOx staining, moist
	73UC			2 00 /2 00	5944	9				
					5943	10				Total Depth Drilled 10 00

520

3 12 TRENCH T-13 (PAC NE-1413)

Trench T-13 was investigated using the following methodologies

- Historical data were compiled to identify potential contaminants trench location and size
- Aerial photographs were examined to identify disturbed areas verify trench dimensions and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- Two electromagnetic (EM) surveys were conducted to locate buried metallic objects and define trench boundaries
- Soil gas surveys were conducted to identify and delineate contaminant plumes
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the trench

This trench was unknown until the recent aerial photo evaluation and does not have an IHSS designation The HRR states that all of the trenches in the Northeast Trenches Area are thought to be about 10 feet deep and to primarily contain sewage sludge This sewage sludge is believe to contain some uranium and plutonium contamination Flattened drums may be present in the trenches At least 2 400 gallons of water and lathe coolant were disposed of in one of the trenches in this area (exact trench unknown) This liquid may or may not have been contained in drums Trench T-13 is located approximately 500 feet east-northeast of the Inner East Guard Station and south of Trench T-8 (IHSS 111 5) as shown in Figure 3 12-1 The total length of the trench is approximately 250 feet The pertinent section of HRR is presented in Exhibit 3 12 A (PAC Reference Number NE111 1-NE111 8)

Aerial photographs dating from 1954 through 1970 were examined to ascertain the period of operation approximate the length and width, identify staging areas and gather information which might confirm the contents of the trench (Colorado Aerial Photo Service 1993) The aerial photographs indicate that it was filled with a dark gray material, which may be sewage sludge Aerial photographs also indicate that this trench was open between 1966 and 1967 It is now entirely covered by asphalt or base material as part of the northern extension of the East Access Road which was built in 1968

3 12 1 Geology

Trench T-13 is covered by the East Access Road and underlain by the Rocky Flats Alluvium, which is approximately 27 feet thick The Rocky Flats Alluvium in the vicinity of Trench T-13 is underlain by the Arapahoe Formation Number 1 Sandstone The hydrograph of monitoring well 4286 located north of Trench T-13 indicates that groundwater fluctuates between six feet bgs to below the bedrock/alluvium contact

Geophysical Surveys

After aerial photographs were examined, a visual survey of the Trench T-13 area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general area of Trench T-13 Soil disturbances such as roads, mounding and subsidence were identified and recent geologic characterization information was used to delineate between Rocky Flats Alluvium and soil disturbance caused by construction related activities Evidence of pavement and fill material deposits was also noted In addition to the geologic characteristics of the area, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material

Upon completion of the visual survey, a geophysical grid was laid out over the area of Trench T-13 using pin flags Grid dimensions were 50 feet wide (north-south) by 200 feet long (east-west) with flags placed at five foot increments

EM-31 Survey

After establishing the geophysical grid, an EM-31 survey was performed The EM-31 survey quadrature response, horizontal dipole showed the presence of one large anomaly with four smaller distinct areas of high conductivity within the large anomaly The large anomaly appears to be 10 feet wide and greater than 150 feet long, and corresponds to a buried utility line. The smaller anomalies correspond to metal debris The EM-31 survey results are presented in Exhibit 3 12.B

EM-61 Survey

To further define the physical characteristics of the grid area, EM-61 was also performed The grid changes from a five foot spacing with EM-31 to a tighter 2 5 foot east-west spacing and a 5 foot north-south spacing The survey identified the same anomalies revealed by the EM-31 survey The EM-61 survey results are presented as Exhibit 3 12 C

522

Ground Penetrating Radar

GPR was not performed at Trench T-13 because of saturated soil conditions

3 12 2 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995 the vadose zone within the Trench T-13 area was highly saturated The increased soil moisture content tended to attenuate soil gas readings making sample collection difficult However, 36 samples were collected during this phase of the characterization and were analyzed for total volatile organic content using field instrumentation Twelve confirmatory samples were analyzed by an on-site laboratory using method 8010 Results are presented in Figure 3 12-2

Based on the trench boundaries determined by the aerial photographs soil gas sampling locations placed along two horizontal lines located 10 feet on either side of the centerline of the trench Soil gas samples were taken every 20 feet along the x-axis (east-west) and 10 feet along the y-axis (north-south) at depths of five and 10 feet bgs If a sample had a field measurement above 100 ppm, the field crew stepped off 10 feet away in the north-south direction and collected an additional sample This procedure was repeated until readings less than 100 ppm were obtained

There was no VOC plume indicated by the survey

3 12 3 Subsurface Soil Sampling

Subsurface soil sampling from Trench T-13 was the final step of the characterization activities Two boreholes (11295 and 11395) were drilled and sampled Lithologic descriptions of each borehole are presented in Exhibit 3 12 D Four boreholes (2274 46692 46792 and 46892) were drilled previously in the area

Data from all characterization efforts indicate elevated concentrations of organic compounds, metals, and radionuclides in the environmental media at Trench T-13 Figure 3 12-3 identifies those boreholes and wells that characterize Trench T-13

Organic Compounds

No organic compounds were detected at concentrations exceeding RFCA Subsurface Soil Action Levels as presented in Table 3 12-1

Metals

Barium (469 mg/kg), cadmium (range 1 4-1 95 mg/kg), calcium (range: 107,000-123,000 mg/kg), chromium (119 mg/kg), manganese (3,160 mg/kg), nickel (105 mg/kg), sodium (range 2,780-2,860 mg/kg), and strontium (range 468-545 mg/kg) concentrations exceeded the background $UTL_{99/99}$ as shown in Table 3 12-2

Radionuclides

Americium-241 (range 0 03-4 23 pCi/g), plutonium-239/240 (range. 0.03-0 46 pCi/g), uranium-233/234 (3 55 pCi/g), uranium-235 (0 20 pCi/g), and uranium-238 (range 1 49-2 43 pCi/g) activities exceeded the background $UTL_{99/99}$ values as presented in Table 3 12-3

3 12.4 Groundwater

There are several wells located in the Trench T-13 areas. Elevated levels of organic compounds, metals and radionuclides were detected in the groundwater as follows.

Organic Compounds

Carbon tetrachloride (range 32-120 µg/L) tetrachloroethene (range 12-22 µg/L), trichloroethene (range 9-78 µg/L), and vinyl chloride (2 µg/L) had detected concentrations greater than the RFCA Tier II Groundwater Action Levels as shown in Table 3 12-4

Metals

Total aluminum (range 25,100-29,500 µg/L), dissolved barium (range 273-313 µg/L), total barium (317 µg/L), dissolved cadmium (6.5 µg/L), total cadmium (5 1 µg/L), total chromium (50 2 µg/L) total lead (range 19 3-24 1 µg/L), total iron (range 25,700-31,800 µg/L), dissolved lithium (184 µg/L) dissolved magnesium, (2,700 µg/L), total potassium (range 7,290-7,580 µg/L), dissolved sodium (177,000 µg/L), and total vanadium (range 70.5-76 3 µg/L) had detected concentrations greater than the background $UTL_{99/99}$ as presented in Table 2 12.5 Dissolved antimony (range 13-15 µg/L) dissolved cadmium (6 µg/L), total cadmium, and total manganese (range 333-358 µg/L), had detected concentrations greater than the RFCA Tier II Groundwater Action Levels as presented in Table 3 12-6

524

Radionuclides

Total americium (range 0 08-0 31 pCi/L) and total plutonium-239/240 (range 0 06-0 97 pCi/L) exceeded the background $UTL_{99/99}$ as shown in Table 3 12-7 Dissolved gross alpha (range 7 3-10 0 pCi/L) total gross alpha (14 2 pCi/L), dissolved gross beta, (range 5 2-7 97 pCi/L), total gross beta (16 7 pCi/L) total plutonium-239/240, dissolved uranium-233/234 (range 1 2-7 01 pCi/L), and uranium-238 (range 0 85-3 07 pCi/L) activities exceeded the RFCA Tier II Groundwater Action Levels as shown in Table 3 12-8

3 12 5 Summary

Geophysical survey data is inconclusive in determining the dimensions of Trench T-13 It is likely that much of this trench was removed and/or capped during construction of the East Access Road

Collected data was compared to background concentrations, negotiated cleanup levels and PPRGs One organic compound was detected at concentration exceeding the RFCA Subsurface Soil Action Level Eight metals had concentrations exceeding the background $UTL_{99/99}$ values and five radionuclides had activities greater than the background subsurface soil $UTL_{99/99}$ values There were no metal concentrations or radionuclide activities observed that were greater than the PPRGs for subsurface soils construction worker scenario Ten metals had concentrations greater than the background groundwater $UTL_{99/99}$ values and two radionuclides had activities greater than the groundwater background $UTL_{99/99}$ values Four organic compounds were detected with concentrations exceeding the RFCA Tier II Groundwater Action Levels Two metals had concentration greater than the RFCA Tier II Groundwater Action Levels and five radionuclides had activities greater than the RFCA Tier II Groundwater Action Levels There were no detected concentrations of organic compounds metals or radionuclides in the groundwater greater than the RFCA Tier I Groundwater Action Levels or PPRGs for surface-water, open-space receptor

Because much of the trench was removed during construction and is now capped by the East Access Road no remedial action is recommended

Trench T-13 summary information is presented in Table 3 12-9

Table 3 12-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
[redacted]										

LABORATORY QUALIFIERS
J = Positively identified below sample quantitation limit result is estimated

NOTES
RFCA Action Levels for Benzoic Acid and 2 Butanone have not been determined

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result
Y = Analytical results in validation process

Best Available Copy

526

Table 3 12-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 13	11295	BH20721WC	8-10	4/21/95	Nickel	105	8		Y	78.7
Trench T 13	11395	BH20722WC	8-11	4/21/95	Chromium	119	2		Y	99.1
Trench T 13	2274	BP08018IT		4/9/92	Calcium	54000	1000		V	53250
Trench T 13	2274	BP0022IT		4/29/92	Sodium	2690	1000	B	V	2000
Trench T 13	2274	BP0023IT		4/29/92	Sodium	2790	1000	B	V	2000
Trench T 13	46792	BH90303IT		6/2/92	Barium	469	40		V	372
Trench T 13	46792	BH90303IT		6/2/92	Cadmium	1.4	1		V	1.33
Trench T 13	46792	BH90328IT		6/25/92	Cadmium	1.95	1	B		1.33
Trench T 13	46792	BH90301IT		6/2/92	Calcium	110000	1000		V	53250
Trench T 13	46792	BH90303IT		6/2/92	Manganese	3160	3	N*	JA	1190
Trench T 13	46892	BH90325IT		6/19/92	Calcium	123000	1000		JA	53250
Trench T-13	46892	BH90328IT		6/19/92	Calcium	107000	1000		JA	53250
Trench T 13	46892	BH90325IT		6/19/92	Strontium	545	40		JA	186
Trench T 13	46892	BH90328IT		6/19/92	Strontium	466	40		JA	186

LABORATORY QUALIFIER

B = Detected concentration was less than the contract required detection limit and above the instrument detection limit

N = Spike recoveries in the matrix spike sample did not meet advisory limits

= Matrix duplicate analysis did not meet advisory limits

VALIDATION CODES

JA = Result accepted, but was estimated

V = Valid result

Y = Analytical results in validation process

527

Table 3 12-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND UTL 99/99
Trench T 13	11295	BH20721WC	8 10	4/21/95	Plutonium 239 240	0 46	0 014	0 073	Y	0 018
Trench T 13	11395	BH20722WC	8 11	4/21/95	Plutonium 239 240	0 03	0 013	0 016	Y	0 018
Trench T 13	2274	BP00018IT		4/9/92	Americium 241	0 18	0	0 039	A	0 012
Trench T 13	2274	BP0023IT		4/29/92	Americium 241	0 03	0	0 013	A	0 012
Trench T 13	2274	BP0023IT		4/29/92	Americium 241	0 03	0	0 013	A	0 012
Trench T 13	2274	BP00018IT		4/9/92	Plutonium 239 240	0 96	0 011	0 112	A	0 018
Trench T 13	2274	BP0022IT		4/29/92	Plutonium 239 240	0 14	0 005	0 028	A	0 018
Trench T 13	2274	BP0023IT		4/29/92	Plutonium 239 240	0 18	0 013	0 036	A	0 018
Trench T 13	2274	BP0022IT		4/29/92	Uranium 233 234	3 55	0 023	0 604	A	2 643
Trench T 13	2274	BP0022IT		4/29/92	Uranium 235	0 2	0 023	0 098	A	0 114
Trench T 13	46692	BH30323IT		6/29/92	Americium-241	0 26	0 006	0 06	A	0 012
Trench T 13	46692	BH30323IT		6/29/92	Plutonium-239 240	0 46	0	0 069	A	0 018
Trench T 13	46792	BH30301IT		6/2/92	Americium-241	4 23	0	0 772	V	0 012
Trench T 13	46792	BH30327IT		6/25/92	Americium 241	0 41	0 006	0 062	A	0 012
Trench T 13	46792	BH30301IT		6/2/92	Cesium 137	0 34	0 04	0 077	A	0 094
Trench T 13	46892	BH30380IT		7/30/92	Gross Alpha	284	1 5	59	A	43 5
Trench T 13	46892	BH30325IT		6/19/92	Uranium 238	2 43	0	0 807	A	1 485

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result
Y = Analytical results in validation process

528

Table 3 12-4 Groundwater Organic Compound Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/L)	DETECTION LIMIT (mg/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (mg/L)	VALIDATON CODE
Trench T 13	2274	G22740390001	3/16/90	Carbon Tetrachloride	0 058	0.005		0.005	
Trench T 13	2274	G22740620021	6/21/90	Carbon Tetrachloride	0 032	0 005		0.005	
Trench T 13	2274	GW00398IT	9/20/90	Carbon Tetrachloride	0.12			0.005	V
Trench T 13	2274	GW00682IT	11/3/90	Carbon Tetrachloride	0 1	0 005		0 005	V
Trench T 13	2274	GW01296IT	5/28/91	Carbon Tetrachloride	0 034	0 005		0 005	V
Trench T 13	2274	GW01689IT	9/9/91	Carbon Tetrachloride	0 091	0 005		0 005	V
Trench T-13	2274	GW01993IT	11/7/91	Carbon Tetrachloride	0.067	0.005		0.005	V
Trench T 13	2274	GW02376IT	2/4/92	Carbon Tetrachloride	0.043	0.005		0.005	V
Trench T 13	2274	G22740390001	3/16/90	Tetrachloroethene	0 014	0 005		0 005	
Trench T 13	2274	G22740620021	6/21/90	Tetrachloroethene	0 014	0 005		0.005	
Trench T-13	2274	GW00398IT	9/20/90	Tetrachloroethene	0.022			0 005	V
Trench T 13	2274	GW00682IT	11/3/90	Tetrachloroethene	0.022	0.005		0.005	V
Trench T 13	2274	GW01296IT	5/28/91	Tetrachloroethene	0.012	0 005		0 005	V
Trench T 13	2274	GW01689IT	9/9/91	Tetrachloroethene	0.015	0.005		0 005	V
Trench T 13	2274	GW01993IT	11/7/91	Tetrachloroethene	0 017	0.005		0.005	V
Trench T-13	2274	GW02376IT	2/4/92	Tetrachloroethene	0.013	0.005		0.005	V
Trench T 13	2274	G22740390001	3/16/90	Trichloroethene	0 013	0 005		0 005	
Trench T 13	2274	G22740620021	6/21/90	Trichloroethene	0 009	0.005		0 005	
Trench T 13	2274	GW00398IT	9/20/90	Trichloroethene	0.016	.		0.005	V
Trench T 13	2274	GW00682IT	11/3/90	Trichloroethene	0.015	0.005		0.005	V
Trench T 13	2274	GW01296IT	5/28/91	Trichloroethene	0 01	0.005		0 005	V
Trench T 13	2274	GW01689IT	9/9/91	Trichloroethene	0.013	0 005		0.005	V
Trench T 13	2274	GW01993IT	11/7/91	Trichloroethene	0.011	0.005		0.005	V
Trench T-13	2274	GW02376IT	2/4/92	Trichloroethene	0.01	0.005		0.005	V
Trench T-13	2274	GW00398IT	9/20/90	Vinyl Chloride	0.002	.	J	0.002	A
Trench T 13	48692	GW01674WC	12/8/93	Trichloroethene	0.078	0.0001	E	0.005	Y

LABORATORY QUALIFIERS
E = Chemical exceeds calibration range of the instrument
J = Positively identified below sample quantitation limit, result is estimated

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result
Y = Analytical results in validation process

529

Table 3 12-5 Groundwater Dissolved Metal Concentrations Exceeding $UTL_{99/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (μ g/L)	DETECTION LIMIT (μ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Trench T 13	2274	GW01993IT	11/7/91	Barium	273	200		V	171 2
Trench T 13	2274	GW02376IT	2/4/92	Barium	313	200	E		171 2
Trench T 13	2274	GW01689IT	9/9/91	Cadmium	6 5	5		JA	4 26
Trench T 13	2274	GW01689IT	9/9/91	Lithium	184	100		V	180
Trench T 13	2274	GW01689IT	9/9/91	Sodium	177000	5000		V	146840

LABORATORY QUALIFIER
E = Reported value is estimated due to interference

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result

Table 3 12-5 Groundwater Total Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µg/L)	DETECTION LIMIT (µg/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Trench T 13	2274	GW01689IT	9/9/91	Barium	317	200		V	296
Trench T 13	2274	GW01689IT	9/9/91	Cadmium	5.1	5		JA	4 4
Trench T 13	2274	GW02376IT	2/4/92	Chromium	50.2	10	E	JA	49 2
Trench T 13	46692	GW03525IT	9/24/92	Aluminum	25100	18.7		JA	24780
Trench T 13	46692	GW03970IT	12/17/92	Aluminum	29500	200	*	JA	24780
Trench T 13	46692	GW03525IT	9/24/92	Arsenic	9 2	0 7		JA	8.2
Trench T 13	46692	GW03970IT	12/17/92	Iron	31800	100		V	30465
Trench T 13	46692	GW03525IT	9/24/92	Lead	19.3	1		V	18.4
Trench T 13	46692	GW03970IT	12/17/92	Lead	24 1	3		V	18.4
Trench T 13	46692	GW03525IT	9/24/92	Potassium	7580	779		V	4980
Trench T 13	46692	GW03970IT	12/17/92	Potassium	7290	5000		V	4980
Trench T 13	46692	GW03525IT	9/24/92	Vanadium	70.5	3 3		V	67
Trench T 13	46692	GW03970IT	12/17/92	Vanadium	76.3	50		V	67

LABORATORY QUALIFIER
E = Reported value is estimated due to interference
= Matrix duplicate analysis did not meet advisory limits

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result

Table 3 12-6 Groundwater Dissolved Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (μ g/L)	DETECTION LIMIT (μ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (μ g/L)
Trench T 13	2274	GW01296IT	5/28/91	Antimony	15	60	B		6
Trench T 13	2274	GW02376IT	2/4/92	Antimony	13	60	B		6
Trench T 13	2274	GW01689IT	9/9/91	Cadmium	6	5		JA	5

LABORATORY QUALIFIER
B = Detected concentration was less than contract required detection limit and above instrument detection limit

VALIDATION CODES
JA = Result accepted but was estimated

Table 3 12-6 Groundwater Total Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (µ g/L)
Trench T 13	2274	GW01689IT	9/9/91	Cadmium	5.1	5		JA	5
Trench T 13	2274	GW01689IT	9/9/91	Manganese	333	15		V	183
Trench T-13	46892	GW03525IT	9/24/92	Manganese	344	2 1		V	183
Trench T 13	46892	GW03970IT	12/17/92	Manganese	358	15		V	183

LABORATORY QUALIFIER

VALIDATION CODES
JA = Result accepted, but was estimated
V = Valid result

533

Table 3 12-7 Groundwater Total Radionuclide Activities Exceeding $UTL_{90/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	BACKGROUND $UTL_{90/99}$
Trench T 13	2274	GW00682IT	11/3/90	Americium 241	0 32	0 01	0 047	A	0 04
Trench T 13	46692	GW01674WC	12/9/93	Americium 241	0 13	0 01	0 021	Y	0 04
Trench T 13	46692	GW03525IT	9/24/92	Plutonium 239 240	0 07	0 007	0 027	A	0 06
Trench T 13	46692	GW01674WC	12/9/93	Plutonium 239 240	0 97	0 004	0 092	Y	0 06
Trench T 13	46792	GW00316GA	2/23/94	Americium 241	0 08	0 023	0 032	V	0 04
Trench T 13	46792	GW00316GA	2/23/94	Plutonium-239 240	0 53	0 008	0 098	V	0 06
Trench T 13	46892	GW00317GA	2/24/94	Plutonium-239 240	0 08	0 009	0 018	V	0 06
Trench T 13	46892	GW01428GA	9/14/94	Plutonium-239 240	0 48	0 021	0 08	Y	0 06

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result
Y = Analytical results in validation process

534

Table 3 12-8 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T 13	2274	GW02376IT	2/4/92	Gross Alpha	10.05	1 7	3 77	A	7
Trench T 13	2274	GW01296IT	5/28/91	Gross Beta	7 791	3.3	5 51	A	5
Trench T 13	2274	GW01689IT	9/9/91	Gross Beta	6 259	3 1	2.07	A	5
Trench T 13	2274	GW01993IT	11/7/91	Gross Beta	5 232	2 7	1 82	A	5
Trench T 13	2274	GW02376IT	2/4/92	Gross Beta	7 029	3	2.17	A	5
Trench T 13	2274	GW00682IT	11/3/90	Uranium-233,234	5 89	0 6	0 73	A	1 07
Trench T 13	2274	GW01296IT	5/28/91	Uranium-233,234	6.96	0	1.35	A	1 07
Trench T 13	2274	GW01689IT	9/9/91	Uranium-233,234	6.005	0.258	1.46	A	1 07
Trench T 13	2274	GW01993IT	11/7/91	Uranium-233,234	5.392	0.222	1.22	A	1 07
Trench T 13	2274	GW02376IT	2/4/92	Uranium-233,234	7 075	0 138	1 45	A	1 07
Trench T 13	2274	GW00682IT	11/3/90	Uranium-238	2.609	0.6	0 401	A	0 768
Trench T 13	2274	GW01296IT	5/28/91	Uranium-238	2.762	0.095	0 748	A	0 768
Trench T 13	2274	GW01689IT	9/9/91	Uranium-238	1 248	0.386	0.606	A	0 768
Trench T 13	2274	GW01993IT	11/7/91	Uranium-238	3 073	0.281	0.866	A	0 768
Trench T 13	2274	GW02376IT	2/4/92	Uranium-238	1 96	0	0 652	A	0 768
Trench T 13	46692	GW03525IT	9/24/92	Gross Beta	6.8	6.19	4.04	V	5
Trench T 13	46692	GW00349WC	3/4/93	Gross Beta	5 2	3.64	2 41	V	5
Trench T 13	46692	GW01319WC	9/21/93	Gross Beta	6.1	2.5	1 9	V	5
Trench T 13	46692	GW03525IT	9/24/92	Uranium-233,234	3.8	0.2783	1.2092	A	1.07
Trench T 13	46692	GW03970IT	12/17/92	Uranium-233,234	3.7	0.1638	0.9645	A	1 07
Trench T 13	46692	GW00349WC	3/4/93	Uranium-233,234	3.3	0 1911	0.6417	A	1 07
Trench T 13	46692	GW00778WC	5/11/93	Uranium-233,234	2.8	0.035	0.76	A	1 07
Trench T 13	46692	GW01319WC	9/21/93	Uranium-233,234	1.6	0.099	0.52	A	1 07
Trench T 13	46692	GW01674WC	12/9/93	Uranium-233,234	1 6106	0.1658	0.5006	Y	1 07
Trench T 13	46692	GW00815GA	2/23/94	Uranium-233,234	1 7	0.07	0.37	V	1 07
Trench T 13	46692	GW00851GA	5/19/94	Uranium-233,234	1 6	0.15	0.53	V	1 07
Trench T 13	46692	GW01427GA	8/12/94	Uranium-233,234	2.3	0.22	0.76	Y	1.07
Trench T-13	46692	GW01825GA	11/16/94	Uranium-233,234	2.13	0.1715	0.5769	Y	1.07
Trench T 13	46692	GW02237GA	3/16/95	Uranium-233,234	1 6145	0.1913	0.3928	Y	1 07
Trench T 13	46692	GW03525IT	9/24/92	Uranium-238	1 9	0.2535	0.7872	JA	0.768
Trench T 13	46692	GW03970IT	12/17/92	Uranium-238	1.2	0.2367	0.4834	JA	0.768
Trench T 13	46692	GW00349WC	3/4/93	Uranium-238	0.95	0.2065	0.4946	JA	0.768
Trench T 13	46692	GW00778WC	5/11/93	Uranium-238	1.7	0.035	0.58	A	0.768
Trench T 13	46692	GW01319WC	9/21/93	Uranium-238	0.96	0.067	0.4	A	0.768
Trench T 13	46692	GW01674WC	12/9/93	Uranium-238	1.2126	0 1512	0.4303	Y	0 768
Trench T-13	46692	GW01427GA	8/12/94	Uranium-238	1 1	0 11	0.48	Y	0.768
Trench T 13	46692	GW02237GA	3/16/95	Uranium-238	0.8553	0.1056	0.2385	Y	0.768
Trench T 13	46792	GW03971IT	12/16/92	Gross Alpha	8.1	3	3.82	V	7
Trench T 13	46792	GW00360WC	3/3/93	Gross Alpha	10.03	1 02	2.51	V	7

535

Table 3 12-8 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Trench T 13	46792	GW00777WC	5/11/93	Gross Alpha	7 3	0 72	1	V	7
Trench T 13	46792	GW01826GA	11/29/94	Gross Alpha	8 9467	2 7207	3 3198	Y	7
Trench T 13	46792	GW03971IT	12/16/92	Uranium-233 234	9 1	0 1781	1 4751	A	1 07
Trench T 13	46792	GW00350WC	3/3/93	Uranium-233 234	8 657	0 4735	2 1	A	1 07
Trench T 13	46792	GW00777WC	5/11/93	Uranium-233 234	4 9	0 055	1	A	1 07
Trench T 13	46792	GW01320WC	9/17/93	Uranium-233 234	4 3	0 2271	0 9048	V	1 07
Trench T 13	46792	GW01675WC	12/13/93	Uranium-233 234	4 3	0 18	0 89	Y	1 07
Trench T 13	46792	GW00316GA	2/23/94	Uranium-233 234	4 4	0 031	0 78	V	1 07
Trench T 13	46792	GW00865GA	6/20/94	Uranium-233 234	3 3	0 25	0 9	V	1 07
Trench T 13	46792	GW01231GA	8/17/94	Uranium-233 234	5 4	0 25	1 4	Y	1 07
Trench T 13	46792	GW01826GA	11/29/94	Uranium-233 234	4 2956	0 1806	0 8666	Y	1 07
Trench T 13	46792	GW02238GA	3/20/95	Uranium-233 234	3 8	0 42	1 1	V	1 07
Trench T 13	46792	GW03971IT	12/16/92	Uranium-238	3 2	0 1953	0 793	JA	0 768
Trench T 13	46792	GW00350WC	3/3/93	Uranium-238	1 982	0 3508	0 852	A	0 768
Trench T 13	46792	GW00777WC	5/11/93	Uranium-238	1 8	0 055	0 58	A	0 768
Trench T 13	46792	GW01320WC	9/17/93	Uranium-238	1 4	0 1602	0 4947	V	0 768
Trench T 13	46792	GW01675WC	12/13/93	Uranium-238	1 4	0 092	0 45	Y	0 768
Trench T 13	46792	GW00316GA	2/23/94	Uranium-238	1 1	0 095	0 28	V	0 768
Trench T 13	46792	GW00865GA	6/20/94	Uranium-238	0 96	0 12	0 43	V	0 768
Trench T 13	46792	GW01231GA	8/17/94	Uranium-238	1 8	0 21	0 62	Y	0 768
Trench T 13	46792	GW01826GA	11/29/94	Uranium-238	1 5402	0 1806	0 512	Y	0 768
Trench T 13	46792	GW02238GA	3/20/95	Uranium-238	1 1	0 4	0 56	V	0 768
Trench T 13	46892	GW00351WC	3/3/93	Gross Beta	7 97	2 95	2 44	V	5
Trench T 13	46892	GW00351WC	3/3/93	Uranium-233 234	2 559	0 7506	1 36	A	1 07
Trench T 13	46892	GW00778WC	5/11/93	Uranium-233 234	2 9	0 06	0 79	A	1 07
Trench T 13	46892	GW01321WC	9/17/93	Uranium-233 234	1 9	0 1691	0 5754	V	1 07
Trench T 13	46892	GW01676WC	12/14/93	Uranium-233 234	2 1193	0 1805	0 6036	Y	1 07
Trench T 13	46892	GW00317GA	2/24/94	Uranium-233 234	1 2	0 064	0 29	V	1 07
Trench T 13	46892	GW01428GA	9/14/94	Uranium-233 234	1 3	0 24	0 57	Y	1 07
Trench T 13	46892	GW01827GA	11/22/94	Uranium-233 234	1 1	0 39	0 58	Y	1 07
Trench T 13	46892	GW02239GA	3/14/95	Uranium-233 234	1 1768	0 0995	0 2819	Y	1 07
Trench T 13	46892	GW00351WC	3/3/93	Uranium-238	0 9004	0 6281	0 774	A	0 768
Trench T 13	46892	GW00778WC	5/11/93	Uranium-238	1 5	0 06	0 55	A	0 768
Trench T 13	46892	GW01321WC	9/17/93	Uranium-238	1	0 1987	0 4267	V	0 768
Trench T 13	46892	GW01428GA	9/14/94	Uranium-238	1 3	0 13	0 54	Y	0 768

536

Table 3 12-8 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL

VALIDATION CODES
A = Result accepted with qualifications
JA = Result accepted, but was estimated
V = Valid result
Y = Analytical results in validation process

TABLE 3 12-9 TRENCH T-13 SUMMARY INFORMATION

CONTAMINANTS			
Media Subsurface Soils			
Greater than $UTL_{99/99}$	Greater than RFCA Standards		Greater than PPRGs
Barium Cadmium Calcium Chromium Manganese Nickel Sodium Strontium			
Americium 241 Plutonium-239/240 Uranium 233/234 Uranium-235 Uranium-238			
Media Groundwater			
Greater than $UTL_{99/99}$	Greater than RFCA Tier II Standards	Greater than RFCA Tier I Standards	Greater than PPRGs
	Carbon tetrachloride Tetrachloroethene Trichloroethene Vinyl chloride		
Aluminum Barium Cadmium Chromium Lead Iron Lithium Magnesium Potassium Sodium Vanadium	Cadmium Manganese Antimony		
Americium 241 Plutonium 239/140	Gross alpha Gross beta Plutonium 239/240 Uranium 233/234 Uranium 238		

538

TABLE 3.12-9 TRENCH T-13 SUMMARY INFORMATION (continued)

PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
250	10-15	10	925-1,400	No	No

Note.

Physical characteristics are based on aerial photographs and information from the HRR.

RFCA subsurface action levels for 2-butanone and benzoic acid have not been determined

Exhibit 3.12.A
Trench T-13 Historical Release Report Information

592

Best Available Copy

PAC REFERENCE NUMBER NE 1111 NE 1118

ISS Reference Number 1111 1118 Operable Unit 2

Unit Name Trenches T-4 through T-11

Approximate Location N750 000 E2 087,500

Date(s) of Operation or Occurrence

The exact dates of operation are unknown except for the period of July 29 1954 through August 14 1968[1] Trenches T 9 T 10 and T 11 were differentiated from the other trenches and added to the disposal trench inventory in 1977[2] See the "Comments" section below for additional discussion of this point

Description of Operation or Occurrence

Trenches T-4 through T 11 along with Trench T 2 (PAC 900 109) and Trench T 3 (PAC NE 110) were used primarily for the disposal of sanitary wastewater treatment plant sludge The sludge removed from the wastewater treatment plant was placed on sludge drying beds The dried material removed from the sludge drying beds was placed in the disposal trenches The sanitary sludge disposal trenches are reported to be approximately 10 feet deep and are provided with two feet of soil cover[3] The trenches are variable in length with the average length being approximately 250 feet[4] The total amount of sludge disposed in Trenches T 2 through T 11 is estimated at 125 000 kilograms[5] Some amounts of additional materials were also disposed in Trenches T 4 T 9 and T 11 These other materials consisted of asphalt planking (approximately 130 000 square feet of asphalt planking) in T-4 and T 11 from the re-design of Solar Pond 207A (PAC 000-101) in 1963 and scrap metal and junk in T 9[5]

At the same time that Trenches T 9 T 10 and T 11 were identified [illegible] appears that the numbering system for the trenches was slightly modified Whereas earlier documents [illegible] consistent numbering system in a 1983 document a trench that had previously [illegible] T 11[5] This 1983 document placed the T-4 trench essentially as an addition [illegible] current designated Trench T 9 as essentially an extension of Trench T 7[4] but in earlier documents [illegible] referred to as Trench T 5[1] Trench T 10 had not been identified or named prior to 1983 [illegible] as Trench T 5 in the 1983 document was a trench not previously identified (comparison of maps [illegible] 1 and 5)

Physical/Chemical Description of Constituents [illegible]

Some uranium and plutonium contamination [illegible] the older sludge would have had primarily uranium contamination with [illegible] plutonium contamination total long lived alpha activity present in the [illegible] of 382 pCi/g in August 1964 to a maximum of 3 591 pCi/g in June 1960 [illegible] in flattened drums that may have been disposed in any of trenches T 2 [illegible] contaminated oils that had been held in the drum[6] The burning of the [illegible] in Pit No-2 (PAC 900-153) from March 1957 to mid 1965[6] not in the [illegible] up to 300 in total number could be present in any of Trenches T 3 through T 11 [illegible] document that Trench T-4 currently designated Trench T 11 as discussed [illegible] 235

On at least one occasion it is believed that [illegible] was also disposed in one of the East Trenches [illegible] dpm/[illegible] It is believed that this is total alpha activity The activity [illegible] with approximately 13 kilograms (kg) of depleted uranium present [illegible] this material was in drums

Responses to Operation or Occurrence

Soil samples were collected from the [illegible] in 1977 [illegible] T 9 T 10 and T 11) during the 1977 to 1982 time frame Soil from [illegible] pCi/g in [illegible] and from [illegible] to [illegible] pCi/g uranium activity [illegible] from 0 18 to 14 pCi/g plutonium

543

activity and from 40 to 126 pCi/g uranium activity. Trench T-11 was found to contain 4.5 to 50 pCi/g plutonium activity and 0.9 to 158 pCi/g in americium activity.[5]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents disposed in Trenches T-4 through T-11. This IHSS is being studied in accordance with the IAG schedule for OU2. The IAG activities will include site investigations, site characterizations, and possible remediation. The Final Phase II RFI/RI Report is to be completed by March 12, 1993.

Comments

Trench T-3, along with these trenches, are also called the East Trenches.

Trenches T-4 through T-11 (PAC NE 111) have few operational differences from Trenches T-2 (PAC 900-109) and T-3 (PAC NE 110).

The sludge disposed of in these trenches should consist primarily of concentrated organic matter typically present in sanitary wastewater treatment plant sludge.

From August 1968 until February 1970 sanitary wastewater treatment plant sludge was disposed in [illegible] landfill.[1] After February 1970, sanitary wastewater treatment plant sludge was shipped offsite for disposal.[9]

To date no documentation has been found that records the time frame during which any particular [illegible] receiving waste. Similarly, none of the HRR interviewees were knowledgeable on dates of operation of individual trenches.

The locations of these trenches on Plate 2 differ from the IAG map but are taken from the O[illegible] Work Plan [illegible] (July 1991).

References	Other references of interest	
[1] 1500793	1500296	1501097
[2] 1501719	1600430	1500369
[3] 1500898	500340	1500460
[4] 1502717	500287	500[illegible]
[5] 1500890	500901	1500[illegible]
[6] 1500656	1500304	1500755
[7] 1500579	1500458	1500921
[8] 1700445	500888	

Exhibit 3.12.B
Trench T-13 EM-31 Surveys

Exhibit 3.12.C
Trench T-13 EM-61 Surveys

550

Exhibit 3.12.D
Trench T-13 Borehole Logs

552

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 10 00	GROUND ELEVATION (FT) 5960 40	PROJECT NUMBER OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749588	AREA TRENCH T-13	CASING DIAMETER (IN)	GEOLOGIST LL GARDINER	11295
EAST	2086981	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED 04/21/95	

REMARKS SOIL TYPE ESTIMATED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5960	0				0 0-4 0' No sample collected
				0 00 /4 00	5959	1				
					5958	2				
					5957	3				
					5956	4			CL	4 0-5 0' silty, clayey, pale brown, soft, some-gravel, dry No recovery (5 0-6 0')
	BH20720MC			1 00 /2 00	5955	5				
					5954	6			SM	6 0-8 0' sand, reddish brown, f g sand, silty, pale brown, gravelly, dry
				2 00 /2 00	5953	7				
					5952	8			SC	8 0-9 0' sand, clayey, reddish brown, v f g to m g, well graded, some gravel and cobbles, dry to slightly moist No recovery (9 0-10 0')
	21MC			1 00 /2 00	5951	9				
						10				Total Depth Drilled 10 00

553

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 11 00	GROUND ELEVATION (FT)	5959 50	PROJECT NUMBER	OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749606	AREA TRENCH 13	CASING DIAMETER (IN)		GEOLOGIST	LL GARDINER	11395
EAST	2087067	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN)	1 00	DATE DRILLED	04/21/93	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0 00 /4 00	5959 5958 5957 5956	0 1 2 3				0 0-4 0' No sample collected
	GH20725AC			1 00 /2 00	5955 5954	4 5			ML	4 0-5 0' Clayey Silt with some gravel pink brown, soft No recovery (5 0-6 0')
				1 00 /2 00	5953 5952	6 7			SC	6 0-7 0' Sand, reddish brown, clayey, f g , gravel and caliche, dry No recovery (7 0-8 0')
	22AC			1 50 /2 00	5951 5950	8 9 10			SM	8 0-9 5' Sand, pale brown to golden brown, silty, v f g to m g , calcareous gravel, dry No recovery (9 5-10 0')

54

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 11 00	GROUND ELEVATION (FT) 5959 50	PROJECT NUMBER OU2 RFI/RI	LOG OF BORING NUMBER
NORTH	749606	AREA TRENCH 13	CASING DIAMETER (IN)	GEOLOGIST LL GARDINER	11395
EAST	2087067	LOCATOR NUMBER N8	BOREHOLE DIAMETER (IN) 1 00	DATE DRILLED 04/21/93	

REMARKS SOIL TYPES ESTIMATED FROM DESCRIPTIONS

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0 30 /1 00	5949	10			SM	10 0-10 3' sand, same as above No recovery (10 3-11 0')
					5948	11				Total Depth Drilled 11 00
					5947	12				
					5946	13				
					5945	14				
					5944	15				
					5943	16				
					5942	17				
					5941	18				
					5940	19				
						20				

555

3 13 MOUND SITE (IHSS 113)

The Mound Site was investigated using the following methodologies

- Historical data were compiled to identify potential contaminants location and size
- Aerial photographs were examined to identify disturbed areas verify trench dimensions and determine time of operation
- A site visual survey was conducted to identify physical features and establish a geophysical sampling grid
- Subsurface soil sampling was conducted to determine whether contamination is present beneath the site

As shown in Figure 3 12-1 the Mound Site is located approximately 100 feet east of the southeast corner of the Protected Area fence and 100 feet north of the East Access Road The dimensions of the Mound Site are approximately 175 feet long and 150 feet wide The site was reportedly used as a disposal site between 1954 and 1975 for drums containing depleted uranium and beryllium-contaminated hydraulic oil and carbon tetrachloride Records indicate burial of drums at this site, some of which were also contaminated with enriched uranium and plutonium and tetrachloroethene All drums were removed from the site in 1970 along with any soil showing visible staining

Although the general location of Mound Site was known the exact location of the site had not been physically determined prior to the Trenches Area and Mound Site Characterization Program of 1995 Aerial photographs dating from 1954 through 1975 were examined to ascertain the period of operation approximate the length and width identify staging areas, and gather information which might confirm the contents Photographs from 1954 show the Mound Site when a single layer of drums were buried Photographs from 1971 show the drums being uncovered and later photographs indicate the area was abandoned The location and dimensions of this soil disturbance are consistent with information from the Historical Release Report The pertinent section of the HRR is included in Exhibit 3 13 A (PAC Reference Number 900-113)

3 13 1 Geology

The Mound Site stratigraphy consists of Rocky Flats Alluvium overlying the Arapahoe and Laramie Formations The Rocky Flats Alluvium ranges in thickness from 11 to 20 feet The bedrock is predominately the Arapahoe Number 1 Sandstone which consists of sandstone clayey sandstone, and silty sandstone (EG&G, 1995) The hydrograph of monitoring well 1987 located within the IHSS boundary indicates that groundwater fluctuates from five feet bgs to below the bedrock/alluvium contact

3 13.2 Site Visual Survey and Geophysical Surveys

After aerial photographs were examined a visual survey of the Mound Site area was performed by the project geologists and a representative from the Rocky Flats Ecology and Watershed Management Division Landmarks from the aerial photographs were used as reference points to locate the general area of the Mound Site Soil disturbances were identified and recent geologic characterization information were used to delineate between Rocky Flats Alluvium and soil disturbance caused by construction related activities Evidence of fill material deposits were also noted The area did not show any evidence of surficial water or seeps In addition to the geologic characteristics of the area, changes in vegetation were used to identify the more recently disturbed soil and revegetated fill material

Because there are no buried materials remaining at the Mound Site, geophysical surveys were not performed in this area. During the drum removal action in 1970, the majority of soil was removed from the area which surrounded the drums During the construction of the Protected Area fence, the northwest corner of the Mound Site was excavated to a depth of approximately fifteen feet. The Central Avenue Ditch was also constructed through the south east corner of the Mound Site, removing another section of the storage area.

3 13 3 Soil Gas Surveys

Due to the unusually high springtime precipitation in 1995, the vadose zone within the Mound Site Area was highly saturated The increased soil moisture content tended to attenuate soil gas readings, making sample collection difficult Due to the low permeability of the soil in the Mound Site coupled with high saturation, the soil gas survey was not performed in this area However, the results of the 1993 Soil Gas Sampling Program were used to determine the proposed borehole locations for characterizing the area Results of the 1993 soil gas investigation are presented in Figure 3 13-2

3 13.4 Subsurface Soil Sampling

Subsurface soil sampling from the Mound Site area was the final step of the characterization activities Four boreholes were sited in the center of the highest areas of VOC contamination identified by the 1993 soil gas sampling Two boreholes were placed along the west edge of the Mound Site and the other two boreholes were placed in the southeast corner of the site, one on the east side of the Central Avenue ditch and the other on the west side of the ditch Lithologic descriptions of each borehole are presented in Exhibit 3 13 B In addition, six boreholes were drilled into the Mound Site and sampled during the OU 2 Phase II RFI/RI investigation Data from all investigations indicate elevated levels of

557

organic compounds, metals and radionuclides Figure 3 13-3 shows the boreholes and wells that characterize the Mound Site

Organic Compounds

Methylene chloride (range 19-44 µg/kg) and tetrachloroethene (range 220-760 µg/kg) were detected at concentrations greater than the RFCA Subsurface Soil Action Levels but less the PPRGs for subsurface soils, construction worker scenario as presented in Table 3 13-1

Metals

Antimony (range 20 0-22 4 mg/kg), arsenic (20 mg/kg), barium (390 mg/kg), cadmium (range 1 3-3 3 mg/kg) calcium (range 64 700-254 000 mg/kg), copper (344 mg/kg), iron (66,200 mg/kg), manganese (1 610 mg/kg), strontium (487 mg/kg) and zinc (232 mg/kg) concentrations exceeded the background $UTL_{99/99}$ values as presented in Table 3 13-2

Radionuclides

Gross alpha (90 51 pCi/g), gross beta (151 pCi/g), americium-241 (0 05-0 36 pCi/g), cesium-137 (0 4-2 3 pCi/g), plutonium-239/240 (0 03-2 6 pCi/g), uranium-233/234 (18 41 pCi/g), uranium-235 (1 38 pCi/g) and uranium-238 (range 2 0-91 03 pCi/g) exceeded background $UTL_{99/99}$ values (see Table 3 13-3) The observed cesium-137 (range 2 1-4 7 pCi/g), uranium-233,234 (18 41 pCi/g), and uranium-238 (91 03 pCi/g) activities exceeded the PPRG for subsurface soils, construction worker scenario as shown in Table 3 13-4

3 13 5 Groundwater

There are several wells located in the Mound Site Area Elevated levels of organics, metals and radionuclides were observed

Organic Compounds

Tetrachloroethene concentrations (range 600-2 300 µg/L) in well 1987 and vinyl chloride concentrations (range 260-950 µg/L) exceeded the Tier I Groundwater Action Levels as presented in Table 3 13-5 Concentrations of methylene chloride (range 6-72 µg/L), tetrachloroethene, trichloroethene (range 6-110 µg/L) 1 1-Dichloroethene (range 9-48 µg/L) carbon tetrachloride (range 7-12 µg/L) chloroform (340 µg/L) and vinyl chloride (range 55-200 µg/L) exceeded the RFCA Tier II Groundwater Action Levels as shown in Table 3 13-6

Metals

Dissolved aluminum (range 30,100-38,500 mg/L), dissolved barium (range 371-504 mg/L), dissolved copper (43 3 mg/L), dissolved iron (36,900 mg/L), dissolved lead (range· 302 -36 2 mg/L), total manganese (range 261-475 mg/L), dissolved potassium (range 5950-9750 mg/L), dissolved thallium (11 6 mg/L), total thallium (11 6 mg/L), and dissolved zinc (175 mg/L) exceeded the RFCA Tier II Groundwater Action Levels (see Table 3 13-5) These metal concentrations did not exceed the RFCA Tier I Groundwater Action Levels or the surface water PPRGs for an open-space receptor as presented in Table 3 13-7

Radionuclides

Dissolved gross alpha (8.62 pCi/L), dissolved gross beta (range 5.3-8.23 pCi/L), uranium-233/234, (range 2 8-8 23 pCi/L), and uranium-238 (range· 0 91 -2.70 pCi/L) activities exceeded the RFCA Tier II Groundwater Action Levels as presented in Table 3 13-8 These radionuclide activities did not exceed the RFCA Tier I Groundwater Action Level or the PPRGs for surface water, open-space receptor

3 13 6 Summary

The data collected from the boreholes were combined with data from previous investigations for comparison to background concentrations negotiated cleanup levels and PPRGs Three organic compound concentrations and one radionuclide activity exceeded the RFCA Subsurface Soil Action Levels Ten metal concentrations and eight radionuclide activities exceeded the subsurface soils background $UTL_{99/99}$ values

There were no metals or radionuclides detected with concentrations or activities exceeding the RFCA Tier I Groundwater Action Levels or the PPRGs for surface water open-space receptor There were seven organic compounds detected with concentrations that exceeded the RFCA Tier II Groundwater Action Levels Nine metals had concentrations exceeding the RFCA Tier II Groundwater Action Levels and four radionuclides had activities exceeding the RFCA Tier II Groundwater Action Levels There were two organic compounds detected exceeding the RFCA Tier I Groundwater Action Levels

In addition, a groundwater plume impacting South Walnut Creek above the RFCA Surface Water Action Levels The Mound Site is believed to be the source A remedial action is indicated, but the extent of contamination in the vicinity of the Mound Site requires further investigation to determine the volume of contaminated soil to be remediated Mound Site summary information is presented in Table 3 13-10

579

Table 3 13-1 Subsurface Soil Organic Compound Concentrations Exceeding RFCA Action Levels

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	ACTION LEVEL	VALIDATION CODE
[redacted]										
Mound Site	14295	BH20840WC	5 8	5/18/95	Methylene Chloride	44	0 005	B	5 77	Y
Mound Site	14295	BH20848WC	13 7 15	5/18/95	Methylene Chloride	19	0 005	B	5 77	Y
Mound Site	14295	BH20837WC	0-3 5	5/15/95	Tetrachloroethene	220	0 005		11 5	Y
Mound Site	14295	BH20840WC	5-8	5/18/95	Tetrachloroethene	760	0 005		11 5	Y
Mound Site	14295	BH20841WC	8-12	5/18/95	Tetrachloroethene	550	0 005		11 5	Y
Mound Site	14295	BH20848WC	13 7 15	5/18/95	Tetrachloroethene	320	0 005		11 5	Y
[redacted]										

LABORATORY QUALIFIERS
B = Indicates chemical was in both the sample and associated method blank
J = Positively identified below sample quantitation limit, result is estimated

NOTES
RFCA Action Levels for Benzoic Acid and 2 Butanone have not been determined

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result
Y = Analytical results in validation process

Best Available Copy

260

Table 3 13-2 Subsurface Soil Metal Concentrations Exceeding $UTL_{95/95}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (mg/kg)	DETECTION LIMIT (mg/kg)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Mound Site	14195	BH20849WC	4-6	5/18/95	Calcium	220000	1000		Y	53250
Mound Site	14195	BH20849WC	4-6	5/18/95	Strontium	487	40		Y	186
Mound Site	14295	BH20898WC	18.7 18	5/18/95	Arsenic	19.7	2		Y	16.2
Mound Site	14295	BH20837WC	0-3.5	5/15/95	Calcium	88600	1000		Y	53250
Mound Site	14295	BH20840WC	5-8	5/18/95	Calcium	98400	1000		Y	53250
Mound Site	14295	BH20840WC	5-8	5/18/95	Copper	344	5		Y	49.1
Mound Site	14295	BH20840WC	5-8	5/18/95	Zinc	232	4		Y	183
Mound Site	21799	BH20325WC	43.2-50	5/18/95	Antimony	20.2	12		JA	15.1
Mound Site	21799	BH20580WC	26.7-31.9	6/3/93	Antimony	22.4	12		JA	15.1
Mound Site	21799	BH20921WC	31.9-37.4	6/3/93	Cadmium	1.5	1		N	1.33
Mound Site	BH-19987	BH19987WS		6/3/93	Cadmium	1.6			N	1.33
Mound Site	BH-19987	BH19987CT	17.7 20.4	7/20/87	Cadmium	2			N	1.33
Mound Site	BH-19987	BH19987SR	23.4-24.5	7/20/87	Cadmium	2.2			N	1.33
Mound Site	BH-19987	BH19987000D	0-5	7/20/87	Cadmium	2.3			N	1.33
Mound Site	BH-19987	BH19987015	5-15	7/20/87	Cadmium	2.4			N	1.33
Mound Site	BH-19987	BH19987WS		7/20/87	Calcium	94700			N	1.33
Mound Site	BH-19987	BH19987000S	0-5	7/20/87	Calcium	188000			N	1.33
Mound Site	BH-19787	BH19787SSR	25-26.2	7/17/87	Arsenic	20			N	53250
Mound Site	BH-19787	BH19787SSR	25-26.2	7/17/87	Barium	390			N	58200
Mound Site	BH-19787	BH19787WS		7/18/87	Cadmium	1.9			N	18.2
Mound Site	BH-19787	BH19787CT	18-21.7	7/17/87	Cadmium	2.9			N	372
Mound Site	BH-19787	BH19871113	11 12.3	7/17/87	Cadmium	3.2			N	1.33
Mound Site	BH-19787	BH19787SSR	25-26.2	7/17/87	Cadmium	3.3			N	1.33
Mound Site	BH-19787	BH19787000SD	0-5	7/17/87	Calcium	254000			N	1.33
Mound Site	BH-19787	BH19787000D	0-5	7/16/87	Iron	68200			N	1.33
Mound Site	BH-19787	BH19787SSR	25-26.2	7/17/87	Manganese	1810			N	53250
									N	53250
									N	1190

LABORATORY QUALIFIER

VALIDATION CODES
JA = Result accepted, but was estimated
N = Will not be validated
Y = Analytical results in validation process

56

Table 3 13-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{99/99}$ Values

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND UTL 99/99
Mound Site	14195	BH20849WC	4-6	5/18/95	Plutonium 239 240	0 07	0 008	0 018	Y	0 025
Mound Site	14295	BH20837WC	0-3 5	5/15/95	Americium 241	0 36	0 013	0 068	Y	0 022
Mound Site	14295	BH20837WC	0-3 5	5/15/95	Gross Alpha	90 51	4 74	16 2	Y	51 4
Mound Site	14295	BH20837WC	0-3 5	5/15/95	Gross Beta	151	3 7	12 8	Y	42
Mound Site	14295	BH20837WC	0-3 5	5/15/95	Plutonium 239 240	1 91	0 009	0 256	Y	0 025
Mound Site	14295	BH20840WC	5-8	5/18/95	Plutonium 239 240	0 03	0 009	0 013	Y	0 025
Mound Site	14295	BH20837WC	0-3 5	5/15/95	Uranium 233 234	18 41	0 031	2 32	Y	3 441
Mound Site	14295	BH20837WC	0-3 5	5/15/95	Uranium 235	1 38	0 04	0 241	Y	0 153
Mound Site	14295	BH20837WC	0-3 5	5/15/95	Uranium 238	91 03	0 045	11 1	Y	1 807
Mound Site	14295	BH20840WC	5-8	5/18/95	Uranium 238	2 05	0 015	0 272	Y	1 807
Mound Site	14395	BH20842WC	4-6	5/19/95	Plutonium 239 240	0 03	0 007	0 013	Y	0 025
Mound Site	21793	BH20325WC	43 2 50	6/3/93	Uranium 235	0 19	0 034	0 06	A	0 153
Mound Site	21793	BH20325WC	43 2 50	6/3/93	Uranium 235	0 19	0 034	0 06	A	0 153
Mound Site	BH3687	BH36870515	5-15	7/20/87	Americium-241	0 03		0 17	N	0 022
Mound Site	BH3687	BH36870005	0-5	7/20/87	Americium 241	0 04		0 18	N	0 022
Mound Site	BH3687	BH368720CT	17 7 20 4	7/20/87	Americium 241	0 04		0 19	N	0 022
Mound Site	BH3687	BH368723BR	23 4-24 5	7/20/87	Americium-241	0 08		0 19	N	0 022
Mound Site	BH3687	BH368723BR	0-5	7/20/87	Americium 241	0 08		0 19	N	0 022
Mound Site	BH3687	BH3687005D	0-5	7/20/87	Americium 241	0 12		0 2	N	0 022
Mound Site	BH3687	BH3687005D	17 7 20 4	7/20/87	Cesium 137	0 4		1	N	0 129
Mound Site	BH3687	BH368720CT	17 7 20 4	7/20/87	Cesium 137	1		1 1	N	0 129
Mound Site	BH3687	BH368720CT	5-15	7/20/87	Cesium-137	1		1 1	N	0 129
Mound Site	BH3687	BH36870515	23 4-24 5	7/20/87	Cesium 137	2 1		1 2	N	0 129
Mound Site	BH3687	BH368723BR	23 4-24 5	7/20/87	Cesium-137	2 3		1 7	N	0 129
Mound Site	BH3687	BH368723BR		7/20/87	Cesium 137	2 3		1 7	N	0 129
Mound Site	BH3687	BH368705WS	17 7 20 4	7/20/87	Plutonium-239 240	0 03		0 09		0 025
Mound Site	BH3687	BH368720CT	17 7 20 4	7/20/87	Plutonium 239 240	0 03		0 09		0 025
Mound Site	BH3687	BH368720CT	0-5	7/20/87	Plutonium 239 240	0 03		0 09		0 025
Mound Site	BH3687	BH3687005D	0-5	7/20/87	Plutonium 239 240	0 41		0 14		0 025
Mound Site	BH3687	BH36870005	17 7 20 4	7/20/87	Plutonium 239 240	0 53		0 16		0 025
Mound Site	BH3687	BH368720CT	17 7 20 4	7/20/87	Uranium 238	2 2		0 4	N	1 807
Mound Site	BH3687	BH368720CT		7/20/87	Uranium 238	2 2		0 4	N	1 807
Mound Site	BH3787	BH378705WS		7/16/87	Americium 241	0 07		0 18	N	0 022
Mound Site	BH3787	BH378705WS	0-5	7/16/87	Americium 241	0 07		0 18	N	0 022
Mound Site	BH3787	BH37870005	25-26 2	7/16/87	Americium-241	0 48		0 24	N	0 022
Mound Site	BH3787	BH378725BR	25-26 2	7/17/87	Americium-241	0 05		0 18	N	0 022
Mound Site	BH3787	BH378725BR	18-21 7	7/17/87	Americium-241	0 05		0 18	N	0 022
Mound Site	BH3787	BH378721CT		7/17/87	Americium-241	0 06		0 18	N	0 022
Mound Site	BH3787	BH378705WS		7/16/87	Cesium-137	0 7		0 8	N	0 129
Mound Site	BH3787	BH378705WS		7/16/87	Cesium-137	0 7		0 8	N	0 129
Mound Site	BH3787	BH37871113	11 12.3	7/17/87	Cesium 137	0 8		1 3	N	0 129
Mound Site	BH3787	BH378721CT	18-21 7	7/17/87	Cesium-137	4 7		2	N	0 129

Table 3 13-3 Subsurface Soil Radionuclide Activities Exceeding $UTL_{95/95}$ Values (continued)

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH (ft)	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	BACKGROUND $UTL_{95/95}$
Mound Site	BH3787	BH378705WS		7/16/87	Plutonium-239,240	0 11		0.11		0 025
Mound Site	BH3787	BH37870005D	0-5	7/16/87	Plutonium-239,240	0 49		0 15		0 025
Mound Site	BH3787	BH37870005	0-5	7/16/87	Plutonium-239,240	2.6		0 3		0 025
Mound Site	BH3787	BH378721CT	18-21 7	7/17/87	Tritium	520		220	N	504
Mound Site	BH3787	BH378721CT	18-21 7	7/17/87	Tritium	520		220	N	504
Mound Site	BH3787	BH37870005D	0-5	7/16/87	Uranium-238	2.4		0 2	N	1 807
Mound Site	BH3787	BH37870005	0-5	7/16/87	Uranium-238	3 1		0 3	N	1 807

VALIDATION CODES
A = Result accepted with qualifications
N = Will not be validated
Y = Analytical results in validation process

563

Table 3 13-4 Subsurface Soil Radionuclide Activities Exceeding PPRGs

LOCATION	BOREHOLE	SAMPLE NUMBER	SAMPLE DEPTH	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/g)	DETECTION LIMIT (pCi/g)	ERROR (pCi/g)	VALIDATION CODE	PPRG (pCi/g)
Mound	14295	BH20837WC	0-3 5	5/15/95	Uranium 233 234	18 41	0 0308	2 32	Y	12 5
Mound	14295	BH20837WC	0-3 5	5/15/95	Uranium 238	91 03	0 0448	11 1	Y	60 1
Mound	BH3687	BH36870515	5-15	7/20/87	Cesium 137	2 1		1 2	N	
Mound	BH3687	BH368723BR	23 4-24 5	7/20/87	Cesium 137	2 3		1 7	N	
Mound	BH3687	BH368723BR	23 4-24 5	7/20/87	Cesium 137	2 3		1 7	N	
Mound	BH3787	BH378721CT	18-21 7	7/17/87	Cesium 137	4 7		2	N	

VALIDATION CODES
N = Will not be validated
Y = Analytical results in validation process

525

Table 3 13-5 Groundwater Organic Compound Concentrations Exceeding Tier I Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	LABORATORY QUALIFIER	TIER I ACTION LEVEL (µ g/L)
Mound	1987	GW00979GA	7/19/98	Tetrachloroethene	600		
Mound	1987	GW02878IT	5/13/96	Tetrachloroethene	740	E	500
Mound	1987	G1987051902105	5/23/94	Tetrachloroethene	790		500
Mound	1987	GW00053IT	7/26/94	Tetrachloroethene	860		500
Mound	1987	GW01665IT	8/16/95	Tetrachloroethene	2900	E	500
Mound	3586	GW00405GA	3/11/98	Vinyl Chloride	210	E	200
Mound	3586	GW00262WC	3/8/97	Vinyl Chloride	260	E	200
Mound	3586	GW00524IT	12/5/94	Vinyl Chloride	360		200
Mound	3586	G3586061802145	6/19/94	Vinyl Chloride	370	E	200
Mound	3586	GW01818IT	10/9/95	Vinyl Chloride	380		200
Mound	3586	35-86-08-10-88	8/11/92	Vinyl Chloride	403		200
Mound	3586	GW01461IT	7/10/95	Vinyl Chloride	420	E	200
Mound	3586	GW02631IT	4/8/96	Vinyl Chloride	420	E	200
Mound	3586	GW03828IT	12/11/96	Vinyl Chloride	420	E	200
Mound	3586	GW00240IT	8/22/94	Vinyl Chloride	440		200
Mound	3586	GW01244WC	9/23/97	Vinyl Chloride	490	E	200
Mound	3586	35-86-03-02-88	3/3/92	Vinyl Chloride	492		200
Mound	3586	35-86-02-09-89	2/10/93	Vinyl Chloride	520		200
Mound	3586	GW03217IT	8/8/96	Vinyl Chloride	530	E	200
Mound	3586	GW02195IT	1/11/96	Vinyl Chloride	650	E	200
Mound	3586	GW01221IT	4/30/95	Vinyl Chloride	670	E	200
Mound	3586	GW00976IT	5/15/95	Vinyl Chloride	690	E	200
Mound	3586	35-86-05-03-89	5/4/93	Vinyl Chloride	770	E	200
Mound	3586	G3586128[illegible]004	12/[illegible]/93	Vinyl Chloride	850	E	200
Mound	3586	35-86-01-09-89	1/4/93	Vinyl Chloride	930		200
Mound	3586	G35860190001	1/24/94	Vinyl Chloride	950	E	200

565

Table 3 13-5 Groundwater Organic Compound Concentrations Exceeding Tier I Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (μ g/L)	LABORATORY QUALIFIER	TIER I ACTION LEVEL (μ g/L)

LABORATORY QUALIFIERS

E = Chemical exceeds calibration range of the instrument

Table 3 13-6 Groundwater Organic Compound Concentrations Exceeding Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (μ g/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (μ g/L)
Mound	1987	G1987051902105	5/23/94	Methylene chloride	14		5
Mound	1987	GW00979GA	7/19/98	Tetrachloroethene	600		5
Mound	1987	GW02878IT	5/13/96	Tetrachloroethene	740	E	5
Mound	1987	G1987051902105	5/23/94	Tetrachloroethene	790		5
Mound	1987	GW00053IT	7/26/94	Tetrachloroethene	860		5
Mound	1987	GW01665IT	8/16/95	Tetrachloroethene	2300	E	5
Mound	1987	GW02878IT	5/13/96	Trichloroethene	46		5
Mound	1987	GW00979GA	7/19/98	Trichloroethene	53		5
Mound	1987	GW00053IT	7/26/94	Trichloroethene	58		5
Mound	1987	G1987051902105	5/23/94	Trichloroethene	70		5
Mound	1987	GW01665IT	8/16/95	Trichloroethene	110		5
Mound	3586	35-86-06-10-88	8/11/92	1,1-Dichloroethene	9		7
Mound	3586	35-86-03-02-88	3/3/92	1,1-Dichloroethene	12		7
Mound	3586	35-86-05-03-89	5/4/93	1,1-Dichloroethene	13		7
Mound	3586	35-86-10-16-87	10/17/91	1,1-Dichloroethene	14		7
Mound	3586	35-86-06-26-87	8/27/91	1,1-Dichloroethene	19		7
Mound	3586	35-86-06-02-87	6/3/91	1,1 Dichloroethene	40		7
Mound	3586	35-86-03-17-87	3/18/91	1,1-Dichloroethene	48		7
Mound	3586	35-86-01-03-89	1/4/93	Carbon Tetrachloride	7		5
Mound	3586	35-86-06-02-87	6/3/91	Carbon Tetrachloride	12		5
Mound	3586	35-86-06-02-87	6/3/91	Chloroform	340		100
Mound	3586	35-86-03-02-88	3/3/92	Methylene chloride	6		5
Mound	3586	35-86-01-03-89	1/4/93	Methylene chloride	6	B	5
Mound	3586	GW00524IT	12/5/94	Methylene chloride	6	BJ	5
Mound	3586	GW02481GA	5/18/99	Methylene chloride	7	BD	5
Mound	3586	GW00976IT	3/15/95	Methylene chloride	10		5
Mound	3586	GW01221IT	4/30/95	Methylene chloride	10		5
Mound	3586	G3586061802145	6/18/94	Methylene chloride	72	B	5
Mound	3586	GW01221IT	4/30/95	Trichloroethene	6		5
Mound	3586	GW00240IT	3/22/94	Trichloroethene	7	J	5
Mound	3586	35-86-06-26-87	8/27/91	Trichloroethene	8		5
Mound	3586	35-86-01-03-89	1/4/93	Trichloroethene	9		5
Mound	3586	35-86-03-02-88	3/3/92	Trichloroethene	10		5
Mound	3586	35-86-05-03-89	5/4/93	Trichloroethene	11		5
Mound	3586	35-86-03-17-87	3/18/91	Trichloroethene	14		5
Mound	3586	35-86-06-02-87	6/3/91	Trichloroethene	16		5

567

Table 3 13-6 Groundwater Organic Compound Concentrations Exceeding Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (μ g/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (μ g/L)
Mound	3586	35 86-05 02 88	5/3/92	Trichloroethene	19		5
Mound	3586	GW02806GA	8/31/99	Vinyl Chloride	55		2
Mound	3586	GW01835GA	12/1/98	Vinyl Chloride	83		2
Mound	3586	GW02158GA	2/18/99	Vinyl Chloride	96	E	2
Mound	3586	GW02581GA	5/18/99	Vinyl Chloride	120	E	2
Mound	3586	G3586061802145	6/19/94	Vinyl Chloride	130		2
Mound	3586	G3586061802145	6/19/94	Vinyl Chloride	134		2
Mound	3586	GW02581GA	5/18/99	Vinyl Chloride	150	D	2
Mound	3586	GW00695WC	5/7/97	Vinyl Chloride	200	X	2
Mound	3586	GW00405GA	3/11/98	Vinyl Chloride	210	E	2
Mound	3586	GW00262WC	3/6/97	Vinyl Chloride	260	E	2
Mound	3586	GW00524IT	12/5/94	Vinyl Chloride	360		2
Mound	3586	G3586061802145	6/19/94	Vinyl Chloride	370	E	2
Mound	3586	GW01818IT	10/9/95	Vinyl Chloride	380		2
Mound	3586	35 86-08 10-88	8/11/92	Vinyl Chloride	403		2
Mound	3586	GW01461IT	7/10/95	Vinyl Chloride	420	E	2
Mound	3586	GW02631IT	4/8/96	Vinyl Chloride	420	E	2
Mound	3586	GW03828IT	12/11/96	Vinyl Chloride	420	E	2
Mound	3586	GW00240IT	8/22/94	Vinyl Chloride	440		2
Mound	3586	GW01244WC	9/23/97	Vinyl Chloride	490	E	2
Mound	3586	35-86-03-02-88	3/3/92	Vinyl Chloride	492		2
Mound	3586	35-86-02 09-89	2/10/93	Vinyl Chloride	520		2
Mound	3586	GW03217IT	8/6/96	Vinyl Chloride	530	E	2
Mound	3586	GW02195IT	1/11/96	Vinyl Chloride	650	E	2
Mound	3586	GW01221IT	4/30/95	Vinyl Chloride	670	E	2
Mound	3586	GW00976IT	3/15/95	Vinyl Chloride	690	E	2
Mound	3586	35-86-05-03-89	5/4/93	Vinyl Chloride	770	E	2
Mound	3586	G35861289004	12/6/93	Vinyl Chloride	850	E	2
Mound	3586	35-86-01-03-89	1/4/93	Vinyl Chloride	930		2
Mound	3586	G35860190001	1/24/94	Vinyl Chloride	950	E	2

Table 3 13-6 Groundwater Organic Compound Concentrations Exceeding Tier II Action Levels (continued)

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (μ g/L)	LABORATORY QUALIFIER	TIER II ACTION LEVEL (μ g/L)

LABORATORY QUALIFIERS
B = Indicates chemical was in both the sample and associated method blank
D = Analysis was performed at a dilution
E = Chemical exceeds calibration range of the instrument
J = Positively identified below sample quantitation level result is estimated

Table 3 13-7 Groundwater Total Metal Concentrations Exceeding $UTL_{99/99}$ Values

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	BACKGROUND $UTL_{99/99}$
Mound Site	22393	GW00447GA	3/21/94	Aluminum	38500	200	N	JA	24780
Mound Site	22393	GW00746GA	5/19/94	Aluminum	30126 92	200		Z	24780
Mound Site	22393	GW00447GA	3/21/94	Barium	504	200		V	296
Mound Site	22393	GW00746GA	5/19/94	Barium	371 74	200		Z	296
Mound Site	22393	GW00447GA	3/21/94	Copper	43 4	25		V	40 6
Mound Site	22393	GW00447GA	3/21/94	Iron	36900	100		V	30465
Mound Site	22393	GW00447GA	3/21/94	Lead	36 2	3		V	18 4
Mound Site	22393	GW00746GA	5/19/94	Lead	30 2	3		Z	18 4
Mound Site	22393	GW00447GA	3/21/94	Potassium	9750	5000		V	4980
Mound Site	22393	GW00746GA	5/19/94	Potassium	8617 09	5000		Z	4980
Mound Site	22393	GW01601GA	10/20/94	Potassium	5950	381		V	4980
Mound Site	22393	GW02407GA	5/16/95	Thallium	11 6	10		Y	8 3
Mound Site	22393	GW00447GA	3/21/94	Vanadium	82 8	50		V	67
Mound Site	22393	GW00447GA	3/21/94	Zinc	175	20		V	174

LABORATORY QUALIFIER
N = Spike recoveries in the matrix spike sample did not meet advisory limits

VALIDATION CODES
JA = Result accepted but was estimated
V = Valid result
Z = Validation was not requested or performed

570

Table 3 13-8 Groundwater Total Metal Concentrations Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (µ g/L)	DETECTION LIMIT (µ g/L)	LABORATORY QUALIFIER	VALIDATION CODE	TIER II ACTION LEVEL (µ g/L)
Mound Site	22393	GW00447GA	3/21/94	Manganese	475	15		V	183
Mound Site	22393	GW00746GA	5/19/94	Manganese	318.29	15		Z	183
Mound Site	22393	GW01601GA	10/20/94	Manganese	261	1		V	183
Mound Site	22393	GW02407GA	5/18/95	Thallium	11 6	10		Y	2

LABORATORY QUALIFIER

VALIDATION CODES
V = Valid result
Y = Analytical results in validation process
Z = Validation was not requested or performed

57

Table 3 13-9 Groundwater Dissolved Radionuclide Activities Exceeding RFCA Tier II Action Levels

LOCATION	WELL	SAMPLE NUMBER	SAMPLE COLLECTION DATE	ANALYTE	RESULT (pCi/L)	DETECTION LIMIT (pCi/L)	ERROR (pCi/L)	VALIDATION CODE	TIER II ACTION LEVEL
Mound Site	22393	GW02407GA	5/16/95	Gross Alpha	8 6215	4 4946	4 1479	Y	7
Mound Site	22393	GW00447GA	3/21/94	Gross Beta	5 3	3	2 1	V	5
Mound Site	22393	GW02407GA	5/16/95	Gross Beta	8 2313	4 4608	3 0952	Y	5
Mound Site	22393	GW00447GA	3/21/94	Uranium 233 234	2 8	0 091	0 7	V	1 07
Mound Site	22393	GW02407GA	5/16/95	Uranium 233 234	8 8592	0 1548	1 0271	Y	1 07
Mound Site	22393	GW00447GA	3/21/94	Uranium 238	0 91	0 091	0 37	V	0 768
Mound Site	22393	GW02407GA	5/16/95	Uranium 238	2 7163	0 1229	0 5312	Y	0 768

VALIDATION CODES
A = Result accepted with qualifications
V = Valid result
Y = Analytical results in validation process

572

TABLE 3 13-10 MOUND SITE SUMMARY INFORMATION

CONTAMINANTS		
Media Subsurface Soils		
Greater than $UTL_{90/90}$	Greater than RFCA Standards	Greater than PPRGs
	Methylene chloride Tetrachloroethene	
Antimony Arsenic Barium Cadmium Calcium Copper Iron Manganese Strontium Zinc		
Gross alpha Gross Beta Americium-241 Cesium-137 Plutonium-239/240 Uranium-233/234 Uranium-235 Uranium-238		Uranium-238

Media Groundwater			
Greater than $UTL_{90/90}$	Greater than RFCA Tier II Standards	Greater than RFCA Tier I Standards	Greater than PPRGs
	Methylene chloride Tetrachloroethene Trichloroethene 1,1-Dichloroethene Carbon tetrachloride Chloroform Vinyl Chloride	Tetrachloroethene Vinyl Chloride	
	Aluminum Barium Copper Iron Lead Manganese Potassium Thallium Zinc		

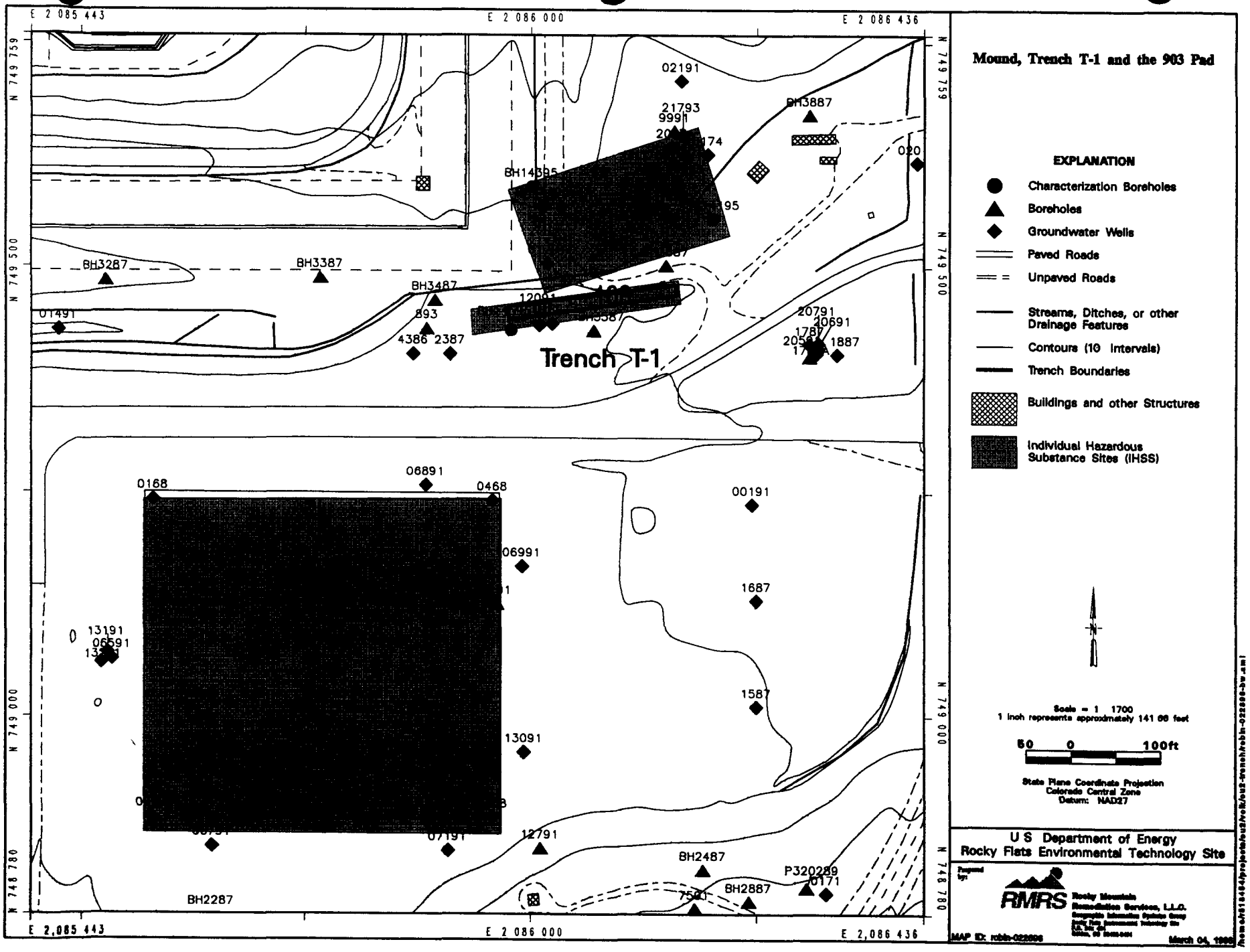
TABLE 3.13-10 MOUND SITE SUMMARY INFORMATION (continued)

	Gross alpha Gross beta Plutonium-239/240 Uranium-233/234 Uranium-238				
PHYSICAL CHARACTERISTICS					
Length (ft)	Width (ft)	Depth (ft)	Volume (cy)	Metallic Objects Present	Plume
175	150	unknown	unknown	No	Possible VOC plume

Note.

Physical characteristics are based on aerial photographs and information from the HRR

RFCA subsurface soil action levels have not been determined for benzoic acid and 2-butanone


Mound, Trench T-1 and the 903 Pad
EXPLANATION
Characterization Boreholes
Boreholes
Groundwater Wells
Paved Roads
Unpaved Roads
Streams, Ditches, or other Drainage Features
Contours (10 Intervals)
Trench Boundaries
Buildings and other Structures
Individual Hazardous Substance Sites (IHSS)
Scale = 1 1700
1 inch represents approximately 141.66 feet
50 0 100ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.
March 04, 1996
Trench T-1
E 2 085 443
E 2 086 000
E 2 086 436
N 749 759
N 749 500
N 749 000
N 748 780
02191
21793
BH3887
BH14395
BH3287
BH3387
BH3487
01491
893
4386
2387
20791
20691
1887
0168
06891
0468
00191
06991
1687
13191
06591
1587
13091
12791
BH2487
P320289
BH2887
BH2287

576

Exhibit 3.13.A
Mound Site Historical Release Report Information

577

PAC REFERENCE NUMBER 900-113

IHSS Reference Number 113, Operable Unit 2

Unit Name Mound Area

Approximate Location N749,500; E2,086,500

Date(s) of Operation or Occurrence

August 1954 - September 1958

Description of Operation or Occurrence

In April 1954, the mounding of contaminated combustible wastes from Building 444 was suggested as a method of disposal [1] The mound was developed by digging a shallow trench, aligning drums in rows, and covering them with soil with the resulting burial site extending above initial ground level RFP photographs[2] from April 21, 1954, show the mounding of the first 869[3] drums of contaminated wastes from Building 444 The drums had been shipped to the mound area between April 12, 1954, and April 21, 1954 [4] Several drums had pinhole leaks at the time of burial [5,6]

Mounding activities continued until September 1958 Drums from Building 444, Building 888, Building 883 Building 774, and Building 776 were placed in the mound Different sides of the mound were opened periodically for disposition of drums After September 1958, additional drums were moved to the mound area but not placed in the mound In July 1959 they were moved to the 903 Pad area which was becoming established as a drum storage area.[7] The burning of uranium-contaminated oil became an acceptable method of disposal in 1959 and mounding was discontinued [8]

On February 9, 1959 one drum of liquid waste from Building 776 was punctured at the mound Additionally, two trucks were contaminated to a level greater than 100,000 cpm and were cleaned at Building 774 One service department employee's shoes were contaminated as well and cleaned at Building 776 [9] One drum of liquid waste from Building 881 leaked at the mound in April 1960 [10]

During the construction of the PSZ in 1981 several areas of uranium-contaminated soil were detected in the mound area and removed [11,12]

Physical/Chemical Description of Constituents Released

Contamination resulted from organic liquid wastes Radioactive elements of the waste were in the forms of depleted uranium and enriched uranium with some limited plutonium [10] As a result of the punctured drum in February 1959, an unknown amount of soil in the mound area was contaminated to a level greater than 100,000 cpm

The ground and pallets had levels of contamination greater than 100 000 cpm due to the liquid waste from Building 881 that leaked in April 1960 The area was roped off pending cleaning [13] No documentation was found detailing the results of the cleaning effort.

Odors of solvents were detected by construction workers when they encountered groundwater in the mound area during construction of the PSZ. [4]

578

Best Available Copy

Responses to Operation or Occurrence

On August 26, 1954, soil samples were taken from a barrel burial site located southeast of Building 991 [15] Soil contaminated as a result of the punctured drum in February 1959 was removed to a level of 1 000 cpm This contaminated soil was associated with the mound and not Trench No 1 because the trench was not activated until November 1954

On April 14, 1970, excavation of the mound began. All drums were removed by the end of May 1970 Approximately 10 percent of the drums were thought to have holes No detectable alpha contamination was found in the soil at the time of removal Solid material was shipped offsite for burial Drums with liquids were sent to Building 774 for processing Those that were leaking at the time of excavation were pumped into sound drums before processing in Building 774 Empty drums were boxed with absorbent material and shipped for off-site burial No personnel or equipment contamination resulted from the excavation of the mound and no airborne contamination was detected Soil from the excavation was graded and excess was placed in the Present Landfill Four wells were drilled in the four corners of the mound area for groundwater monitoring [7]

Fate of Constituents Released to Environment

At the time of initial mounding of drums it was believed that any water leaching the material contained in the drums would have drained into the gully north of the mound because of the natural topographic slope The gully also received sewage treatment plant effluent. Any activity not removed by the soil in the mound and then carried by water to the gully would have been diluted by the effluent and the retention ponds [3] These retention ponds have been monitored since the beginning of plant operations Migrating contaminants would have been detected prior to their off-site release These retention ponds are detailed in PAC NE 142 5 - NE-142 9

Groundwater monitoring reports indicate that groundwater in the vicinity of the Mound Area is contaminated with inorganics radionuclides and volatile organic compounds These contaminants are not necessarily from the mound itself but are reflective of the materials buried in the mound These same materials were buried in Trench No 1 and burned in Oil Burning Pit No 2 (PAC 900 153) [16]

This IHSS is being studied in accordance with the IAG schedule for OU2 The IAG activities will include site investigations site characterizations and possible site remediation The Final Phase II RFI/RI Report is to be completed by August 9, 1993

Comments

Many references document that the mound was no longer used for the burial of waste materials after 1959 [10,17] however several documents indicate activities at the mound at later dates [10,13] A request was made and approval was given in December 1962 for the burial of 14 drums of depleted uranium waste in the mound burial area [10] No documentation was found stating that the burial occurred yet documents indicate that Trench T 1 (PAC 900 108) located adjacent to the mound accepted these drums [10] Therefore it is assumed that activities occurring at the mound after September 1958 related to storage activities and not burial

The chemical characteristics of the materials stored in the mound and the materials stored on the 903 Pad (PAC 900-112) are similar and therefore, the impact that the mound area had on the environment may be difficult to differentiate from the impact of the 903 Pad area.

References

[1] 1600672
[2] 1700856
1500308
1700857
[3] 1600598
[4] 1600277
[5] 1600670
[6] 1601049
[7] 1500934
[8] 1500456
[9] 1600042
[10] 1500793
[11] 1501184
[12] 1501182
[13] 1600033
[14] 1501175
[15] 1500362
[16] 1500768
[17] 1501790

Other References of Interest

1500338
1500340
1500356
1500357
1500394
1500537
1500538
1500592
1500765
1500791
1500792
1500853
1500887
1501036
1501097
1501100
1600106
1600122
1600173
1600569
1600810
1601048

Exhibit 3.13.B
Mound Site Borehole Logs

581

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT

FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG 002 ~~059~~ 061

PAGE 1 OF 2

Borehole Number 14195
Location - North _____ East. _____
Date 5/18/95
Geologist DK Nicholson
Drilling Equip Mobile B57

Surface Elevation _____
Area Mound
Total Depth 20.0
Company WCFS Project No OU2
Sample Type continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
	Run 1	1.0/2.0						1		
	2.0							2		
	Run 2	2.0/2.0						3		
	4.0							4		
Box 1 of 1	Run 3	2.0/2.0						5		
	6.0							6		
	Run 4	1.0/2.0						7		
	8.0							8		
	Run 5	0.4/2.0						9		
	10.0							10		

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

QC'd 6/13/95

582

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG 003 059

PAGE 1 OF 2

Date 5/18/95 Borehole Number 14195

Rig Geologist. DK Nicholson Company WCFS

FEET

0-2' rec = 1.0/2.0
silt, gravelly, sandy, dark brown, moist

2-4' rec = 2.0/2.0
silt, clayey, slight gravelly, calcareous, tan-brown, slightly moist

4-6' rec = 2.0/2.0
silt, clayey, calcareous, white-tan, slightly moist

6-8' rec = 1.0/2.0
gravel, silty, sandy, clayey, slightly calcareous, brown, dry

8-10 rec = 0.4/2.0
same as above

1 2 3 4 5 6 7 8 9 10

NOTES

Qc'dly [signature] 6/13/95

583

(4011 930-0135-930)(Form GT.1B)(03/01/92)

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG 004 059 061

Borehole Number 14195
Location - North _____ East. _____
Date 5/18/95
Geologist DK Nicholson
Drilling Equip Mobile B57

Surface Elevation _____
Area Mound
Total Depth 20.0
Company WCFS Project No OU2
Sample Type continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
Box 1 of 1	Run 6	1.2/2.0						11		
	12.0							12		
	Run 7	2.0/2.0						13		
	14.0							14		
	Run 8	2.0/2.0						15		
	16.0							16		
	Run 9	2.0/2.0						17		
	18.0							18		
	Run 10	2.0/2.0						19		
	20.0							20		TD = 20.0

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

6/13/95

504

U.S DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG 005 / 059

Date 5/18/95 Borehole Number 14195

Rig Geologist: DK Nicholson Company WCPS

FEET

10-12' rec = 1.2/2.0
sand, clayey, slightly gravelly, moist, slightly calcareous, brown

12-14' rec = 2.0/2.0
12-12.4 as above
12.4-14 claystone, silty, sandy, red-brown, moist
~~TOB = 12.4'~~ DIN 5/18/95

14-16' rec = 2.0/2.0
sand, clayey, slightly gravelly, reddish-brown, moist

16-18' rec = 2.0/2.0
Same as above

18-20' rec = 2.0/2.0
18-19.8 same
19.8-20.0 No 1 sand, med-grained, olive-grey, moist

TD = 20.0'

NOTES

QC'd by [illegible] 6/13/95

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG

010 ~~059~~ 061

PAGE 1 OF 2

Borehole Number 14295
Location - North _____ East _____
Date 5/12/95
Geologist DK Nicholson
Drilling Equip Mobile B-57

Surface Elevation 061
Area Mound
Total Depth 20.0
Company WCFS
Project No 4040a
Sample Type Continuous Core

EG&G LOGGING SUPERVISOR

APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0 0	0 0									
	Run 1	1.5/20						1		
	2 0							2		
	Run 2	10/10								
	3 0							3		
	Run 3	05/05								
	3 5									
Box 1 of 1	Run 4	08/15						4		
	5 0							5		
	Run 5	1.0/2.0						6		
	7 0							7		
	Run 6	1.0/1.0								
	8 0							8		
	Run 7	06/20						9		
	10.0									

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

Rec'd by [signature] 6/13/95

586

(4011 930-0134-930V Form GT 1A V03.01.97)

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT 1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG 011 ~~059~~ 061

PAGE 1 OF 2

Date 5/12/95 Borehole Number 14295

Rig Geologist DK Nicholson Company WCFS

FEET

0-2 rec = 1.5/2.0 Rocky Flats alluvium
Sand, gravelly, silty, dark brown, slightly moist, slightly calcareous
BH20837WC collected from 0-3.5'
PID reading >2,000 ppm

2-3 rec = 1.0/1.0
RFA, sandy, clayey gravel, light brown, slightly moist
max gravel size 2", average 1", fine- to coarse-grained sand, some caliche,

3-3.5 rec = 0.5/0.5

3.5-5.0 rec = 0.8/1.5
Gravel, sandy, clayey, light brown, wet (from rain)

5-7' rec = 1.0/2.0
Same as above, calcareous, moist

7-8' rec = 1.0/1.0 Same as above, dry.

8-10' rec = 0.6/2.0
Sand, gravelly, silty, dry, light brown slightly calcareous

NOTES

587

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT — FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG 012 ~~059~~

PAGE 2 OF 2

Borehole Number 14295
Location - North _____ East _____
Date 5/18/95
Geologist DK Nicholson
Drilling Equip Mobile B57

Surface Elevation 061
Area Mound
Total Depth 20.0
Company WCFS Project No OU2
Sample Type continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
	Run 8	0.8/2.0						11		
	12.0							12		
		2.0/2.0						13		
Box 1 of 1	14.0							14		
		2.0/2.0						15		
	16.0							16		
		0.0/2.0						17		
	18.0							18		
		0.4/2.0						19		
	20.0							20		TD = 20.0

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

6/13/95

U S DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG 013/~~059~~ 061

Date 5/18/95 Borehole Number 14295

Rig Geologist DK Nicholson Company WCFS

FEET

10-12' rec = 0.8/2.0
sand, silty, gravelly, light brown, slightly calcareous, dry

12-14' rec = 2.0/2.0
12-12.3 sand, clayey, v. calcareous
12.3-14 claystone, olive-tan, some black streaks, reddish, sand silty in lower 6"
top of bedrock = 12.3'

14-16' rec = 2.0/2.0
claystone, silty in places, orange-tan, slightly moist

16-18' no recovery

18-20' rec = 0.4/2.0
claystone, silty, fractured, slightly moist

TD = 20.0

NOTES

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT

FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG 024/059

Borehole Number 14395
Location - North _____ East _____
Date 5/19/95
Geologist DK Nicholson
Drilling Equip Mobile B57

Surface Elevation _____
Area Mound
Total Depth 16.0
Company WCFS Project No OU2
Sample Type Continuous Core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
	Run 1	1.8/2.0						1		
	2.0							2		
	Run 2	0.8/2.0						3		
	4.0							4		
Box 1 of	Run 3	1.4/2.0						5		
	6.0							6		
	Run 4	1.0/2.0						7		
	8.0							8		
	Run 5	0.0/2.0						9		
	10.0							10		

QC'd by [illegible] 6/14/95

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

540

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG

025 / 059 / 061

PAGE 1 OF 2

Date 5/19/95 Borehole Number 14395

Rig Geologist DK Nicholson Company. WCFS

FEET

0-2 rec = 1.8/2.0
clay, sandy, gravelly, brown, moist

2-4' rec = 0.8/2.0 same as above

4-6' rec = 1.4/2.0 clay, sandy, slight gravelly, orange-brown, slightly calcareous, moist

6-8 rec = 1.0/2.0
same as above

8-10 no recovery

1 2 3 4 5 6 7 8 9 10

NOTES

591

(4011 930-0135-930)(Form GT.1B)(03/01/92)

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG 026 / ~~059~~

Borehole Number 14395
Location - North _____ East _____
Date 5/19/95
Geologist DK Nicholson
Drilling Equip Mobile B57

Surface Elevation 061
Area Mound
Total Depth 16.0
Company WCFS Project No OU-2
Sample Type continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
	Run 6	00/20						11		
	12.0							12		
	Run 7	00/20						13		
	14.0							14		
Box 1 of 1	Run 8	2.0/20						15		
	16.0							16		TD = 16.0
								17		
								18		
								19		
								20		

Q'd by [illegible] 6/14/95

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

592

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT 027/~~059~~ 061 FORM GT.1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG

~~02059~~ na 6-21-95

PAGE 2 OF ~~9~~

Date 5/19/95 Borehole Number 14395

Rig Geologist DK Nicholson Company WCB3

FEET

10-12 no recovery (Void space)

12-14 no recovery

14-16 claystone, fractured, olive-grey to light brown, ~~at~~ wet, slightly gravelly in DW top 6".

TD = 16.0'

NOTES

543

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG 034 ~~059~~ 061 PAGE 1 OF 2

Borehole Number 14495
Location - North _____ East. _____
Date 5/19/95
Geologist DK Nicholson
Drilling Equip Mobile B57

Surface Elevation _____
Area. Mound
Total Depth 15.0'
Company WCFS Project No OU2
Sample Type continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
Box 1 of 1	Run 1	0.5/2.0								
	2.0							1		
	Run 2	1.5/2.0						2		
	4.0							3		
	Run 3	1.8/2.0						4		
	6.0							5		
	Run 4	2.0/2.0						6		
	8.0							7		
	Run 5	2.0/2.0						8		
	10.0							9		
								10		

QC'd by DJ 6/14/95

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

54

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG 035 ~~059~~ 061 PAGE 1 OF 2

Date 5/19/95 Borehole Number: 14495

Rig Geologist DKNicholson Company WCTS

FEET

0-2 rec = 0.5/2.0
(road base material) silt, gravelly, clayey, dk. brown, moist

2-4' rec = 1.5/2.0
clay, sandy, calcareous, slightly moist, tan-orange-brown

4-6' rec = 1.8/2.0
4-5.5 clay, sandy, gravelly, orange-brown,
5.5-6.0 sand, med-grained, orange, moist, and claystone, bluish-grey (No. 1 SS).

6-8 rec = 2.0/2.0
6-7 interbedded sand, fine-med grained, orange, and claystone, bluish-grey w/ black streaks
7-8 claystone, slightly silty, grey, and orange w/ some sandy sections

8-10 rec = 2.0/2.0 interbedded claystone + med-gr sandstone, orange

NOTES

545

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT

FORM GT.1A (REV. 2)

ROCKY FLATS PLANT BOREHOLE LOG 036/~~059~~ 061

PAGE 2 OF 2

Borehole Number 14495
Location - North _____ East. _____
Date 5/19/95
Geologist DK Nicholson
Drilling Equip Mobile B57

Surface Elevation _____
Area Mound
Total Depth 15.0
Company WCPS Project No DU2
Sample Type continuous core

EG&G LOGGING SUPERVISOR
APPROVAL _____ DATE _____

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL (FIELD MEASUREMENT)	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
	Run 6	0.4 / 2.0								
								11		
	12.0							12		
	Run 7	0.4 / 2.0						13		
	14.0							14		
Box 1 of 1	Run 8	1.0 / 1.0								
	15.0							15		TD = 15.0
								16		
								17		
								18		
								19		
								20		

EG&G 6/14/95

NOTES General USCS is modified for this log as follows
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core accurate footage measurements not possible
(2) Core breaks cannot be matched accurate footage measurements not possible

546

(4011-930-0134-930)(Form GT.1A)(03/01/87)

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.1B (REV. 2)

PRELIMINARY WELL-SITE FIELD LOG 037/~~059~~ C61

Date 5/19/95 Borehole Number: 14495

Rig Geologist DK Nicholson Company WCFS

FEET

10-12 rec = 0.4/2.0 - Same as above

12-14 rec = 0.4/2.0 - Same as above

14-15 rec = 1.0/2.0 same

TD = 15.0'

11 12 13 14 15 16 17 18 19 20

NOTES

547

(4011-930-0135-930)(Form GT.1B)(03/01/92)

4 0 CONCLUSIONS

The Trenches and Mound Site characterization project successfully identified trenches and sites where a remedial action may be required as there are contaminants above the recently negotiated Action Levels defined in the RFCA The investigation also identified areas where more information is required in order to determine whether a site will require remedial action, or where more information is required to better define the type and size of a remedial action Finally, trenches were identified that should not require remedial action

4 1 AREAS REQUIRING REMEDIAL ACTION

Analytical data from the Ryan's Pit, and Trench T-4 exceed the RFCA Subsurface Soil Action Levels and Tier I Groundwater Action Levels and these sites probably must be remediated Previously reported data for Trench T-3 also indicated the need for a remedial action Analytical data from the Mound Site indicates several exceedances of the RFCA Subsurface Soil Action Levels and the RFCA Tier II Groundwater Action Levels Additionally, the contamination source remaining at the Mound Site is impacting surface water in Woman Creek Ryan's Pit, and Trench T-4 have already been removed as accelerated actions

4 2 AREAS REQUIRING PRE-REMEDIAL INVESTIGATION

While the source area within the Mound Site has been located, the extent and volume of contaminated material must be delineated in order to effectively plan a remedial action A closer spaced sampling grid is recommended to delineate the area requiring remedial action

There are no samples taken within Trench T 1 Data is required to determine if this site is a source of groundwater contamination, to design the most appropriate remedial action, and to determine how to manage the resulting waste Due to the potential for encountering pyrophoric materials, the sampling should proceed cautiously

A RFCA Subsurface Action Level has not been determined for benzoic acid or 2-butanone Trench T-7, Trench T-8, Trench T-10, Trench T-11, and Trench T-13 have low levels of benzoic acid and 2-butanone present and the analytical data will need reevaluation when the Subsurface Soil Action Levels are negotiated

4.3 AREAS NOT REQUIRING REMEDIAL ACTION

Many of the sites investigated did not reveal contamination at levels sufficient to justify remedial actions In several cases, only one analyte was above action levels at a site Therefore, these sites are recommended to be closed without remedial actions

Trench T-5 There were no concentrations above any RFCA Subsurface Soil Action Levels for this trench There is no contaminant plume resulting from this trench and the area is often dry With no pathway to surface water and without a well defined source, it is recommended that this trench not be remediated

Trench T-6 There were no concentrations above any RFCA Subsurface Soil or Groundwater Action Levels for this trench There is no contaminant plume resulting from this trench and the area is often dry With no pathway to surface water and without a source, this trench should not be remediated

Trench T-7 There was one hit of tetrachloroethene at 14 mg/kg which is above the RFCA Subsurface Soil Action Level Without a well defined source, it is recommended that this trench not be remediated

Trench T-8 There were no concentrations above any RFCA Subsurface Soil or Groundwater Action Level for this trench Without a source, this trench should not be remediated

Trench T-9 Samples analyzed from this trench contained one hit of tetrachloroethene at 16 mg/kg which is above the RFCA Subsurface Soil Action Level There is no contaminant plume resulting from this trench and the area is often dry With no pathway to surface water and without a well defined source, it is recommended that this trench not be remediated

Trench T-10 There were no concentrations above any RFCA Subsurface Soil or Groundwater Action Levels for this trench Without a source, this trench should not be remediated

Trench T-11 There were no concentrations above any RFCA Subsurface Soil or Groundwater Action Level for this trench Without a source, this trench should not be remediated

Trench T-12 There were no concentrations above any RFCA Subsurface Soil or Groundwater Action Level for this trench Without a source, this trench should not be remediated

Trench T-13 There were no concentrations above any RFCA Subsurface Soil or Groundwater Action Level for this trench This trench has already been at least partially excavated during construction of the East Access Road Without any indication of a source, this trench should not be remediated

600

5.0 REFERENCES

Colorado Aerial Photo Service, Order 18372 Frame 123-41, August 11, 1962, Frame 115-28, May 5, 1963, Frame 123-280, April 15, 1966, Frame 27-207, April 29, 1967, Frame 26-386, April 10, 1968, and Frame 132-26 April 25, 1970

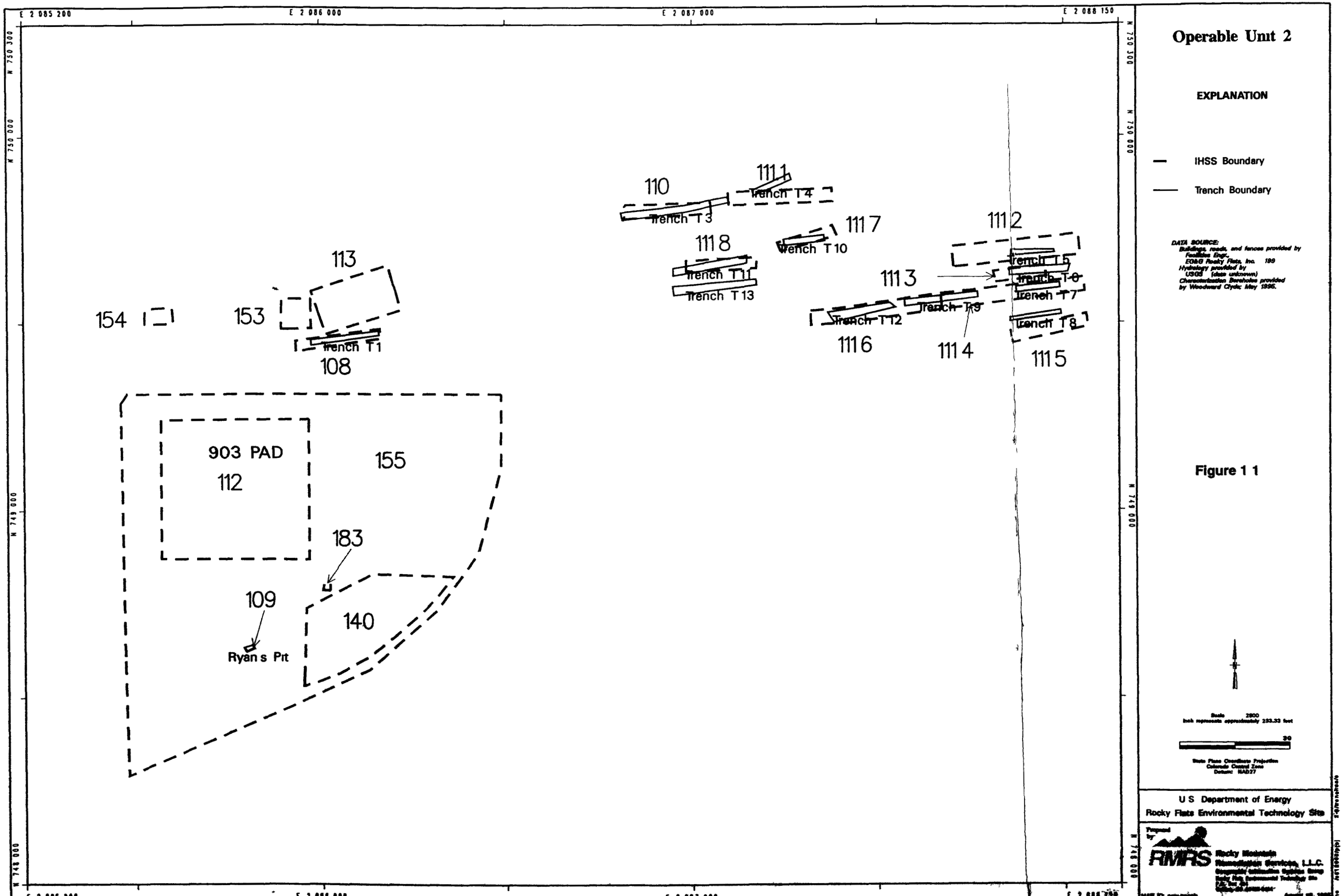
EG&G 1995a, Trenches and Mound Site Characterization Work Plan February

EG&G 1995b, Phase II RFI/RI Report for Operable Unit No 2, 903 Pad, Mound, and East Trenches Area October

EG&G 1995c, Geologic Characterization Report for the Rocky Flats Environmental Technology Site March

EPA 1986, Test Methods for Evaluating Solid Waste Physical/Chemical Methods SW-846 (3rd Edition) Office of Solid Waste and Emergency Response, Washington, DC November

RMRS 1996, Completion Report for the Remediation of IHSS 109, Ryan's Pit RF/ER-96-0034 UN August



Operable Unit 2

EXPLANATION

IHSS Boundary

Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 199
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 1995.

Figure 1 1

Scale 2800
Inch represents approximately 233.33 feet

30

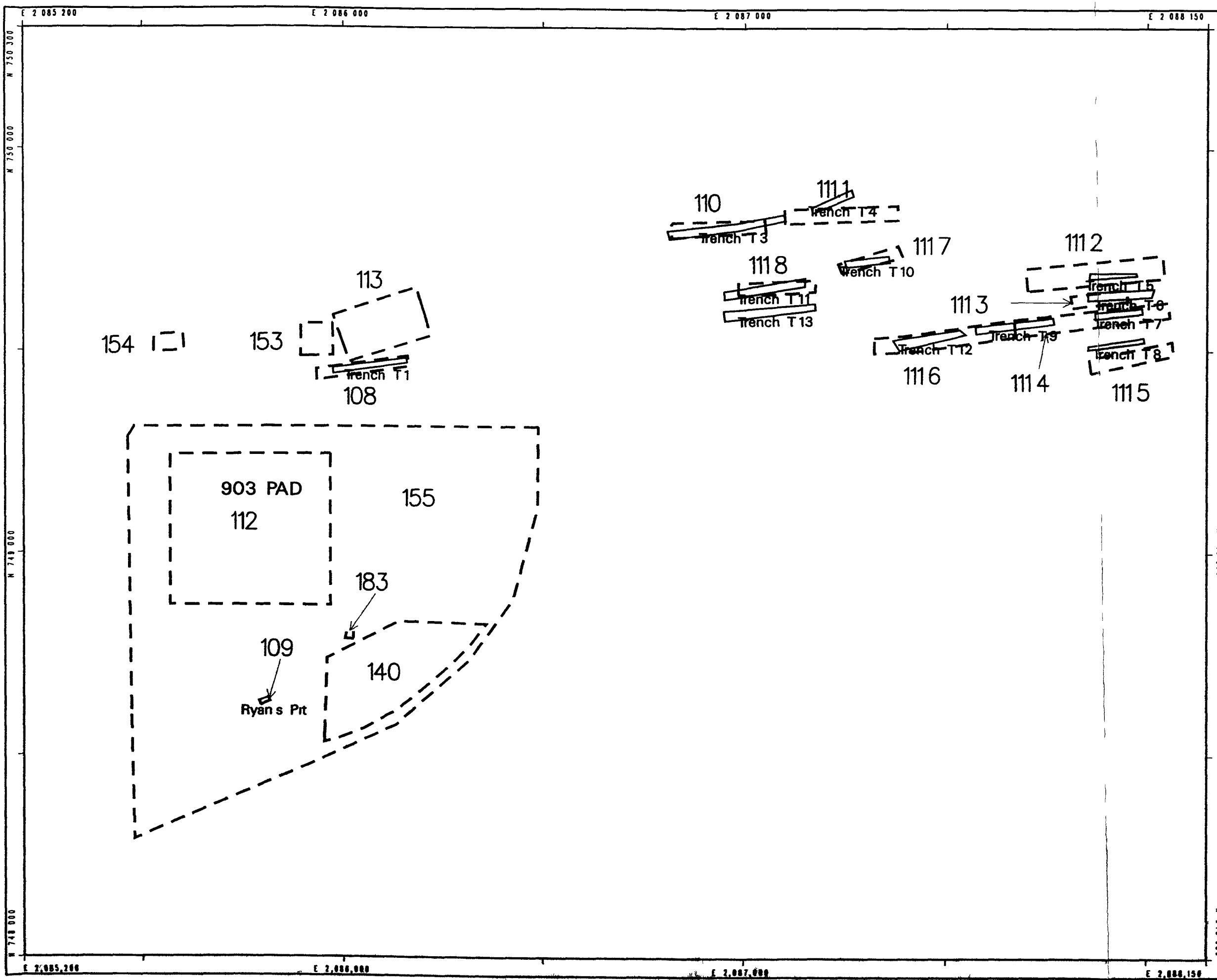
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: [illegible]
August 28, 1996

17



Operable Unit 2

EXPLANATION

IHSS Boundary

Trench Boundary

DATA SOURCE.
Buildings, roads, and fences provided by Facilities Engr
EG& Rocky Flats, Inc. 199
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 1995

Figure 3 1 1

Scale 2800
Inch represents approximately 33.33 feet

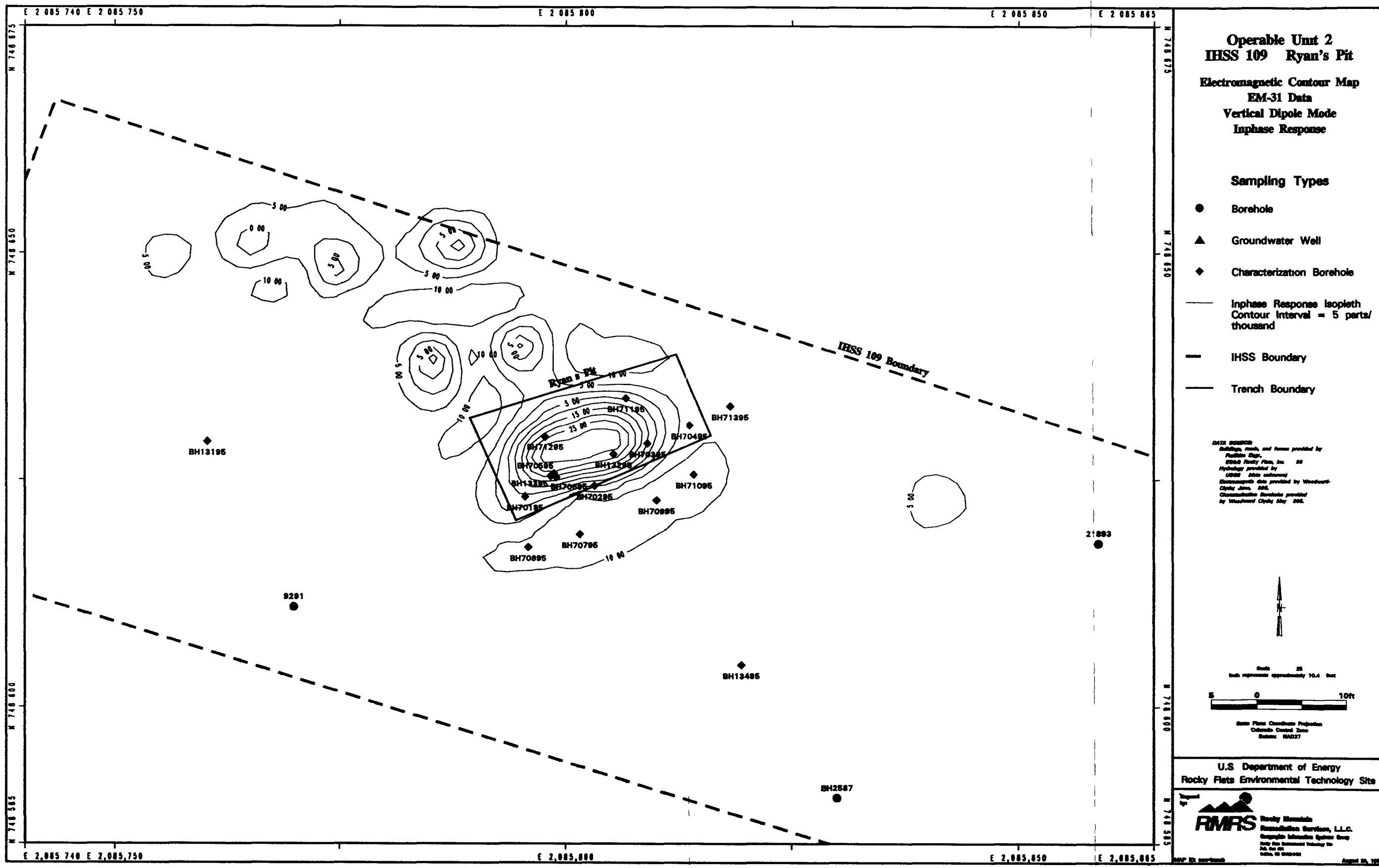
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S Department of En gy
Rocky Flats Environmental Tech ology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: [illegible]
August 20, 1996

43



Operable Unit 2
IHSS 109 Ryan's Pit

Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Inphase Response

Sampling Types

- ● Borehole
- ▲ Groundwater Well
- ◆ Characterization Borehole
- Inphase Response Isopleth Contour Interval = 5 parts/thousand
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr.
EG&G Rocky Flats, Inc. 90
Hydrology provided by
USGS (data unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Borehole provided by Woodward Clyde; May 1995.

Scale 25
Inch represents approximately 10.4 feet

5 0 10ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

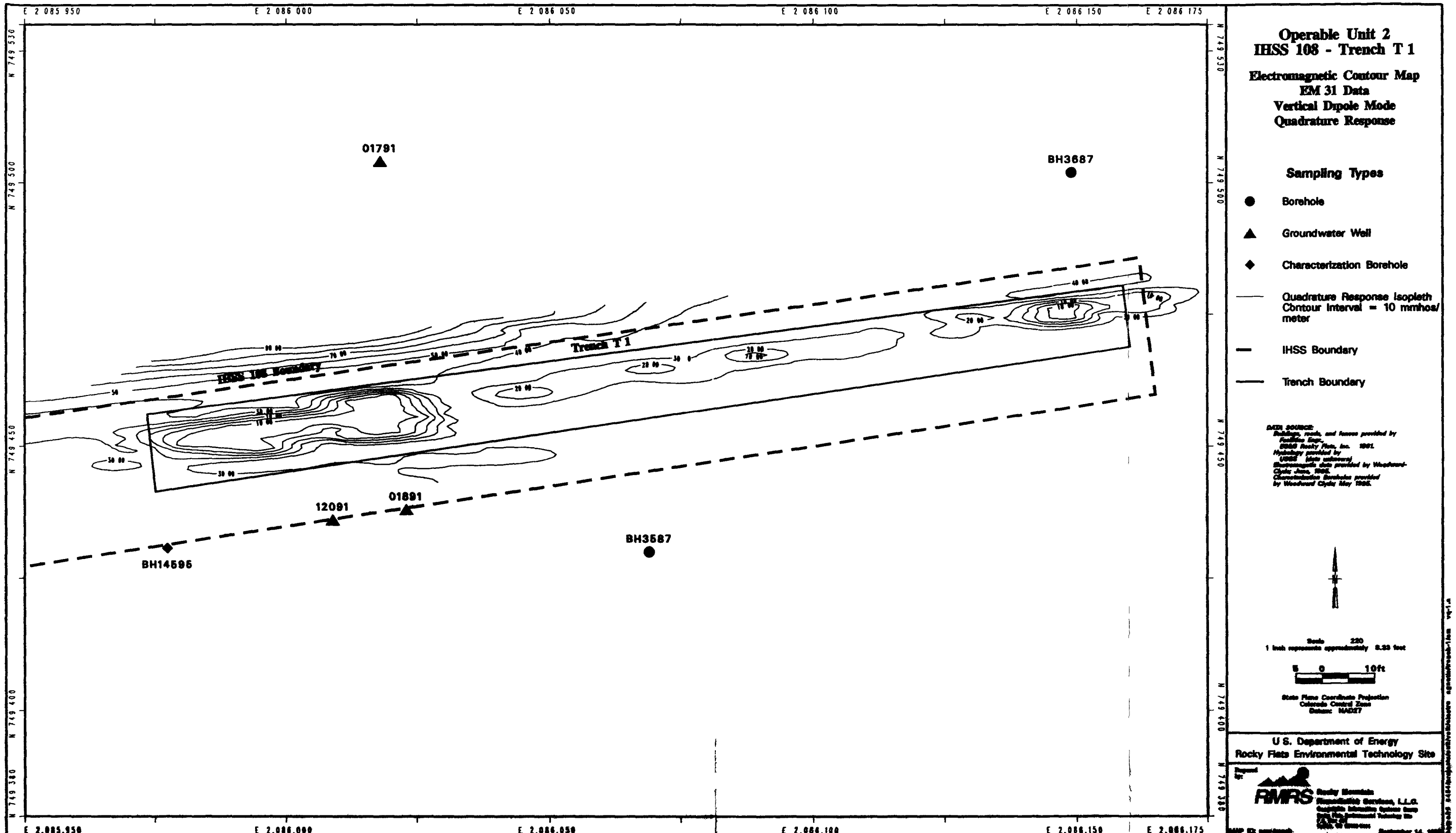
U.S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: rmrs-trench

August 30, 1995

125



Operable Unit 2
IHSS 108 - Trench T 1

Electromagnetic Contour Map
EM 31 Data
Vertical Dipole Mode
Quadrature Response

Sampling Types

- ● Borehole
- ▲ Groundwater Well
- ◆ Characterization Borehole
- Quadrature Response Isopleth Contour Interval = 10 mmhos/meter
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward Clyde May 1995.

Scale 220
1 inch represents approximately 8.33 feet

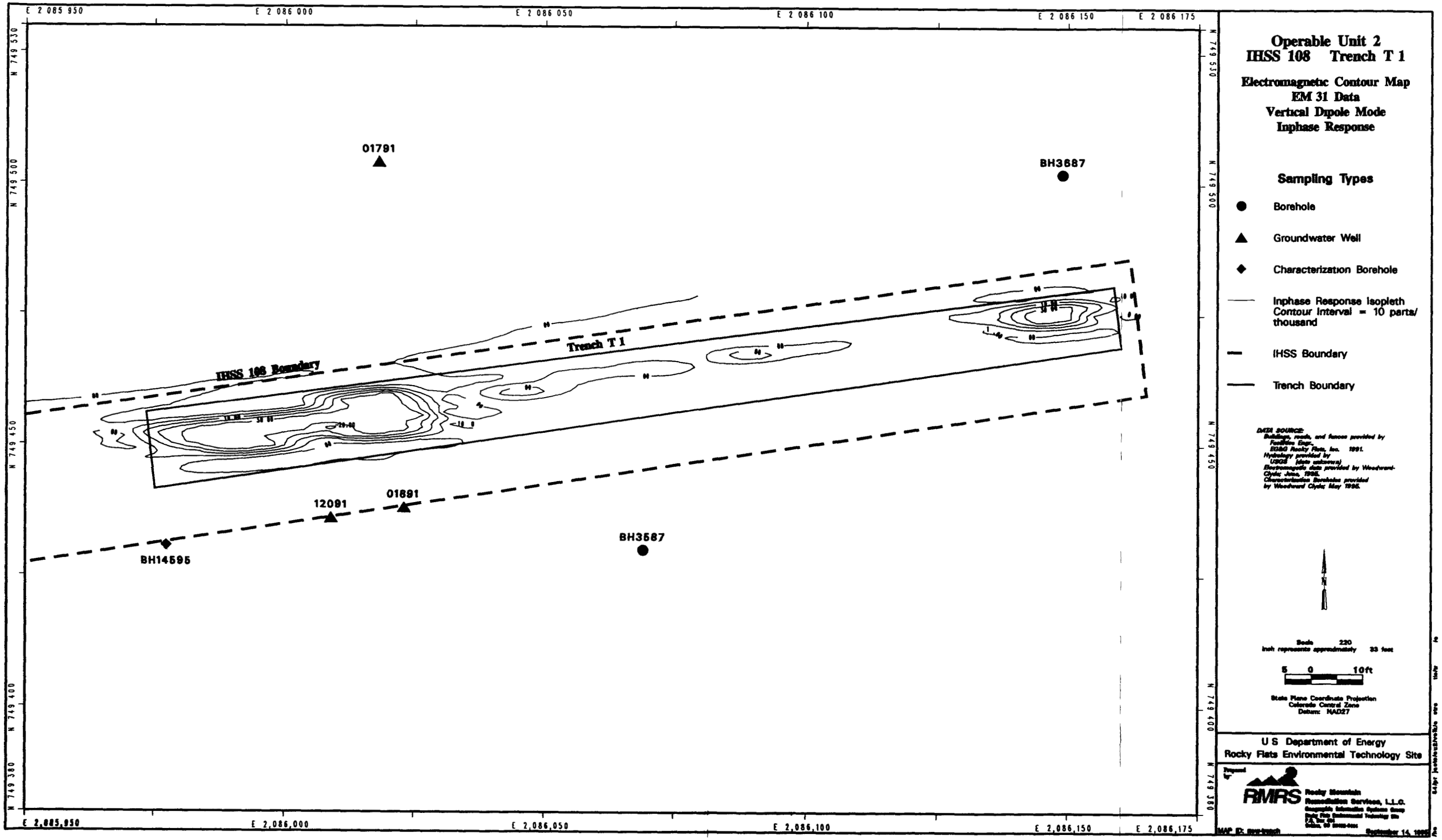
5 0 10ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

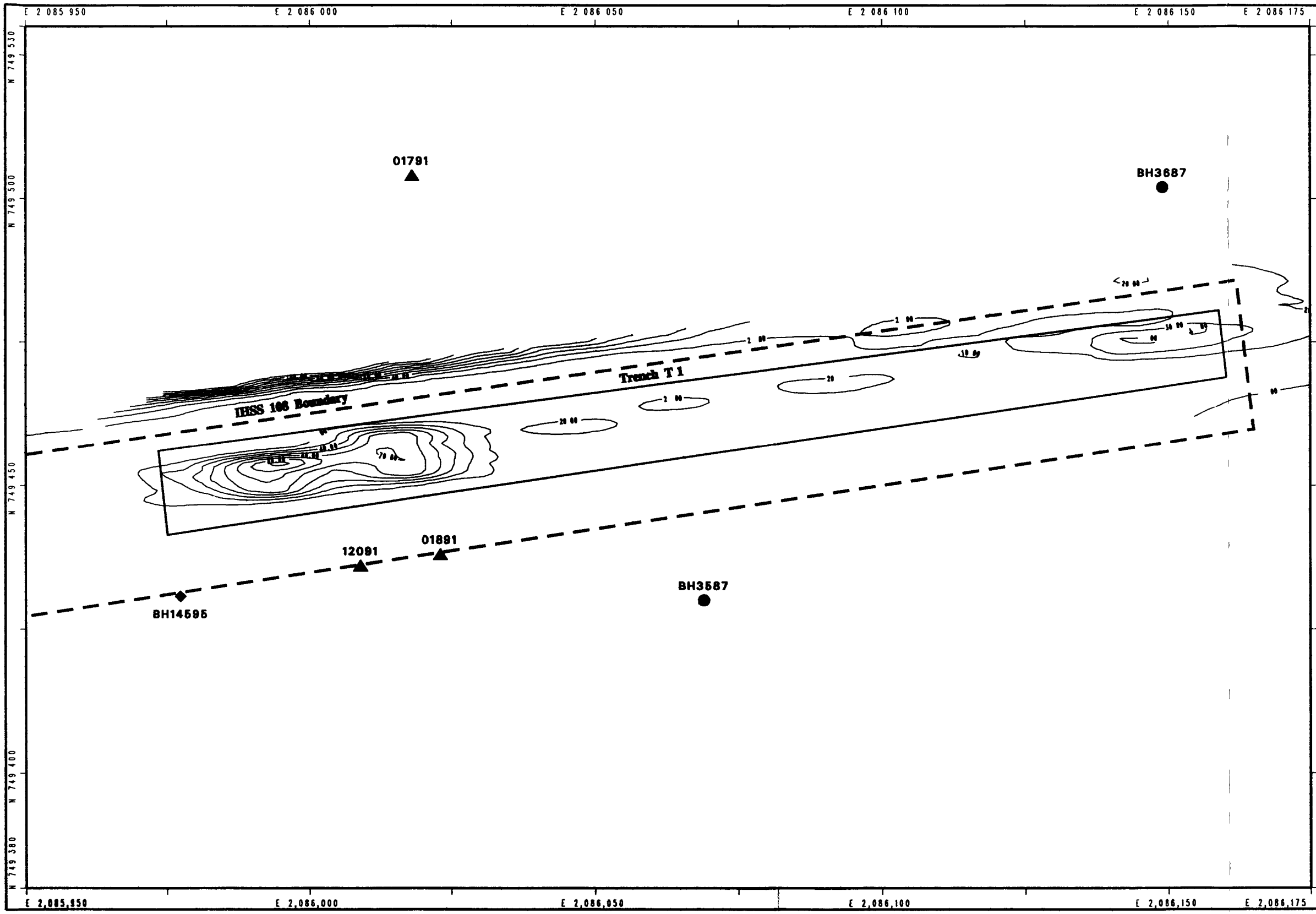
U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Golden, CO 80402-0464

MAP ID: [illegible]
September 14, 19[illegible]



E 2 085 950
E 2 086 000
E 2 086 050
E 2 086 100
E 2 086 150
E 2 086 175
N 749 530
N 749 500
N 749 450
N 749 400
N 749 380
01791
BH3687
IHSS 108 Boundary
Trench T 1
12091
01891
BH14595
BH3587
Operable Unit 2
IHSS 108 Trench T 1
Electromagnetic Contour Map
EM 31 Data
Vertical Dipole Mode
Inphase Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Inphase Response Isopleth
Contour Interval = 10 parts/thousand
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.
Scale 220
Inch represents approximately 33 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: new-trench
September 14, 1995



Operable Unit 2
IHSS 108 Trench T 1

Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Quadrature Response

Sampling Types

- ● Borehole
- ▲ Groundwater Well
- ◆ Characterization Borehole
- Quadrature Response Isopleth Contour Interval = 10 mmhos/meter
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward Clyde May 1995.

Scale 220
inch represents approximately 8.33 feet

5 0 10ft

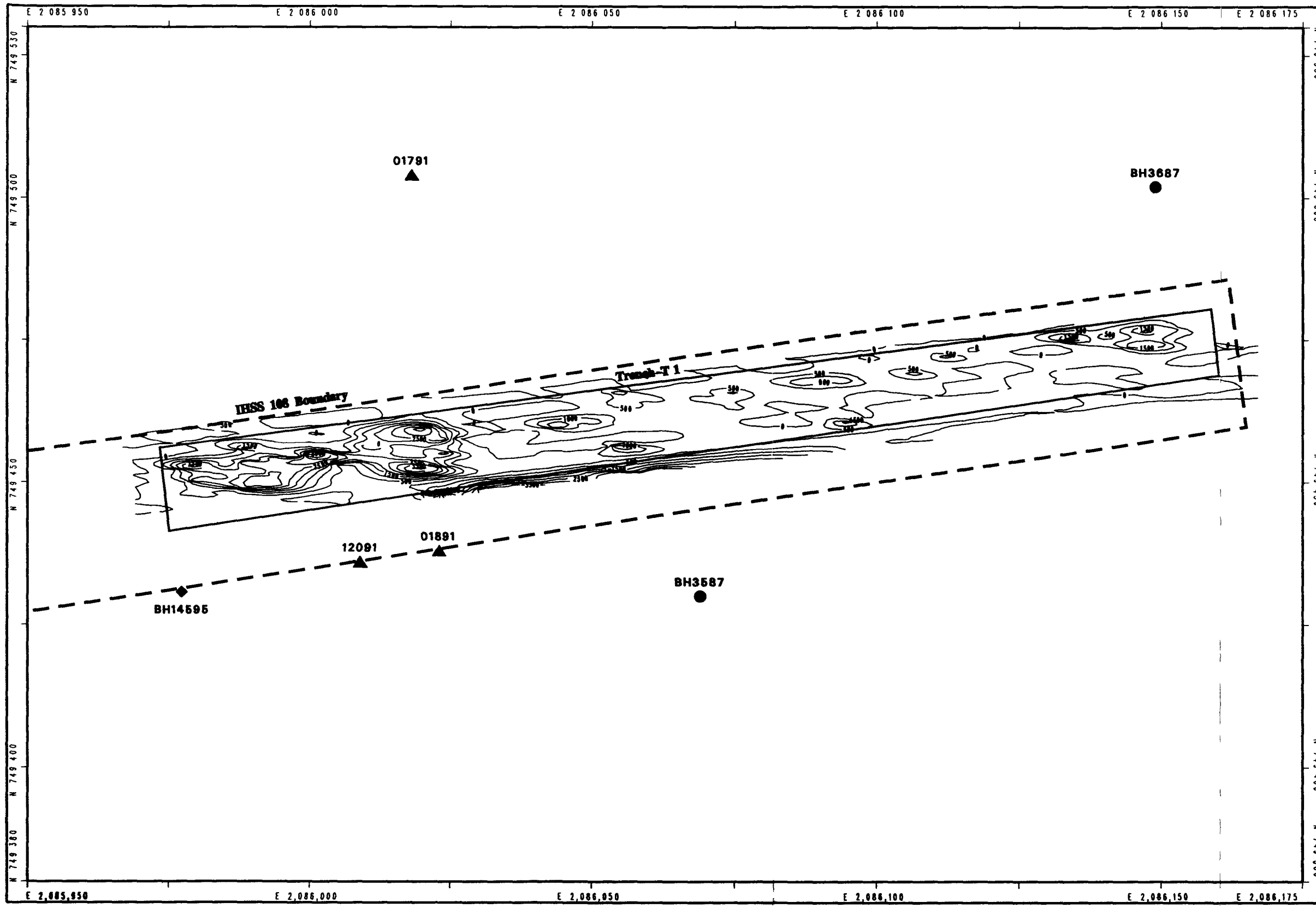
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench
September 14, 1995

52



Operable Unit 2
IHSS 108 Trench T 1

Electromagnetic Contour Map
EM-61 Data
Channel 2 Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Channel 2 Response Isopleth Contour Interval = 500 mv
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr. EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

N

Scale 220
Inch represents approximately 8.33 feet

5 0 10ft

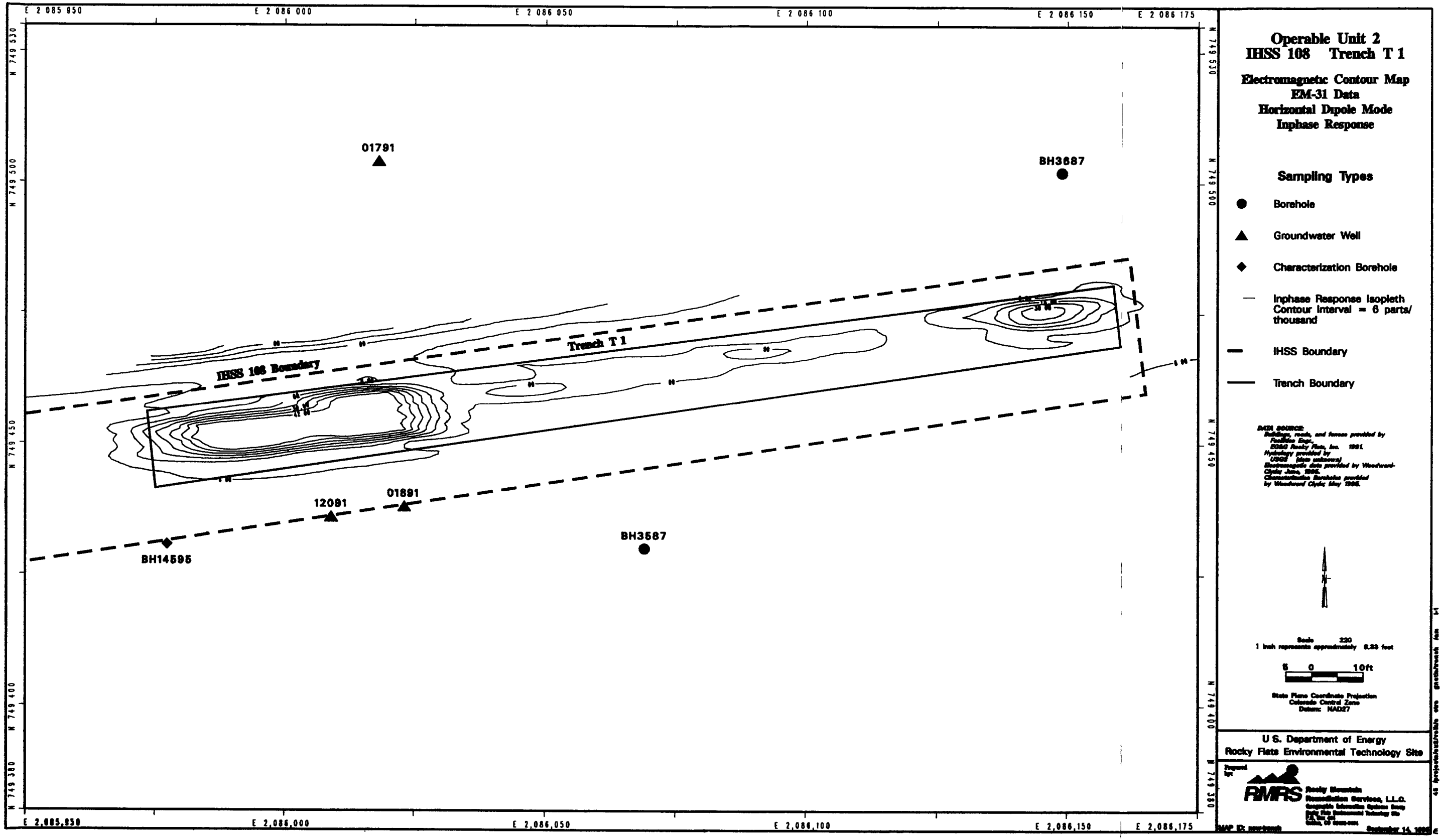
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

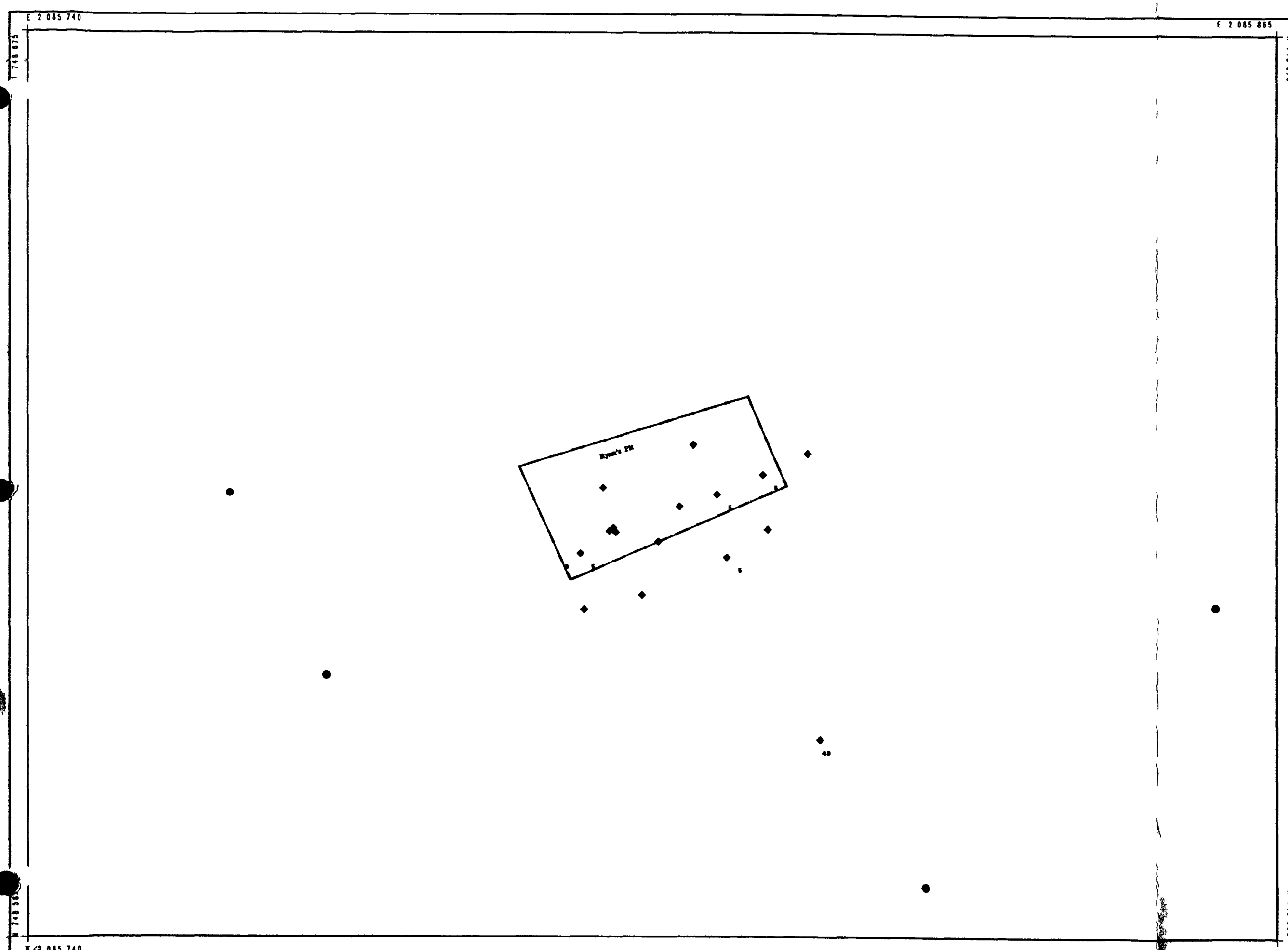
Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: [illegible]

September 14, 1995



E 2 085 950
E 2 086 000
E 2 086 050
E 2 086 100
E 2 086 150
E 2 086 175
N 749 530
N 749 500
N 749 450
N 749 400
N 749 380
01791
BH3687
Trench T 1
IHSS 108 Boundary
12091
01891
BH3587
BH14595
Operable Unit 2
IHSS 108 Trench T 1
Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Inphase Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Inphase Response Isopleth Contour Interval = 6 parts/thousand
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.
Scale 220
1 inch represents approximately 6.33 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S. Department of Energy
Rocky Flats Environmental Technology Site
Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: new-trench
September 14, 1995



Operable Unit 2
IHSS 109 - Trench 2
Ryan's Pit

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole

Standard Map Features

- IHSS Boundary
- Trench Boundary

DATA SOURCE
Buildings, roads, and fences provided by
Facilities Engr
EG&G Rocky Flats, Inc. 99
Hydrology provided by
SGS (date unknown)
Characterization Boreholes provided
by Woodward Clyde, May 995

Scale
Inch epresent approximately feet

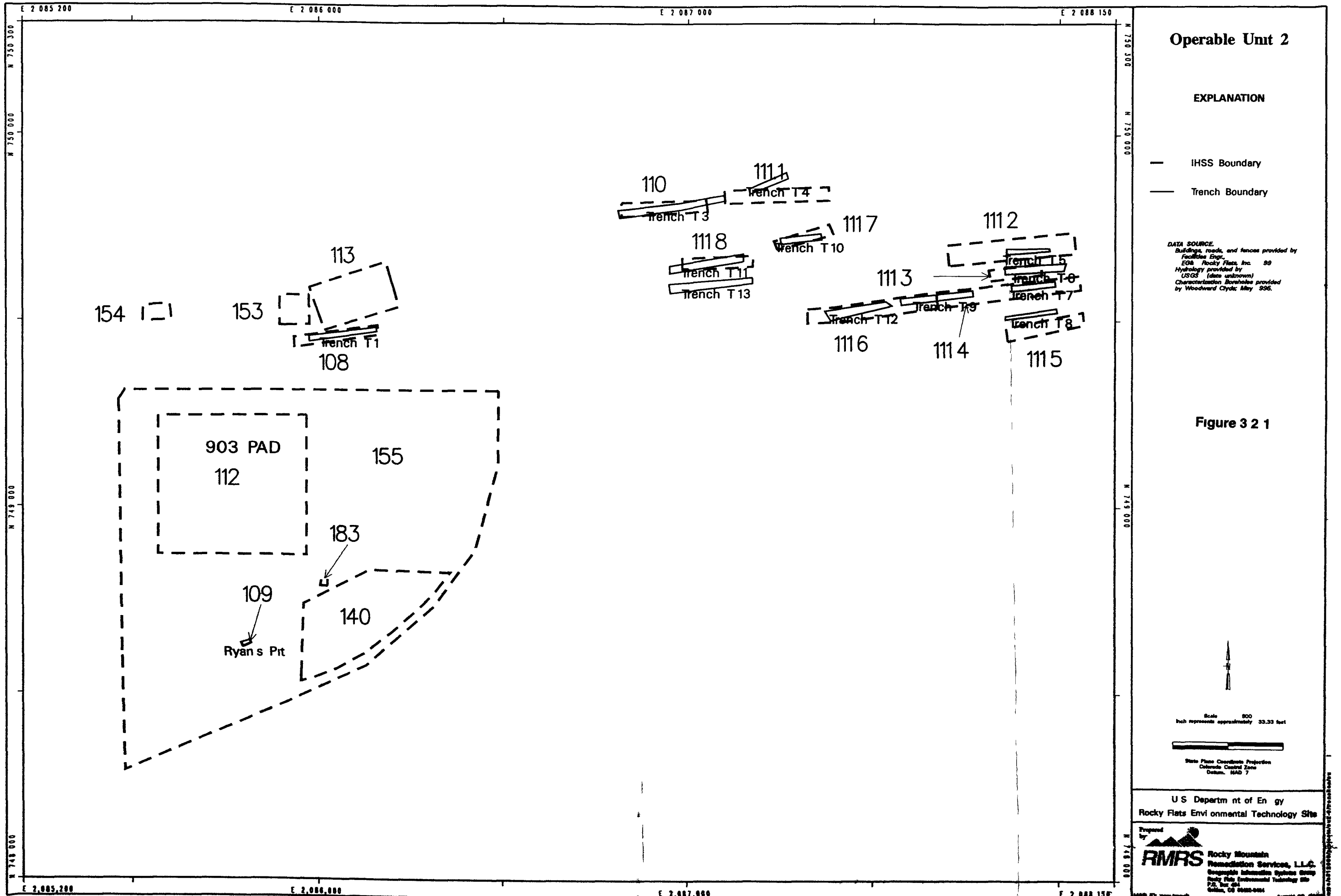
0 ft

St e ane Coordinate Projection
Colorado Centr Zone
Datum NAD2

U S Department f E ergy
Rocky Flats Envi onmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P O Box 464
Golden, CO 80402-0464

MAP ID: opu-trench
August 29, 995



Operable Unit 2

EXPLANATION

IHSS Boundary

Trench Boundary

DATA SOURCE.
Buildings, roads, and fences provided by Facilities Engr., EG& Rocky Flats, Inc. 99
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 996.

Figure 3 2 1

Scale 800
Inch represents approximately 33.33 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum. NAD 7

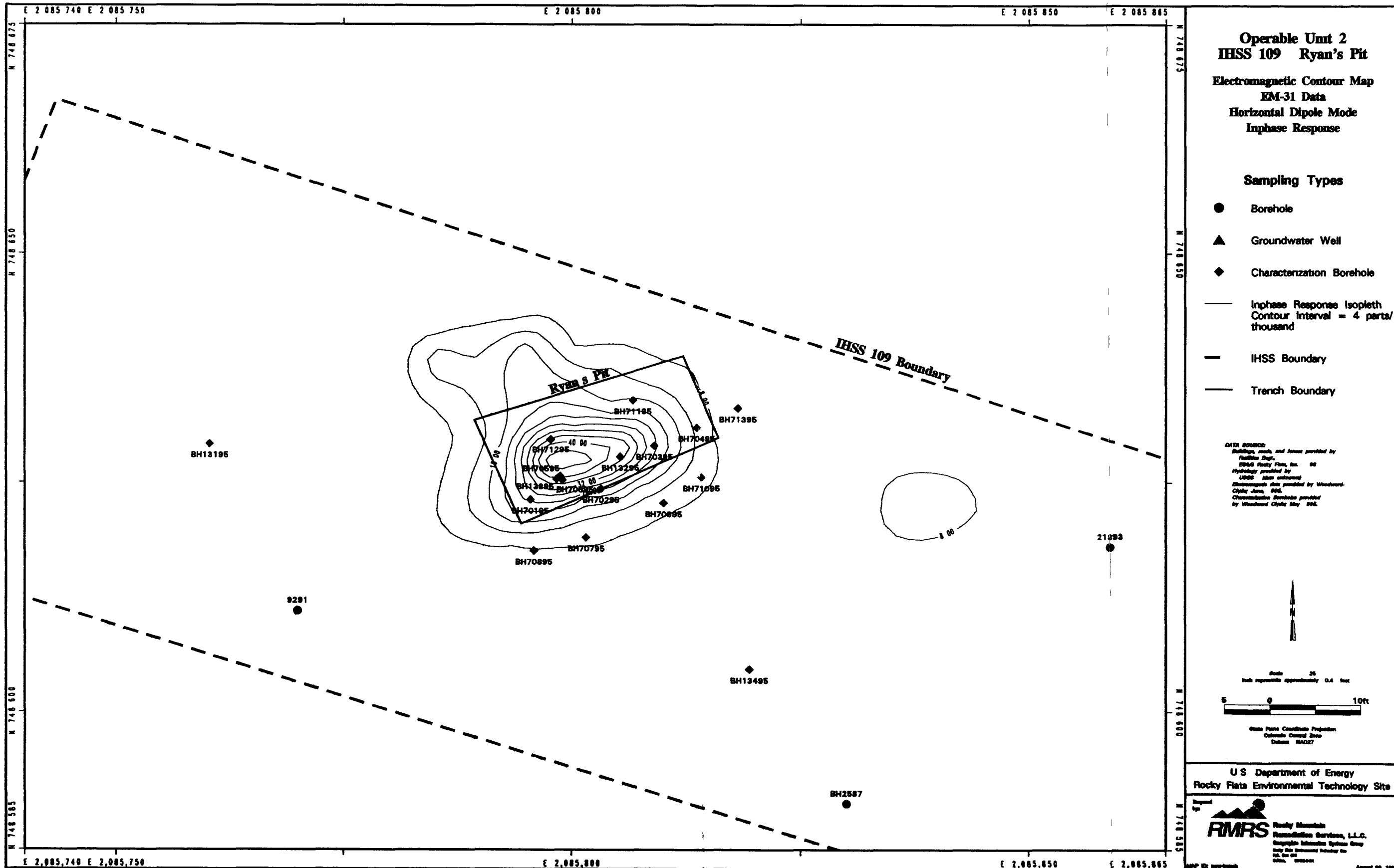
U S Departm nt of En gy
Rocky Flats Envi onmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: ww-trench

August 20, 1999

115



Operable Unit 2
IHSS 109 Ryan's Pit

Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 4 parts/thousand
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 98
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 995.
Characterization Borehole provided by Woodward Clyde May 995.

Scale 25
Inch represents approximately 0.4 feet

5 0 10ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

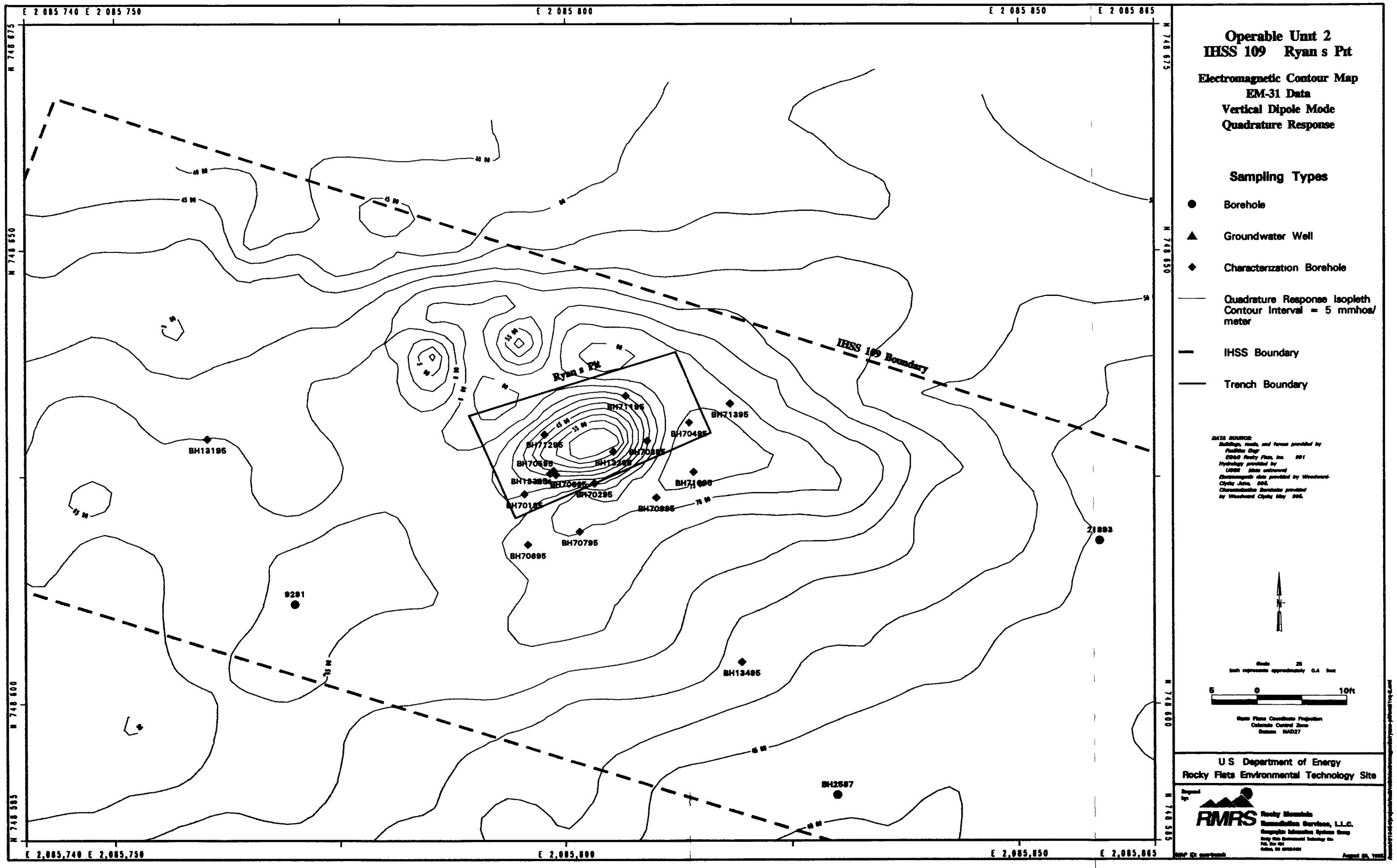
U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, Colorado

MAP ID: nmr-bmrch

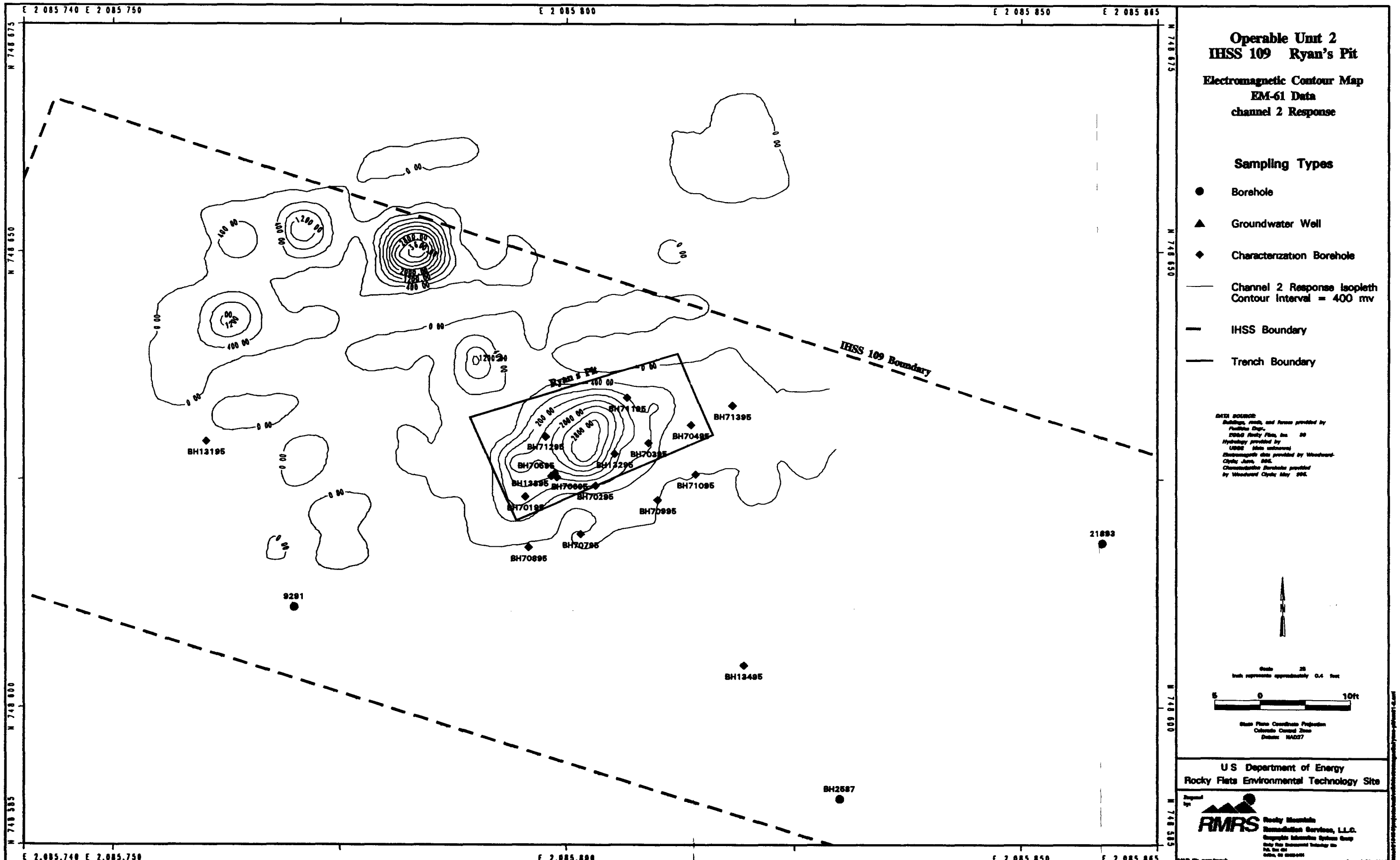
August 20, 1998

122



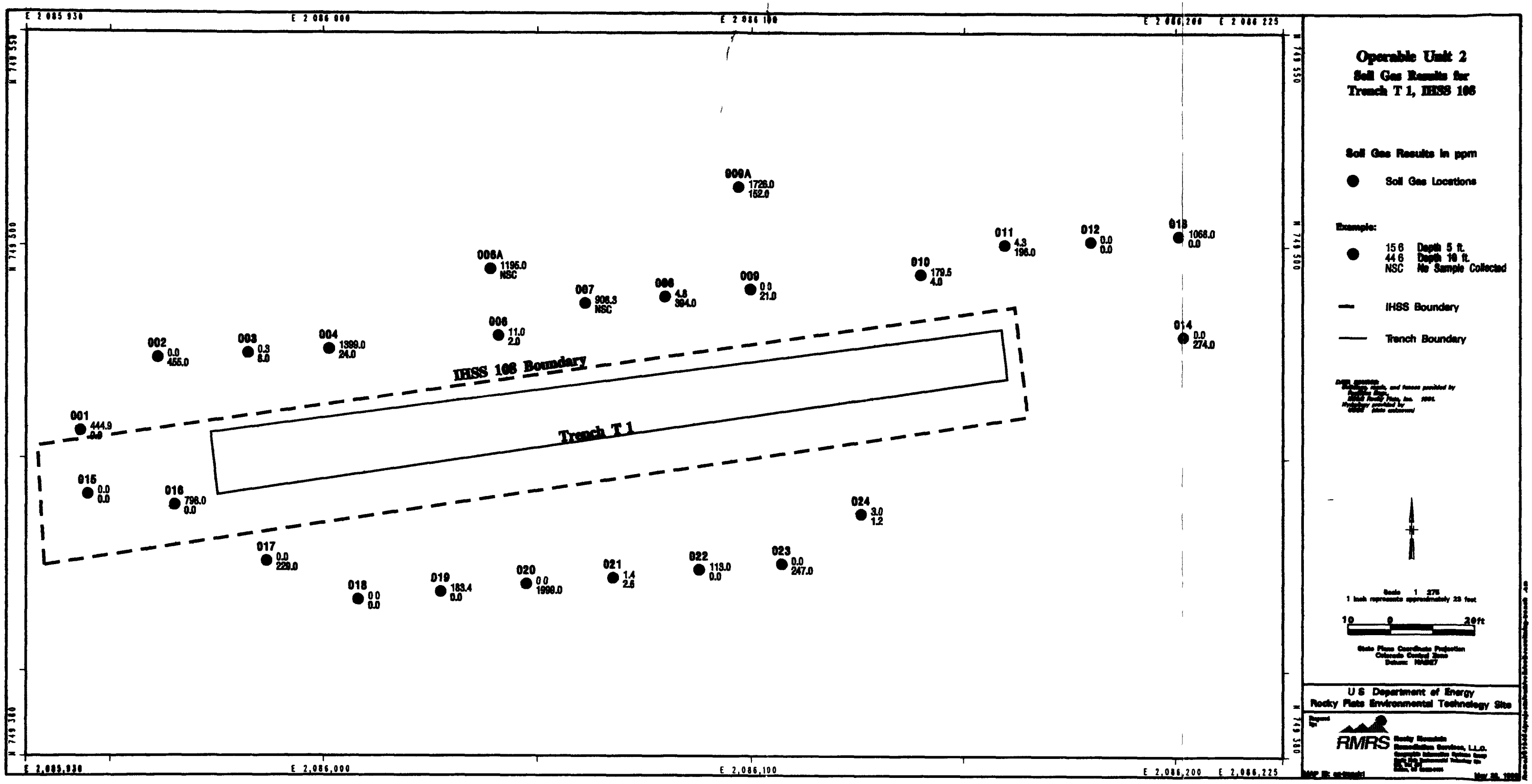
Operable Unit 2
IHSS 109 Ryan s Pit
Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth Contour Interval = 5 mmhos/meter
IHSS Boundary
Trench Boundary
IHSS 109 Boundary
Ryan s Pit
BH71195
BH71395
BH70495
BH71295
BH70595
BH70895
BH70295
BH70195
BH70995
BH70795
BH13195
BH13495
BH2587
9291
21893
E 2 085 740
E 2 085 750
E 2 085 800
E 2 085 850
E 2 085 865
N 748 675
N 748 650
N 748 600
N 748 585
5 0 10ft
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS

123



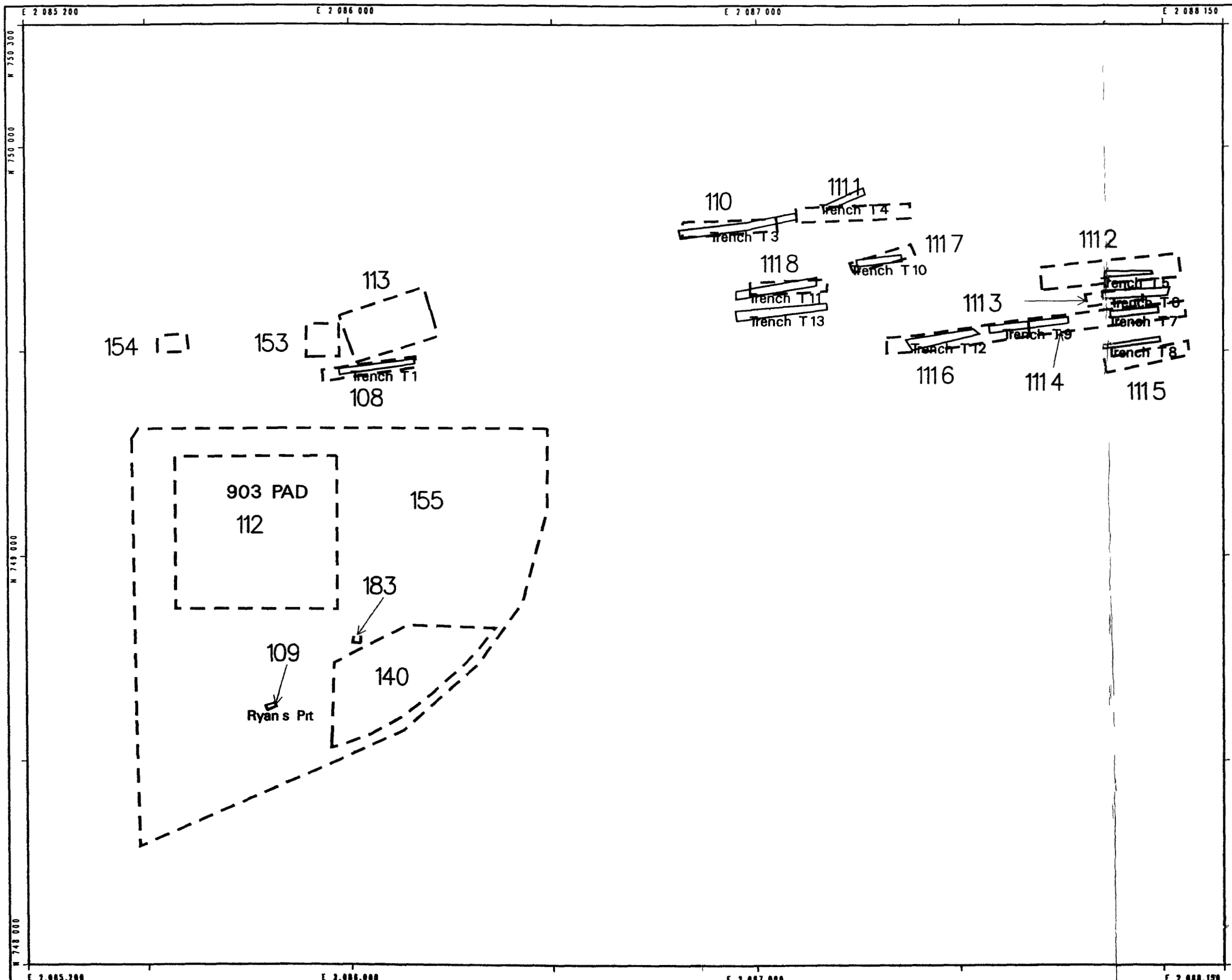
Operable Unit 2
IHSS 109 Ryan's Pit
Electromagnetic Contour Map
EM-61 Data
channel 2 Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Channel 2 Response Isopleth Contour Interval = 400 mv
IHSS Boundary
Trench Boundary
IHSS 109 Boundary
Ryan's Pit
BH13195
BH71195
BH71395
BH70495
BH71295
BH70395
BH70695
BH13295
BH13895
BH70695
BH70295
BH71095
BH70195
BH70995
BH70795
BH70895
21893
9291
BH13495
BH2587
5 0 10ft
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS

124



Operable Unit 2
Soil Gas Results for
Trench T 1, IHSS 108
Soil Gas Results in ppm
Soil Gas Locations
Example:
15 6 Depth 5 ft.
44 6 Depth 10 ft.
NSC No Sample Collected
IHSS Boundary
Trench Boundary
IHSS 108 Boundary
Trench T 1
001 444.9 0.0
002 0.0 455.0
003 0.3 8.0
004 1399.0 24.0
006 11.0 2.0
006A 1195.0 NSC
007 906.3 NSC
008 4.8 394.0
009 0.0 21.0
009A 1726.0 152.0
010 179.5 4.0
011 4.3 196.0
012 0.0 0.0
013 1068.0 0.0
014 0.0 274.0
015 0.0 0.0
016 798.0 0.0
017 0.0 229.0
018 0.0 0.0
019 183.4 0.0
020 0.0 1999.0
021 1.4 2.6
022 113.0 0.0
023 0.0 247.0
024 3.0 1.2
Scale 1 275
1 inch represents approximately 23 feet
10 0 20ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
E 2,085,930
E 2,086,000
E 2,086,100
E 2,086,200
E 2,086,225
N 749 550
N 749 500
N 749 380

44



Operable Unit 2

EXPLANATION

IHSS Boundary

Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 99
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 1995.

Figure 3 3-1

Scale 2800
Inch represents approximately 33.33 feet

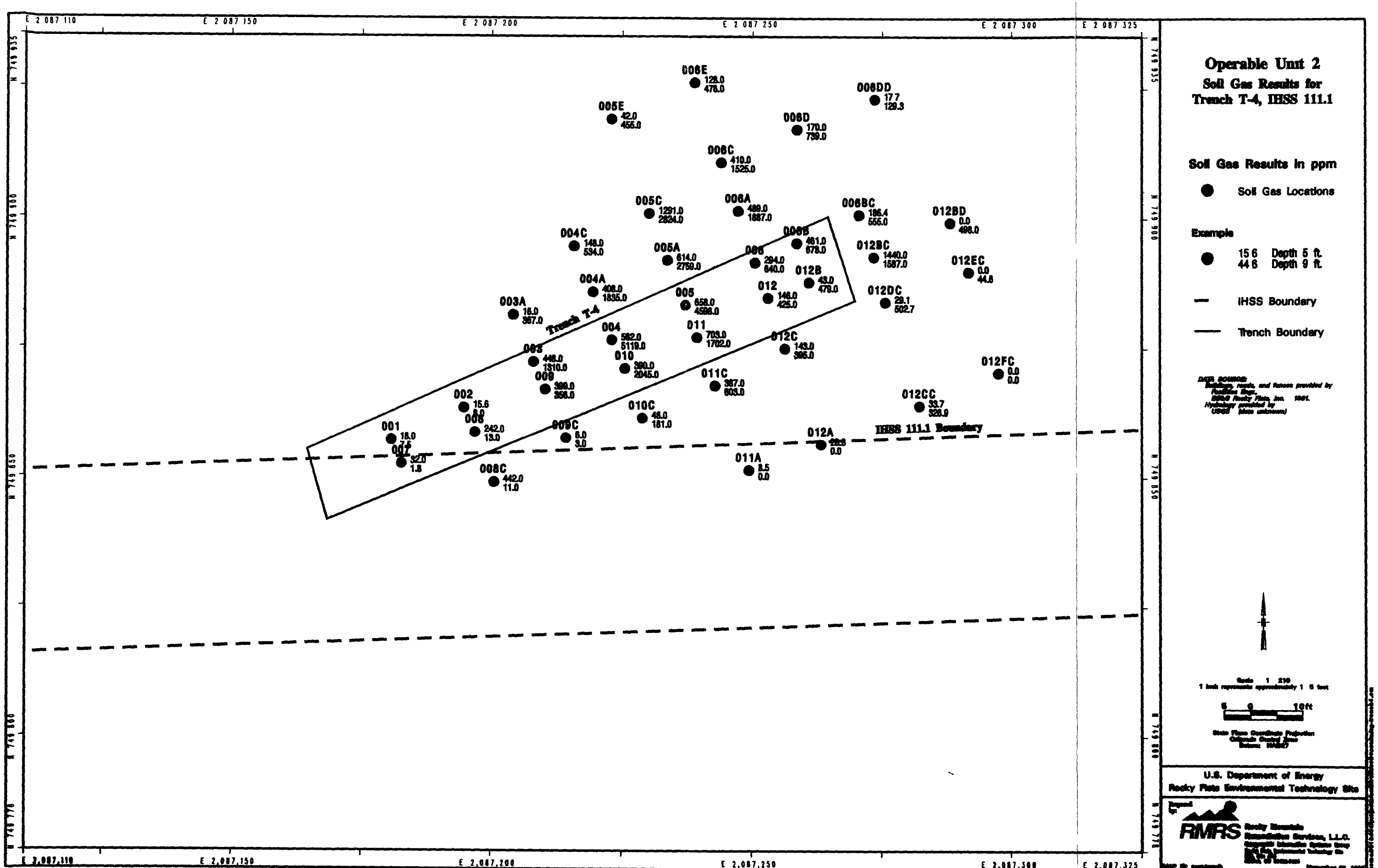
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Ene gy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

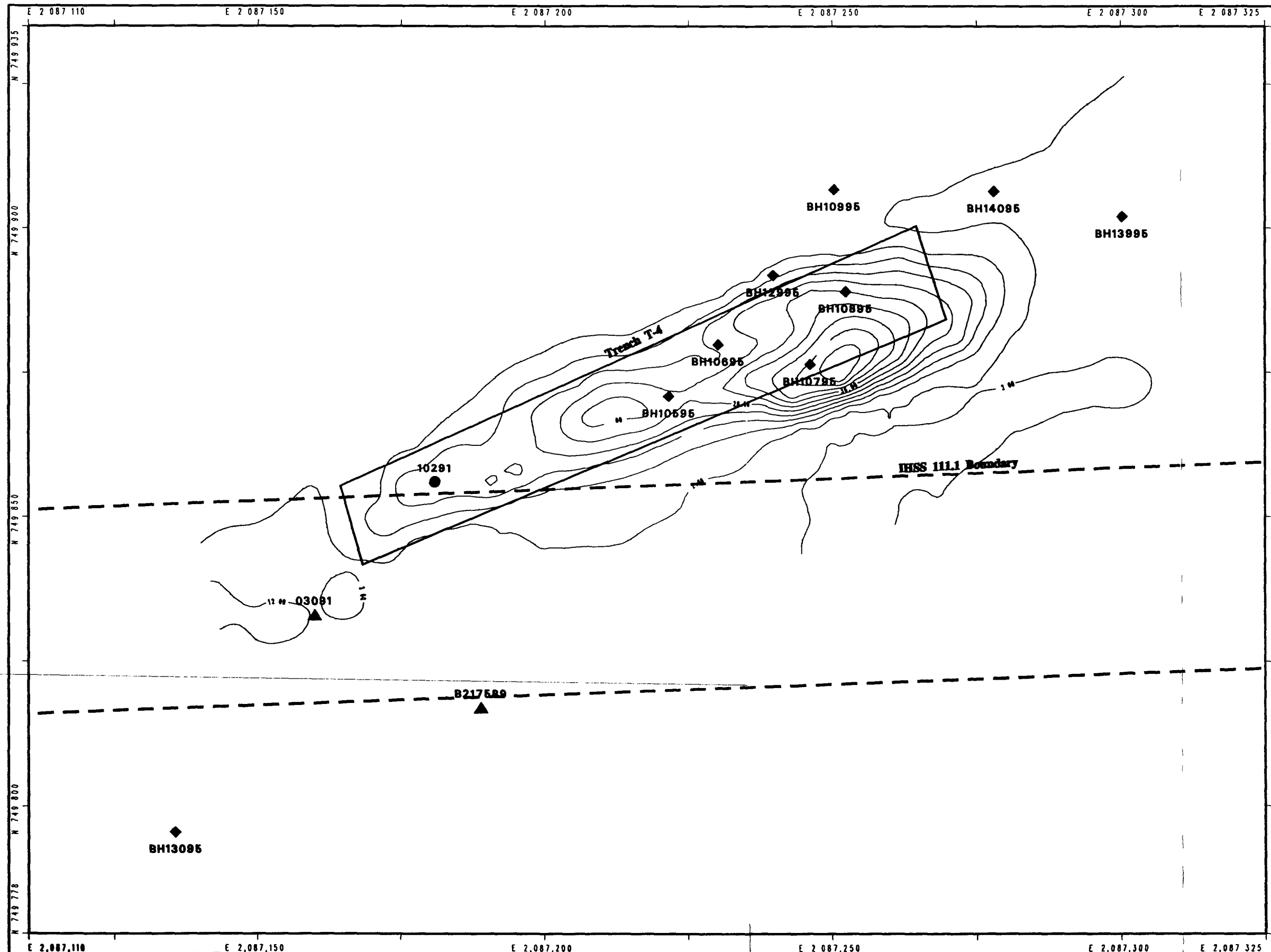
MAP ID: [illegible]
August 28, 1996

168



Operable Unit 2
Soil Gas Results for
Trench T-4, IHSS 111.1
Soil Gas Results in ppm
Soil Gas Locations
Example
15.6 Depth 5 ft.
44.6 Depth 9 ft.
IHSS Boundary
Trench Boundary
Trench T-4
IHSS 111.1 Boundary
006E 128.0 476.0
006DD 17.7 129.3
005E 42.0 455.0
006D 170.0 739.0
006C 410.0 1525.0
005C 1291.0 2824.0
006A 489.0 1887.0
006BC 186.4 555.0
012BD 0.0 498.0
004C 148.0 534.0
005A 614.0 2759.0
006B 461.0 678.0
012BC 1440.0 1587.0
012EC 0.0 44.6
006 294.0 640.0
012B 43.0 479.0
004A 408.0 1835.0
005 658.0 4598.0
012 146.0 425.0
012DC 29.1 502.7
003A 16.0 367.0
004 582.0 5119.0
011 703.0 1702.0
012C 143.0 395.0
003 448.0 1310.0
010 390.0 2045.0
012FC 0.0 0.0
009 399.0 356.0
011C 387.0 603.0
002 15.6 8.0
012CC 33.7 326.9
010C 48.0 181.0
001 18.0 7.5
008 242.0 13.0
009C 6.0 3.0
012A 0.0
007 32.0 1.8
011A 8.5 0.0
008C 442.0 11.0
U.S. Department of Energy
Rocky Flats Environmental Technology Site
RMRS

169



Operable Unit 2
IHSS 111.1 Trench T-4

Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Quadrature Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Quadrature Response Isopleth Contour Interval = 4 mmhos/meter
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr EG&G Rocky Flats, Inc. 1991.
Hydrology provided by: USGS (data unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

Scale
Inch represents approximately feet

5 0 10ft

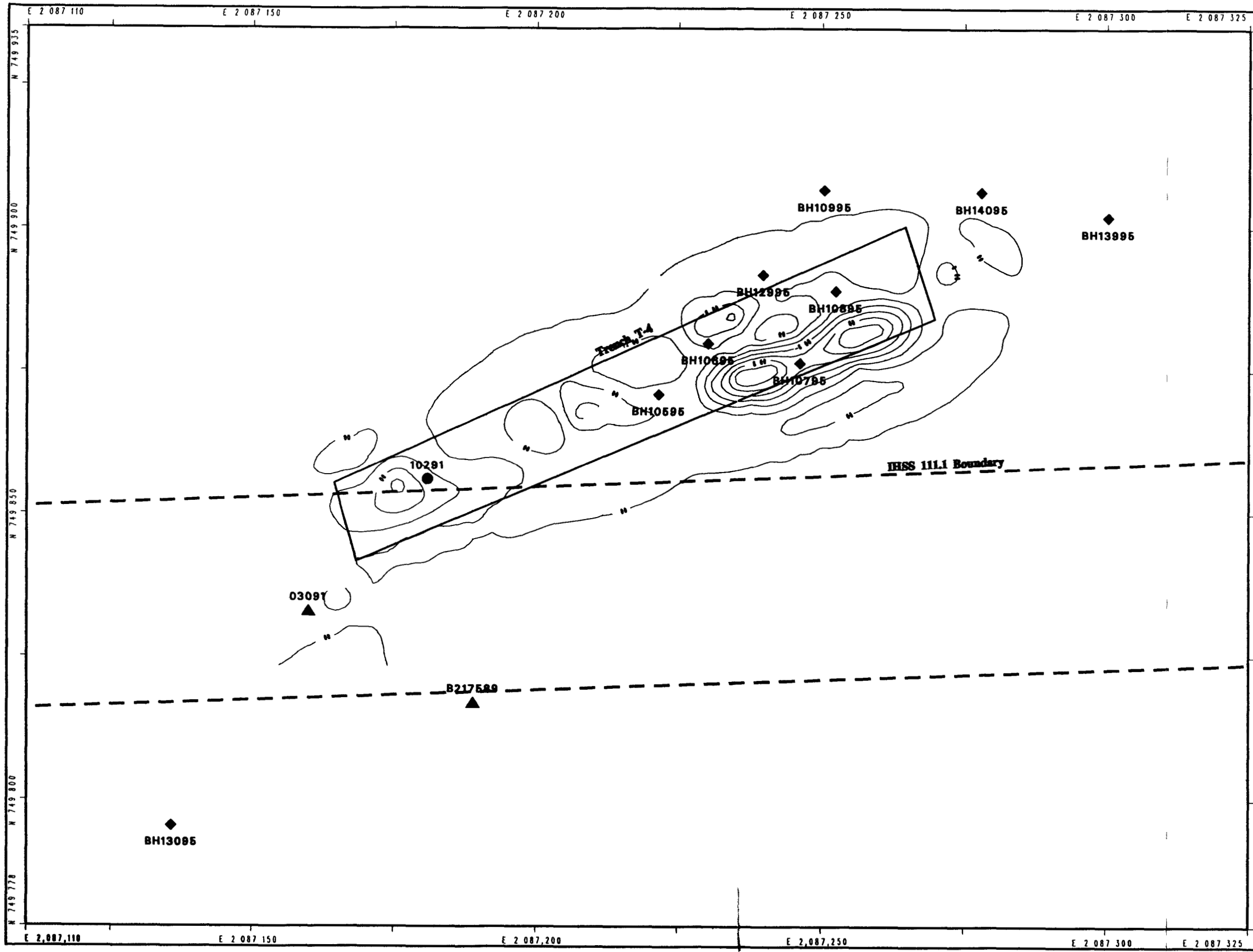
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: new-bench

October 02, 1995



Operable Unit 2
IHSS 111 1 Trench T-4

Electromagnetic Contour Map
EM 31 Data
Vertical Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 6 parts/thousand
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr EG&G Rocky Flats, Inc. 991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 996.
Characterization Boreholes provided by Woodward Clyde; May 1996.

Scale
Inch represents approximately feet

5 0 10ft

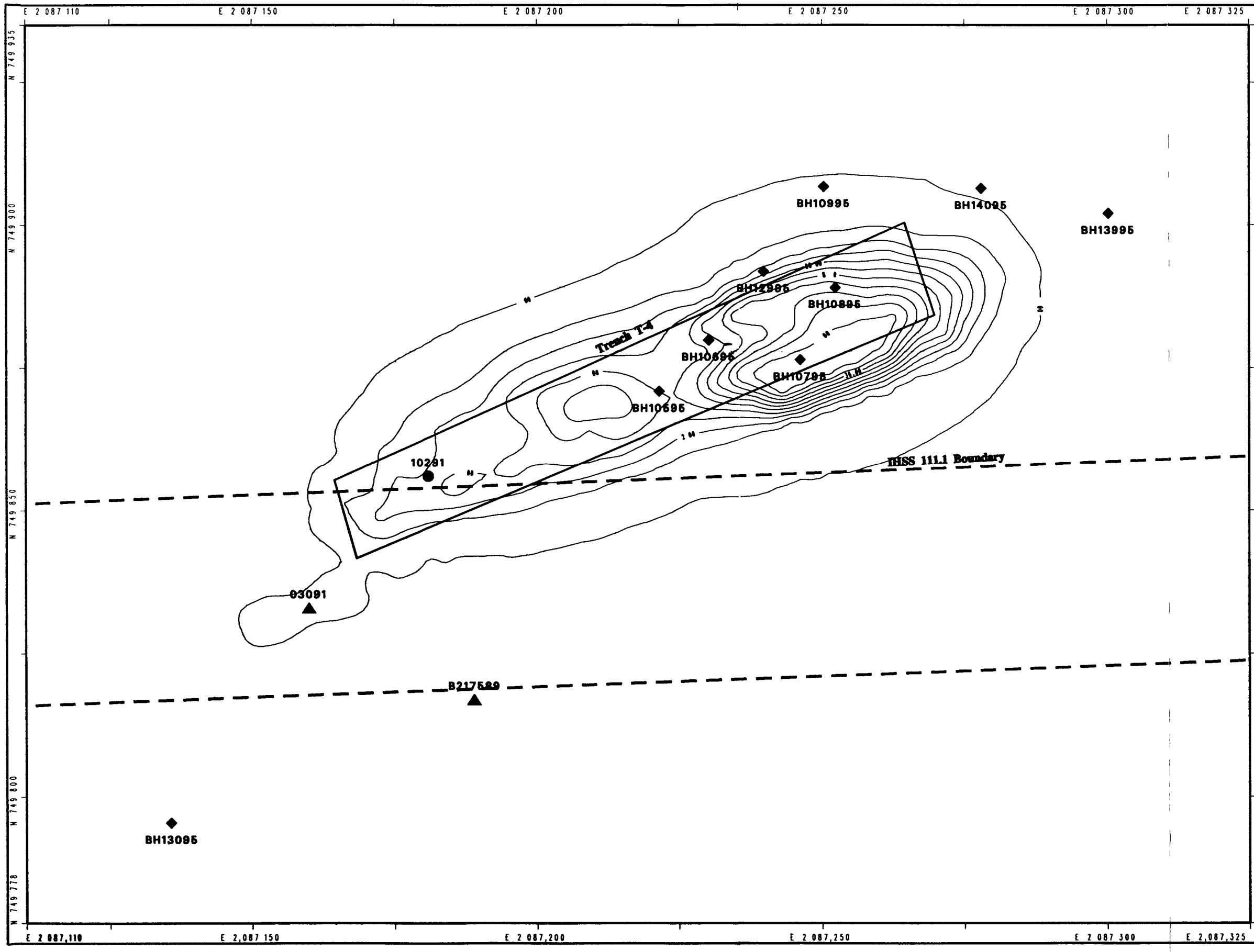
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P. O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench
October 02, 996

176



Operable Unit 2
IHSS 111 1 - Trench T-4

Electromagnetic Contour Map
EM 31 Data
Horizontal Dipole Mode
Inphase Response

Sampling Types

- ● Borehole
- ▲ Groundwater Well
- ◆ Characterization Borehole
- Inphase Response Isopleth Contour Interval = 4 parts/thousand
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG& Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

Scale
Inch represents approximately feet

5 0 10ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

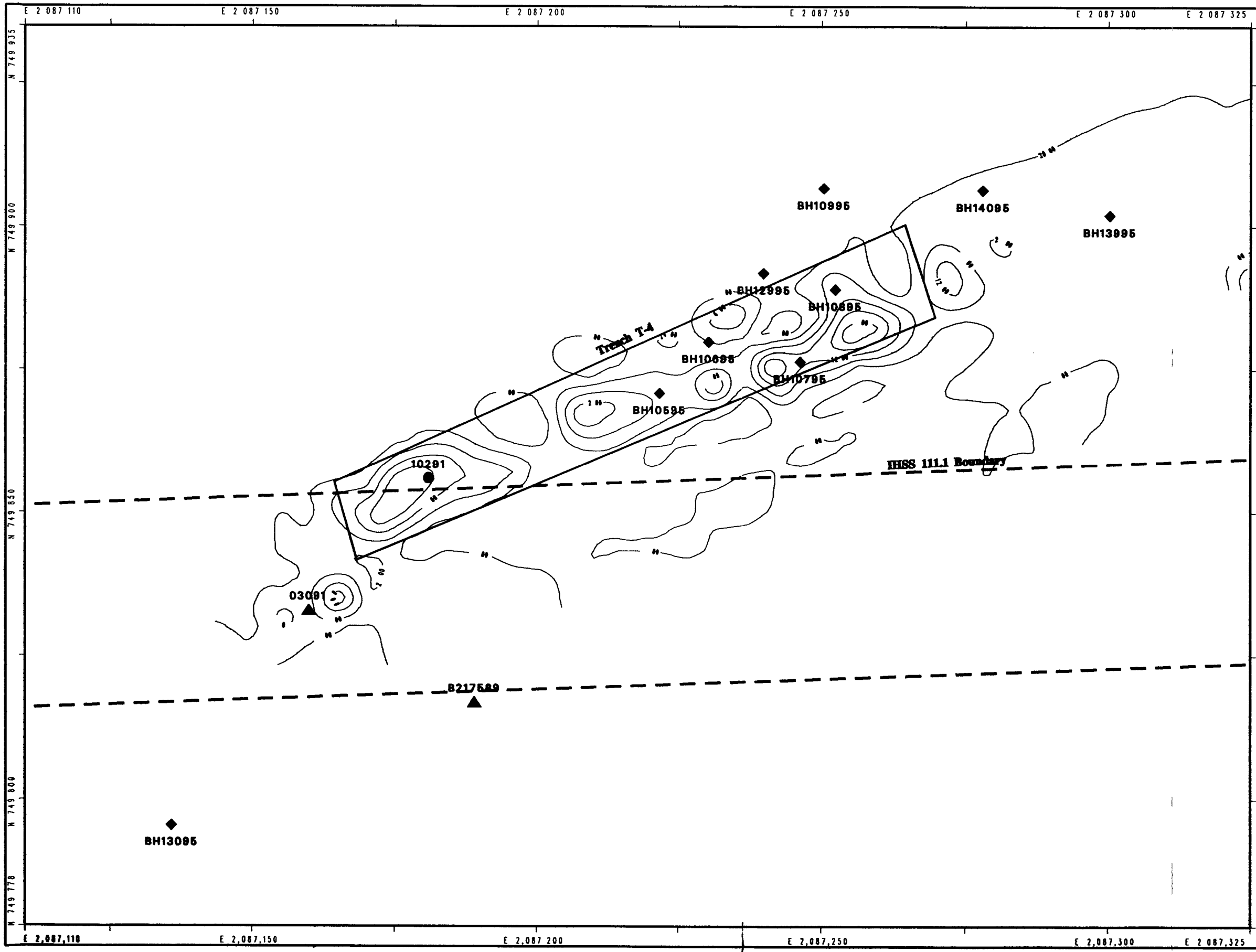
U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench

October 02, 1995

177



Operable Unit 2
IHSS 111 1 Trench T-4

Electromagnetic Contour Map
EM 31 Data
Vertical Dipole Mode
Quadrature Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Quadrature Response Isopleth Contour Interval = 4 mmhos/meter
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr
EG&G Rocky Flats, Inc. 93
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

Scale
Inch represents approximately .5 feet

5 0 10ft

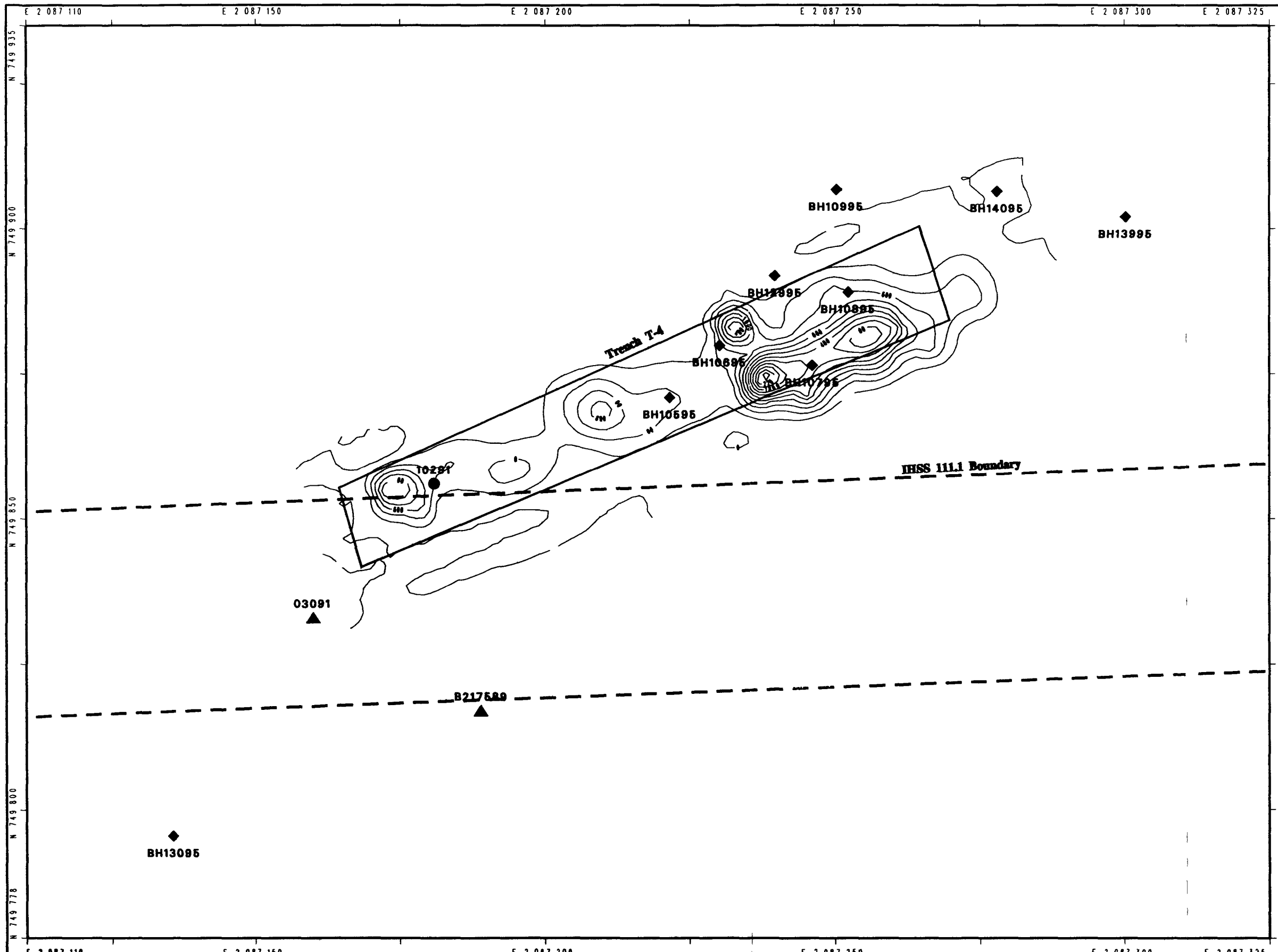
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: eem-trench
October 02, 1995

178



Operable Unit 2
IHSS 111 1 Trench T-4

Electromagnetic Contour Map
EM-61 Data
Channel 2 Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Channel 2 Response Isopleth Contour Interval = 200 mv
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr, EG& Rocky Flats, Inc. 89
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 995.
Characterization Boreholes provided by Woodward Clyde May 995.

Scale
Inch represents approximately feet

5 0 10ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

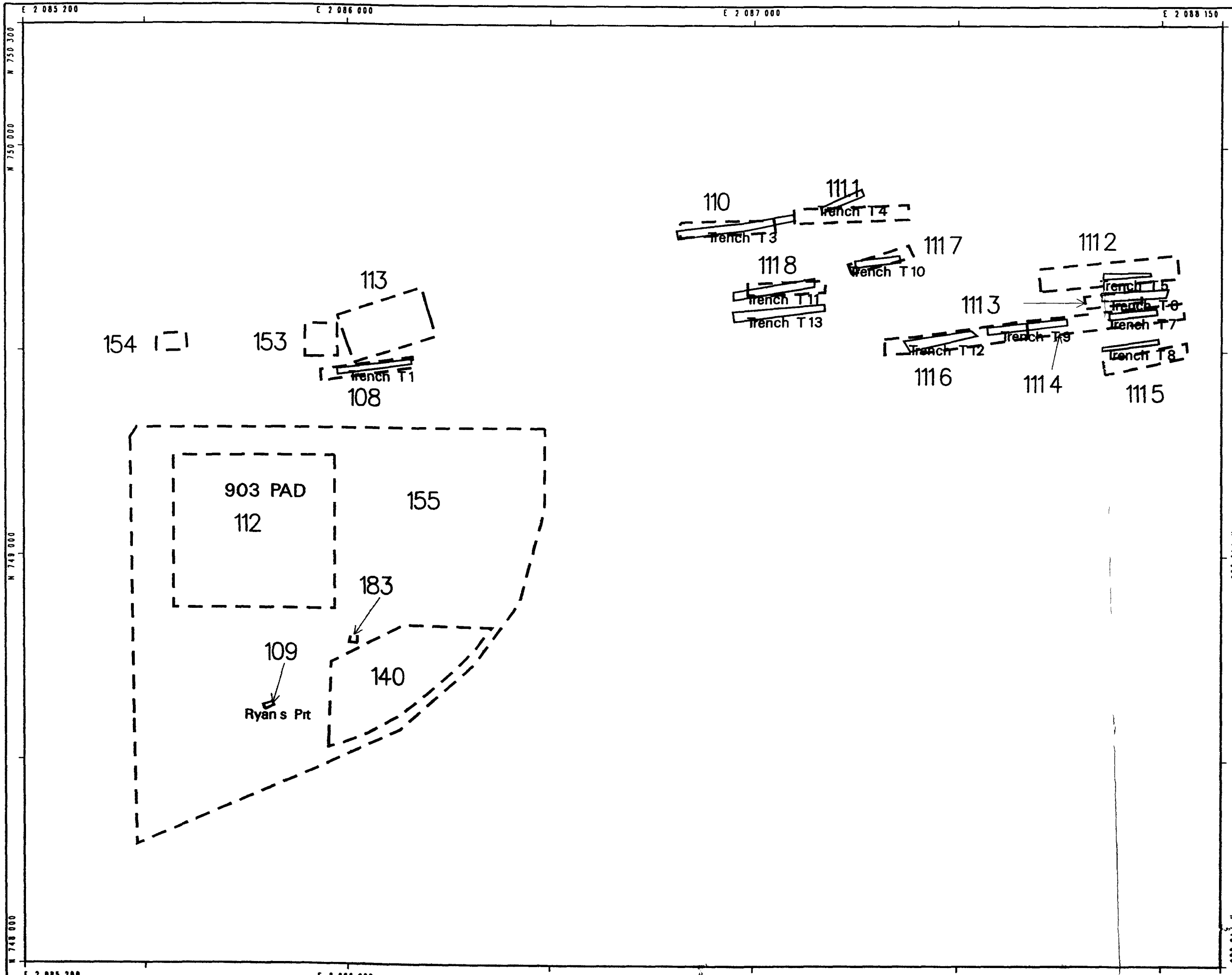
U S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P. O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench

October 02, 1995

180



Operable Unit 2

EXPLANATION

— IHSS Boundary

— Trench Boundary

DATA SOURCE.
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 99
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde, May 1996.

Figure 3 4-1

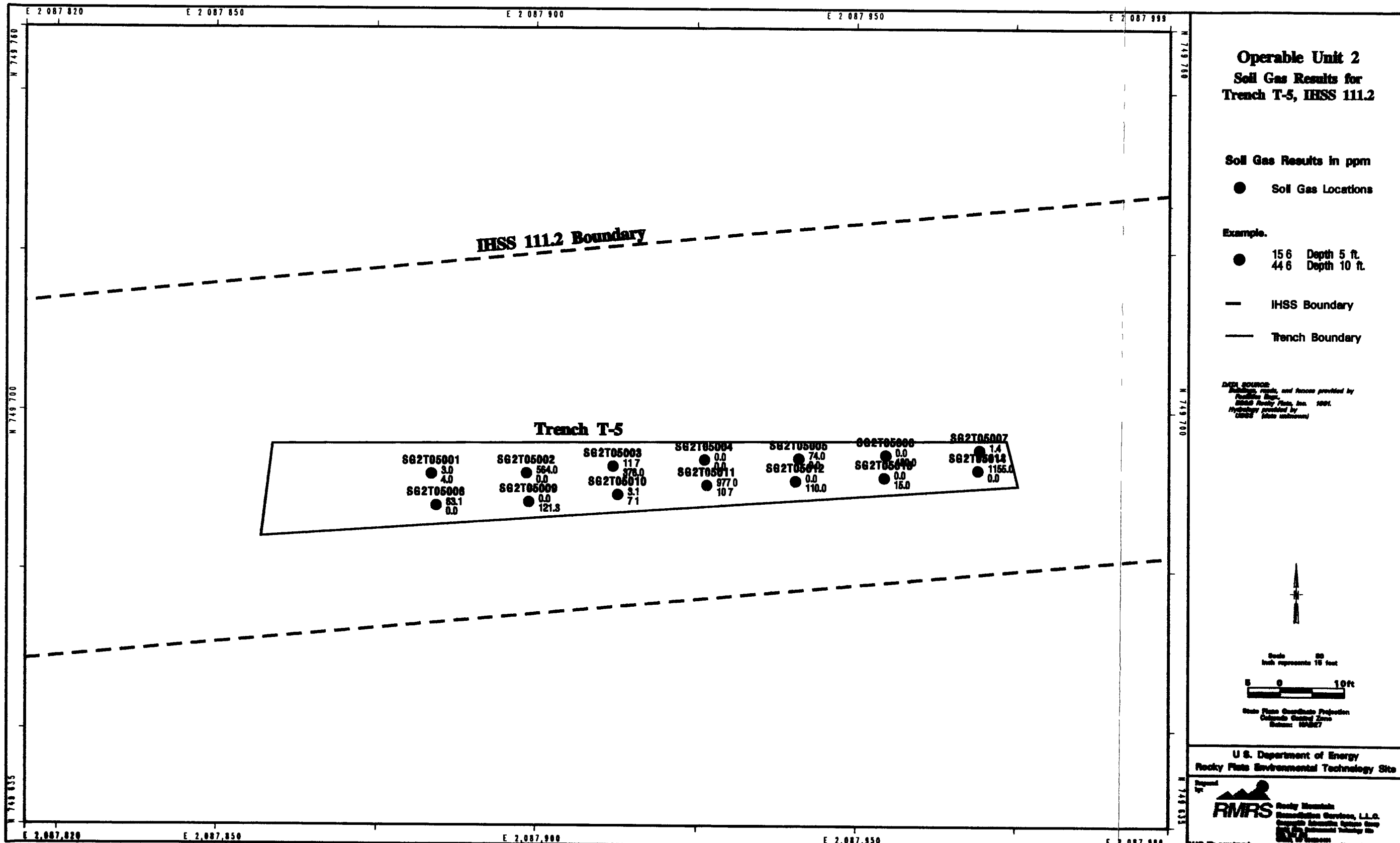
Scale 2800
Inch represents approximately 233.33 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Envi onmental Tech ology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: [illegible]
August 28, 1996



Operable Unit 2

Soil Gas Results for Trench T-5, IHSS 111.2

Soil Gas Results in ppm

● Soil Gas Locations

Example.

● 15.6 Depth 5 ft.
44.6 Depth 10 ft.

— IHSS Boundary

—— Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)

Scale 50
Inch represents 15 feet

5 0 10ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

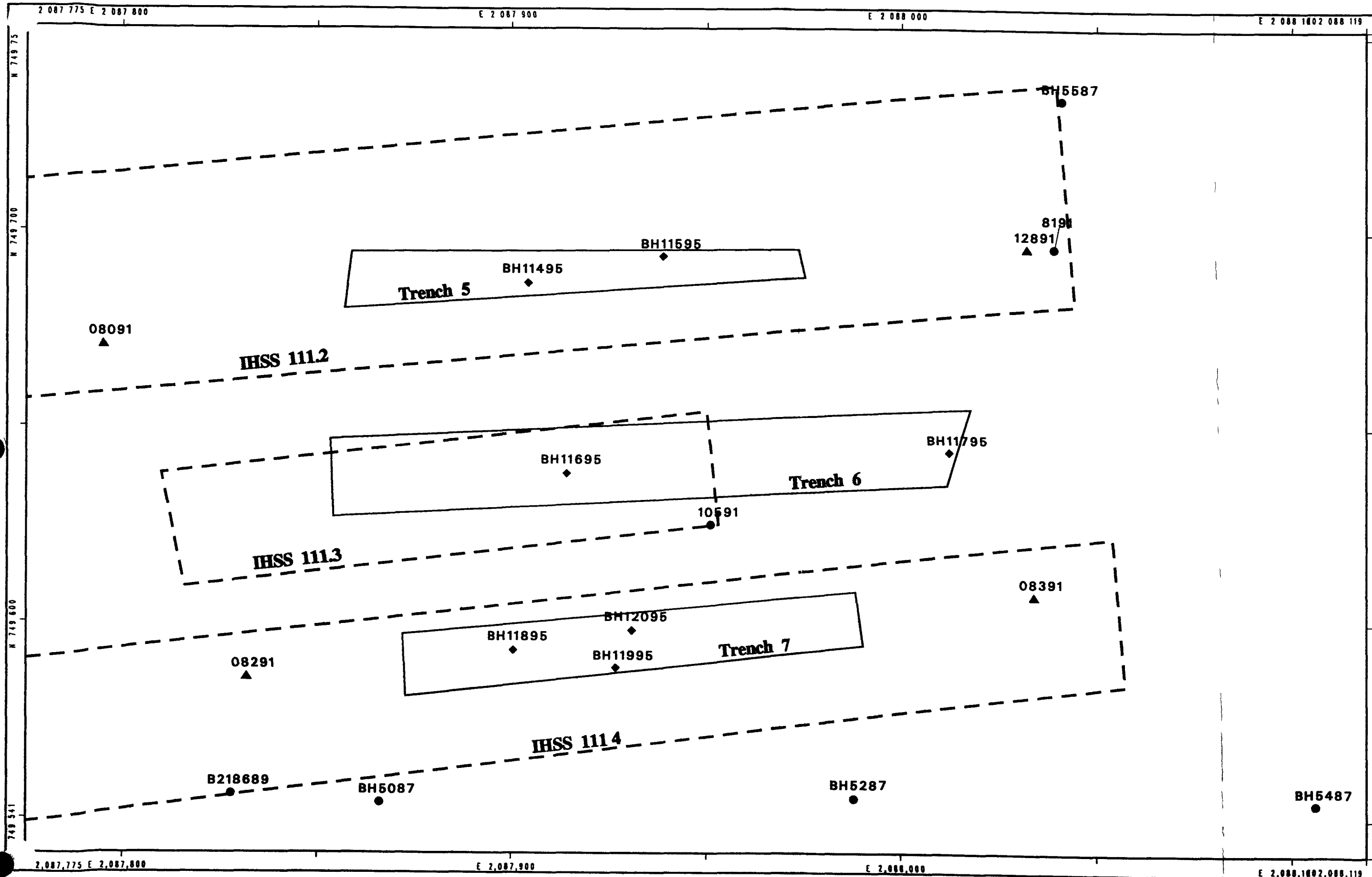
U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Golden, CO 80403

MAP ID: [illegible]

November 14, 1995

208



Operable Unit 2
IHSS 111.3 111.2 and 111.4
Trench 5 6 and 7

Sampling Types

- ● Boreh l
- ▲ Grou dw ter Well
- ◆ Ch act atl Bo eh le

Standard Map Features

- — IHSS Bo d ry
- —— Te ch Bo d ry

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr, EG&G Rocky Flats, Inc. 9
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 95

Scale 300
Inch represents 25 feet

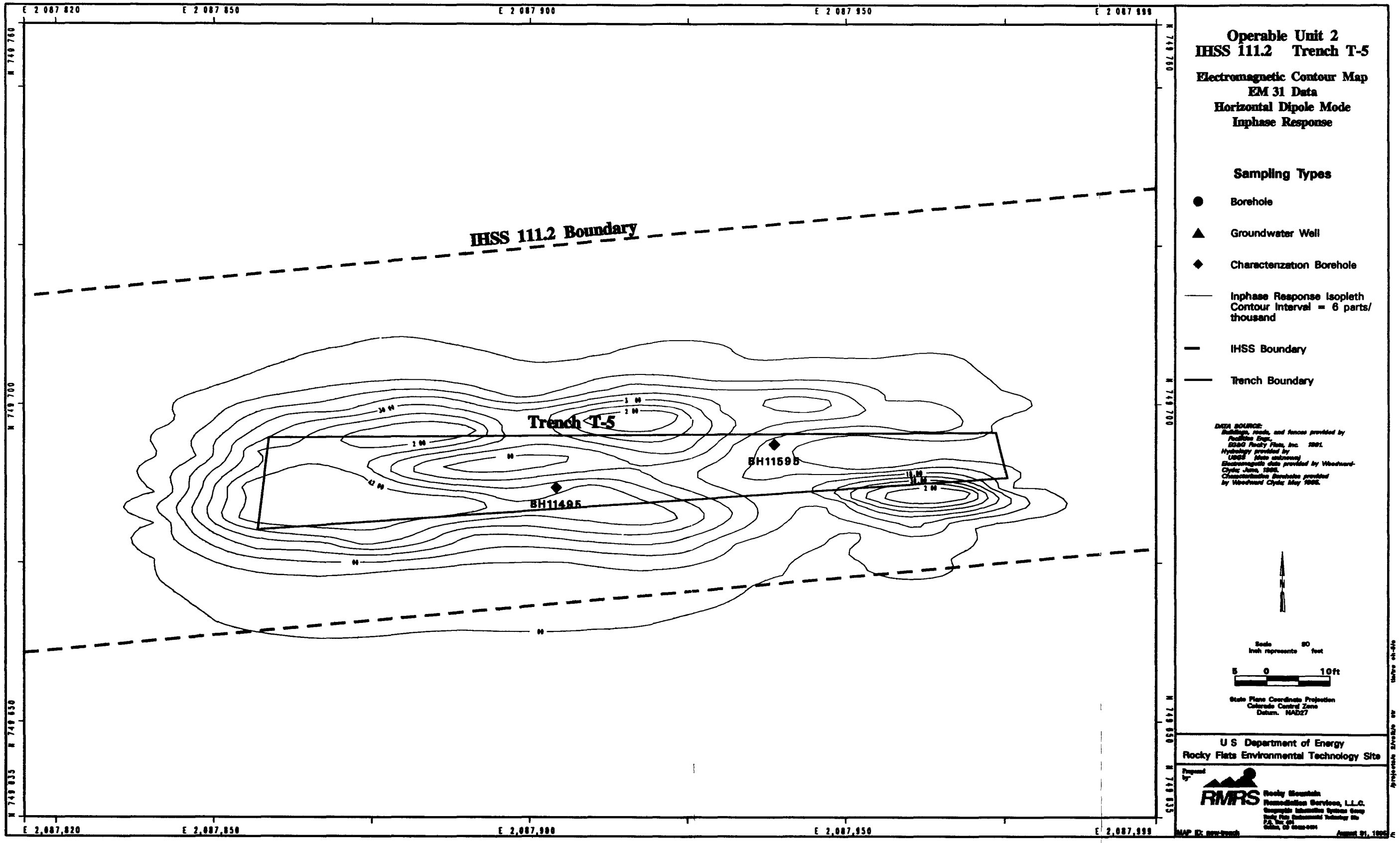
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department f Energy
Rocky Flats E vi onm tal Tech ology Sit

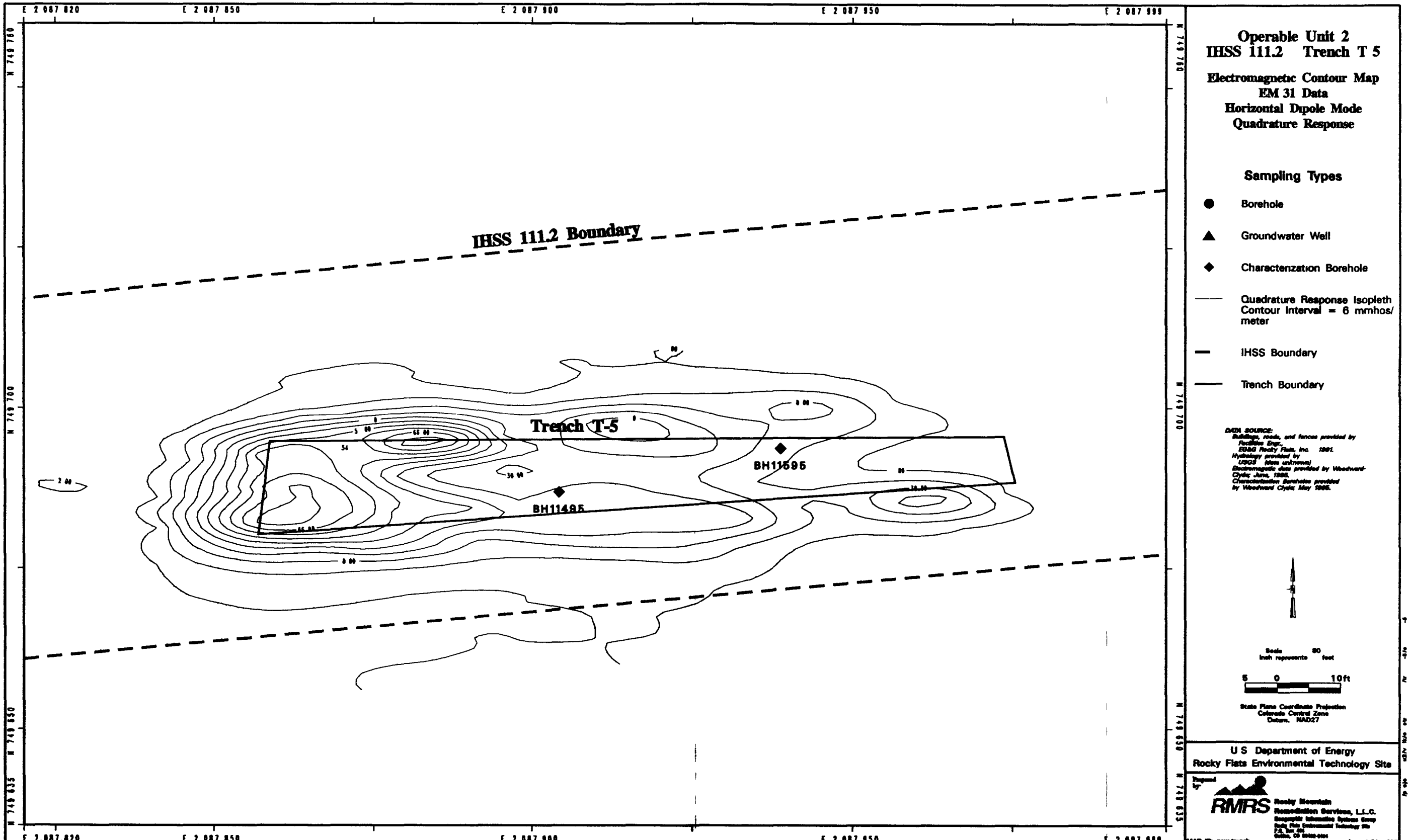
Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information System map
Rocky Ma nmental ology Site
P. Box 464
Golden, CO 80402-0464

MAP ID: new-trench
August 28, 995

207

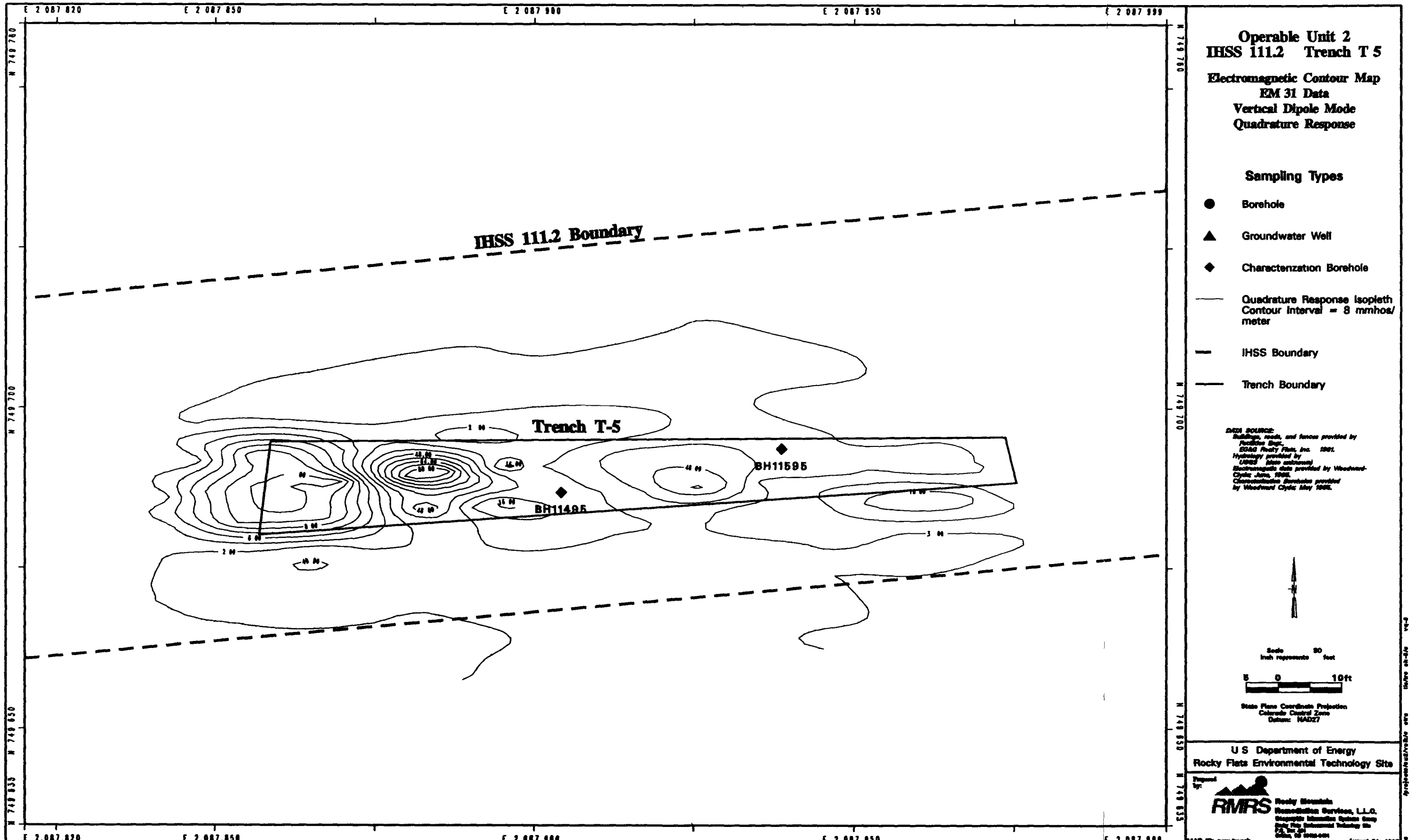

E 2 087 820
E 2 087 850
E 2 087 900
E 2 087 950
E 2 087 999
N 749 760
N 749 750
N 749 700
N 749 650
N 749 635
IHSS 111.2 Boundary
Trench T-5
BH11595
BH11495
E 2,087,820
E 2,087,850
E 2,087,900
E 2,087,950
E 2,087,999
Operable Unit 2
IHSS 111.2 Trench T-5
Electromagnetic Contour Map
EM 31 Data
Horizontal Dipole Mode
Inphase Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Inphase Response Isopleth
Contour Interval = 6 parts/
thousand
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by
Facilities Dept.,
EG&G Rocky Flats, Inc. 1991.
Hydrology provided by
USGS (date unknown)
Electromagnetic data provided by Woodward-
Clyde; June, 1995.
Characterization Boreholes provided
by Woodward Clyde; May 1995.
N
Scale
Inch represents 50 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain
Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464
MAP ID: new-trench
August 21, 1995

214



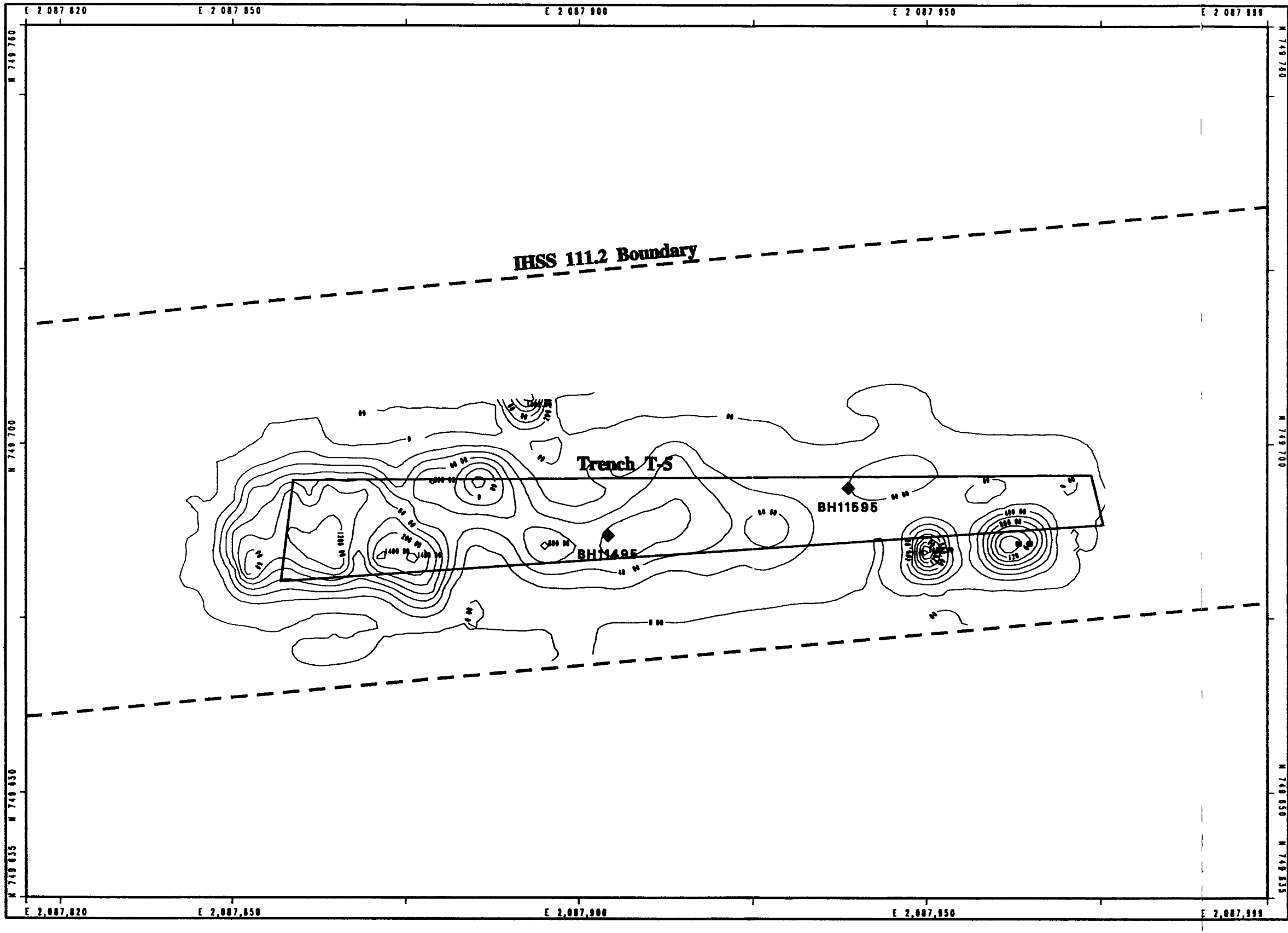
E 2 087 820
E 2 087 850
E 2 087 900
E 2 087 950
E 2 087 999
N 749 760
N 749 700
N 749 650
N 749 635
IHSS 111.2 Boundary
Trench T-5
BH11595
BH11495
2 00
5 00
65 00
54
30 00
8 00
Operable Unit 2
IHSS 111.2 Trench T 5
Electromagnetic Contour Map
EM 31 Data
Horizontal Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth Contour Interval = 6 mmhos/meter
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.
Scale 80
Inch represents feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum. NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: new-trench
August 31, 1995

215



E 2 087 820
E 2 087 850
E 2 087 900
E 2 087 950
E 2 087 999
N 749 760
N 749 700
N 749 650
N 749 635
IHSS 111.2 Boundary
Trench T-5
BH11595
BH11495
Operable Unit 2
IHSS 111.2 Trench T 5
Electromagnetic Contour Map
EM 31 Data
Vertical Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth Contour Interval = 8 mmhos/meter
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.
Scale 50
Inch represents feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: new-trench
August 31, 1995

216



Operable Unit 2
IHSS 111.2 Trench T 5

Electromagnetic Contour Map
EM-61 Data
Channel 2 Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Channel 2 Response Isopleth Contour Interval = 200 mv
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward Clyde May 1995.

Scale
Inch represents 50 feet

5 0 10ft

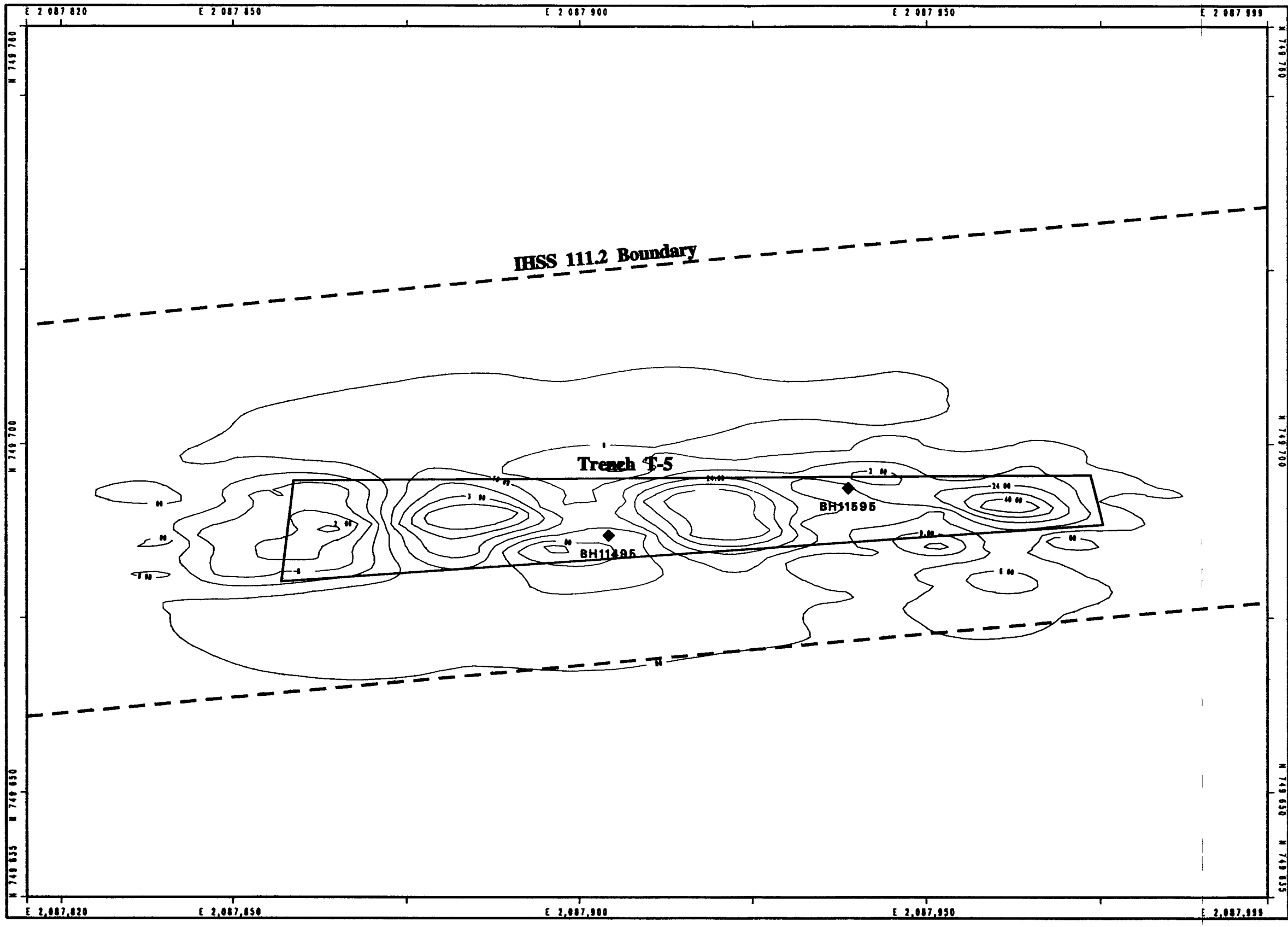
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench
August 01, 1995

219



Operable Unit 2
IHSS 111.2 Trench T 5

Electromagnetic Contour Map
EM 31 Data
Vertical Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 8 parts/thousand
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Dept. EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward Clyde May 1995.

Scale
inch represents 50 feet

5 0 10ft

State Plane Coordinate Projection
Colorado Central Zone
Datum. NAD27

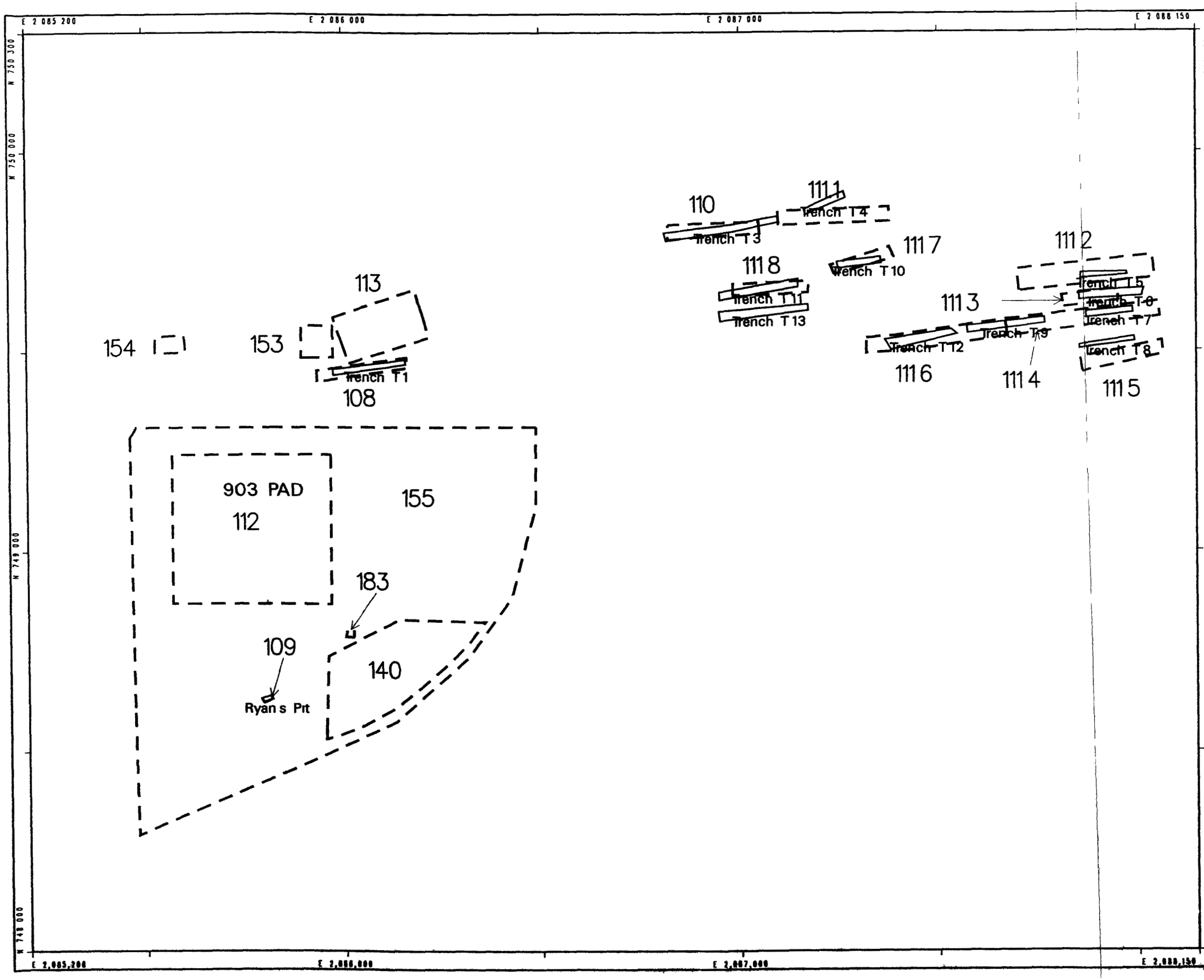
U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P. O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench

August 01, 1995

212



Operable Unit 2

EXPLANATION

— IHSS Boundary

—— Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde, May 1995.

Figure 3 5-1

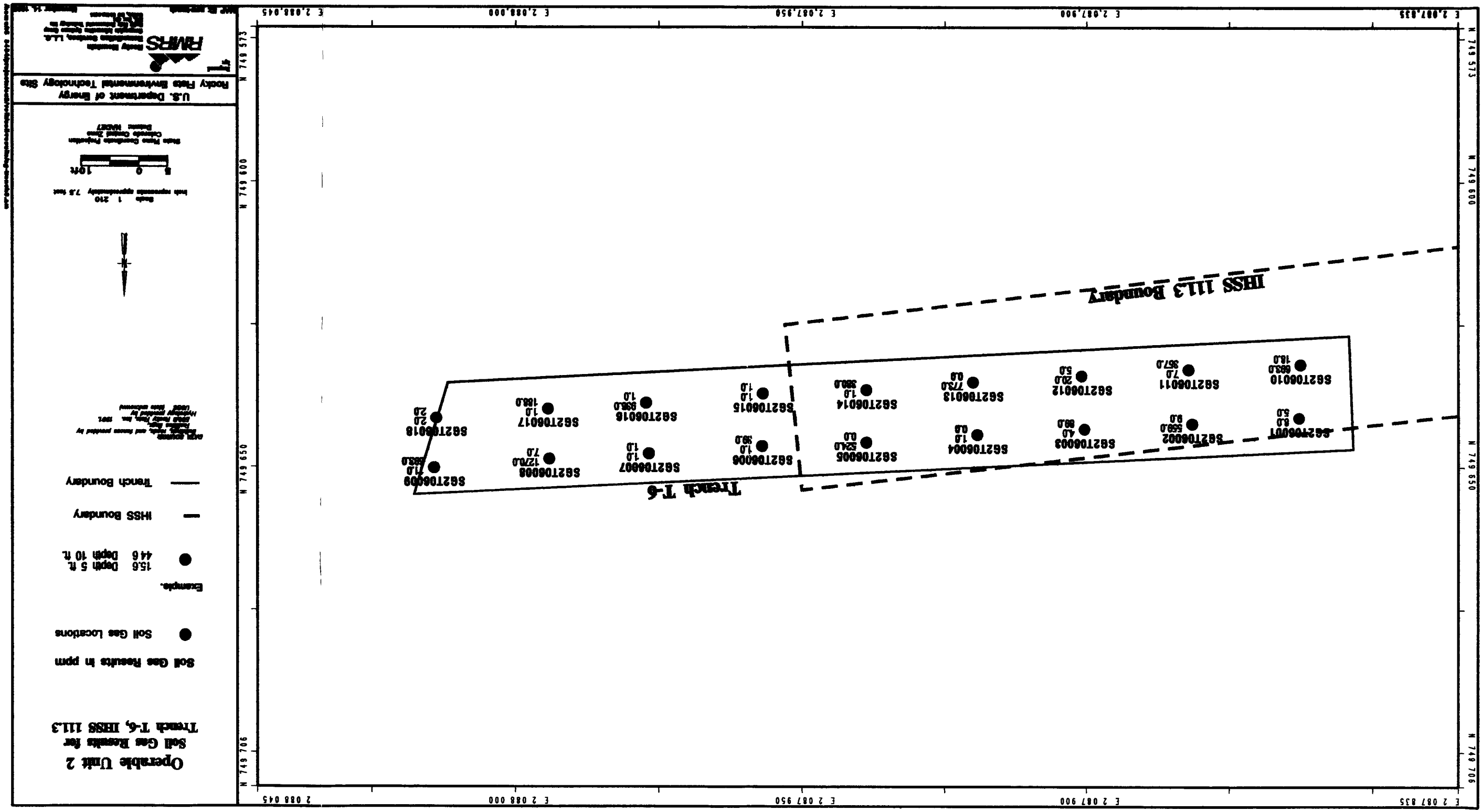
Scale 2800
Inch represents approximately 233.33 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

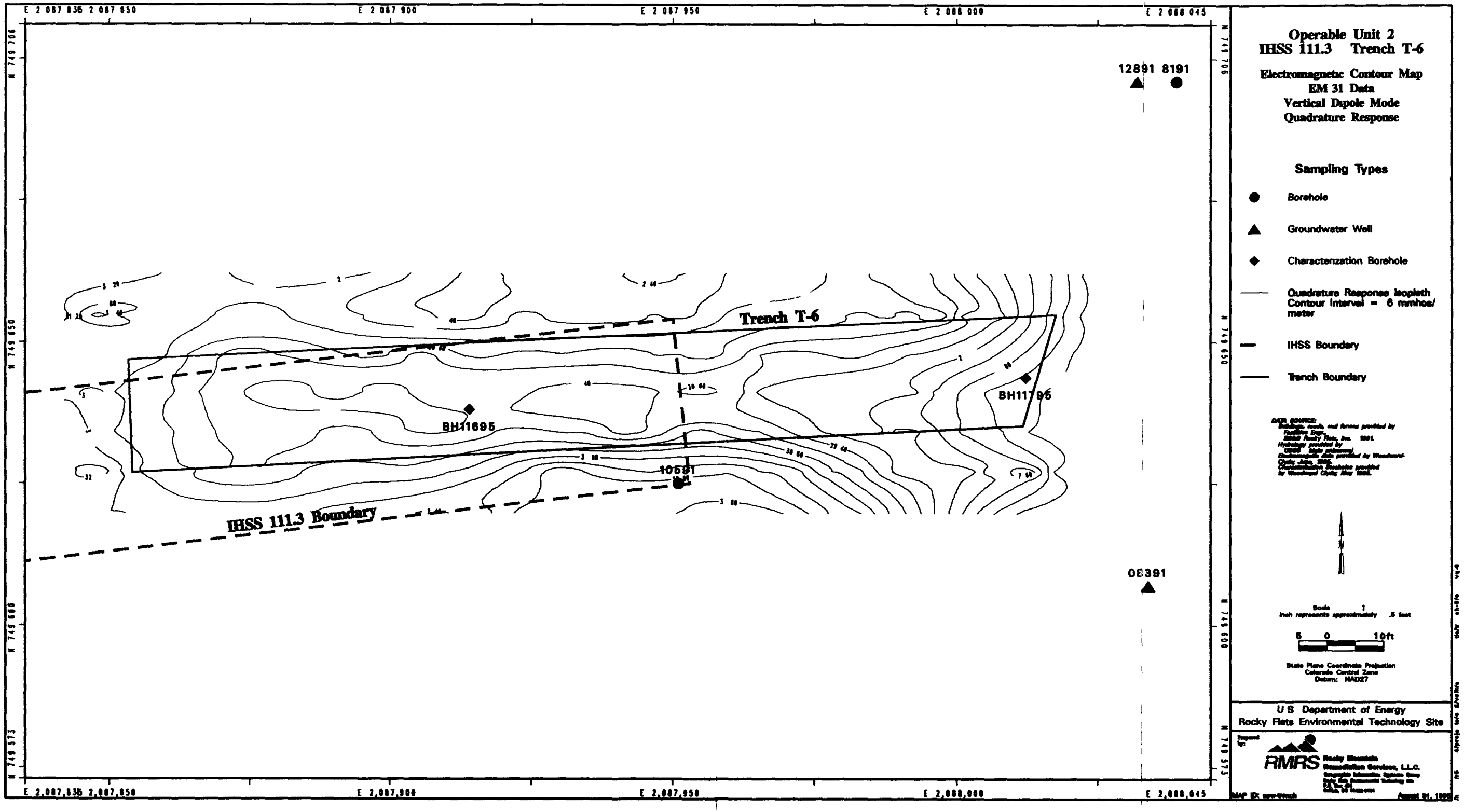
U S. Department of Energy
Rocky Flats Environmental Technology Site

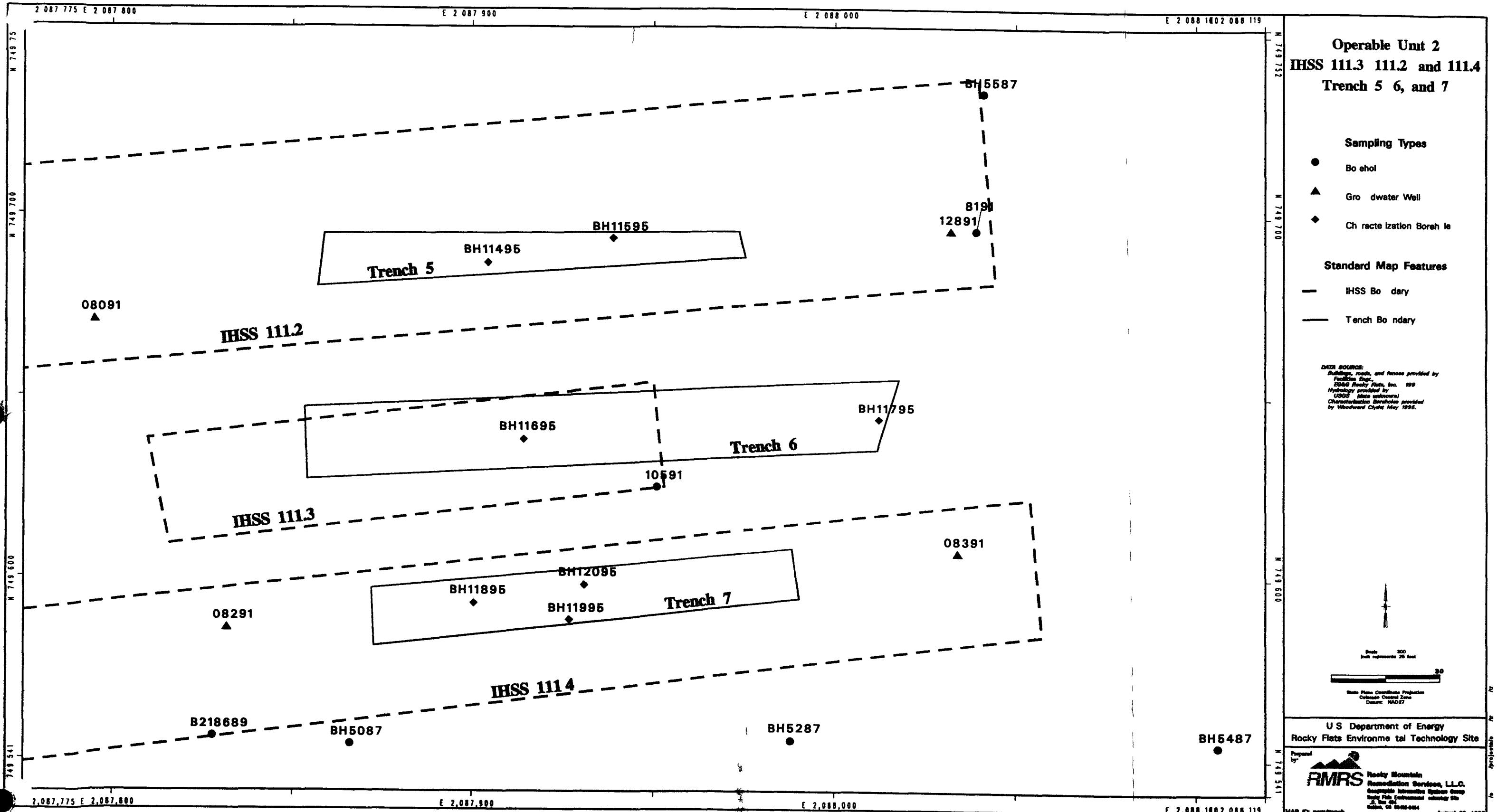
Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

243



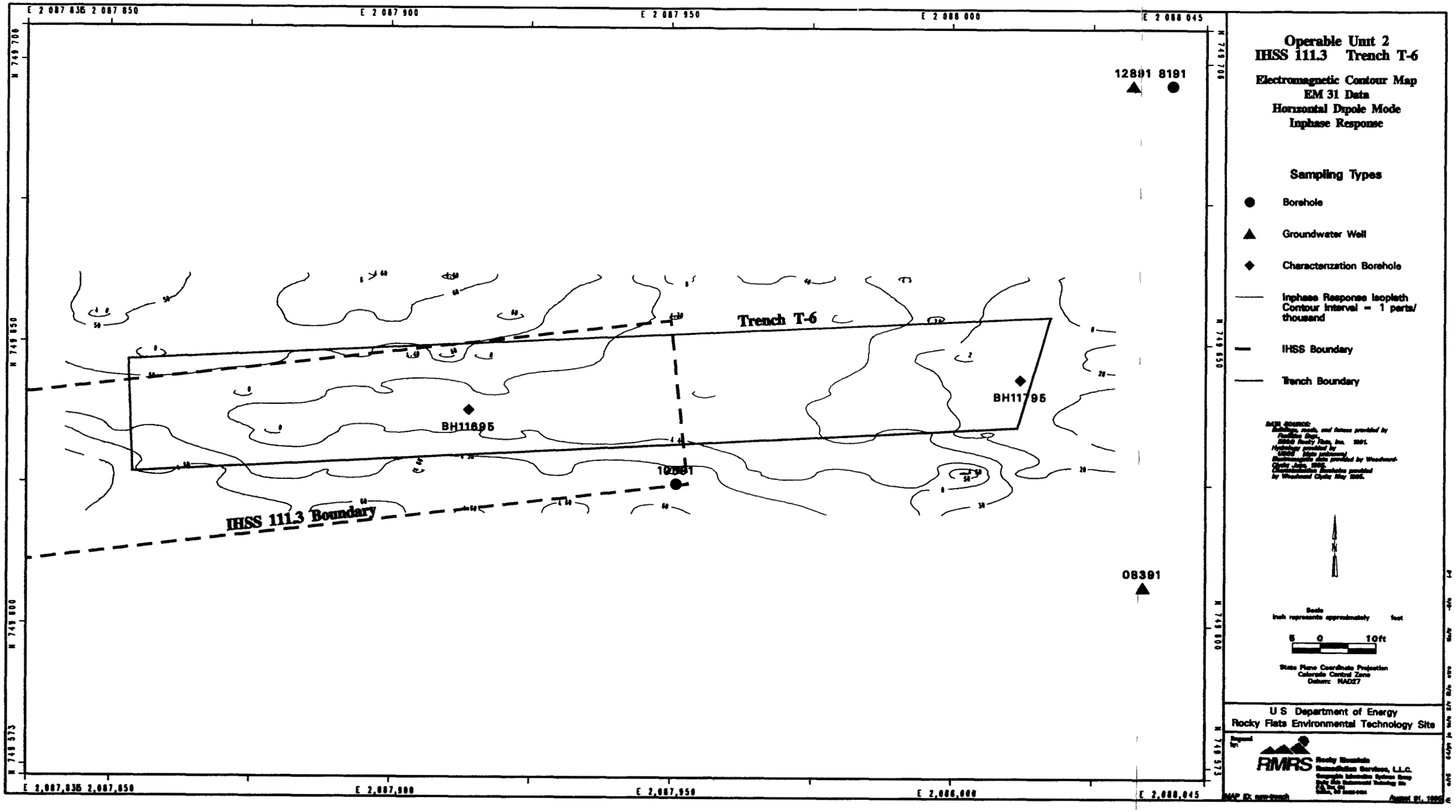
Operable Unit 2
Soil Gas Results for
Trench T-6, IHSS 111.3
Soil Gas Results in ppm
Soil Gas Locations
Example.
15.6 Depth 5 ft.
44.6 Depth 10 ft.
IHSS Boundary
Trench Boundary
Scale 1 : 210
Inch represents approximately 7.5 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Project
Date
Revision
Number 14, 1998
IHSS 111.3 Boundary
Trench T-6
SG2T06001 8.0 5.0
SG2T06002 559.0 9.0
SG2T06003 4.0 89.0
SG2T06004 1.0 0.0
SG2T06005 524.0 0.0
SG2T06006 1.0 39.0
SG2T06007 1.0 1.0
SG2T06008 1270.0 7.0
SG2T06009 71.0 683.0
SG2T06010 683.0 18.0
SG2T06011 7.0 357.0
SG2T06012 20.0 5.0
SG2T06013 773.0 0.0
SG2T06014 1.0 380.0
SG2T06015 1.0 1.0
SG2T06016 936.0 1.0
SG2T06017 1.0 188.0
SG2T06018 2.0 2.0
N 749 573
N 749 600
N 749 650
N 749 706
E 2,088,045
E 2,088,000
E 2,087,950
E 2,087,900
E 2,087,835


Operable Unit 2
IHSS 111.3 Trench T-6
Electromagnetic Contour Map
EM 31 Data
Vertical Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth Contour Interval = 6 mmhos/meter
IHSS Boundary
Trench Boundary
Trench T-6
IHSS 111.3 Boundary
BH11695
BH11796
10591
12891
8191
08391
E 2,087,836 2,087,850
E 2,087,900
E 2,087,950
E 2,088,000
E 2,088,045
N 749,706
N 749,650
N 749,600
N 749,573
Scale
1 inch represents approximately 5 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.

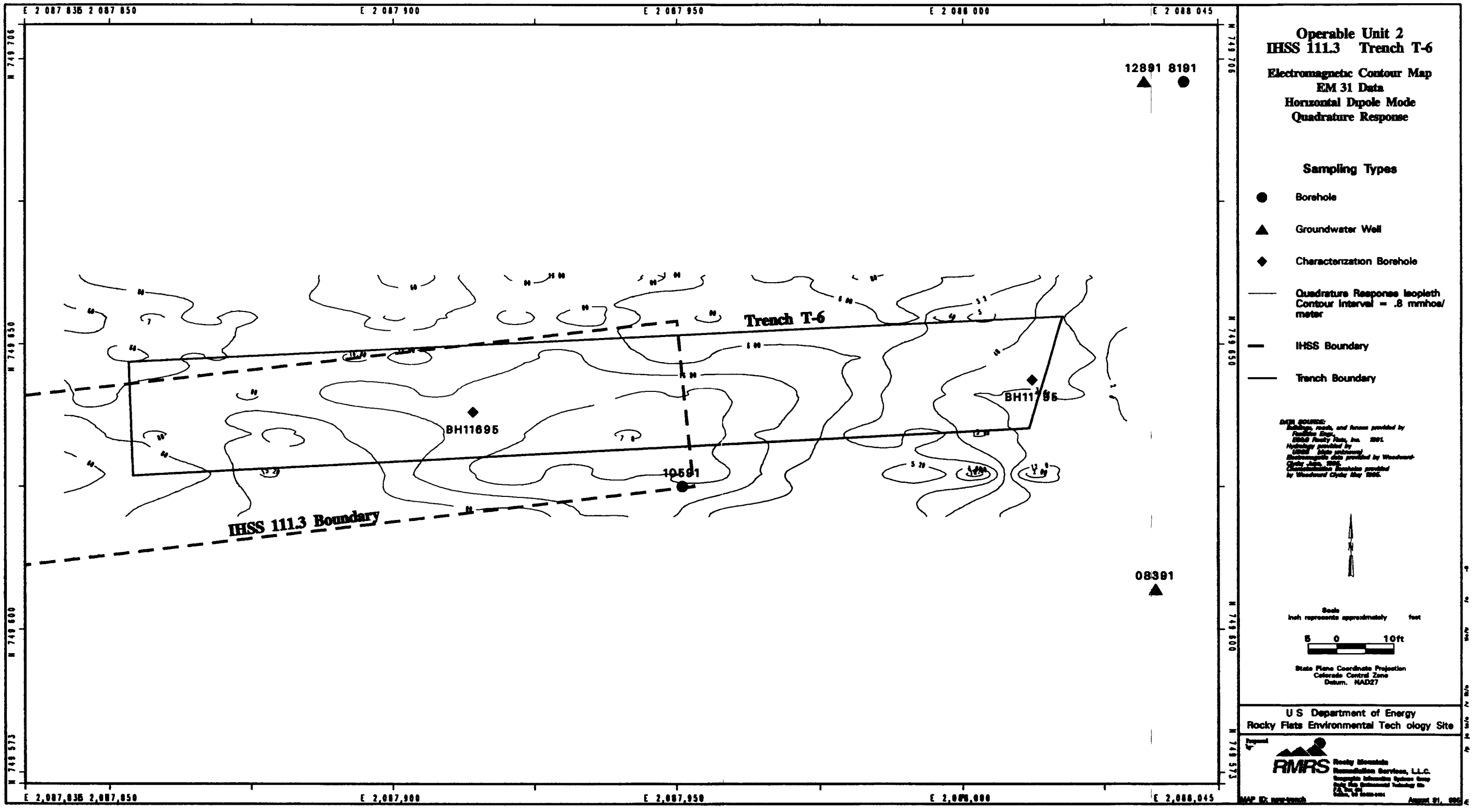


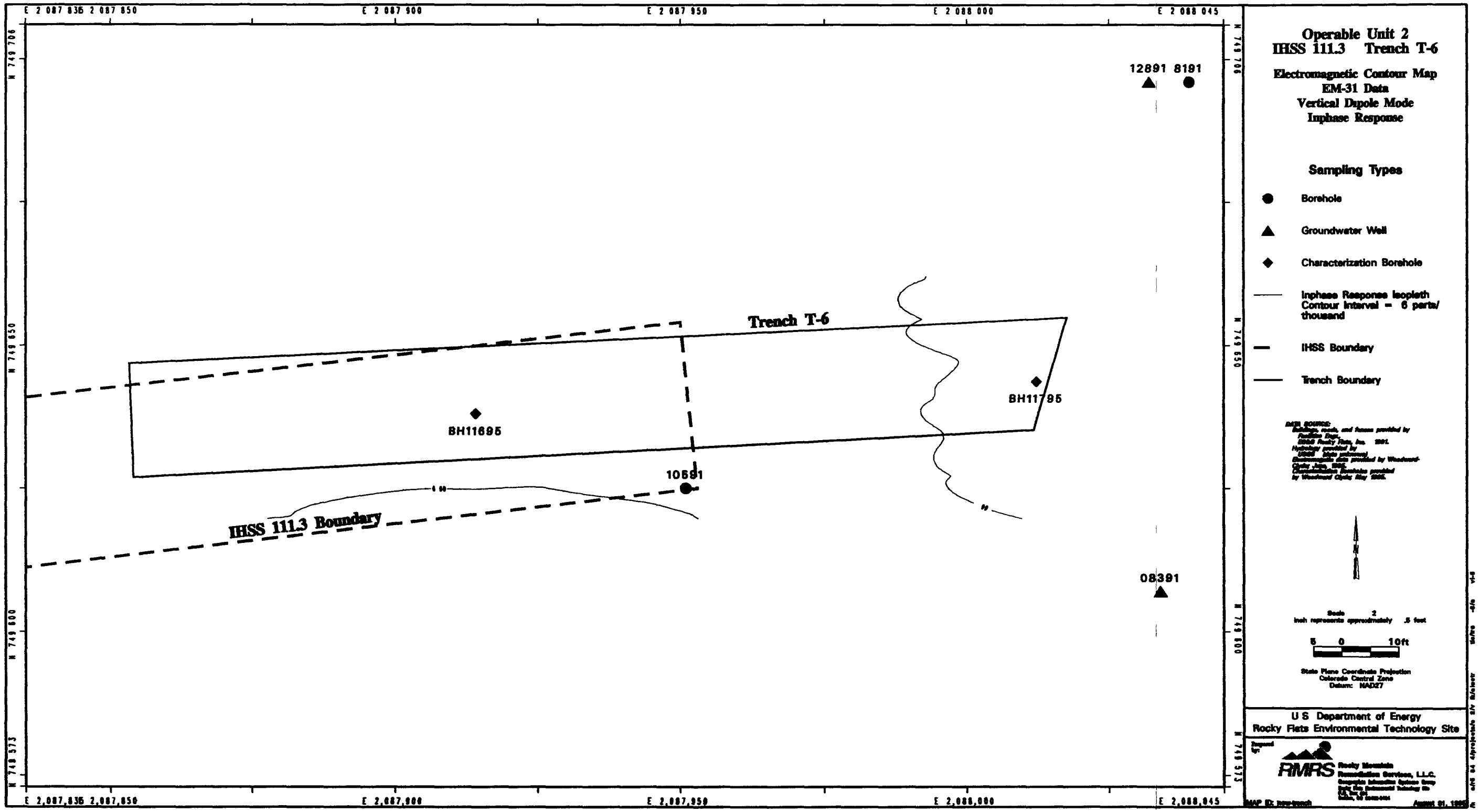
Operable Unit 2
IHSS 111.3 111.2 and 111.4
Trench 5 6, and 7
Sampling Types
Bo ehol
Gro dwater Well
Ch racte ization Boreh le
Standard Map Features
IHSS Bo dary
Tench Bo ndary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 199
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde May 1995.
Scale 300
Inch represents 25 feet
30
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environme tal Technology Site
Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
MAP ID: new-trench
August 28, 1996
2 087 775 E 2 087 800
E 2 087 900
E 2 088 000
E 2 088 1602 088 119
N 749 75
N 749 700
N 749 600
N 749 541
BH5587
8191
12891
BH11595
BH11495
Trench 5
08091
IHSS 111.2
BH11695
BH11795
Trench 6
10591
IHSS 111.3
08391
BH12095
BH11895
BH11995
Trench 7
08291
IHSS 111 4
B218689
BH5087
BH5287
BH5487

249

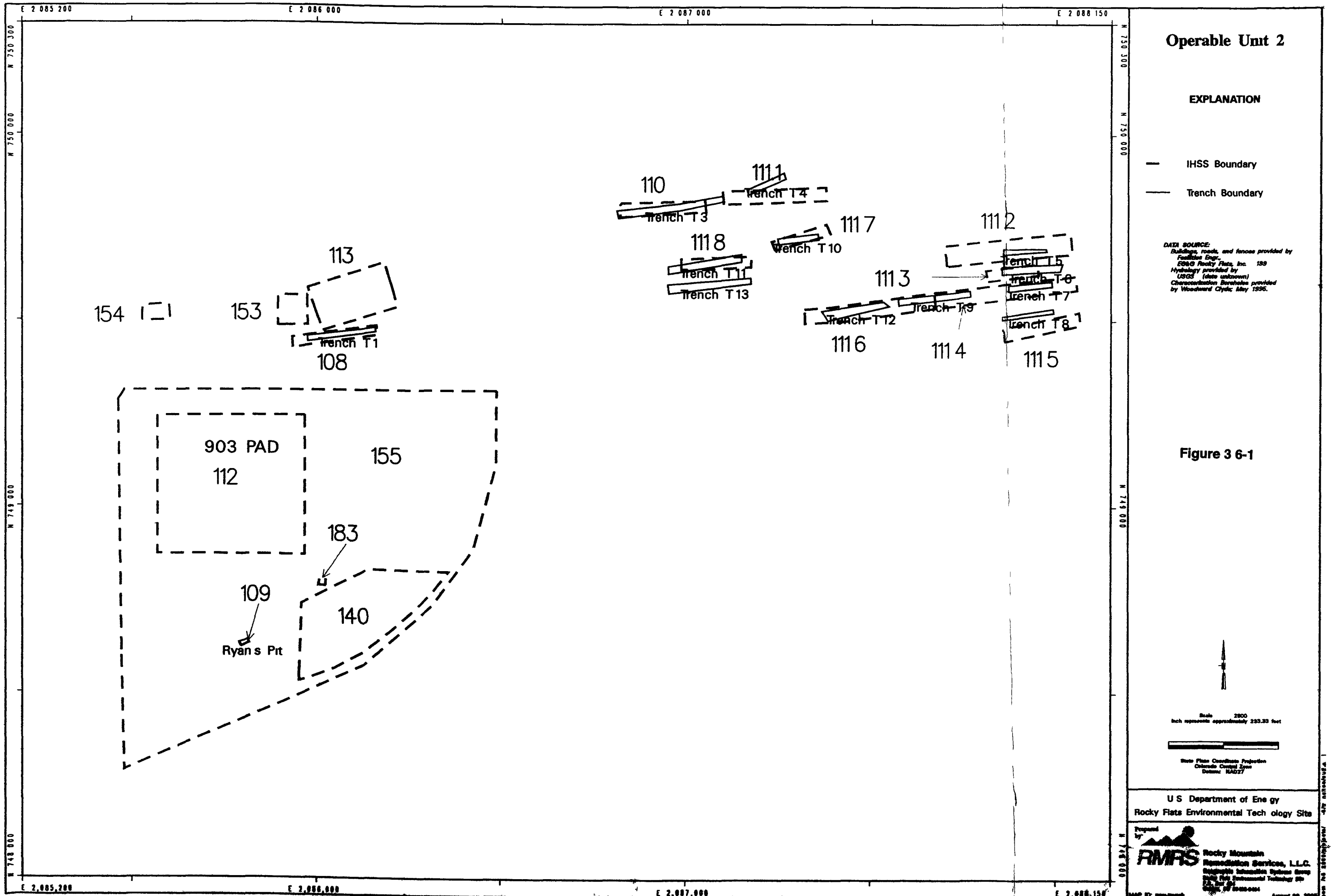

Operable Unit 2
IHSS 111.3 Trench T-6
Electromagnetic Contour Map
EM 31 Data
Horizontal Dipole Mode
Inphase Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Inphase Response Isopleth Contour Interval = 1 parts/thousand
IHSS Boundary
Trench Boundary
Scale
Inch represents approximately feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Trench T-6
IHSS 111.3 Boundary
BH11695
BH11795
12801
8191
08391
E 2 087 835 2 087 850
E 2 087 900
E 2 087 950
E 2 088 000
E 2 088 045
N 749 700
N 749 650
N 749 600
N 749 573
E 2,087,835 2,087,850
E 2,087,900
E 2,087,950
E 2,088,000
E 2,088,045

25


Operable Unit 2
IHSS 111.3 Trench T-6
Electromagnetic Contour Map
EM 31 Data
Horizontal Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth
Contour Interval = .8 mmhos/meter
IHSS Boundary
Trench Boundary
Scale
inch represents approximately feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Trench T-6
IHSS 111.3 Boundary
BH11695
BH11795
10591
08391
12891
8191
E 2 087 835
2 087 850
E 2 087 900
E 2 087 950
E 2 088 000
E 2 088 045
N 749 706
N 749 650
N 749 600
N 749 573
E 2,087,835
2,087,850
E 2,087,900
E 2,087,950
E 2,088,000
E 2,088,045


Operable Unit 2
IHSS 111.3 Trench T-6
Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Inphase Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Inphase Response Isopleth Contour Interval = 6 parts/thousand
IHSS Boundary
Trench Boundary
Scale 2 inch represents approximately 5 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.
Trench T-6
IHSS 111.3 Boundary
12891
8191
BH11695
BH11795
10591
08391
E 2,087,836 2,087,850
E 2,087,900
E 2,087,950
E 2,088,000
E 2,088,045
N 749 700
N 749 650
N 749 600
N 749 573

259



Operable Unit 2

EXPLANATION

— IHSS Boundary

— Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 199
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 1996.

Figure 3 6-1

Scale 2800
Inch represents approximately 233.33 feet

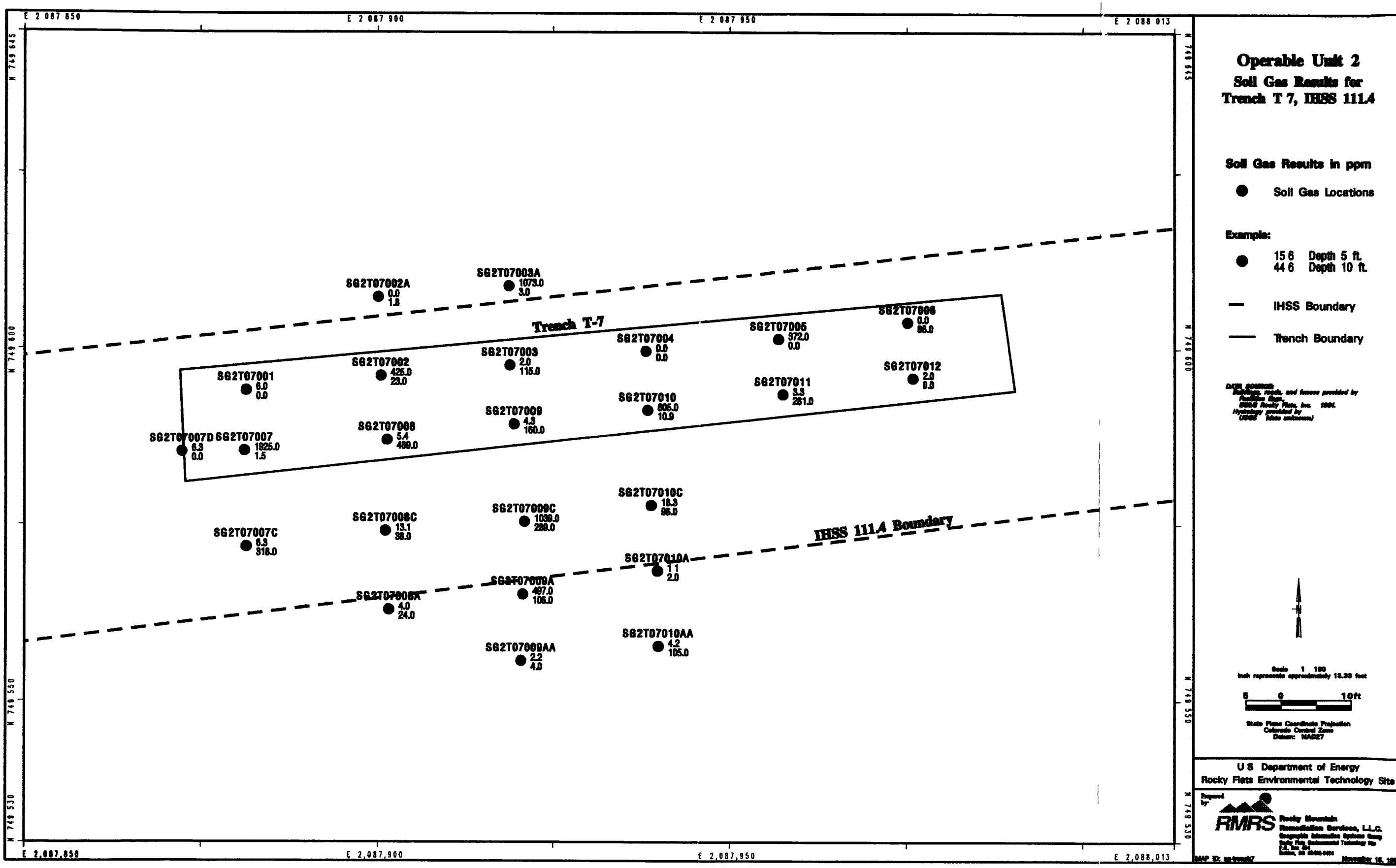
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Ene gy
Rocky Flats Environmental Tech ology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: [illegible]
August 20, 1996

182



Operable Unit 2

Soil Gas Results for Trench T 7, IHSS 111.4

Soil Gas Results in ppm

● Soil Gas Locations

Example:

● 15 6 Depth 5 ft.
44 6 Depth 10 ft.

— IHSS Boundary

— Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)

Scale 1 160
Inch represents approximately 13.33 feet

5 0 10ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

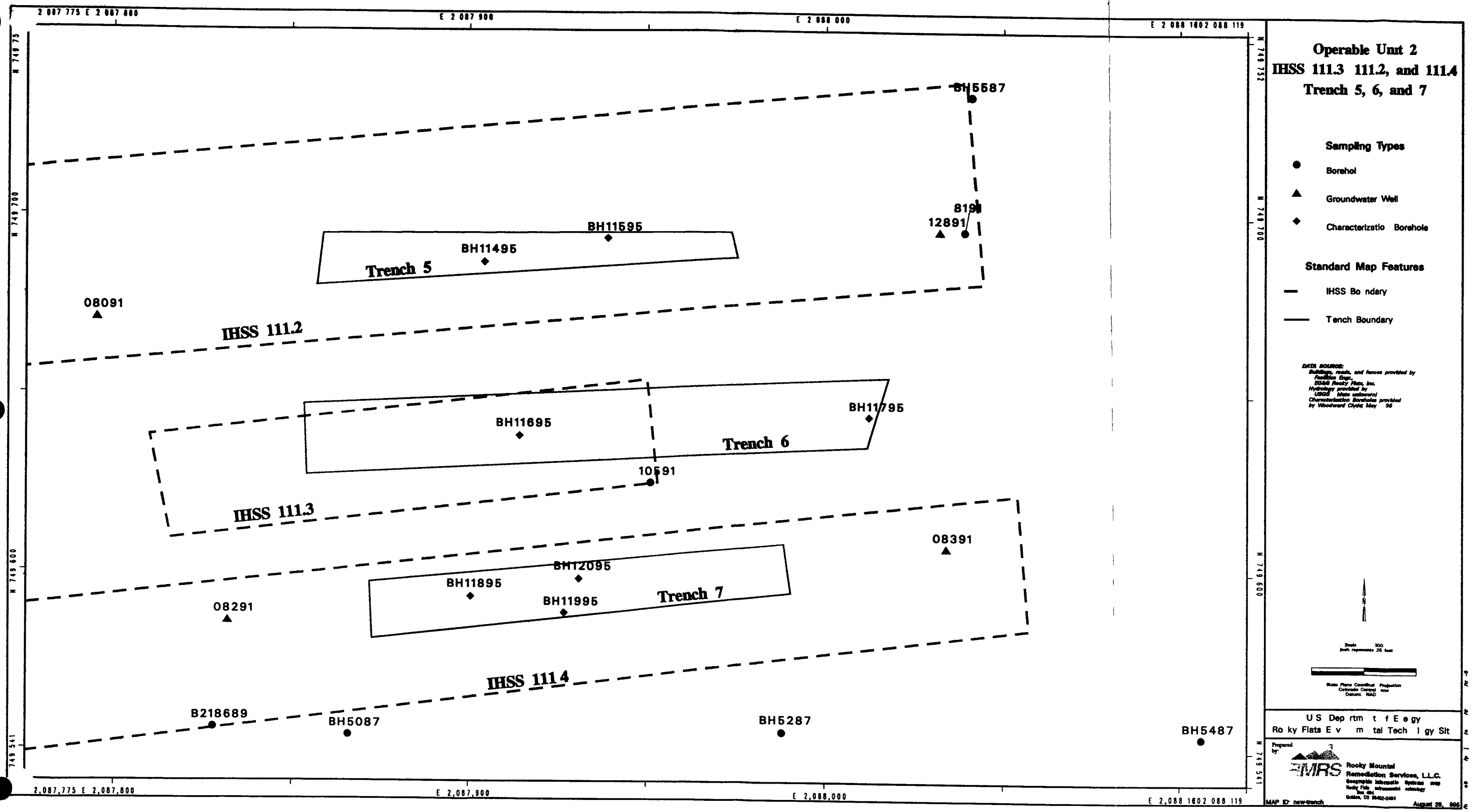
U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: sg-trench7

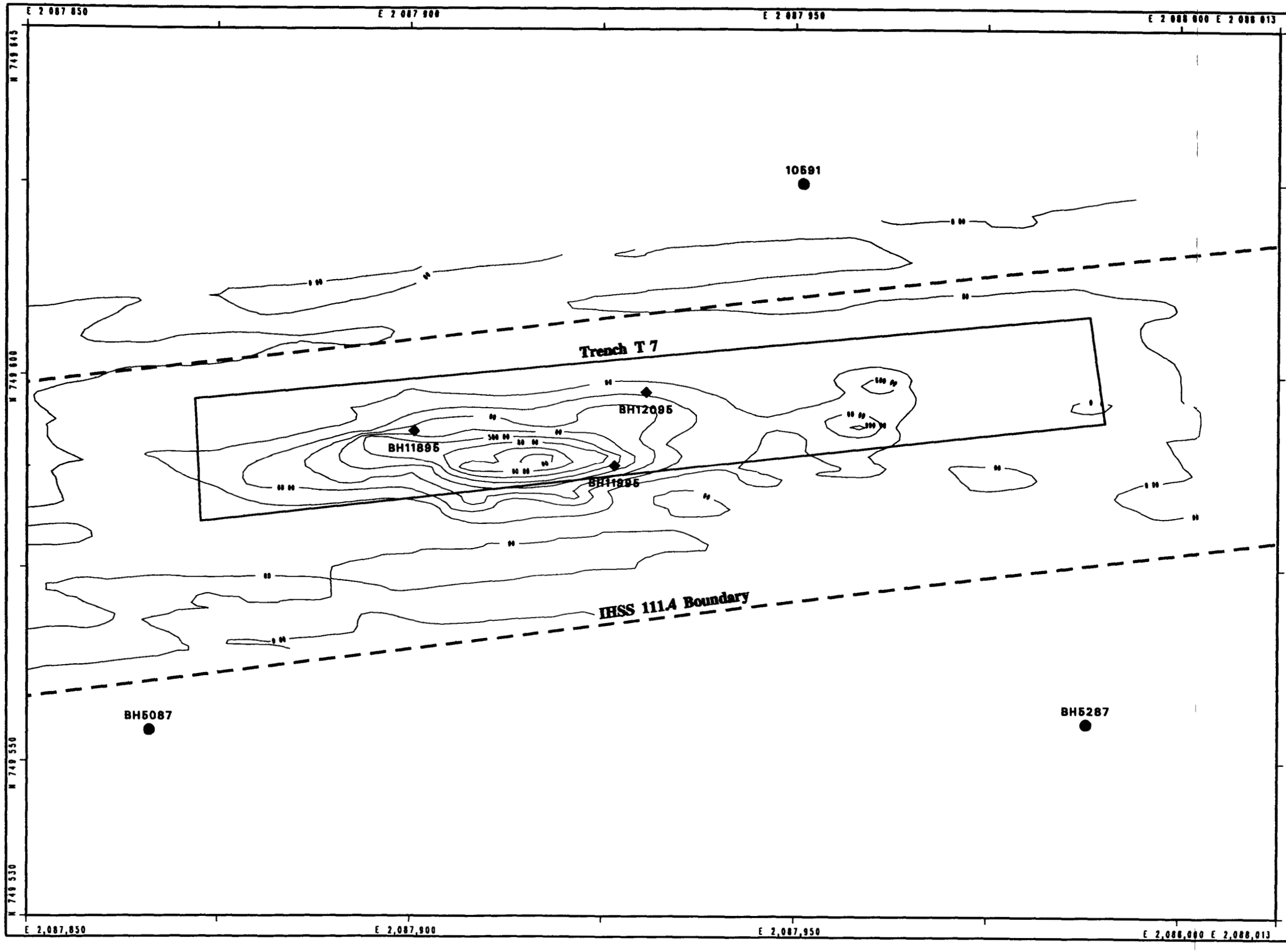
November 15, 1995

282



Operable Unit 2
IHSS 111.3 111.2, and 111.4
Trench 5, 6, and 7
Sampling Types
Borehol
Groundwater Well
Characterizatio Borehole
Standard Map Features
IHSS Bo ndary
Tench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc.
Hydrology provided by USGS (Mate unknown)
Characterization Boreholes provided by Woodward Clyde; May 95
Scale 200
Inch represents 25 feet
State Plane Coordinat Projection
Colorado Central one
Datum: NAD
U S Dep rtm t f E e gy
Ro ky Flats E v m tal Tech l gy Slt
Prepared by:
RMRS
Rocky Mountai Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology
Box 464
Golden, CO 80402-0464
MAP ID: new-trench
August 28, 995
2 087 775 E 2 087 800
E 2 087 900
E 2 088 000
E 2 088 1602 088 119
N 749 75
N 749 700
N 749 600
N 749 541
BH5587
8191
12891
BH11595
BH11495
Trench 5
08091
IHSS 111.2
BH11695
BH11795
Trench 6
10591
IHSS 111.3
08391
BH12095
BH11895
BH11995
Trench 7
08291
IHSS 111.4
B218689
BH5087
BH5287
BH5487

283



Operable Unit 2
IHSS 111.4 Trench T 7

Electromagnetic Contour Map
EM-61 Data
Channel 2 Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Channel 2 Response Isopleth Contour Interval = 300 mv
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde, June, 1995.
Characterization Boreholes provided by Woodward Clyde, May 1995.

Scale 50
Inch represents approximately 33 feet

5 0 10ft

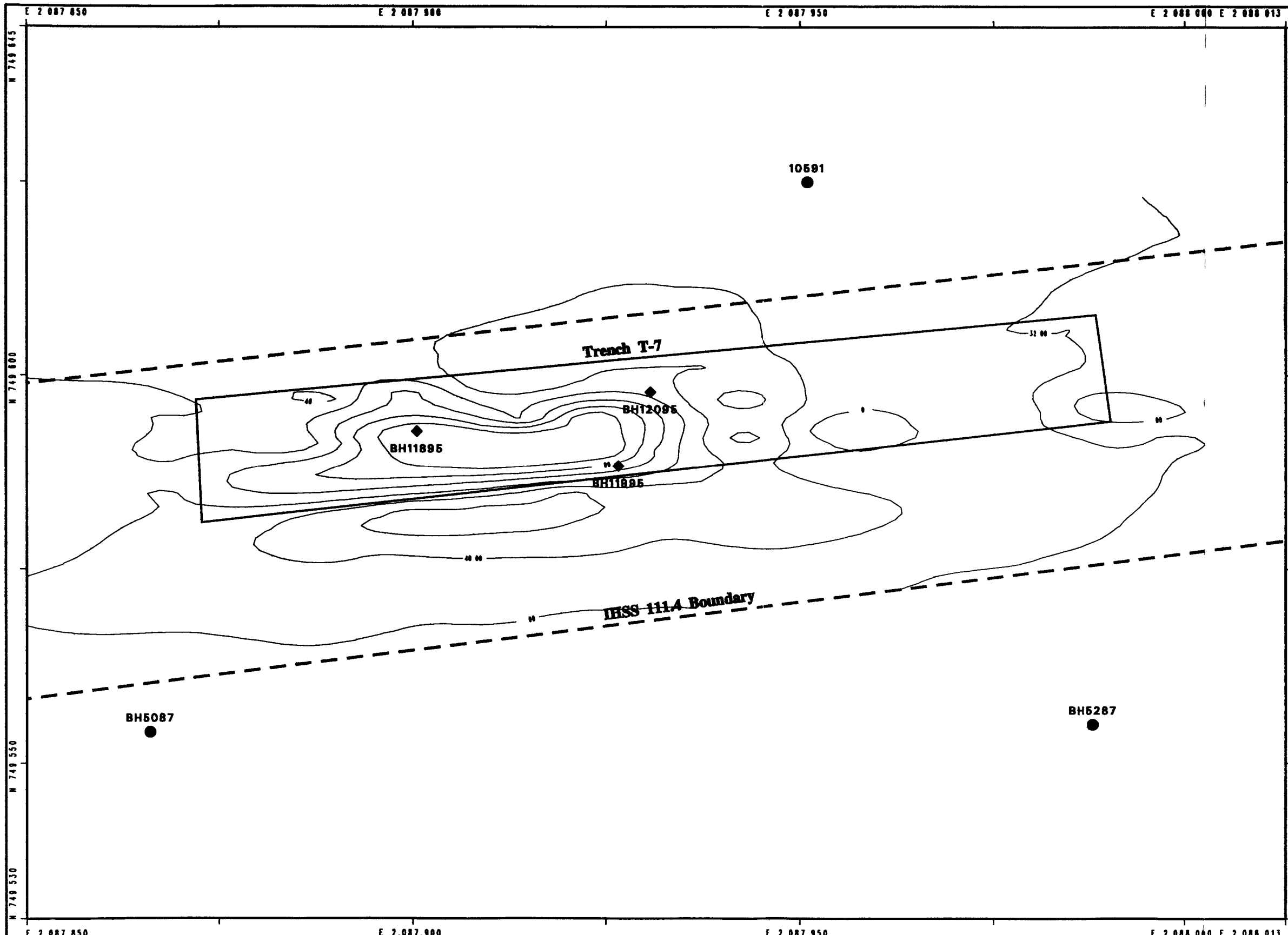
State Plane Coordinate Projection
Colorado Centr Zone
Datum NAD27

U S Departm nt of Ene gy
Rocky Flats Envi onmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Box 464
Golden, CO 80402-0464

MAP ID: new-trench
September 05, 1995

482



Operable Unit 2
IHSS 111.4 Trench T 7

Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Quadrature Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Quadrature Response Isopleth Contour Interval = 8 mmhos/meter
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

Scale 60
Inch represents approximately 3.33 feet

5 0 10ft

State Plane Coordinate Projection
Colorado Central Zone
Datum NAD27

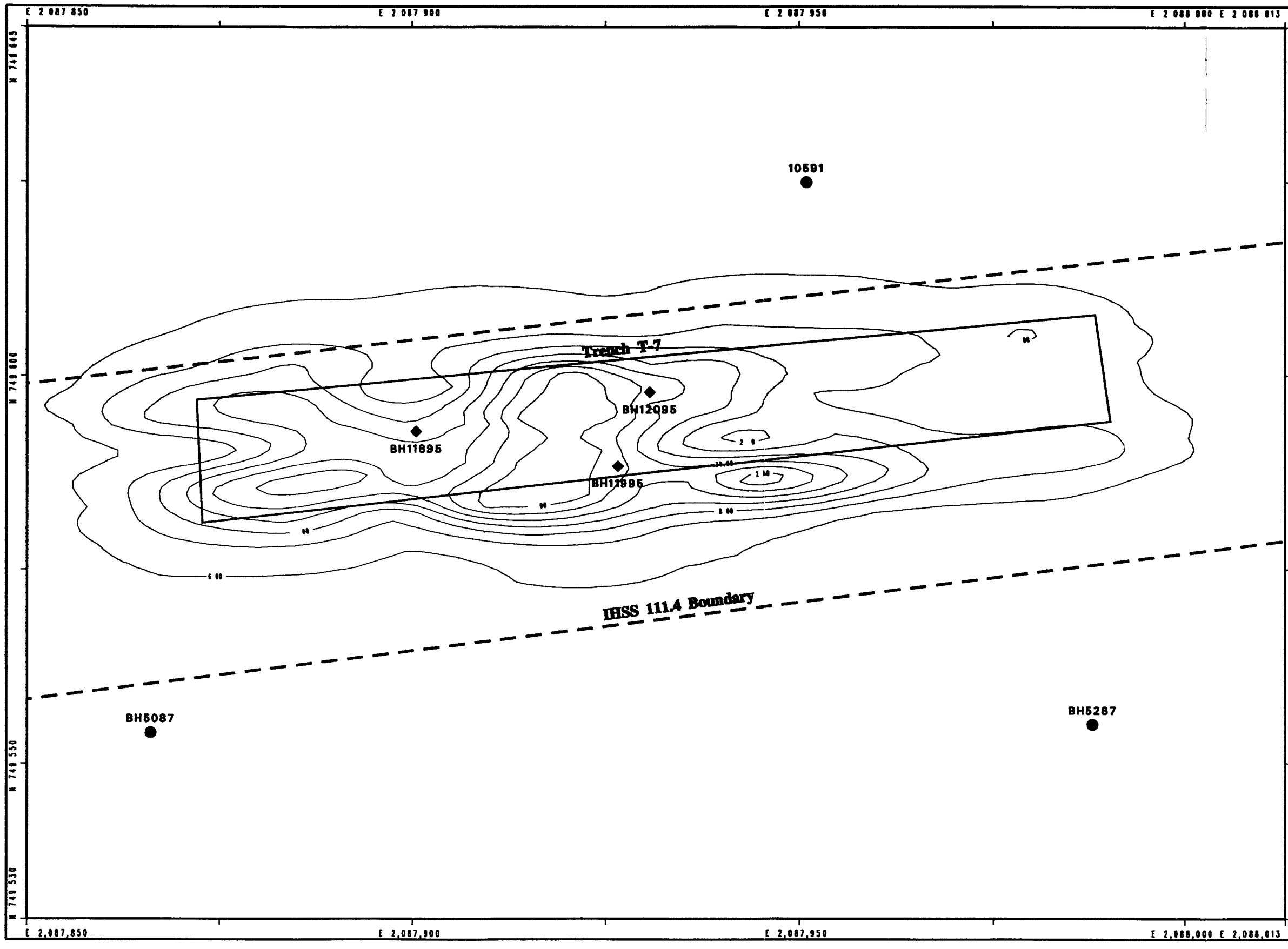
U S Department of Ene gy
Rocky Flats Environmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Box 464
Golden, CO 80402-0464

MAP ID: new-trench

September 05, 1995

282



Operable Unit 2
IHSS 111.4 Trench T 7

Electromagnetic Contour Map
EM 31 Data
Horizontal Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 6 parts/thousand
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 995.

Scale 60
Inch represents approximately 33 feet

5 0 10ft

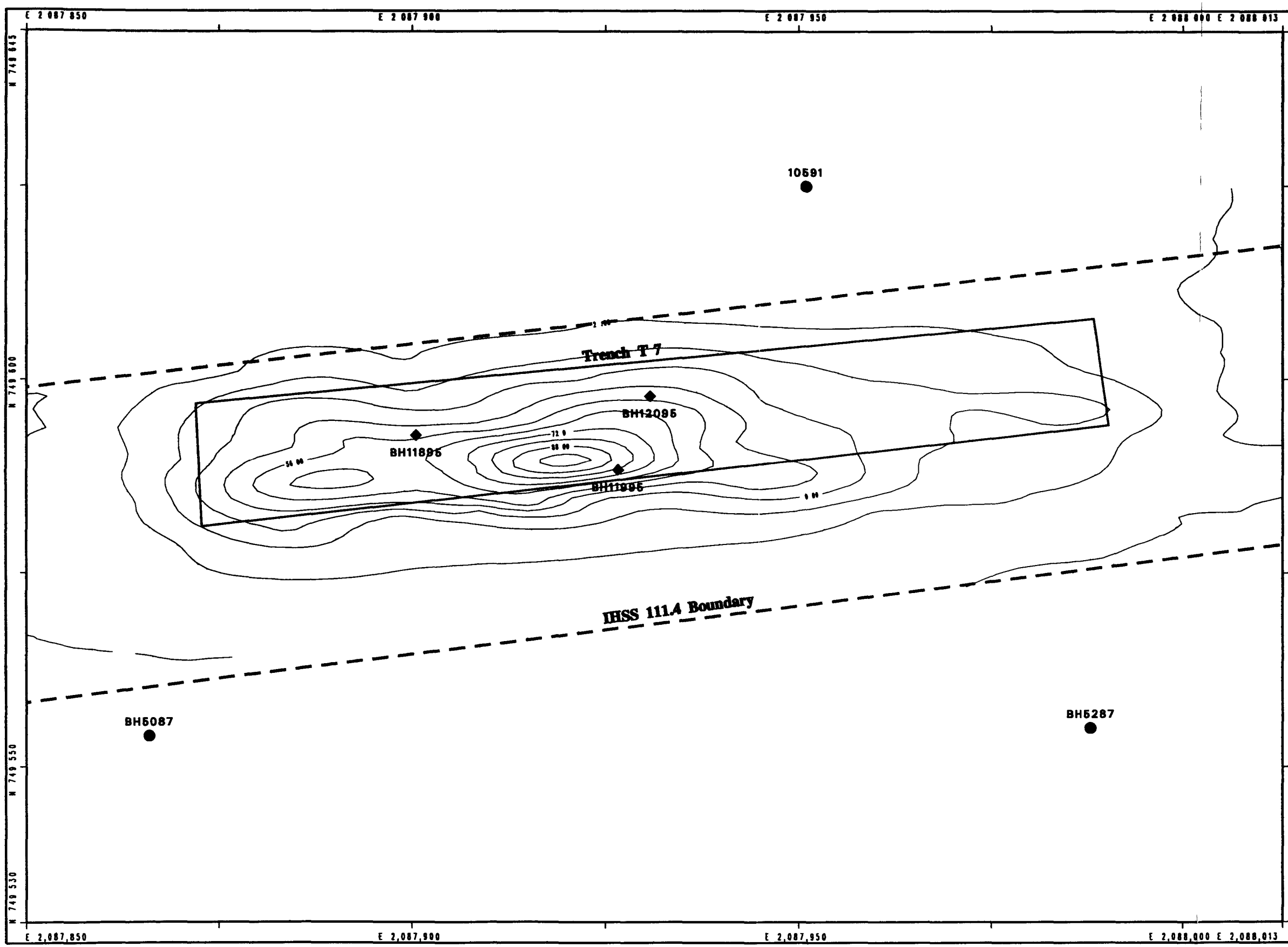
State Plane Coordinate Projection
Colorado Centr Zone
Datum NAD27

U S Departm t of En rgy
Rocky Flats Envi onmental Technology Sit

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Box 464
Golden, CO 80402-0464

MAP ID: nwe-trench
September 05, 995

290



Operable Unit 2
IHSS 111.4 - Trench T 7

Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Quadrature Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Quadrature Response Isopleth Contour Interval = 8 mmhos/meter
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Eng., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward Clyde May 995.

Scale 60
Inch represents approximately 33 feet

5 0 10ft

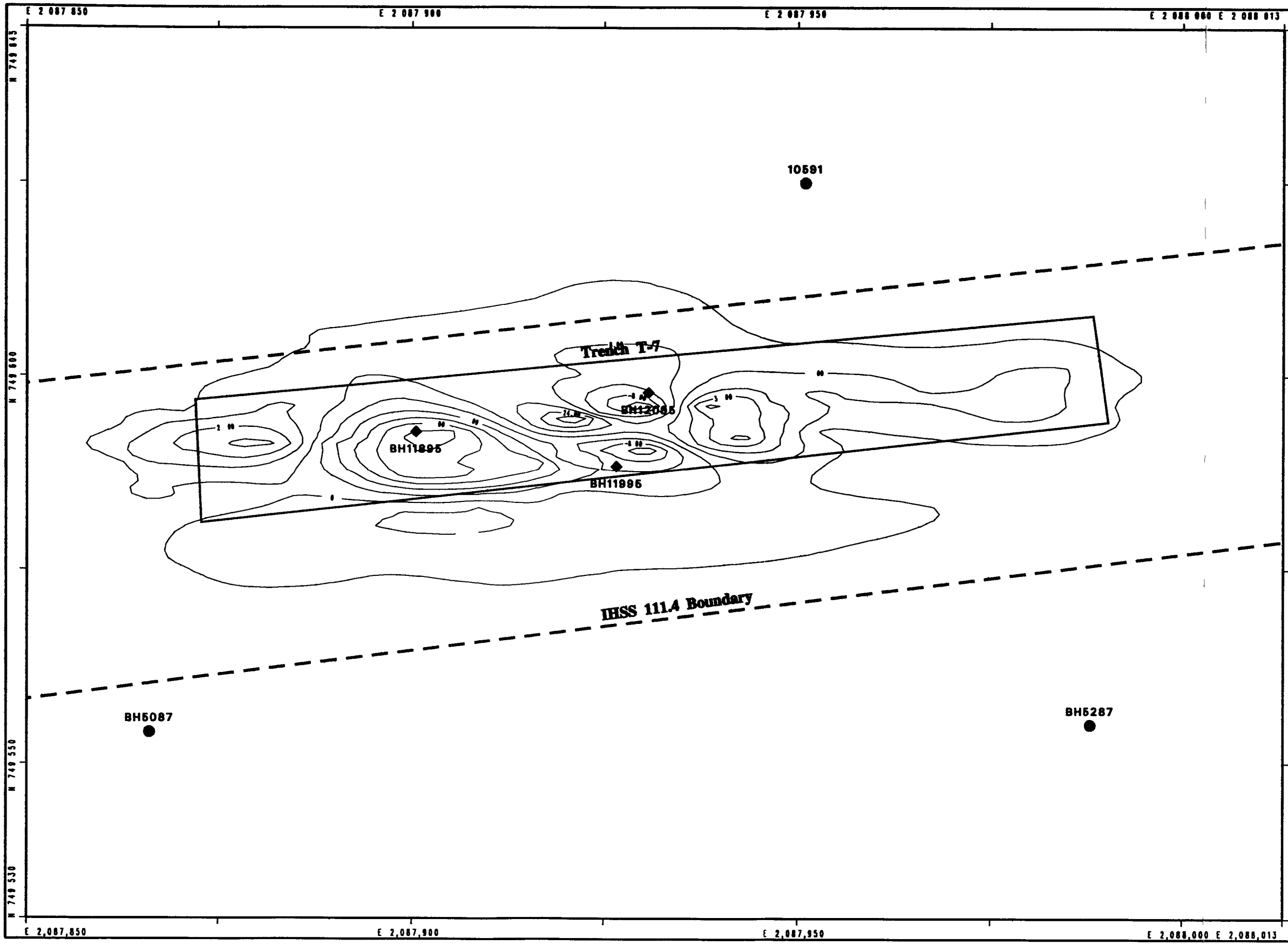
State Plane Coordinate Projection
Colorado Central Zone
Datum NAD27

U S Departme t of Ene gy
Rocky Flats Environmental Technology Site

Prepared by
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Golden, CO 80402-0464

MAP ID: new-trench
September 05, 995

192



Operable Unit 2
IHSS 111.4 Trench T 7

Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 8 parts/thousand
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

N

Scale 60
Inch represents approximately 3 33 feet

5 0 10ft

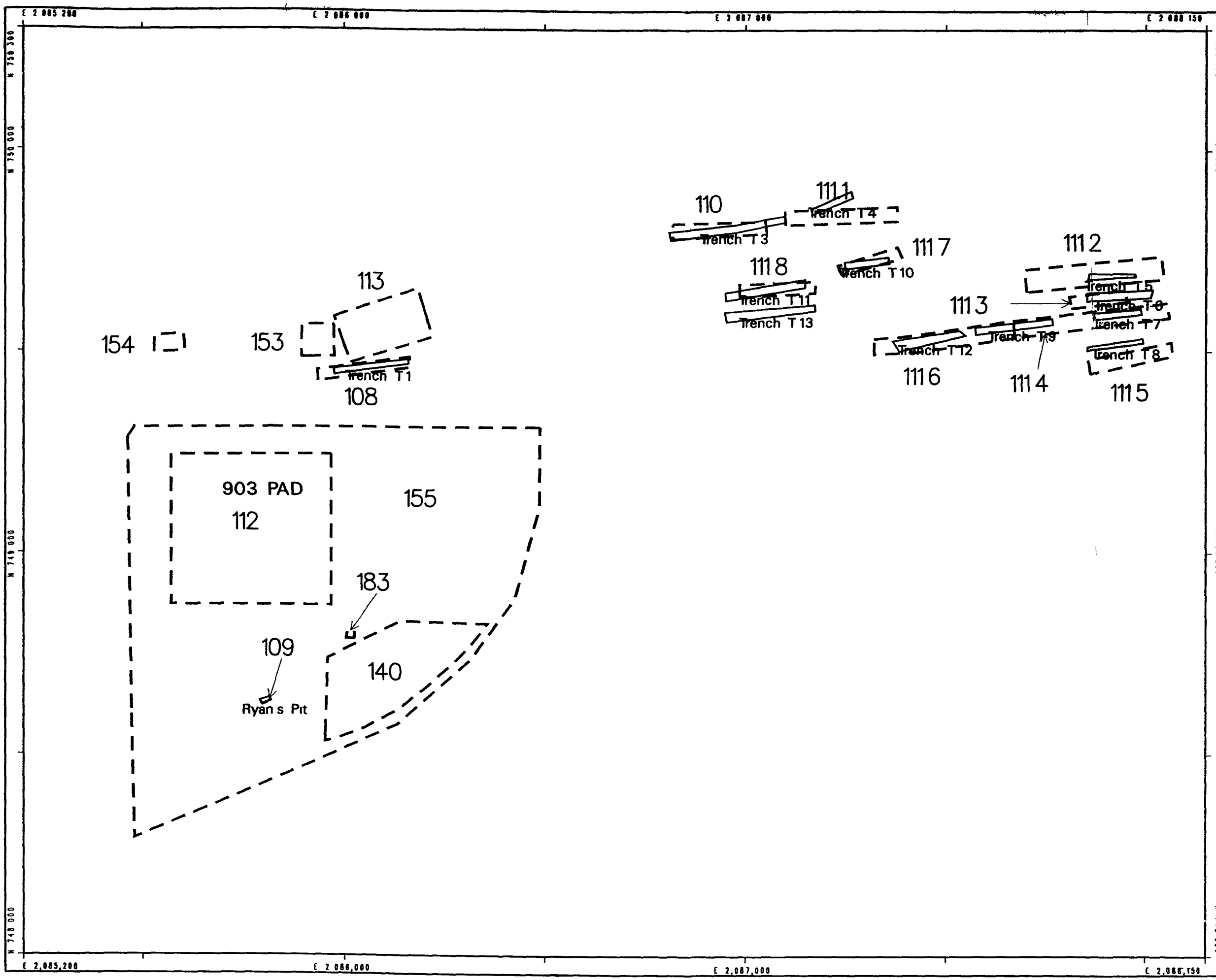
State Plane Coordinate Projection
Colorado Centr Zone
Datum NAD27

U S Departm nt of En gy
Rocky Flats Environmental Tech ology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental ology Site
Box 464
Golden, CO 80402-0464

MAP ID: new-trench
September 05, 995

242



Operable Unit 2

EXPLANATION

IHSS Boundary

Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 93
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde, May 1995

Figure 3 7 1

Scale 2800
Inc presents approximately 233.33 fee

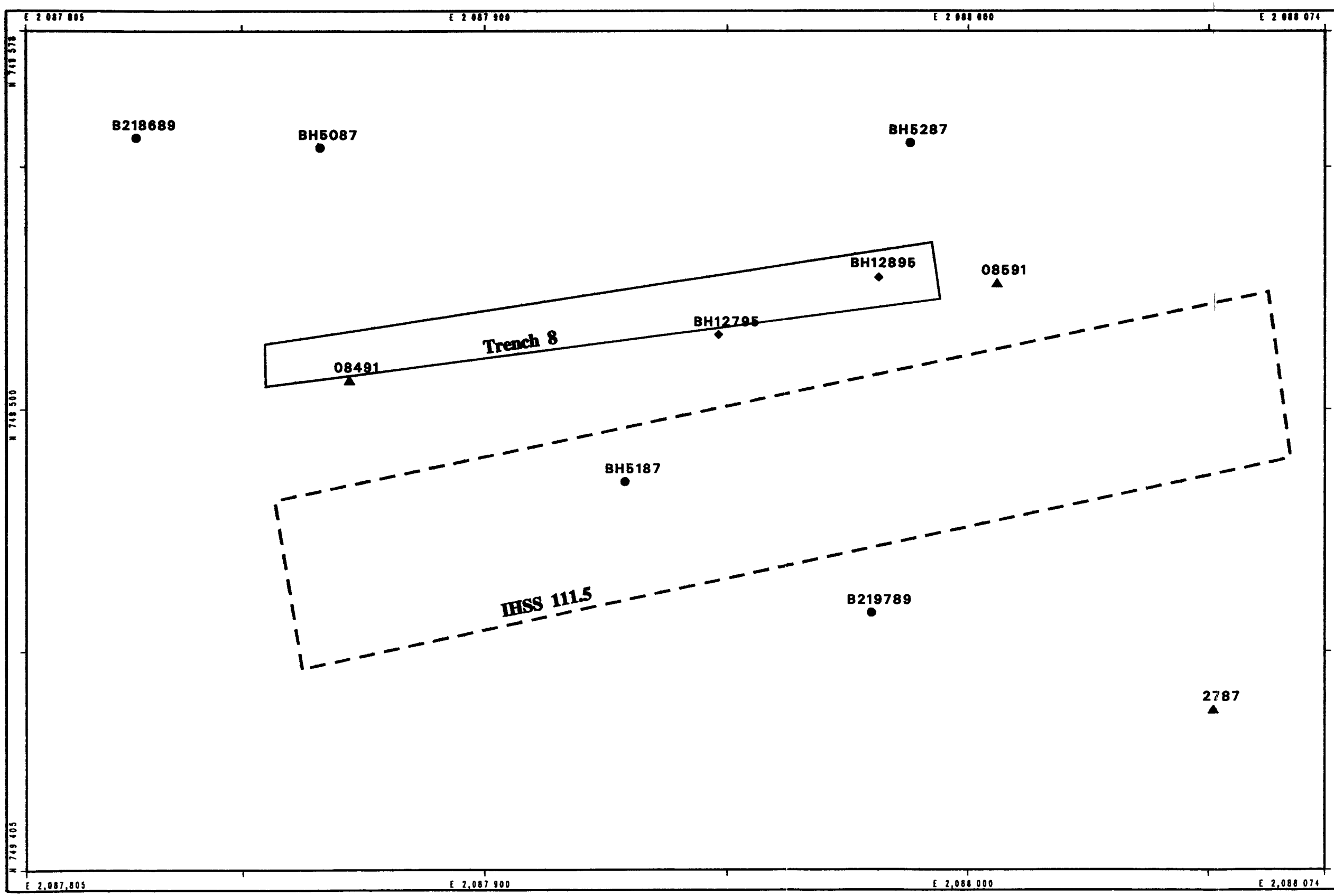
State Plane Coordinate Projectio
Colorado Central one
Datum: NAD

U S Departm t of E gy
Rocky Flats E vi m t l T h ology S te

Prepared by:
RMRS Rocky Mountai Remediatio Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental echnology Site
P.O. box 464
Golden, CO 80402-0464

MAP ID: new-trench
August 28, 995

325



Operable Unit 2
IHSS 111.5 Trench 8

Sampling Types

- Borehole
- Groundwate Well
- Characterization Borehole

Standard Map Features

- IHSS Bo ndary
- Trench Bo nd ry

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Div., EG&G Realty Files, Inc. 199
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde May 1995.

Scale 250
Inch represents approximately 20. feet

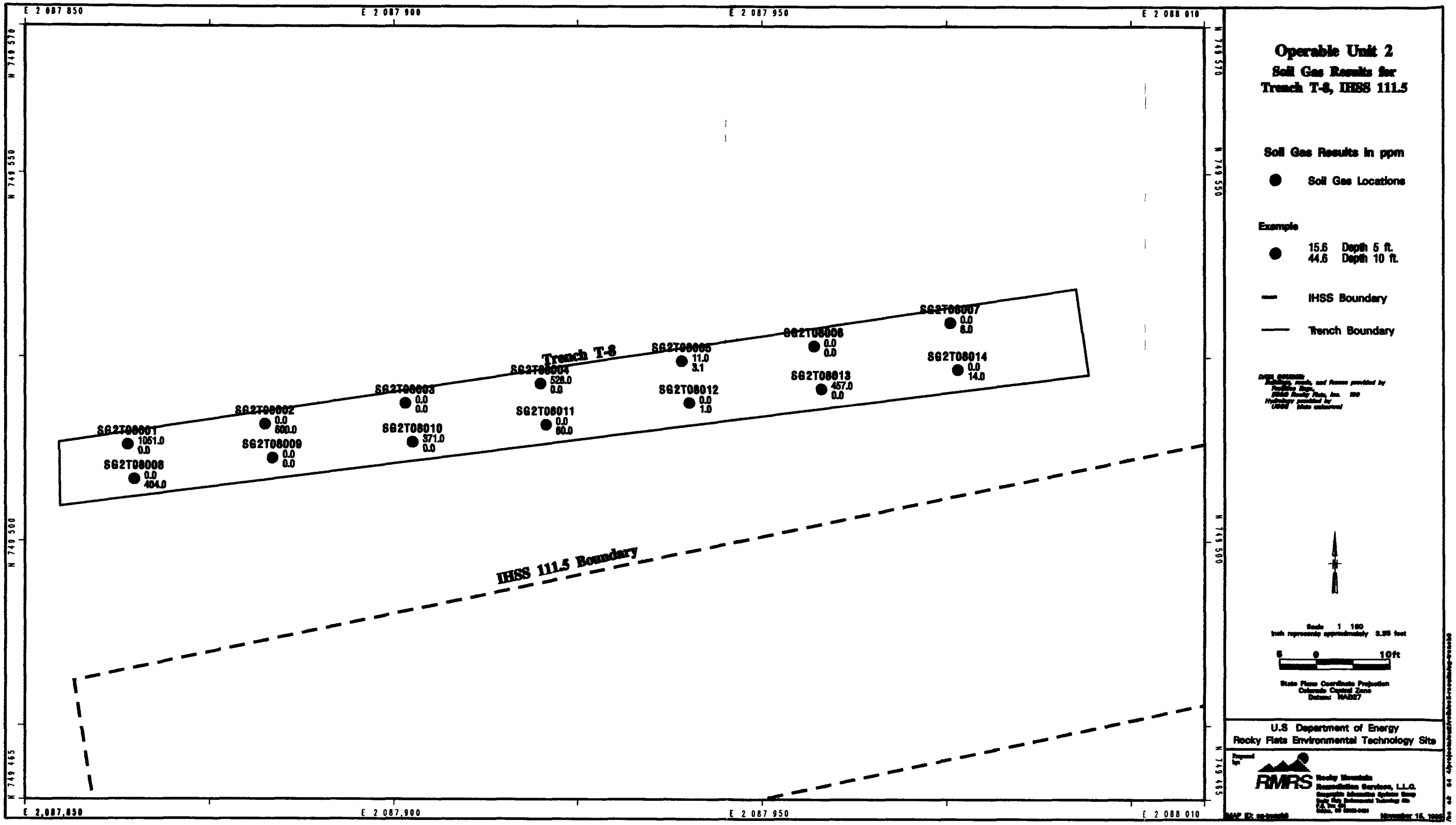
State Plane Coordinate Projection
Colorado Central zone
Datum: NAD27

U S Department of En gy
Rocky Flats E vi onm tal Tech ology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems map
Rocky Flats Environmental Technology Site
Box 464
Golden, CO 80402-0464

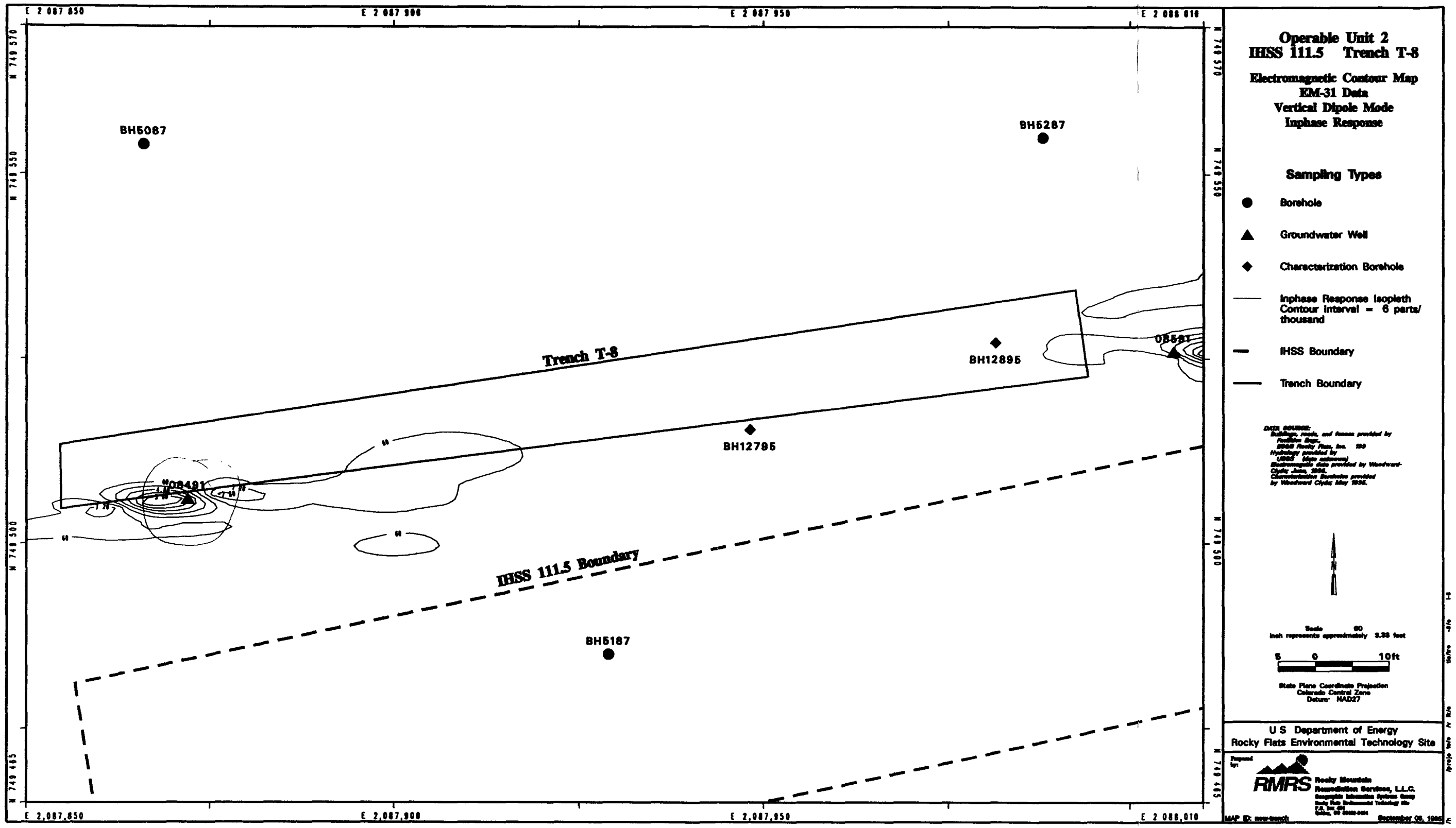
MAP ID: new-trench
August 28, 996

331

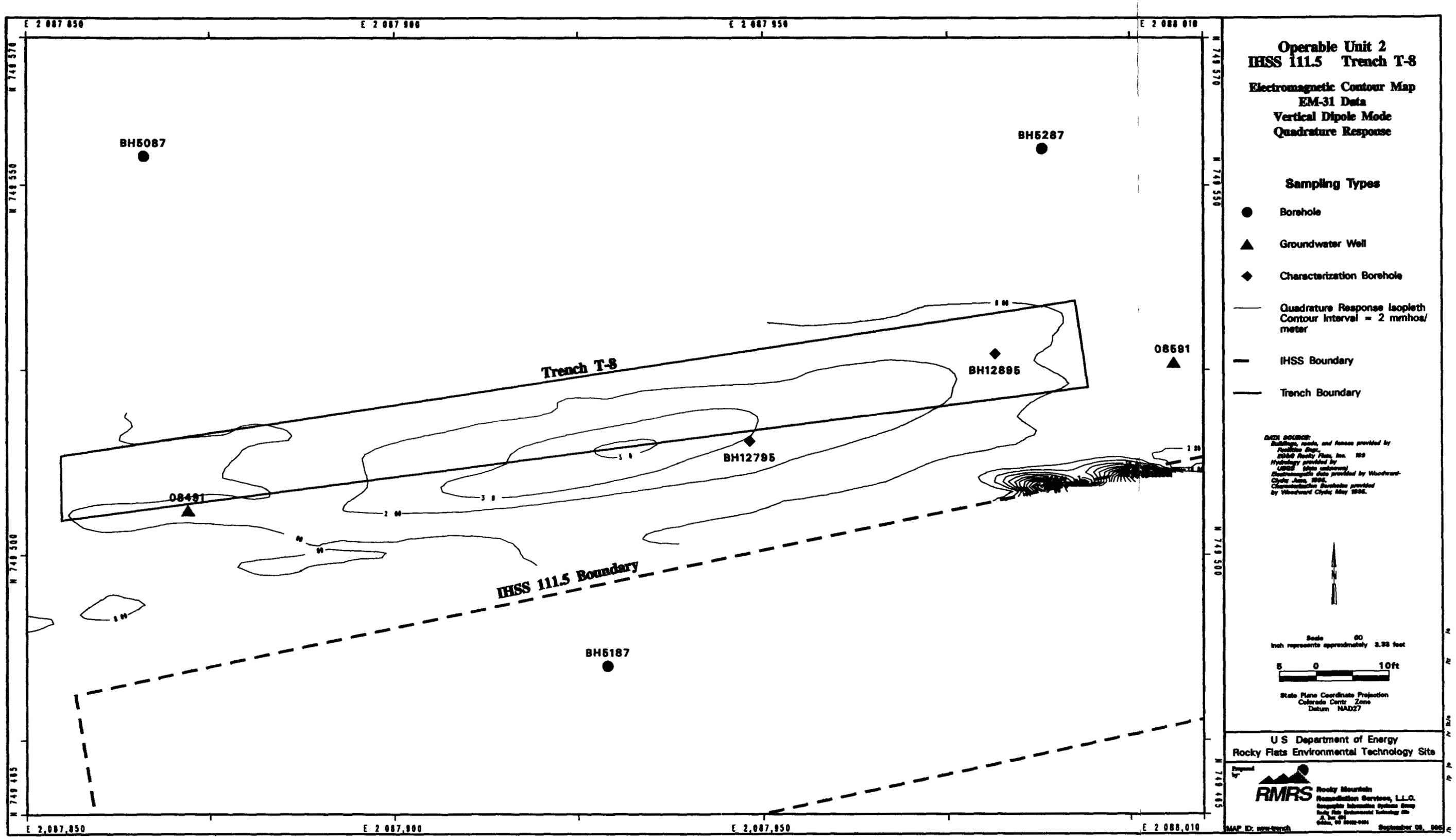


Operable Unit 2
Soil Gas Results for
Trench T-8, IHSS 111.5
Soil Gas Results in ppm
Soil Gas Locations
Example
15.6 Depth 5 ft.
44.6 Depth 10 ft.
IHSS Boundary
Trench Boundary
Trench T-8
IHSS 111.5 Boundary
SG2T08001 1051.0 0.0
SG2T08008 0.0 404.0
SG2T08002 0.0 600.0
SG2T08009 0.0 0.0
SG2T08003 0.0 0.0
SG2T08010 371.0 0.0
SG2T08004 528.0 0.0
SG2T08011 0.0 60.0
SG2T08005 11.0 3.1
SG2T08012 0.0 1.0
SG2T08006 0.0 0.0
SG2T08013 457.0 0.0
SG2T08007 0.0 6.0
SG2T08014 0.0 14.0
E 2 087 850
E 2 087 900
E 2 087 950
E 2 088 010
N 749 570
N 749 550
N 749 500
N 749 465
Scale 1 : 160
Inch represents approximately 3.33 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U.S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
November 15, 1995

330

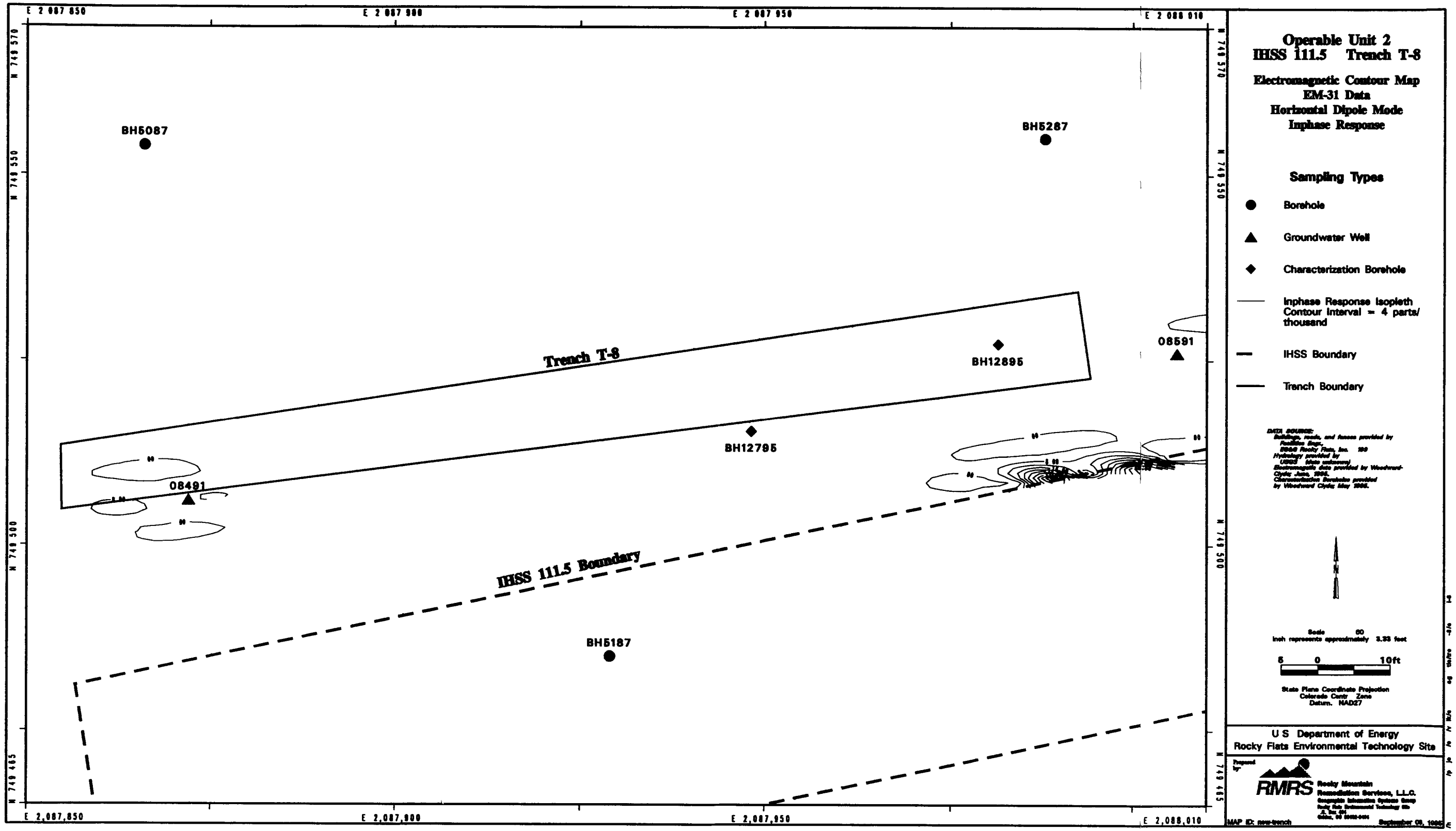

Operable Unit 2
IHSS 111.5 Trench T-8
Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Inphase Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Inphase Response Isopleth Contour Interval = 6 parts/thousand
IHSS Boundary
Trench Boundary
Scale 60 inch represents approximately 3.33 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.
Trench T-8
IHSS 111.5 Boundary
BH5087
BH5287
BH12895
BH12795
BH5187
08491
08591
E 2,087,850
E 2,087,900
E 2,087,950
E 2,088,010
N 749 570
N 749 550
N 749 500
N 749 465

336

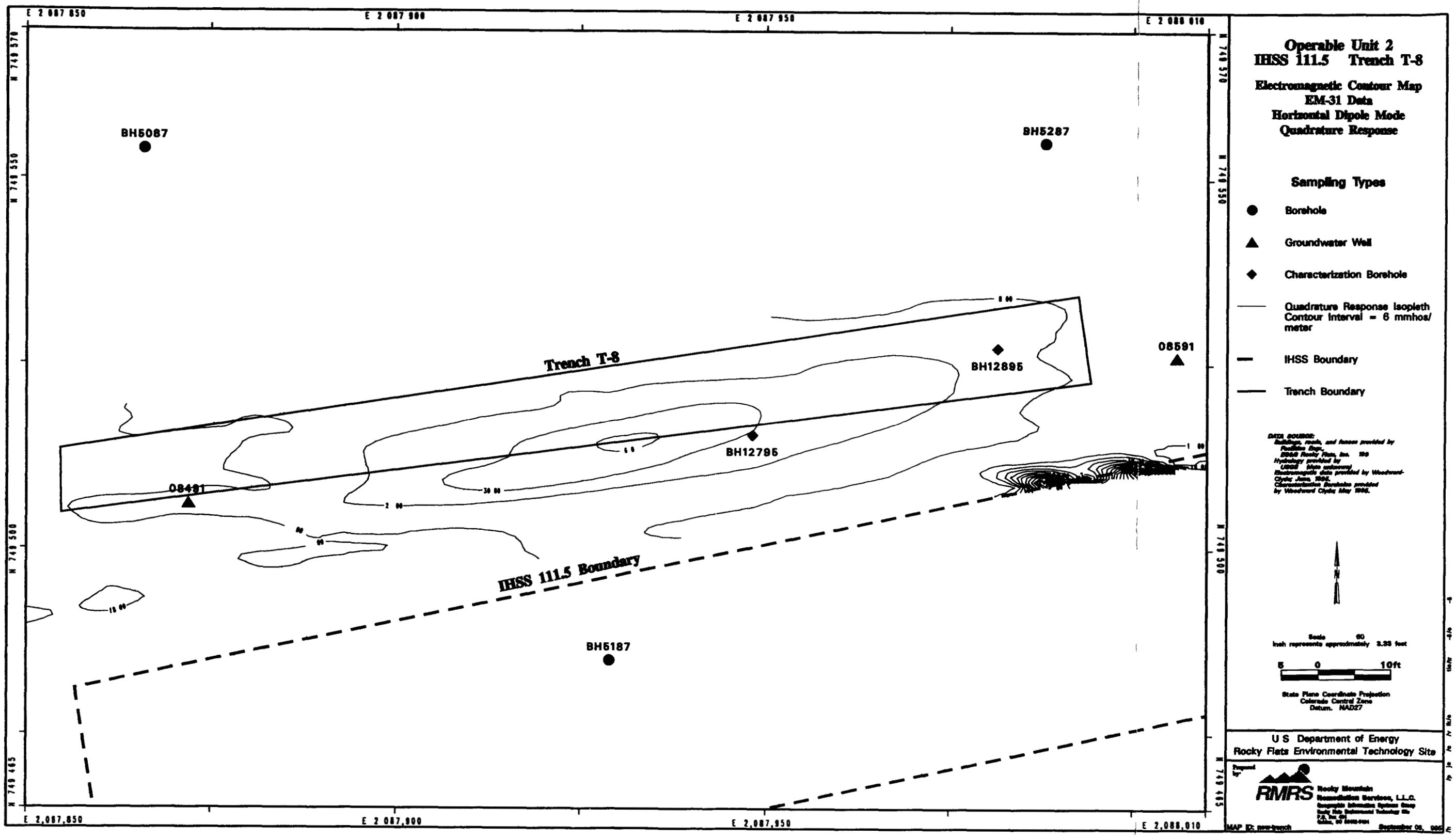


Operable Unit 2
IHSS 111.5 Trench T-8
Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth Contour Interval = 2 mmhos/meter
IHSS Boundary
Trench Boundary
Trench T-8
IHSS 111.5 Boundary
BH5087
BH5287
BH12895
BH12795
BH5187
08591
08491
E 2 087 850
E 2 087 900
E 2 087 950
E 2 088 010
N 749 570
N 749 550
N 749 500
N 749 465
Scale 60
Inch represents approximately 3.33 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Centr Zone
Datum NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: new-trench
September 08, 1995

337

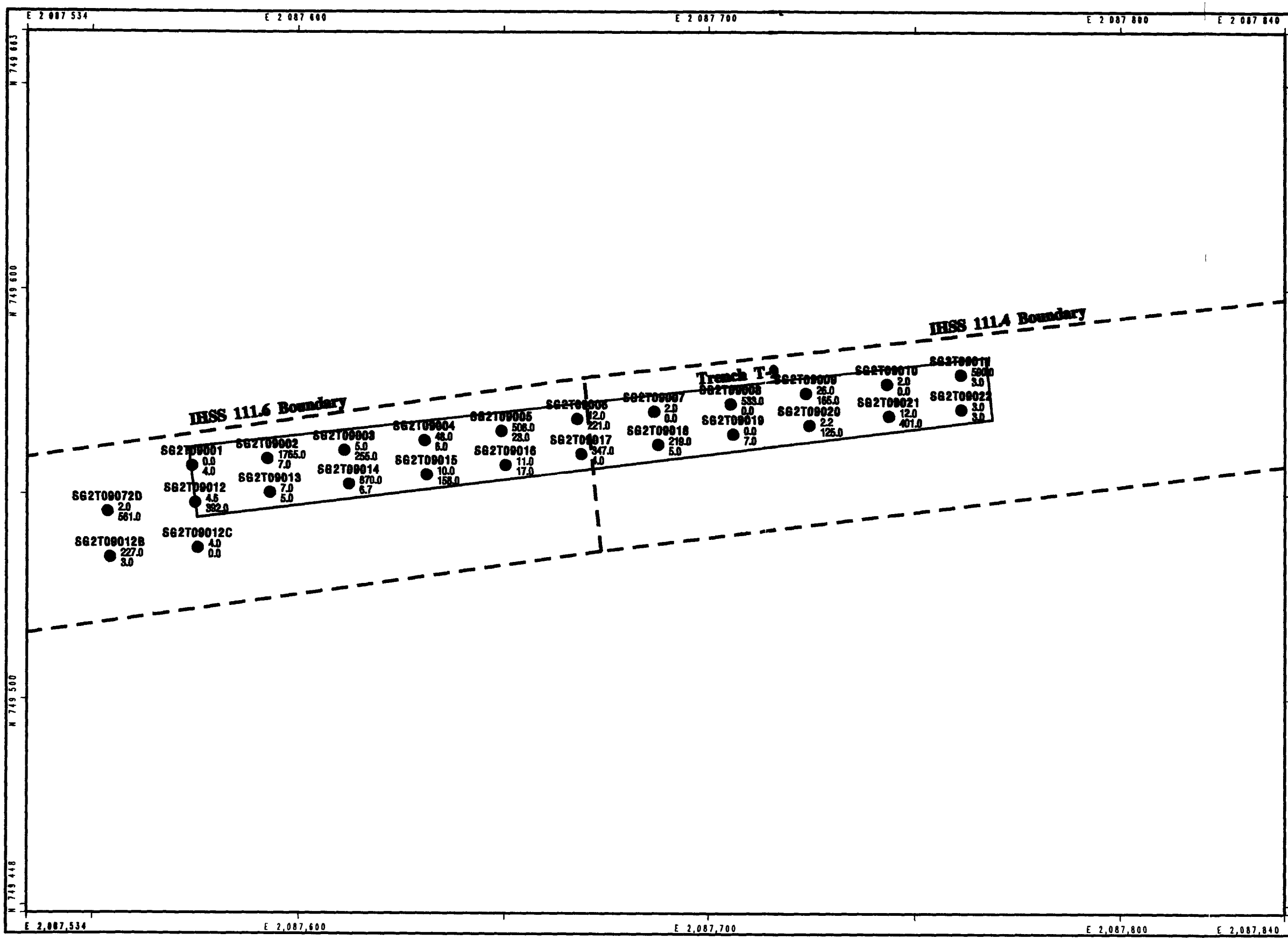

E 2 087 850
E 2 087 900
E 2 087 950
E 2 088 010
N 749 570
N 749 550
N 749 500
N 749 465
BH5087
BH5287
Trench T-8
BH12895
08591
BH12795
08491
IHSS 111.5 Boundary
BH5187
E 2,087,850
E 2,087,900
E 2,087,950
E 2,088,010
Operable Unit 2
IHSS 111.5 Trench T-8
Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Inphase Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Inphase Response Isopleth Contour Interval = 4 parts/thousand
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Radian Engr.
Hydrology provided by
Electromagnetic data provided by Woodward-Clyde June, 1994.
Characterization Boreholes provided by Woodward Clyde May 1995.
N
Scale 60 inch represents approximately 3.33 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Centr Zone
Datum. NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: new-trench
September 09, 1996

38



Operable Unit 2
IHSS 111.5 Trench T-8
Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth Contour Interval = 6 mmhos/meter
IHSS Boundary
Trench Boundary
Trench T-8
IHSS 111.5 Boundary
BH5087
BH5287
BH12895
BH12795
BH5187
08591
08491
E 2,087,850
E 2,087,900
E 2,087,950
E 2,088,010
N 749,570
N 749,550
N 749,500
N 749,465
Scale 60
Inch represents approximately 3.33 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: new-trench
September 08, 1995

339



Operable Unit 2

Soil Gas Results for IHSS 111.4, 111.6 Trench T-9

Soil Gas Results in ppm

● Soil Gas Locations

Example:

● 15 6 Depth 5 ft.
44 6 Depth 10 ft.

— IHSS Boundary

—— Trench Boundary

DATA SOURCE:
Boundary, roads, and fences provided by Rockies Geo.
RMRS Rocky Flats, Inc. 1997.
Hydrology provided by USGS (date unknown)

Scale 1 300
Inch represents 25 feet

10 0 20ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared for:

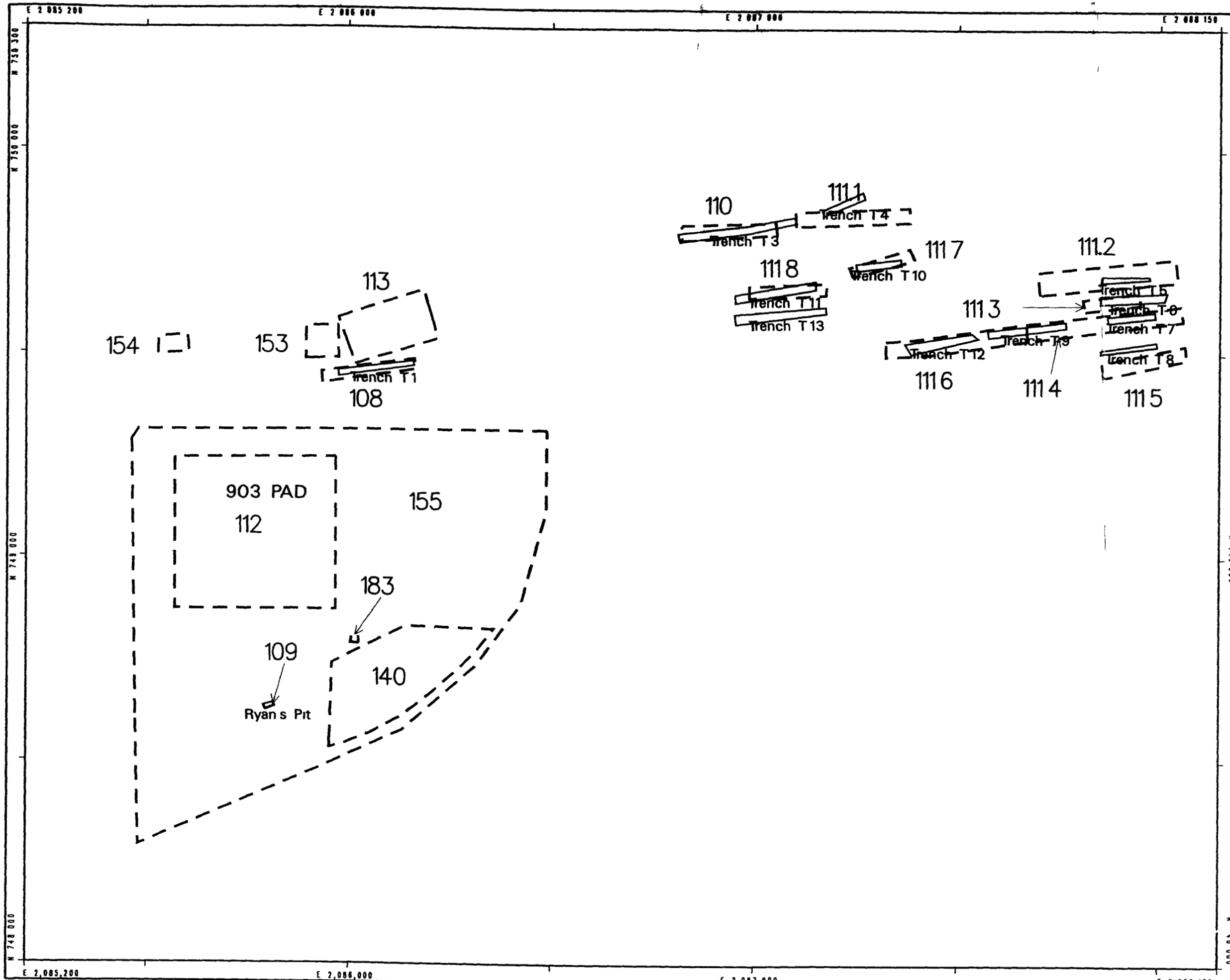
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: sc-trench9

November 16, 1998

GIS 84 /projects/ Div/Sec/investigations/trench 9

369



Operable Unit 2

EXPLANATION

IHSS Boundary

Trench Boundary

DATA SOURCE.
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 99
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 1995.

Figure 3 8-1

Scale 2800
Inc presents approximately 33.33 fee

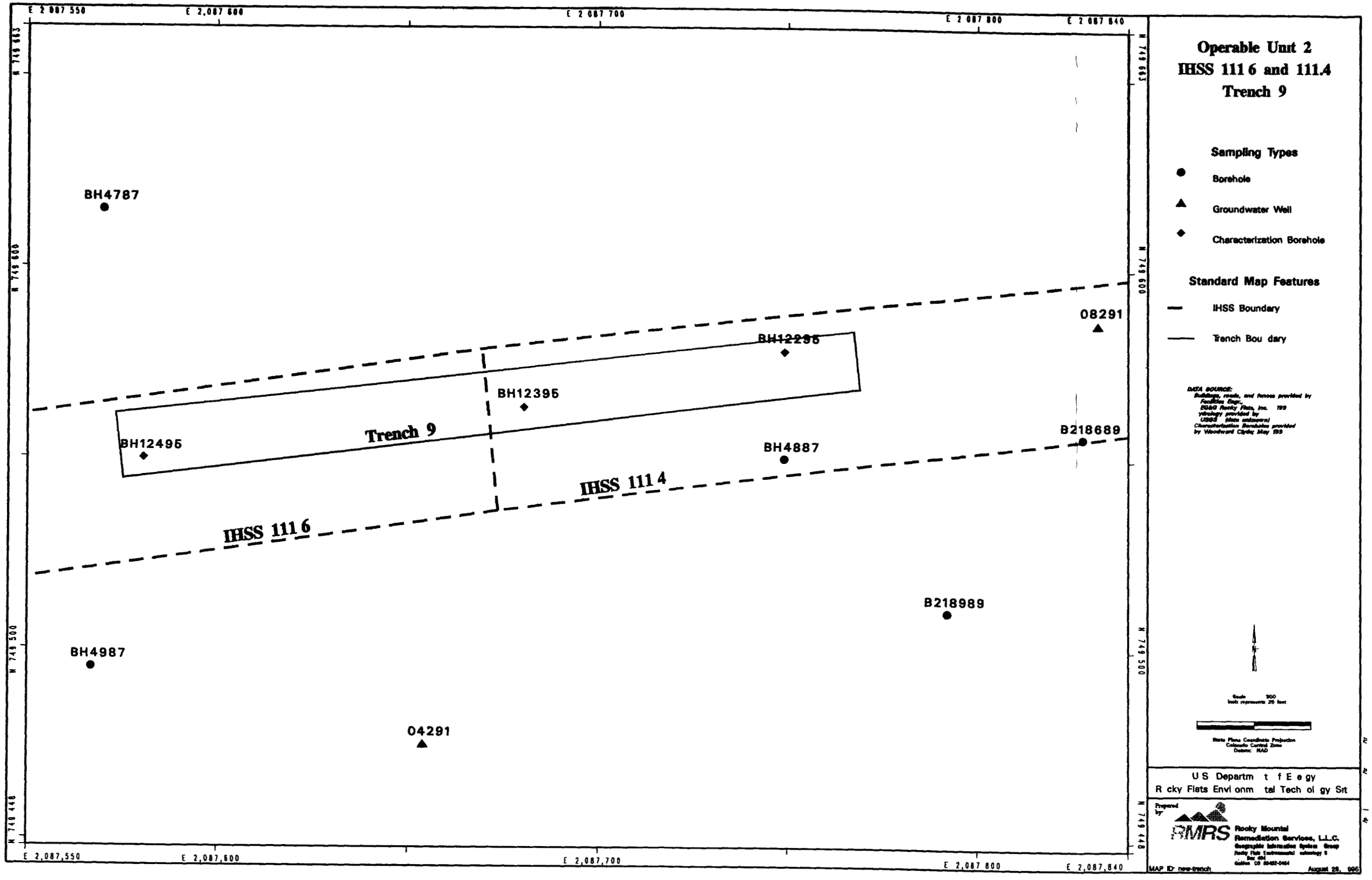
State Plane Coordina Projectio
Colorado Central one
atum NAD

U S Departm t f En gy
Rocky Flats Envi m t l Tech ol gy Sit

Prepared by
RMRS Rocky Mountai
Remediatio Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental echnology Site
Box 464
Golden, CO 80402-0464

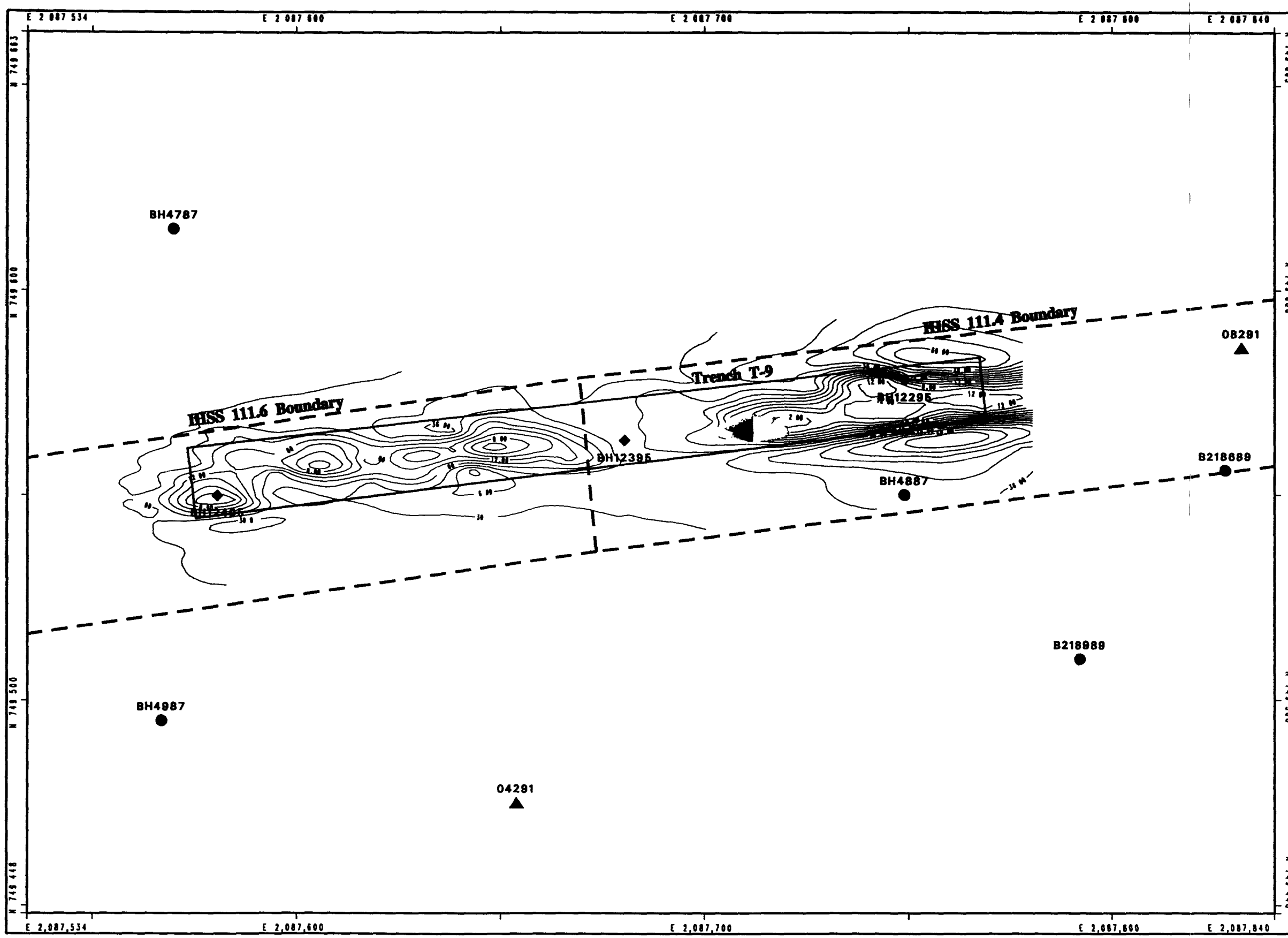
MAP ID: new-trench
August 28, 995

368



Operable Unit 2
IHSS 111 6 and 111.4
Trench 9
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Standard Map Features
IHSS Boundary
Trench Bou dary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr.,
EG&G Rocky Flats, Inc. 199
ydrology provided by
USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 199
Scale 300
Inch represents 25 feet
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD
U S Departm t f E e gy
R cky Flats Envi onm tal Tech ol gy Srt
Prepared by
RMRS
Rocky Mountai
Remediation Services, L.L.C.
Geographic Information System Group
Rocky Flats Environmental echnology S
Box 464
Golden CO 80402-0464
MAP ID: new-trench
August 28, 996
BH4787
BH12495
BH12395
BH12295
BH4887
08291
B218689
B218989
BH4987
04291
Trench 9
IHSS 111 4
IHSS 111 6
E 2 087 550
E 2,087 600
E 2 087 700
E 2 087 800
E 2 087 840
N 749 663
N 749 600
N 749 500
N 749 448

370



Operable Unit 2
IHSS 111.4, 111 6
Trench T 9

Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Quadrature Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Quadrature Response Isopleth Contour Interval = 6 mmhos/meter
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

Scale 300
inch represents 25 feet

10 0 20ft

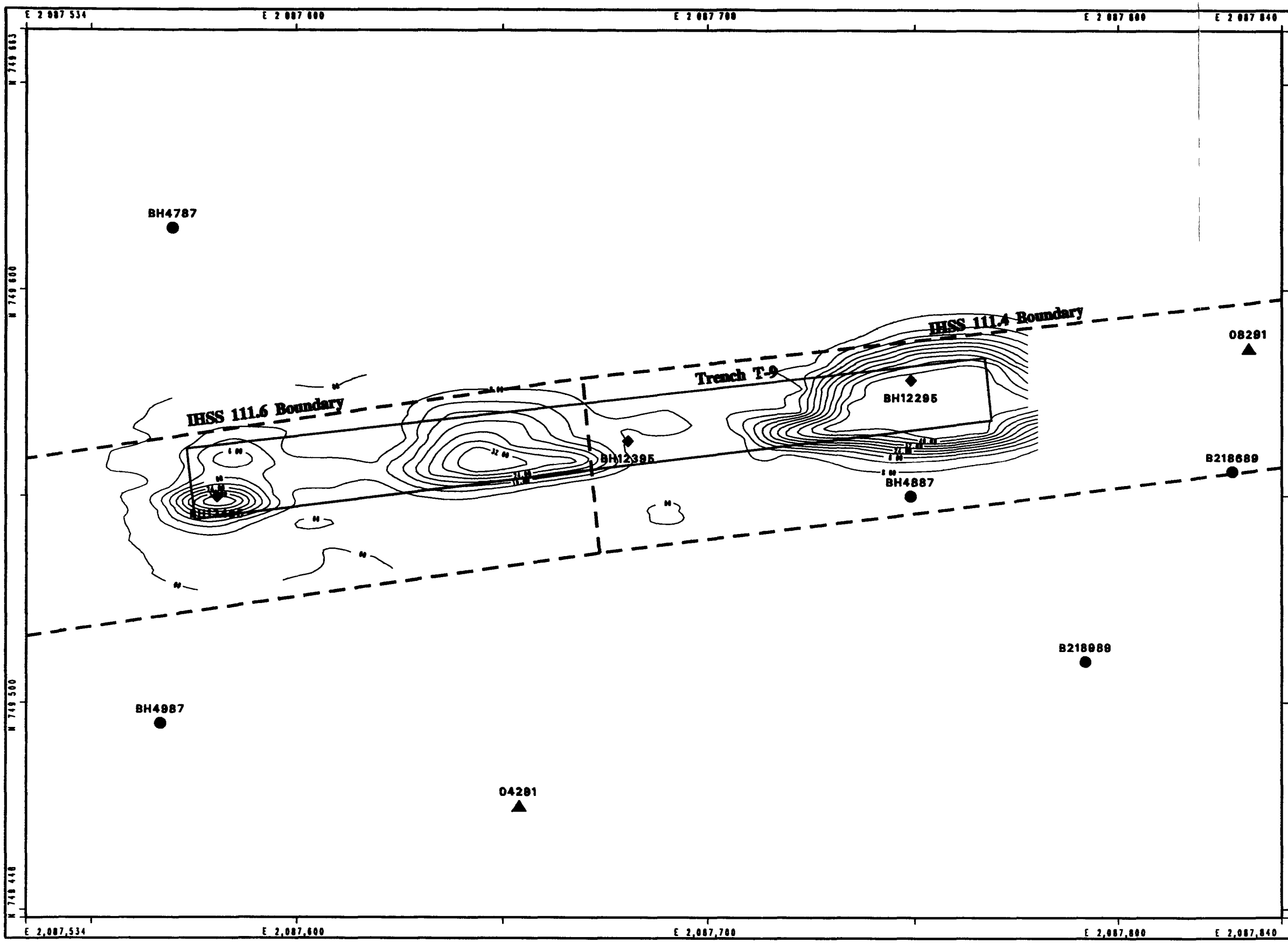
State ane Coordinate Projection
Colorado Central Zone
Datum: NAD2

U S Department of Energy
Rocky Flats Environme tal Tech ology Sit

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental ology Site
P. O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench

September 07, 995



Operable Unit 2
IHSS 111.4, 111.6
Trench T-9

Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 4 parts/thousand
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Dept. EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

Scale 300
1 inch represents 25 feet

10 0 20ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

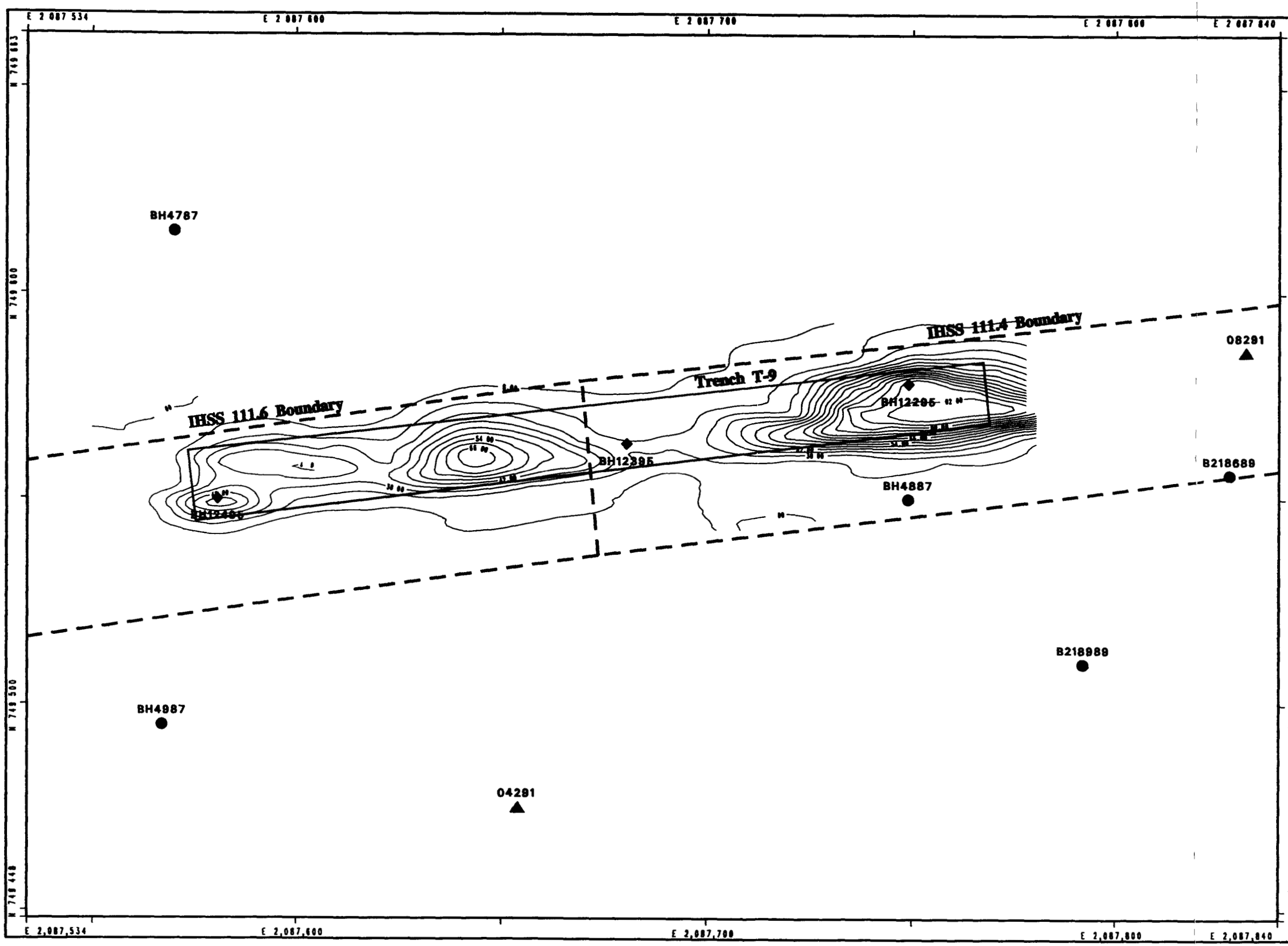
U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P. O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench

September 07, 1995

377



Operable Unit 2
IHSS 111.4, 111.6
Trench T-9

Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Quadrature Response

Sampling Types

- ● Borehole
- ▲ Groundwater Well
- ◆ Characterization Borehole
- Quadrature Response Isopleth Contour Interval = 6 mmhos/meter
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward-Clyde May 1995.

Scale 300
Inch represents 25 feet

10 0 20ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD2

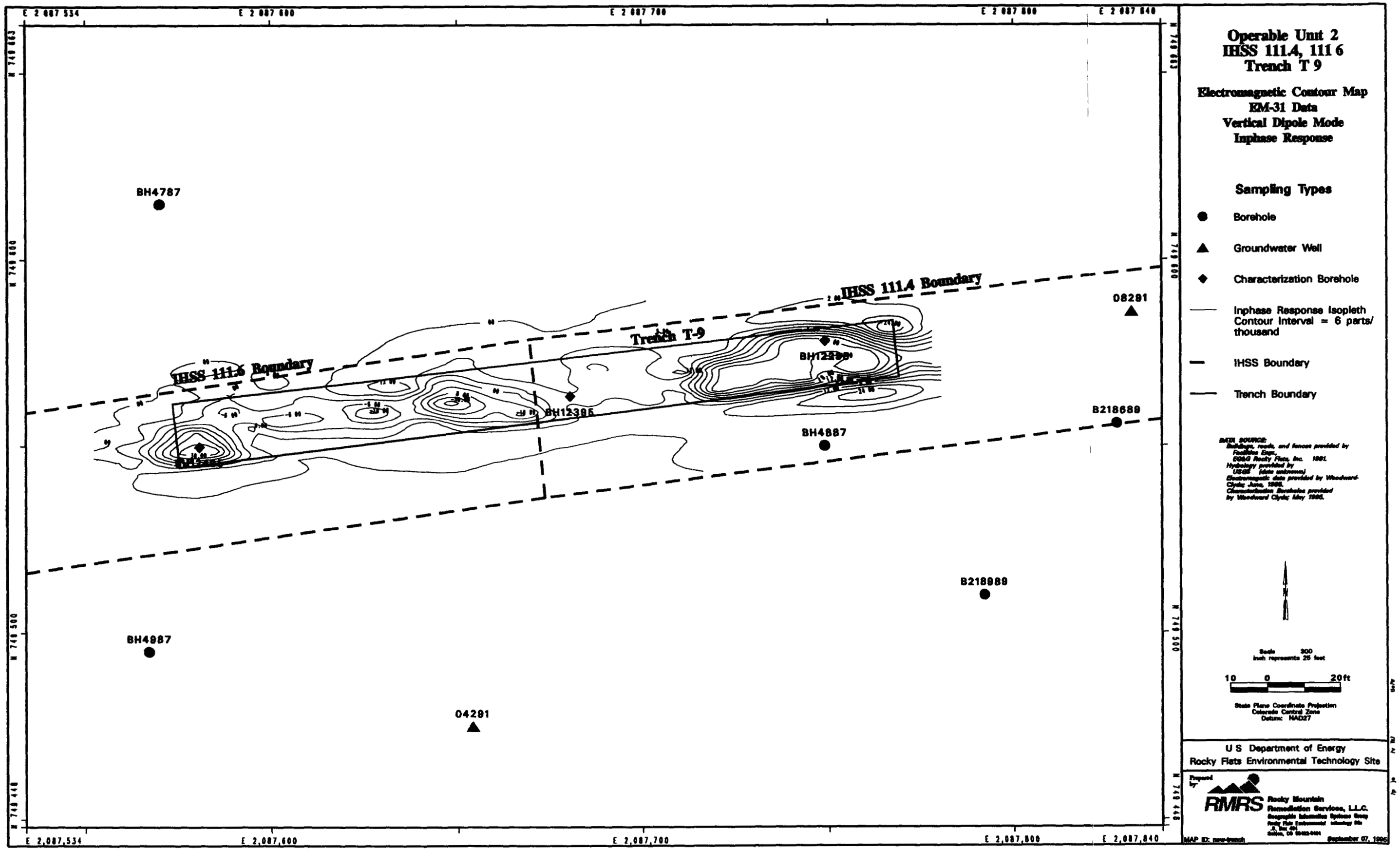
U S Department of Energy
Rocky Flats Environmental Tech ology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information System Group
Rocky Flats Environmental Technology Site
P. O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench

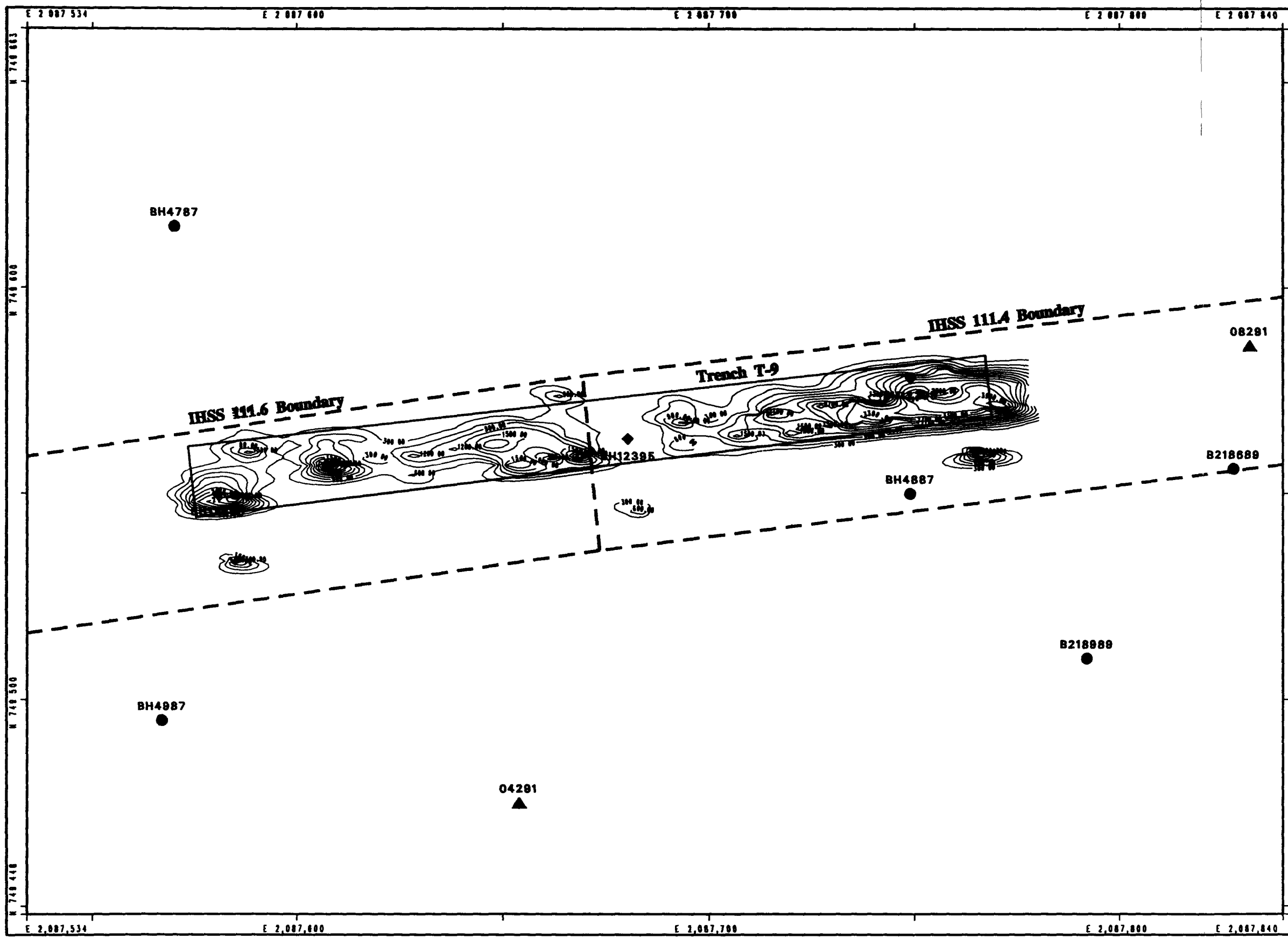
September 07, 1995

376



Operable Unit 2
IHSS 111.4, 111 6
Trench T 9
Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Inphase Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Inphase Response Isopleth Contour Interval = 6 parts/ thousand
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.
Scale 300
inch represents 25 feet
10 0 20ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: new-trench
September 07, 1995
IHSS 111.4 Boundary
IHSS 111.6 Boundary
Trench T-9
BH4787
BH4987
BH4887
BH12395
BH12396
08291
B218689
B218989
04291
E 2,087,534
E 2,087,600
E 2,087,700
E 2,087,800
E 2,087,840
N 749 663
N 749 600
N 749 500
N 749 448

378



Operable Unit 2
IHSS 111.4, 111 6
Trench T-9

Electromagnetic Contour Map
EM-61 Data
Channel 2 Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Channel 2 Response Isopleth Contour Interval = 300 mv
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr.
EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June 1995.
Characterization Boreholes provided by Woodward Clyde May 1995.

Scale 300
inch represents 25 feet

10 0 20ft

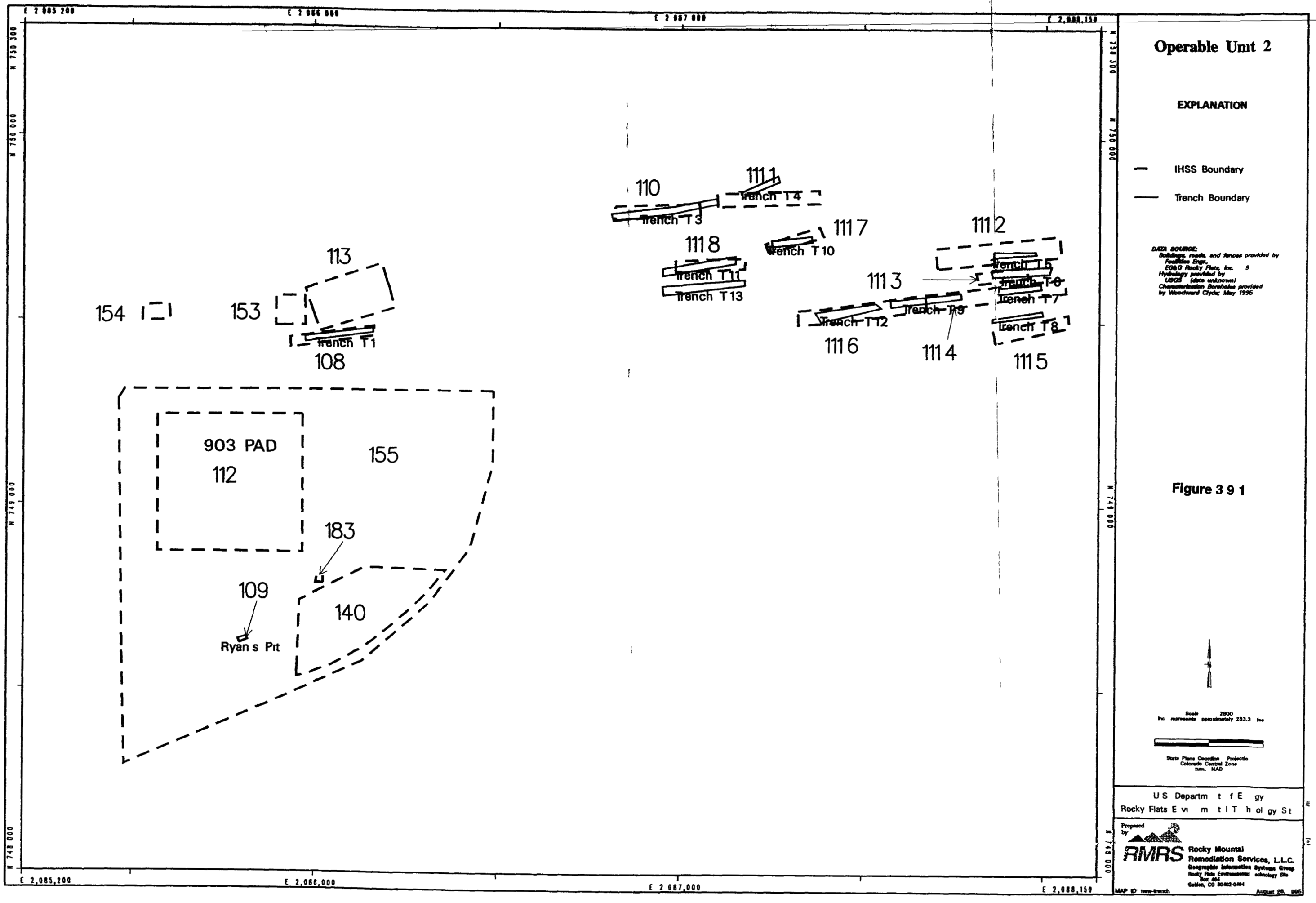
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Tech ology Site

Prepared by
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P. O. Box 464
Golden, CO 80402-0464

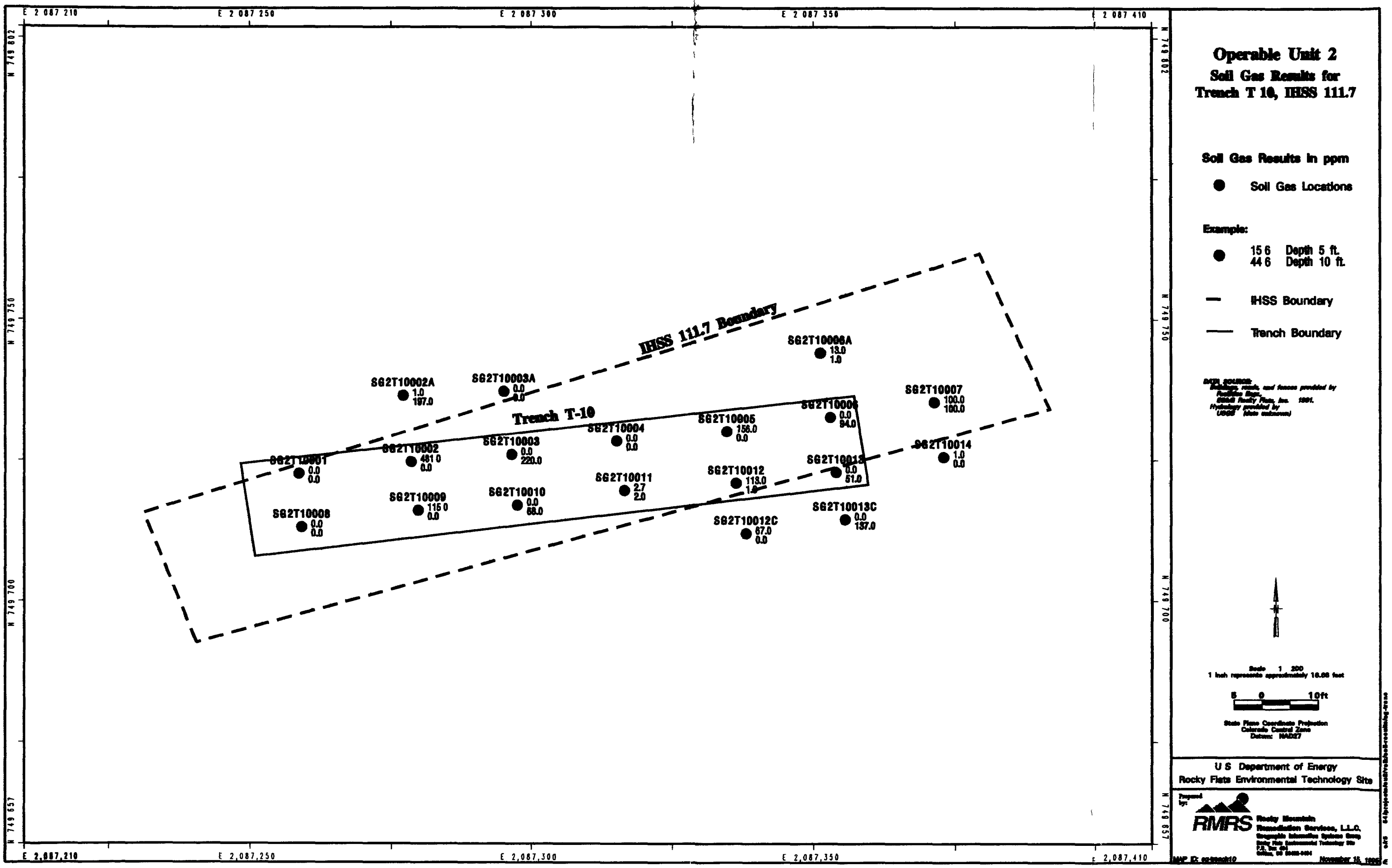
MAP ID: new-trench

September 07, 1995

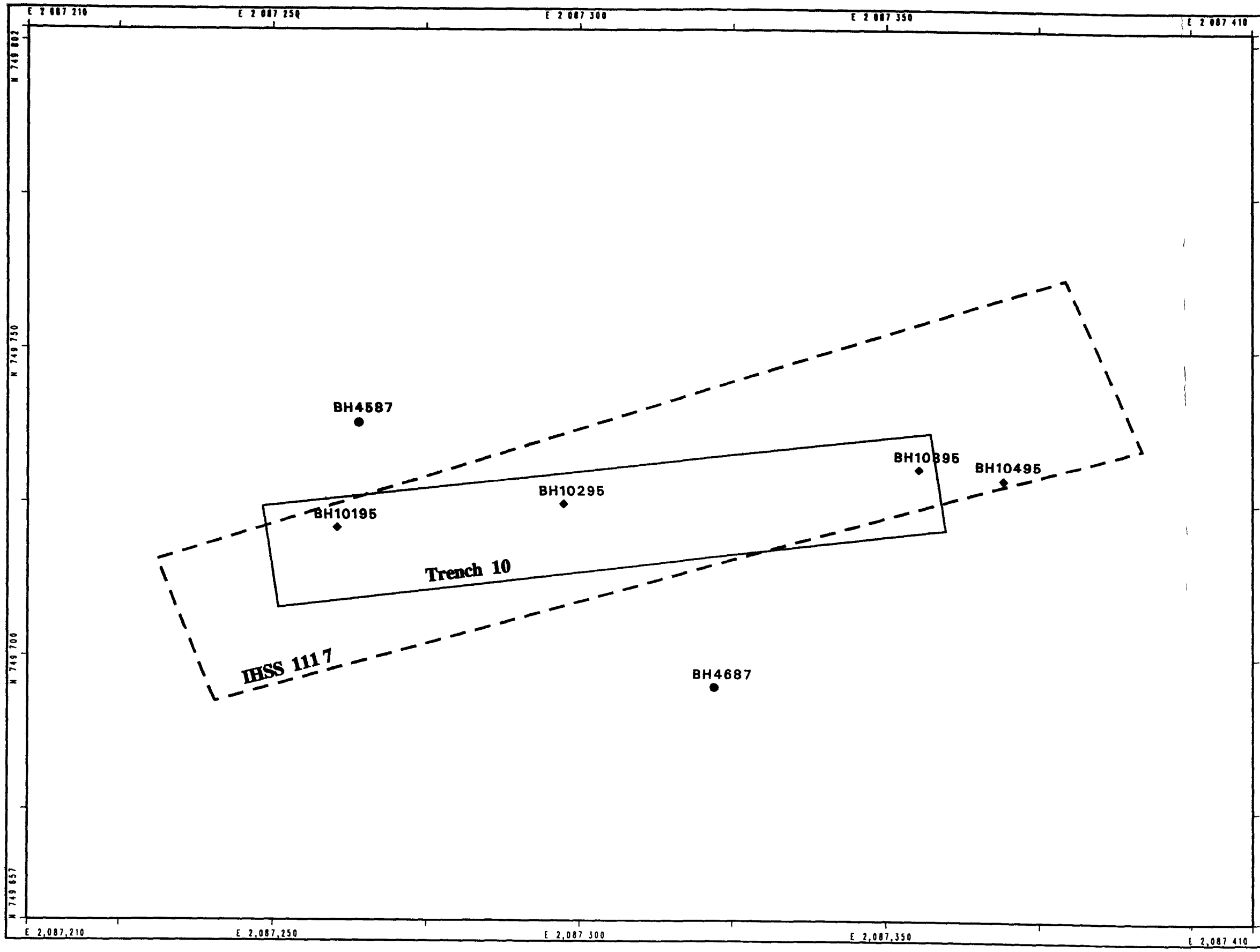


Operable Unit 2
EXPLANATION
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 9
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 1996
Figure 3 9 1
Scale 2800
Inc represents pproximately 233.3 fee
State Plane Coordina Projectio
Colorado Central Zone
tum. NAD
U S Departm t f E gy
Rocky Flats E vi m t l T h ol gy St
Prepared by
RMRS
Rocky Mountai
Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental echnology Site
Box 464
Golden, CO 80402-0464
MAP ID: new-trench
August 26, 996
E 2 085 200
E 2 086 000
E 2 087 000
E 2,088,150
N 750 300
N 750 000
N 749 000
N 748 000
110
111 1
Trench T 4
Trench T 3
111 7
111 8
Trench T 10
111 2
Trench T 5
Trench T 6
Trench T 7
Trench T 8
Trench T 11
Trench T 13
111 3
Trench T 9
Trench T 12
111 6
111 4
111 5
113
154
153
Trench T 1
108
903 PAD
112
155
183
109
140
Ryan s Prt

411


E 2 087 210
E 2 087 250
E 2 087 300
E 2 087 350
E 2 087 410
N 749 802
N 749 750
N 749 700
N 749 657
E 2,087,210
E 2,087,250
E 2,087,300
E 2,087,350
E 2,087,410
IHSS 111.7 Boundary
Trench T-10
SG2T10002A 1.0 197.0
SG2T10003A 0.0 0.0
SG2T10006A 13.0 1.0
SG2T10007 100.0 160.0
SG2T10001 0.0 0.0
SG2T10002 481.0 0.0
SG2T10003 0.0 220.0
SG2T10004 0.0 0.0
SG2T10005 156.0 0.0
SG2T10006 0.0 94.0
SG2T10014 1.0 0.0
SG2T10008 0.0 0.0
SG2T10009 115.0 0.0
SG2T10010 0.0 68.0
SG2T10011 2.7 2.0
SG2T10012 113.0 1.0
SG2T10013 0.0 51.0
SG2T10012C 67.0 0.0
SG2T10013C 0.0 137.0
Operable Unit 2
Soil Gas Results for
Trench T 10, IHSS 111.7
Soil Gas Results in ppm
Soil Gas Locations
Example:
15 6 Depth 5 ft.
44 6 Depth 10 ft.
IHSS Boundary
Trench Boundary
Scale 1 200
1 inch represents approximately 16.66 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
November 15, 1996

412



Operable Unit 2
IHSS 111 7 Trench 10

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole

Standard Map Features

- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 199
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde May 1996.

Scale 200
Inch represents approximately 66 fee

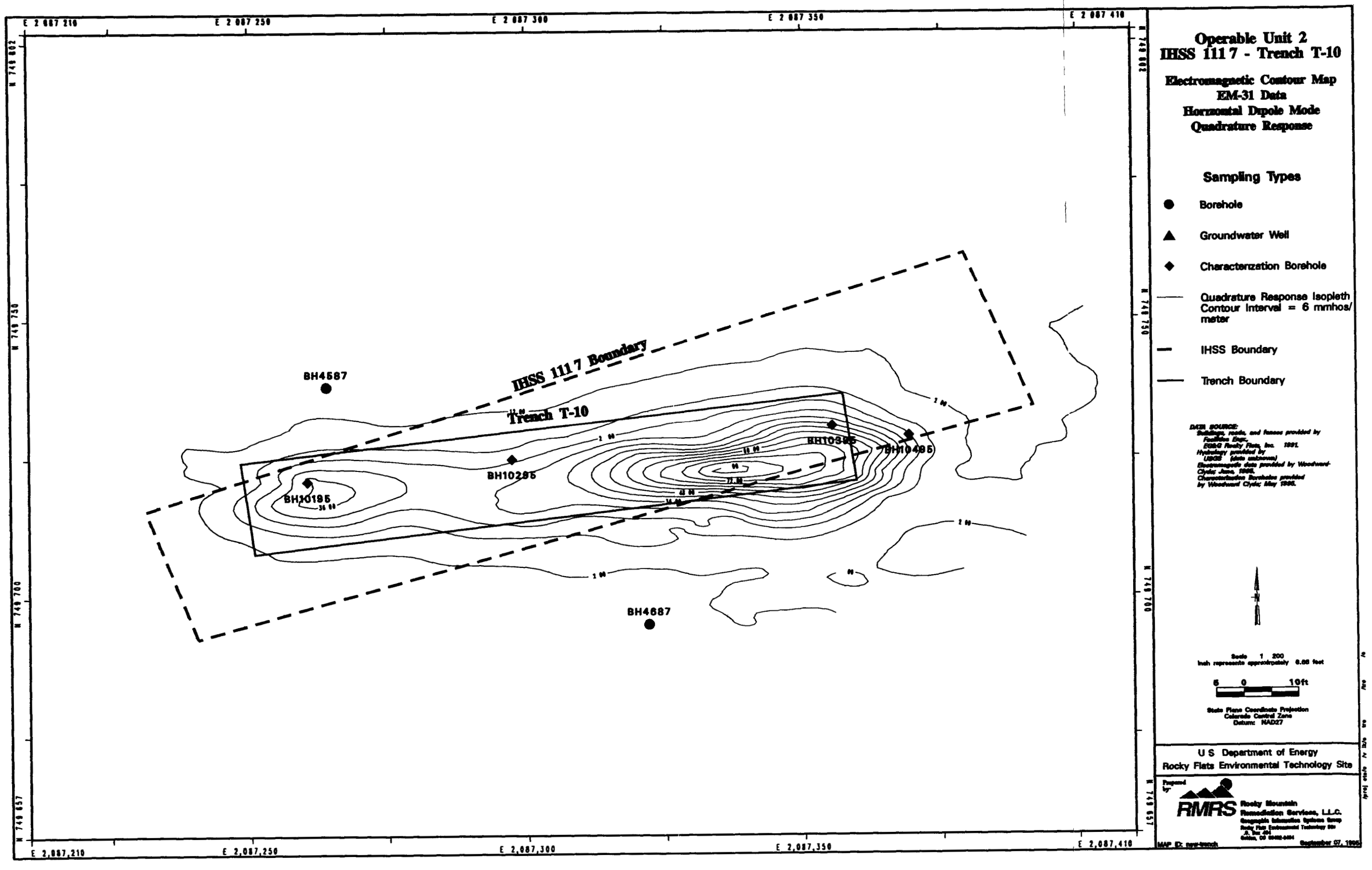
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD2

U S Departme t of E e gy
Rocky Flats E i onm ntal Tech ology Sit

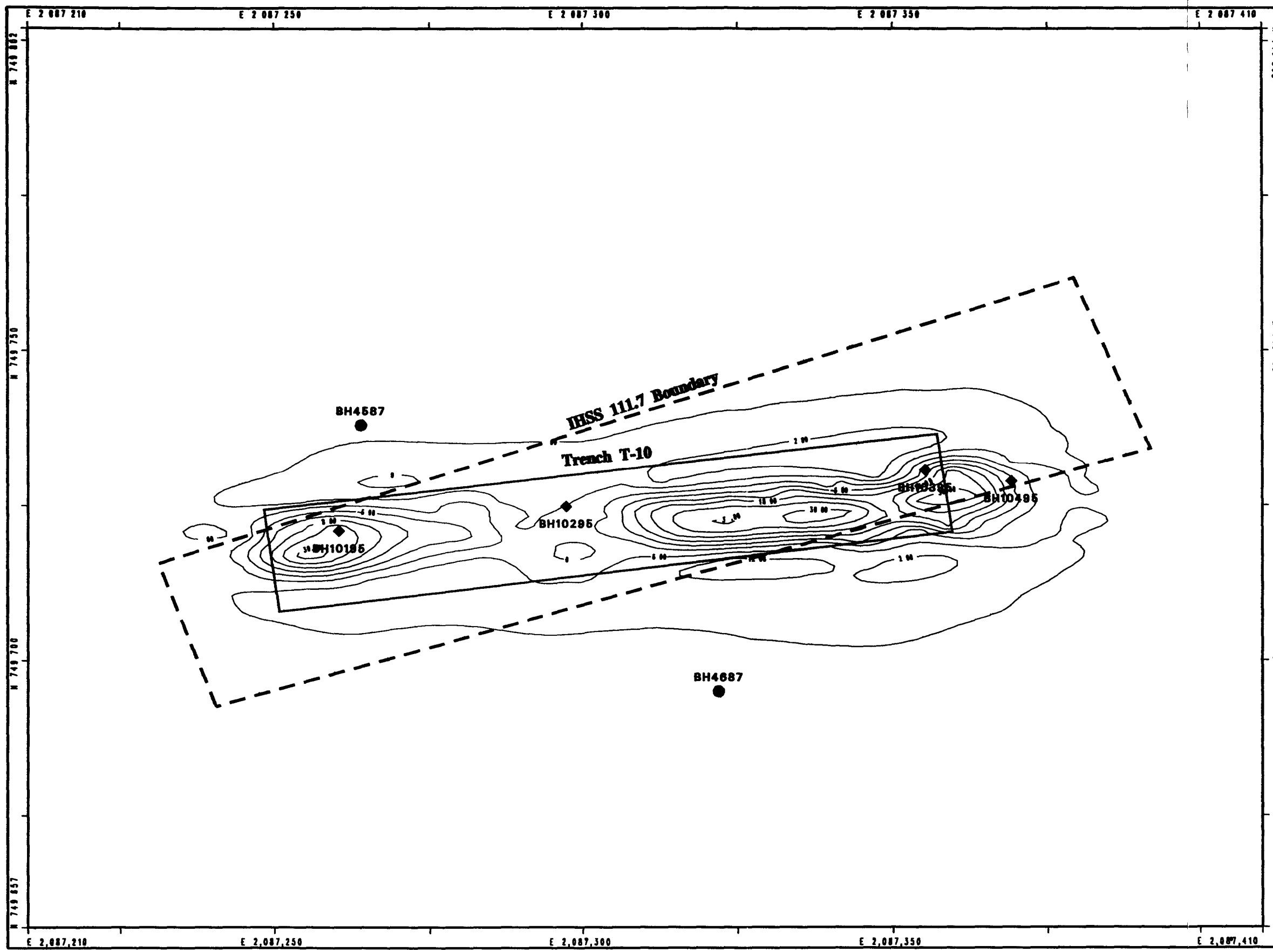
Prepared by
RMRS Rocky Mountai Remediation Services, L.L.C
Geographic Information Syste Group
Rocky Flats Environmental echnology Site 464
Golden, CO 80402-0464

MAP ID: new-trench
August 28, 996

43


Operable Unit 2
IHSS 111 7 - Trench T-10
Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth
Contour Interval = 6 mmhos/meter
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by
Facilities Dept.
EG&G Rocky Flats, Inc. 1991.
Hydrology provided by
USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.
Scale 1 200
Inch represents approximately 0.08 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P. O. Box 464
Golden, CO 80402-0464
MAP ID: rpt-trench
September 07, 1995
IHSS 111 7 Boundary
Trench T-10
BH4587
BH10195
BH10295
BH10395
BH10495
BH4687
E 2 087 210
E 2 087 250
E 2 087 300
E 2 087 350
E 2 087 410
N 749 802
N 749 750
N 749 700
N 749 657
E 2,087,210
E 2,087,250
E 2,087,300
E 2,087,350
E 2,087,410

48



Operable Unit 2
IHSS 111 7 Trench T 10

Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 6 parts/thousand
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr. EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

Scale 200
Inch represents approximately 6 66 feet

5 0 10ft

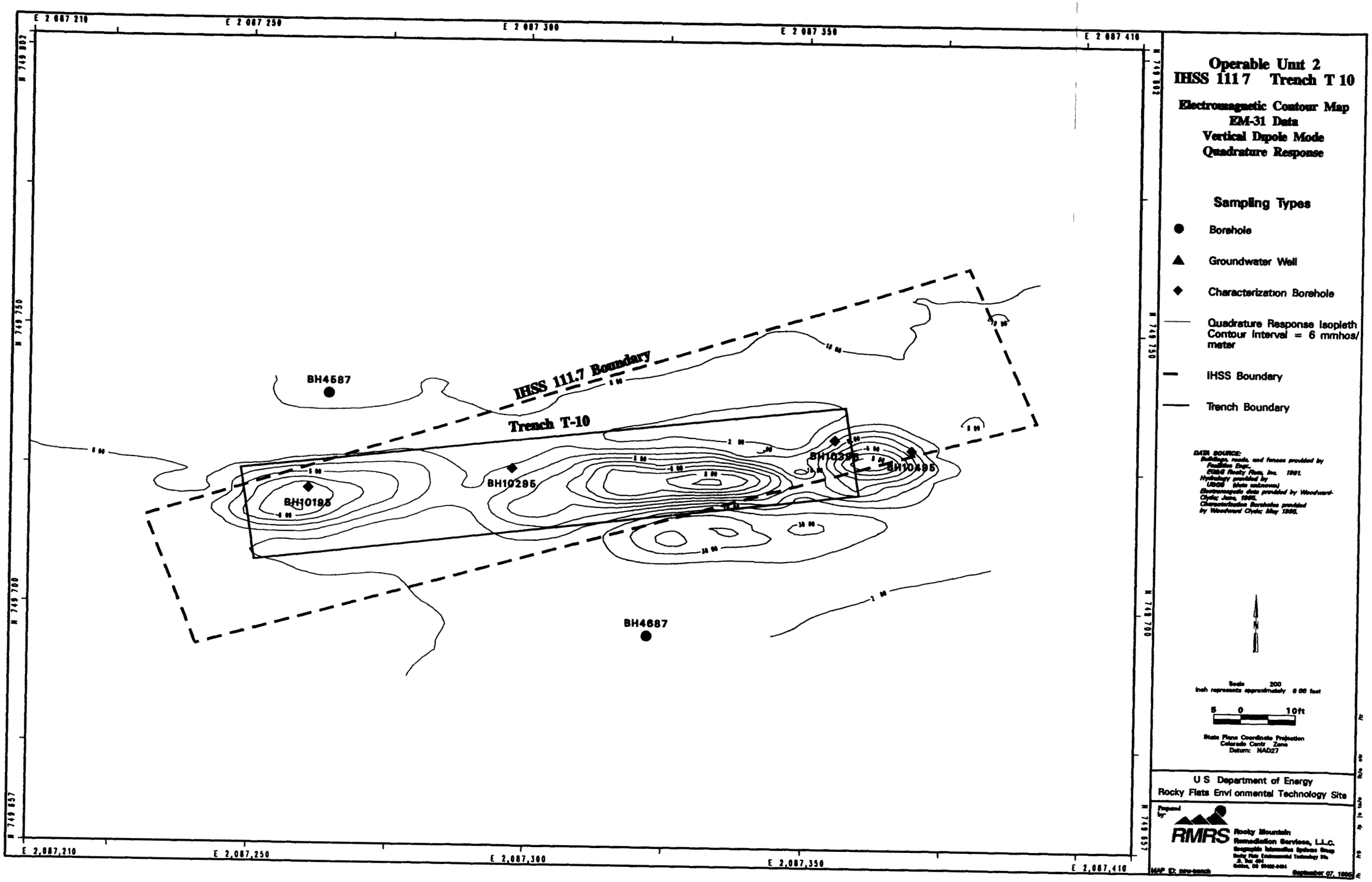
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Ene gy
Rocky Flats Envi o mental Technology Site

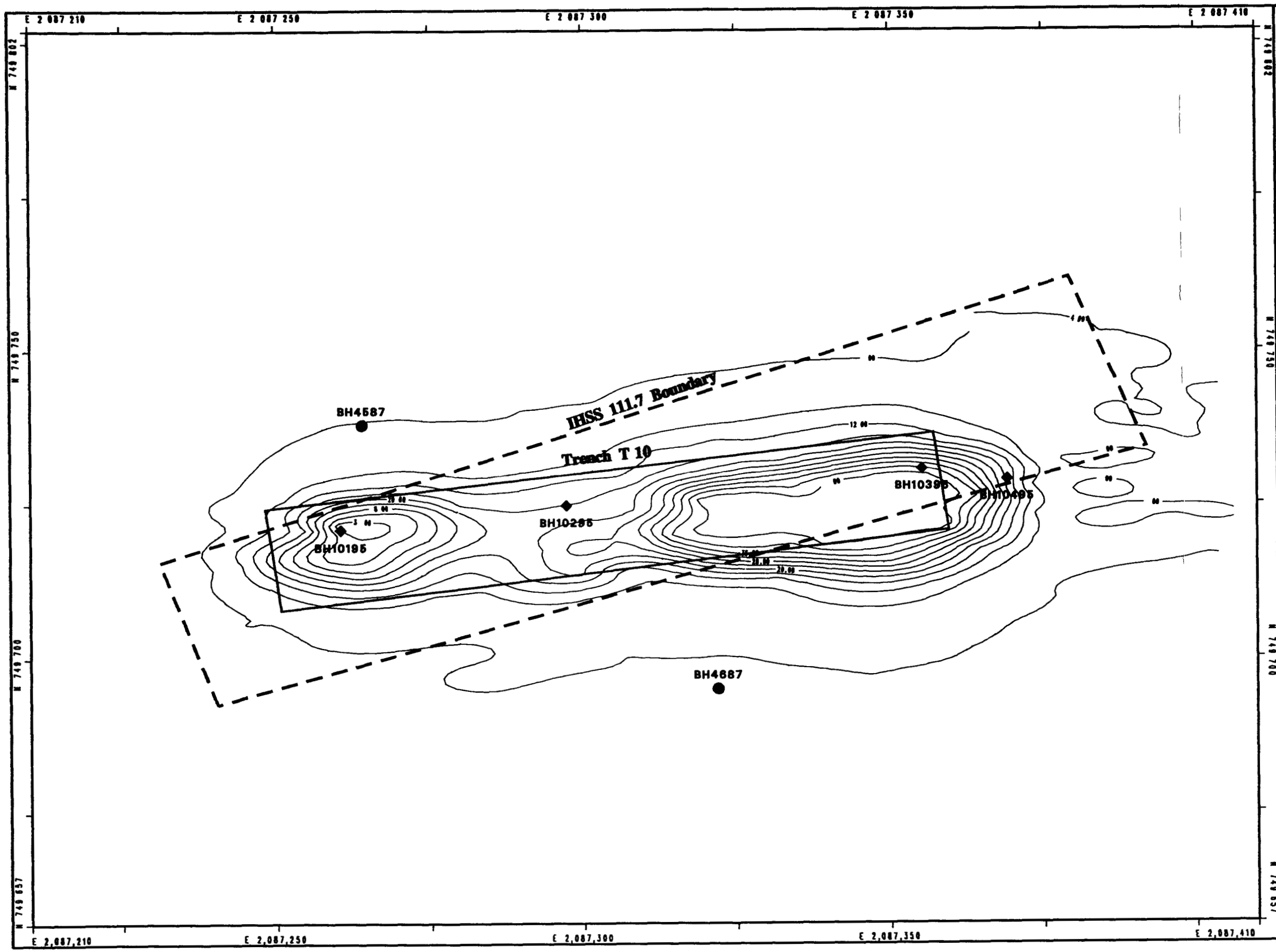
Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench
September 07, 1995

49


Operable Unit 2
IHSS 111.7 Trench T 10
Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth Contour Interval = 6 mmhos/meter
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde: June, 1995.
Characterization Boreholes provided by Woodward Clyde: May 1995.
Scale 200
Inch represents approximately 8.33 feet
5 0 10ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P. O. Box 464
Golden, CO 80402-0464
MAP ID: new-trench
September 07, 1995
IHSS 111.7 Boundary
Trench T-10
BH4587
BH10195
BH10295
BH10395
BH10495
BH4687
E 2,087,210
E 2,087,250
E 2,087,300
E 2,087,350
E 2,087,410
N 749,857
N 749,750
N 749,700

420



Operable Unit 2
IHSS 111 7 Trench T 10

Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 4 parts/thousand
- IHSS Boundary
- Trench Boundary

DATA SOURCE
Buildings, roads, and fences provided by Facilities Engr, EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

Scale 200
Inch represents approximately 6.66 feet

5 0 10ft

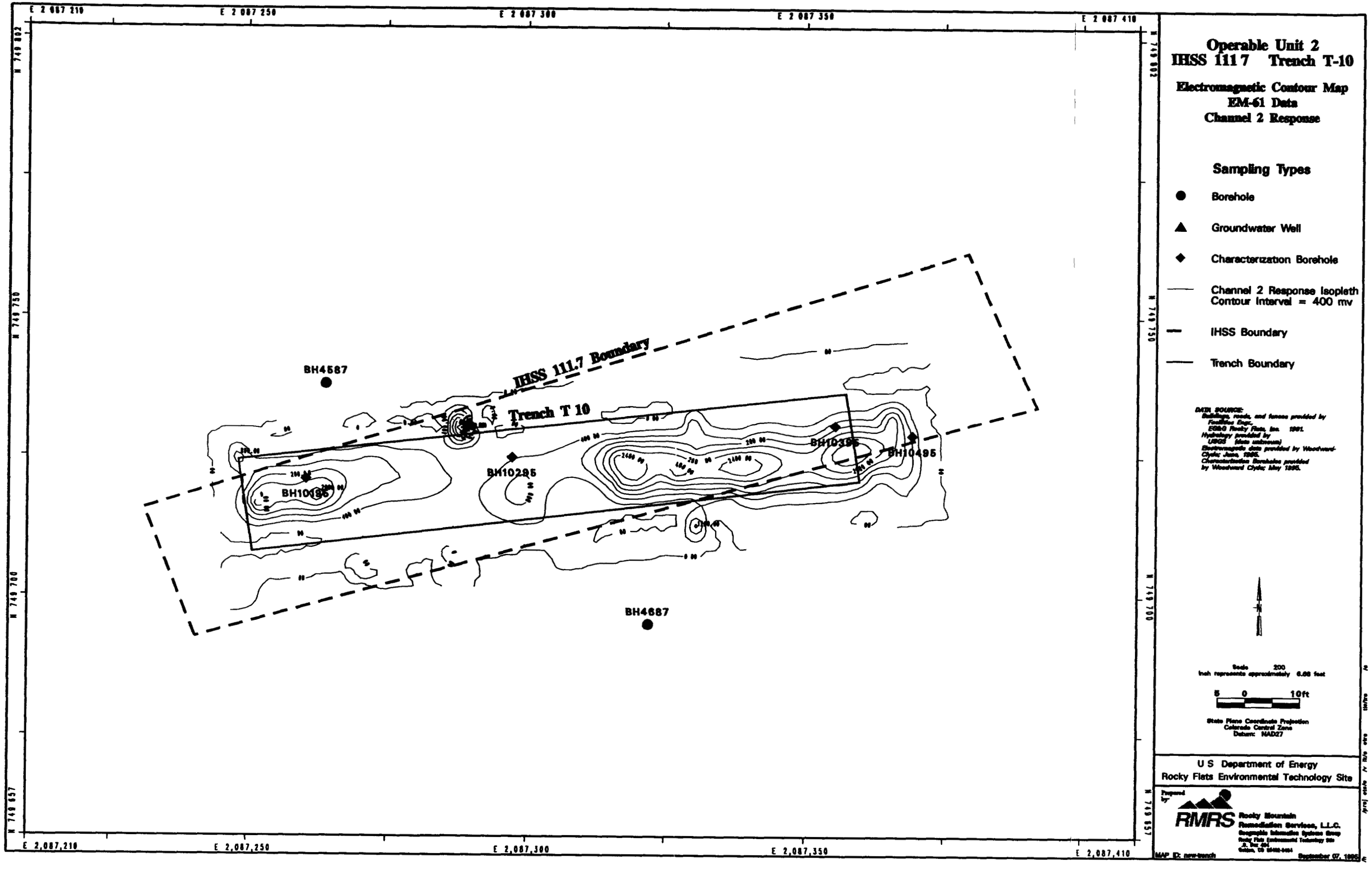
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Ene gy
Rocky Flats Environme tal Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Box 464
Golden, CO 80402-0464

MAP ID: new-bench
September 07, 995

420



Operable Unit 2
IHSS 111 7 Trench T-10

Electromagnetic Contour Map
EM-61 Data
Channel 2 Response

Sampling Types

- ● Borehole
- ▲ Groundwater Well
- ◆ Characterization Borehole
- Channel 2 Response Isopleth Contour Interval = 400 mv
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

Scale 200
Inch represents approximately 6.68 feet

5 0 10ft

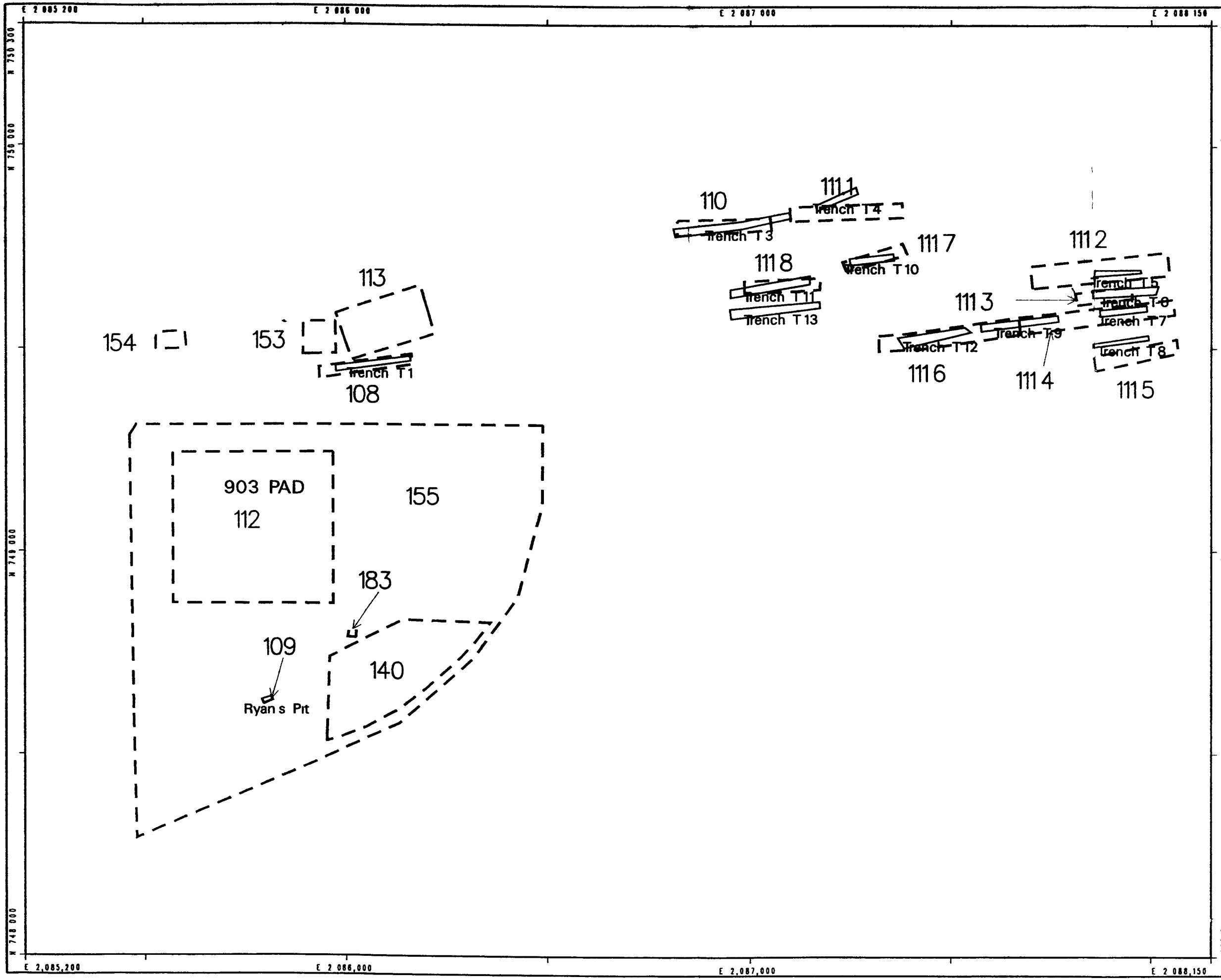
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P. Box 464
Golden, CO 80402-0464

MAP ID: new-trench
September 07, 1995

423



Operable Unit 2

EXPLANATION

IHSS Boundary

Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 99
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde, May 1996

Figure 3 10-1

Scale 2800
Inc represents approximately 233.3 foo

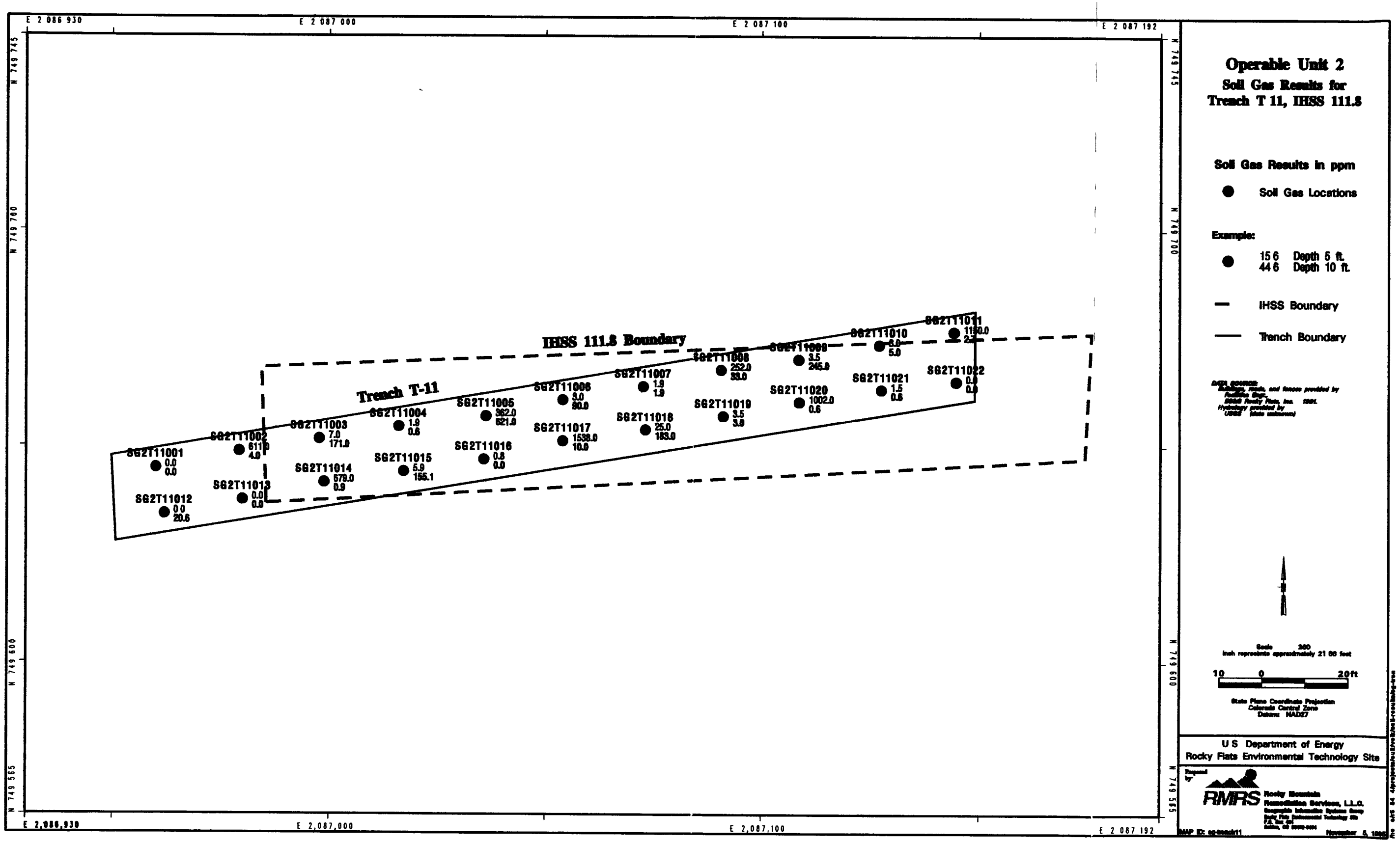
State Plane Coordinate Projection
Colorado Central one
Datum NAD

U S Dep rtm t f E gy
Rocky Flats E vi onm t l T h ol gy Sit

Prepared by:
RMRS Rocky Mountal Remediatio Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Box 464
Golden, C 80402-0464

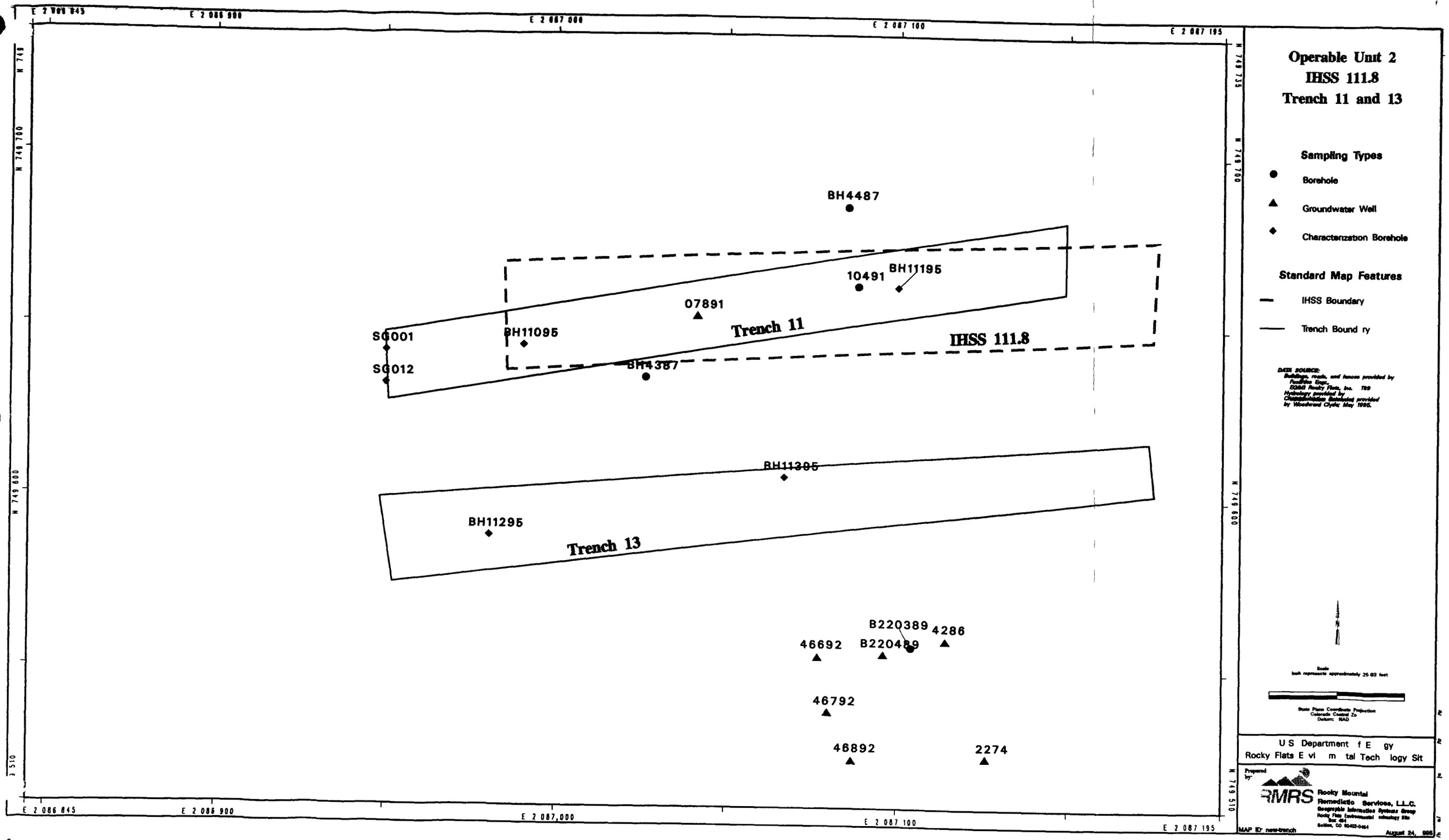
MAP ID: new-trench

August 28, 996



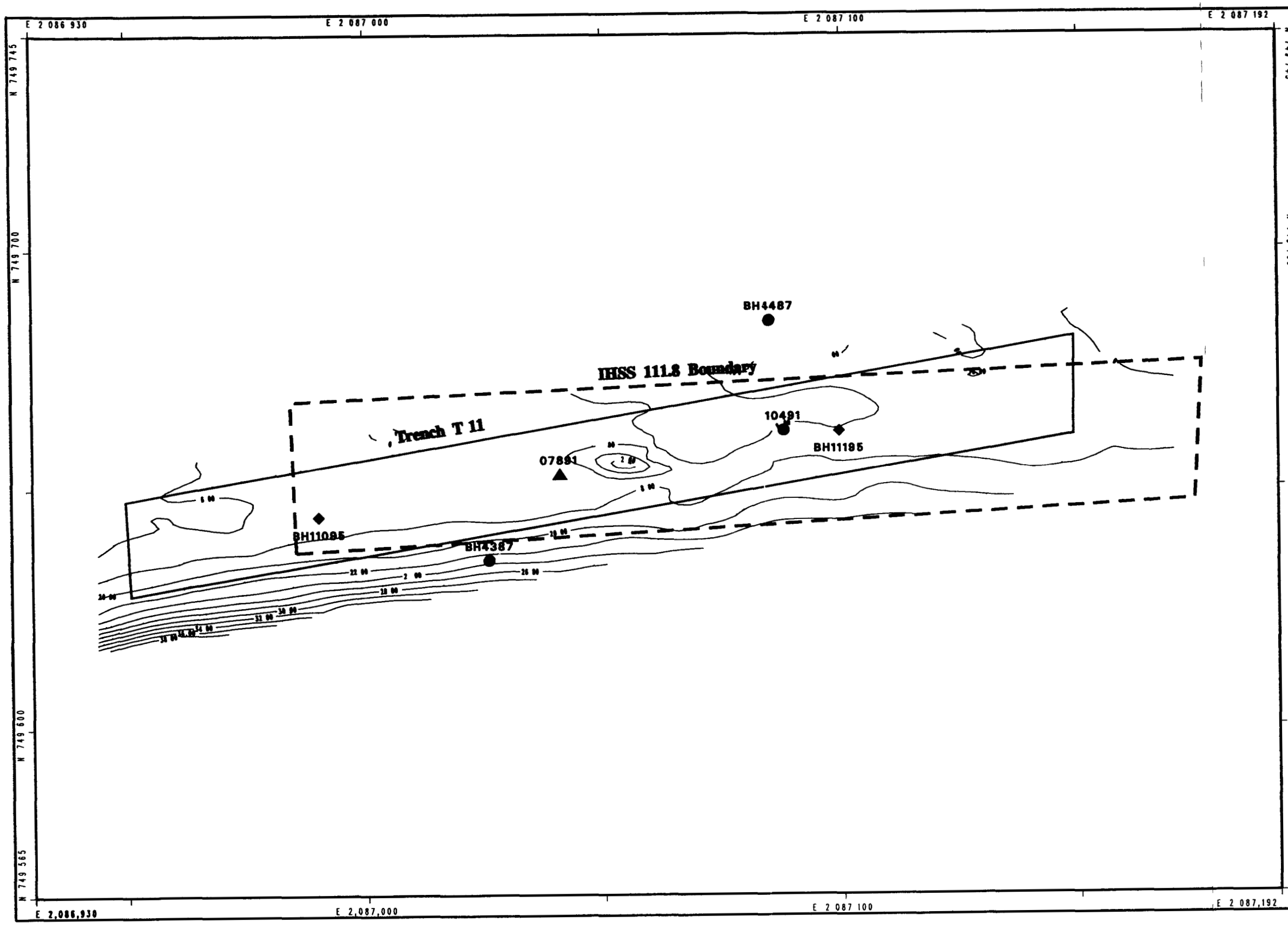
Operable Unit 2
Soil Gas Results for
Trench T 11, IHSS 111.8
Soil Gas Results in ppm
Soil Gas Locations
Example:
15 6 Depth 5 ft.
44 6 Depth 10 ft.
IHSS Boundary
Trench Boundary
IHSS 111.8 Boundary
Trench T-11
SG2T11001 0.0 0.0
SG2T11002 611.0 4.0
SG2T11003 7.0 171.0
SG2T11004 1.9 0.6
SG2T11005 362.0 621.0
SG2T11006 3.0 90.0
SG2T11007 1.9 1.9
SG2T11008 252.0 33.0
SG2T11009 3.5 245.0
SG2T11010 3.0 5.0
SG2T11011 1150.0 2.7
SG2T11012 0.0 20.6
SG2T11013 0.0 0.0
SG2T11014 679.0 0.9
SG2T11015 5.9 155.1
SG2T11016 0.8 0.0
SG2T11017 1538.0 10.0
SG2T11018 25.0 183.0
SG2T11019 3.5 3.0
SG2T11020 1002.0 0.6
SG2T11021 1.5 0.6
SG2T11022 0.0 0.0
Scale 200
inch represents approximately 21 66 feet
10 0 20ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.
November 5, 1995
E 2 086 930
E 2 087 000
E 2 087 100
E 2 087 192
N 749 745
N 749 700
N 749 600
N 749 565

462



Operable Unit 2
IHSS 111.8
Trench 11 and 13
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Standard Map Features
IHSS Boundary
Trench Boundary
BH4487
10491
BH11195
07891
Trench 11
IHSS 111.8
SG001
SG012
BH11095
BH4387
BH11395
BH11295
Trench 13
B220389
4286
46692
B220489
46792
46892
2274
E 2 086 845
E 2 086 900
E 2 087,000
E 2 087 100
E 2 087 195
N 749 700
N 749 600
N 749 735
N 749 510
U S Department f E gy
Rocky Flats E vi m tal Tech logy Sit
Prepared by:
RMRS
Rocky Mountai
Remediatio Services, L.L.C.
MAP ID: new-trench
August 24, 995

463



Operable Unit 2
IHSS 111.8 Trench T 11

Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Quadrature Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Quadrature Response Isopleth Contour Interval = 2 mmhos/meter
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Radian Corp., ©1992 Rocky Flats, Inc. 1991.
Hydrology provided by USGS (data unknown)
Electromagnetic data provided by Woodward-Clyde John, 1995.
Characterization Boreholes provided by Woodward Clyde May 1995.

Scale 200
Inch represents approximately 60 feet

1 0 0 2 0 f t

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

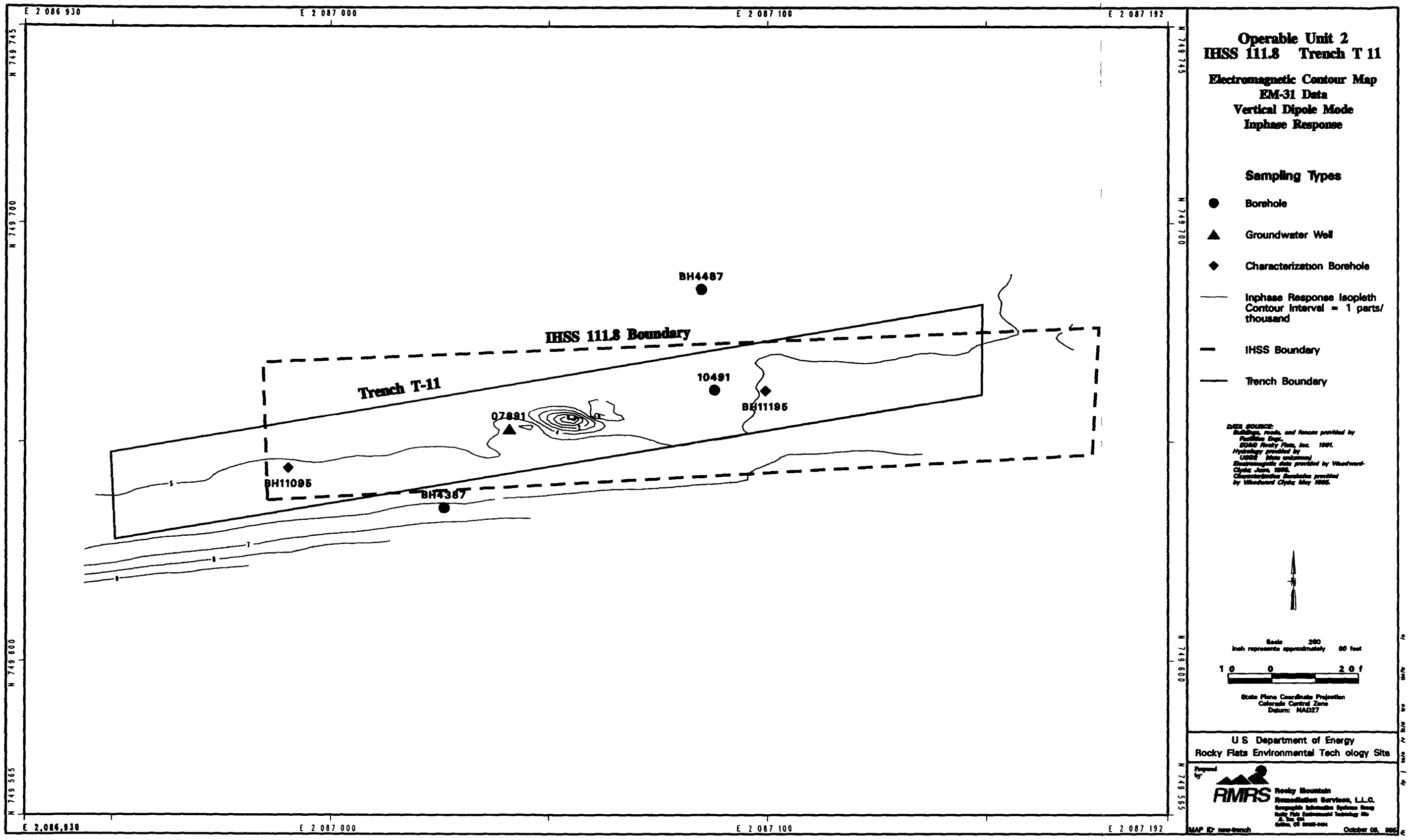
U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. box 464
Golden, CO 80402-0464

MAP ID: new-trench

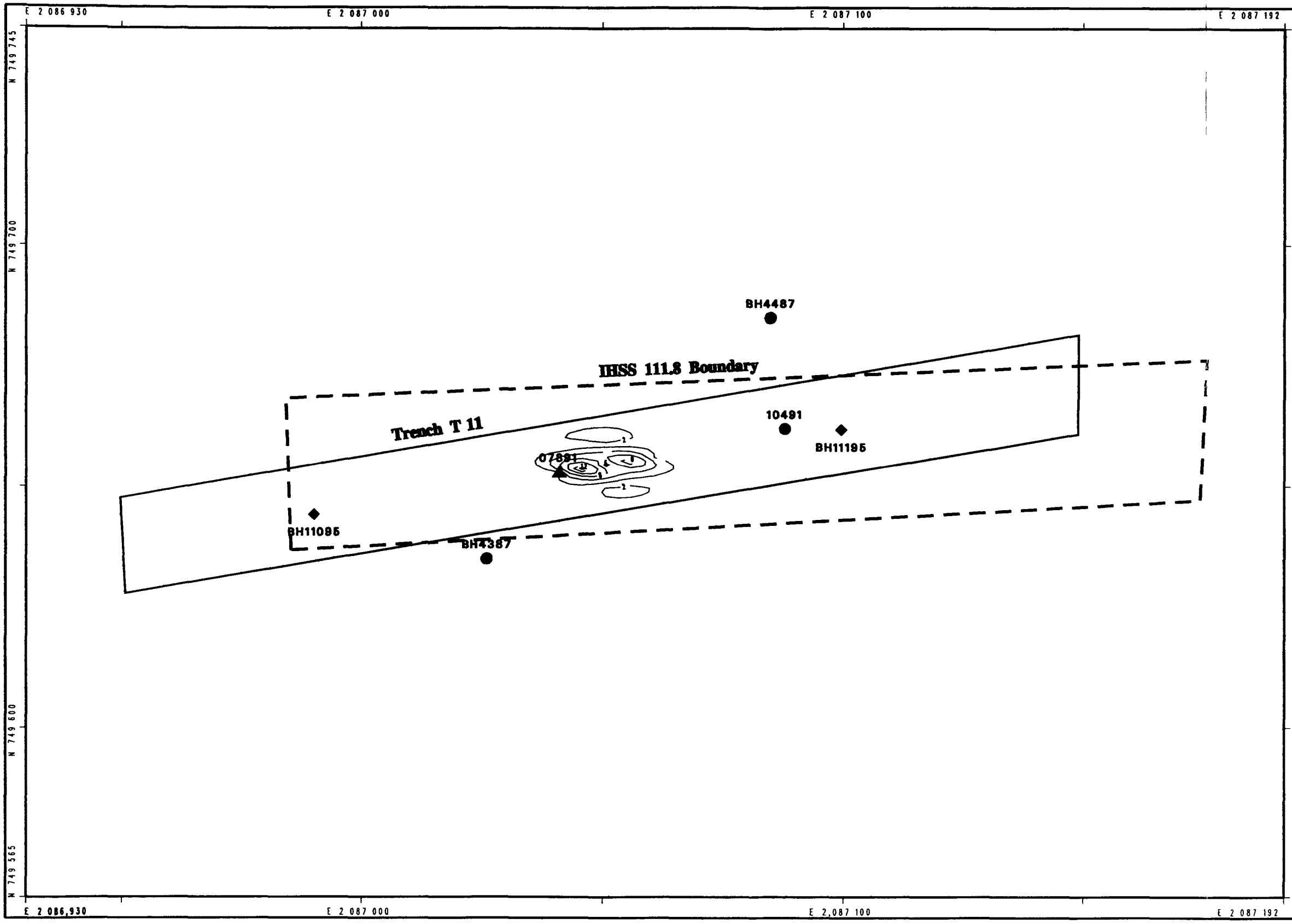
October 05, 1995

468



E 2 086 930
E 2 087 000
E 2 087 100
E 2 087 192
N 749 745
N 749 700
N 749 600
N 749 565
BH4487
IHSS 111.8 Boundary
Trench T-11
10491
BH11195
07891
BH11095
BH4387
5
7
8
9
Operable Unit 2
IHSS 111.8 Trench T 11
Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Inphase Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Inphase Response Isopleth Contour Interval = 1 parts/ thousand
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.
Scale 200
Inch represents approximately 60 feet
1 0 0 2 0 f
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Tech ology Site
Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: new-trench
October 06, 1995

469



Operable Unit 2
IHSS 111.8 Trench T 11

Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 2 parts/thousand
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Rockfire Engr. EG&G Rocky Flats, Inc. 1991
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward Clyde May 1995.

Scale 200
Inch represents approximately 66 feet

10 0 20 ft

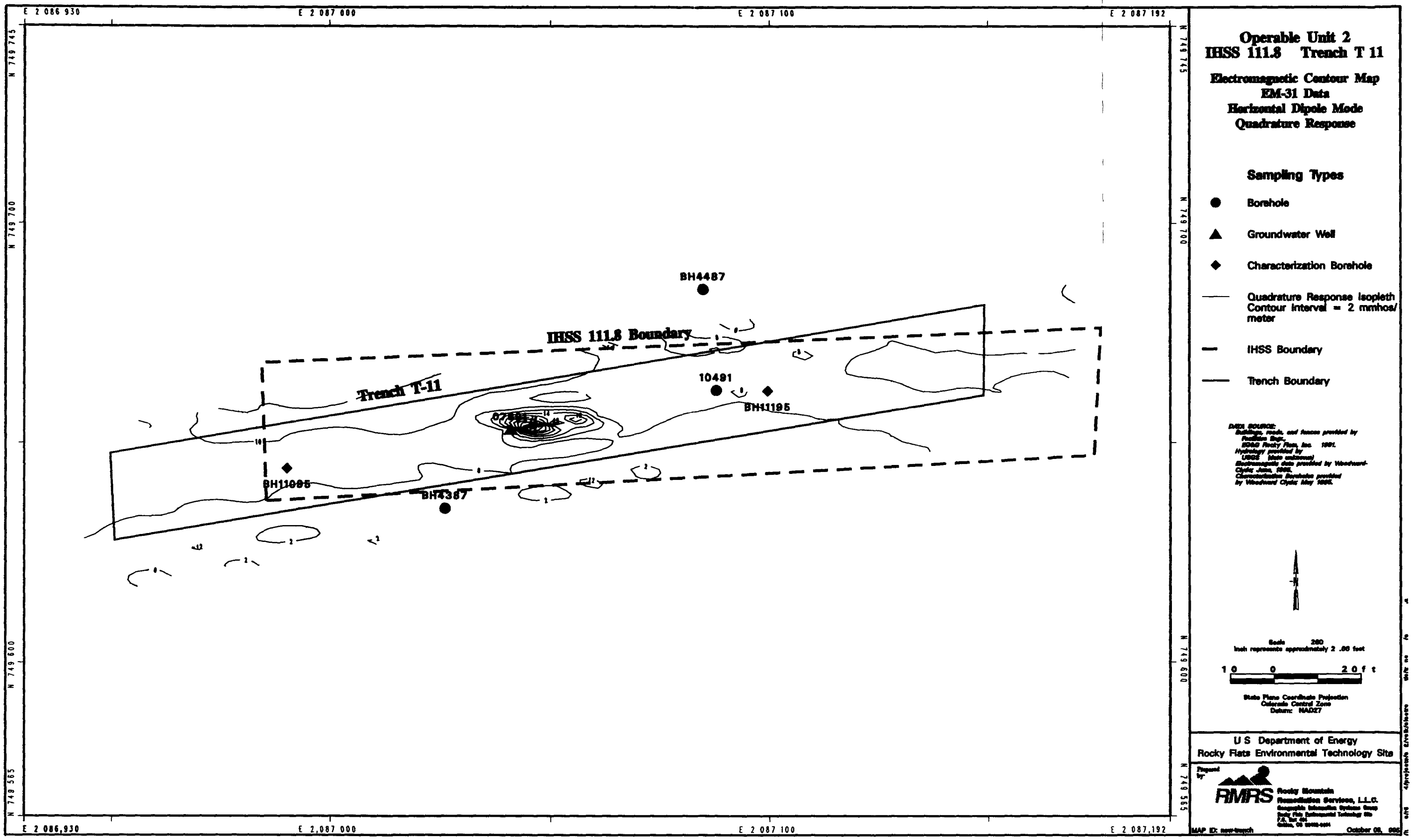
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Tech ology Site

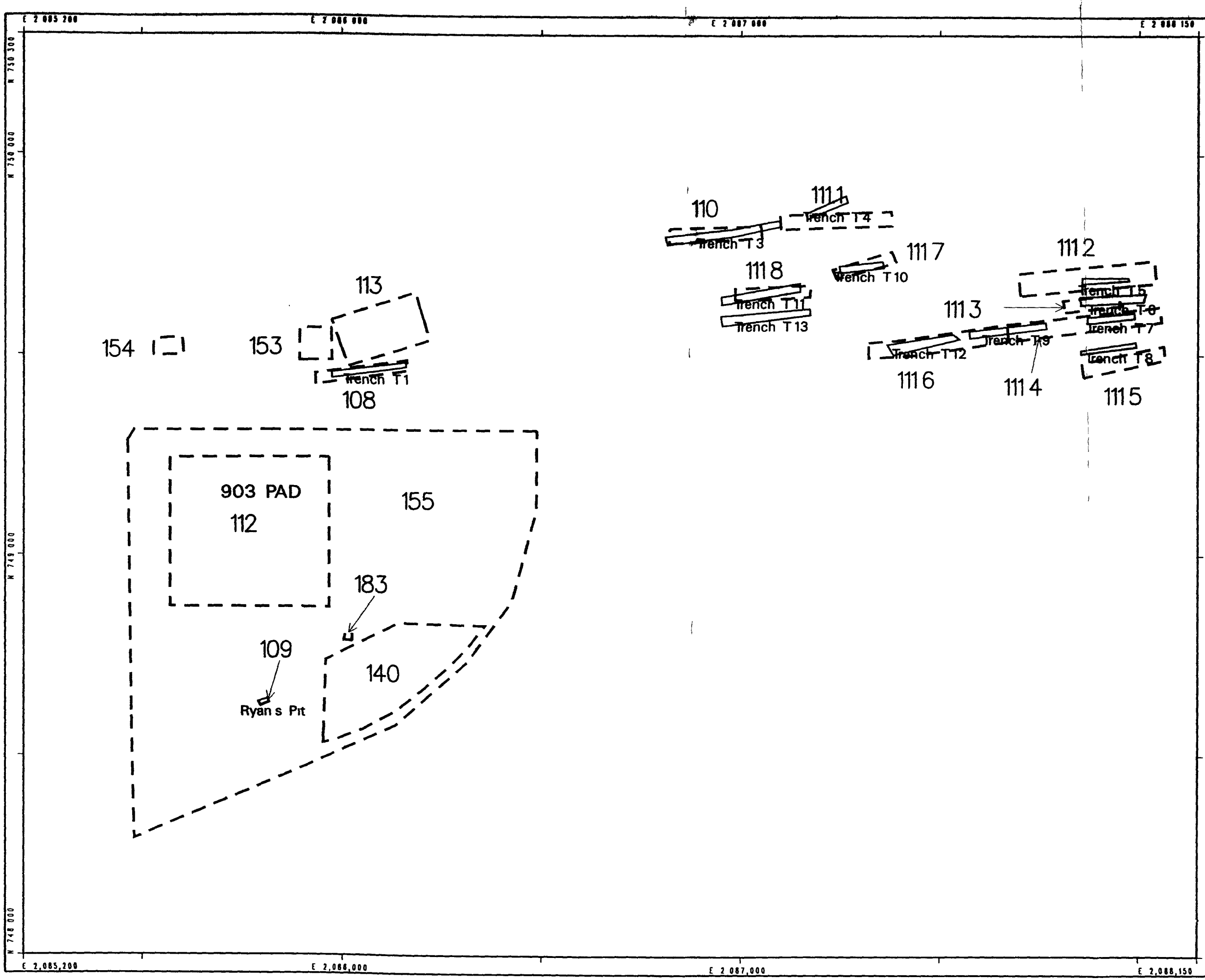
Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P. Box 464
Golden, CO 80402-0464

MAP ID: new-trench
October 05, 1995

470


E 2 086 930
E 2 087 000
E 2 087 100
E 2 087 192
N 749 745
N 749 700
N 749 600
N 749 565
BH4487
IHSS 111.8 Boundary
Trench T-11
10491
BH11195
BH11095
BH4387
Operable Unit 2
IHSS 111.8 Trench T 11
Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth Contour Interval = 2 mmhos/meter
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Mgr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1992.
Characterization Boreholes provided by Woodward Clyde May 1992.
Scale 20D
Inch represents approximately 2 .00 feet
10 0 20 ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464
MAP ID: new-trench
October 08, 1992

411



Operable Unit 2

EXPLANATION

IHSS Boundary

Trench Boundary

DATA SOURCE.
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 199
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 1996

Figure 3 11 1

Scale 2800
Inc presents approximately 233.3 fee

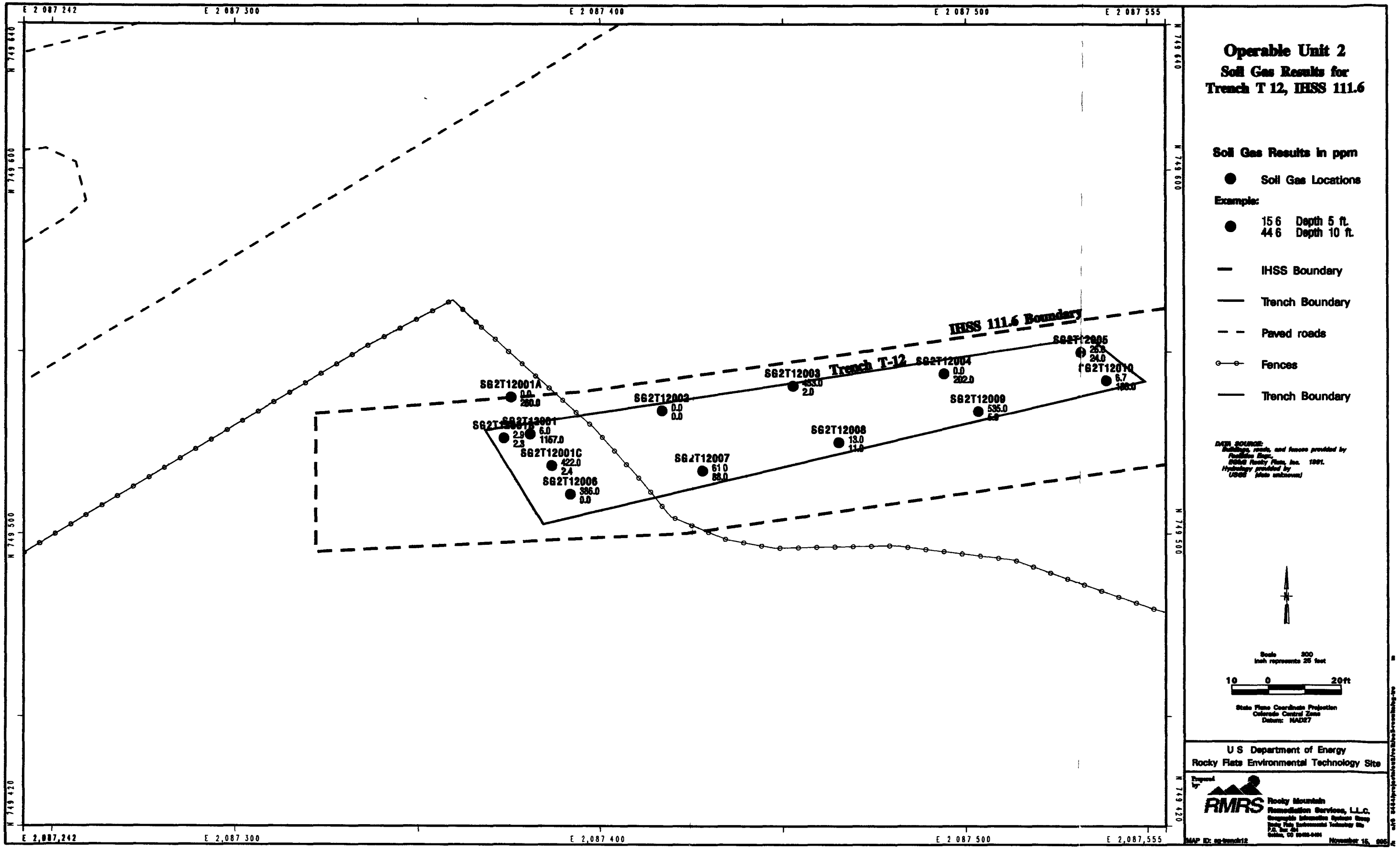
State Plane Coordina Projection
Colorado Central one
Datum. NAD

U S Dep rtm t of E gy
Rocky Flats E vi o me t l T h l gy St

Prepared by
RMRS Rocky Mountai Remediatio Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental echnology Site
Box 464
Golden, CO 80402-0464

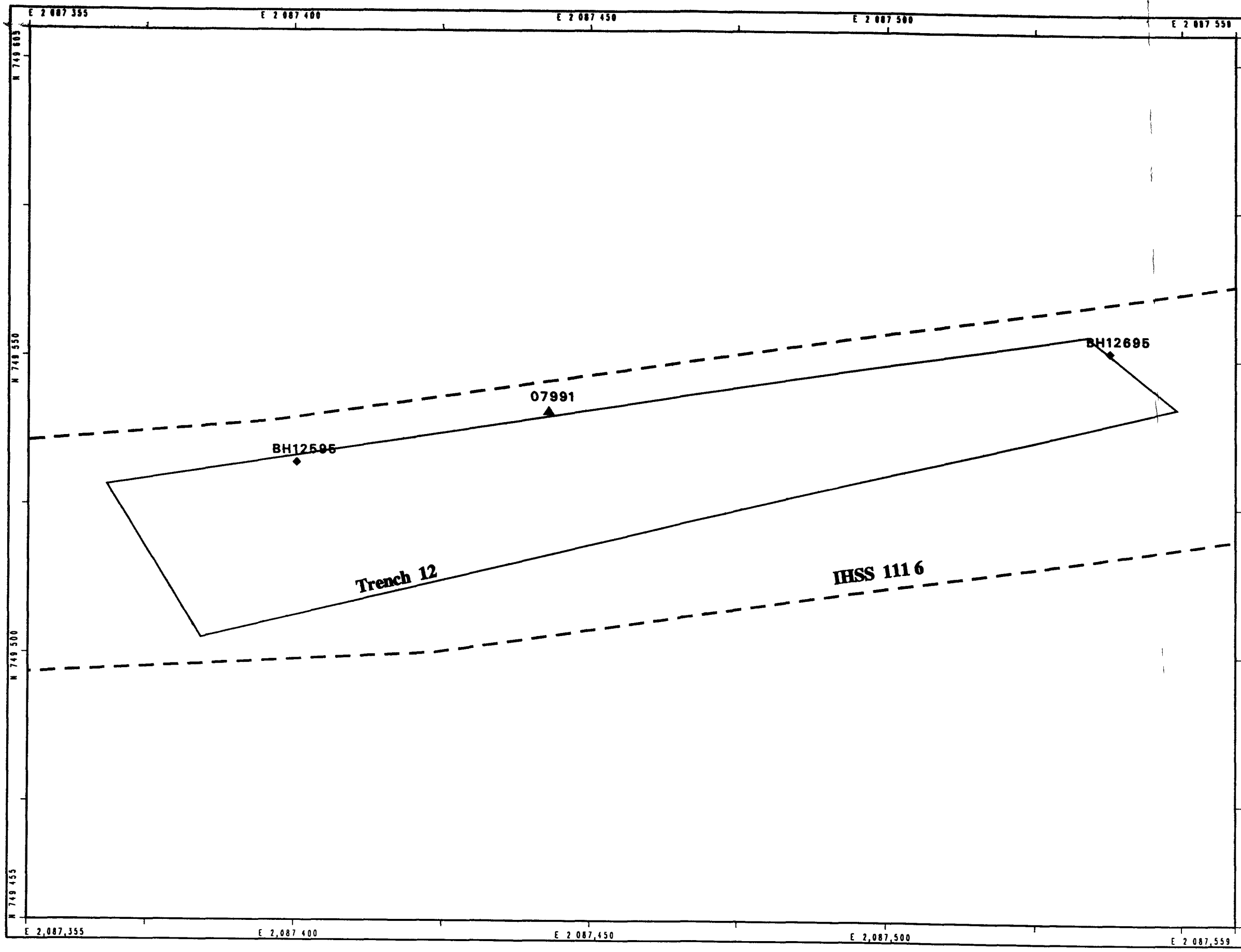
MAP ID: new-trench
August 26, 995

494



Operable Unit 2
Soil Gas Results for
Trench T 12, IHSS 111.6
Soil Gas Results in ppm
Soil Gas Locations
Example:
15 6 Depth 5 ft.
44 6 Depth 10 ft.
IHSS Boundary
Trench Boundary
Paved roads
Fences
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by
Facilities Engr.,
EG&G Rocky Flats, Inc. 1991.
Hydrology provided by
USGS (date unknown)
Scale 300
Inch represents 25 feet
10 0 20ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by:
RMRS
Rocky Mountain
Remediation Services, L.L.C.
MAP ID: sg-trench12
November 15, 995
IHSS 111.6 Boundary
Trench T-12
SG2T12001A
0.0
260.0
SG2T12001
6.0
1157.0
SG2T12001C
422.0
2.4
SG2T12006
386.0
0.0
SG2T12002
0.0
0.0
SG2T12003
2.0
SG2T12007
61.0
88.0
SG2T12008
13.0
SG2T12004
0.0
202.0
SG2T12009
535.0
SG2T12005
24.0
SG2T12010
6.7
E 2 087 242
E 2 087 300
E 2 087 400
E 2 087 500
E 2 087 555
N 749 640
N 749 600
N 749 500
N 749 420

455



Operable Unit 2
IHSS 111 6 - Trench 12

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole

Standard Map Features

- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr
EG&G Rocky Flats, Inc. 199
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde May 1995.

N

Scale 200
1 inc represents approximately 66 feet

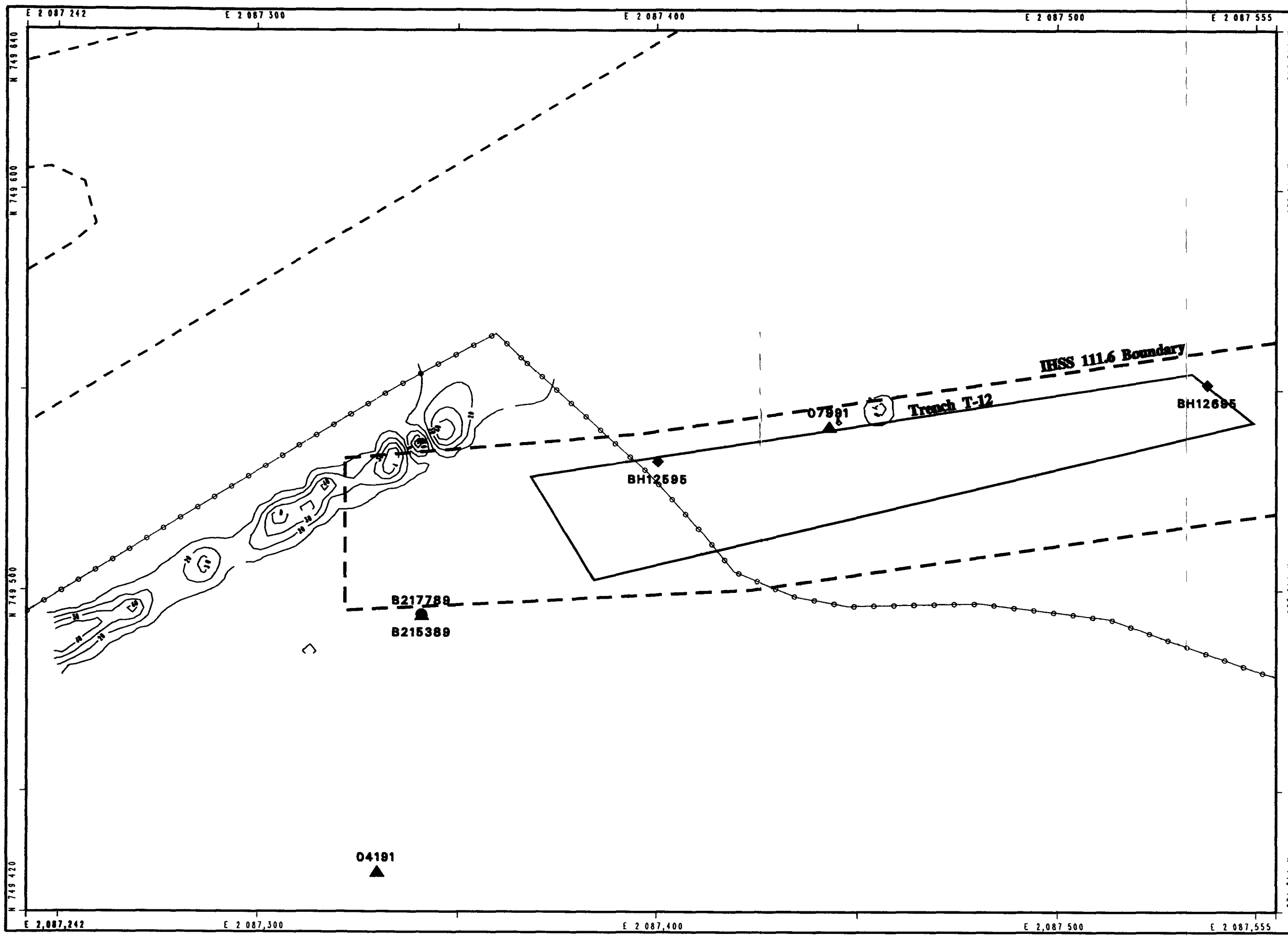
State Plane Coordinate Projection
Colorado Central zone
Datum NAD

U S D p rtm t of E gy
Rocky Fl t E me t l Tech l gy St

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information System
Rocky Flats Environmental Technology Site
Box 464
Golden, CO 80402-0464

MAP ID: new-trench
August 996

440



Operable Unit 2
IHSS 111.6 Trench T 12

Electromagnetic Contour Map
EM 31 Data
Vertical Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 10 parts/thousand
- Paved roads
- Fences
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 89
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

Scale 300
Inch represents 25 feet

10 0 20ft

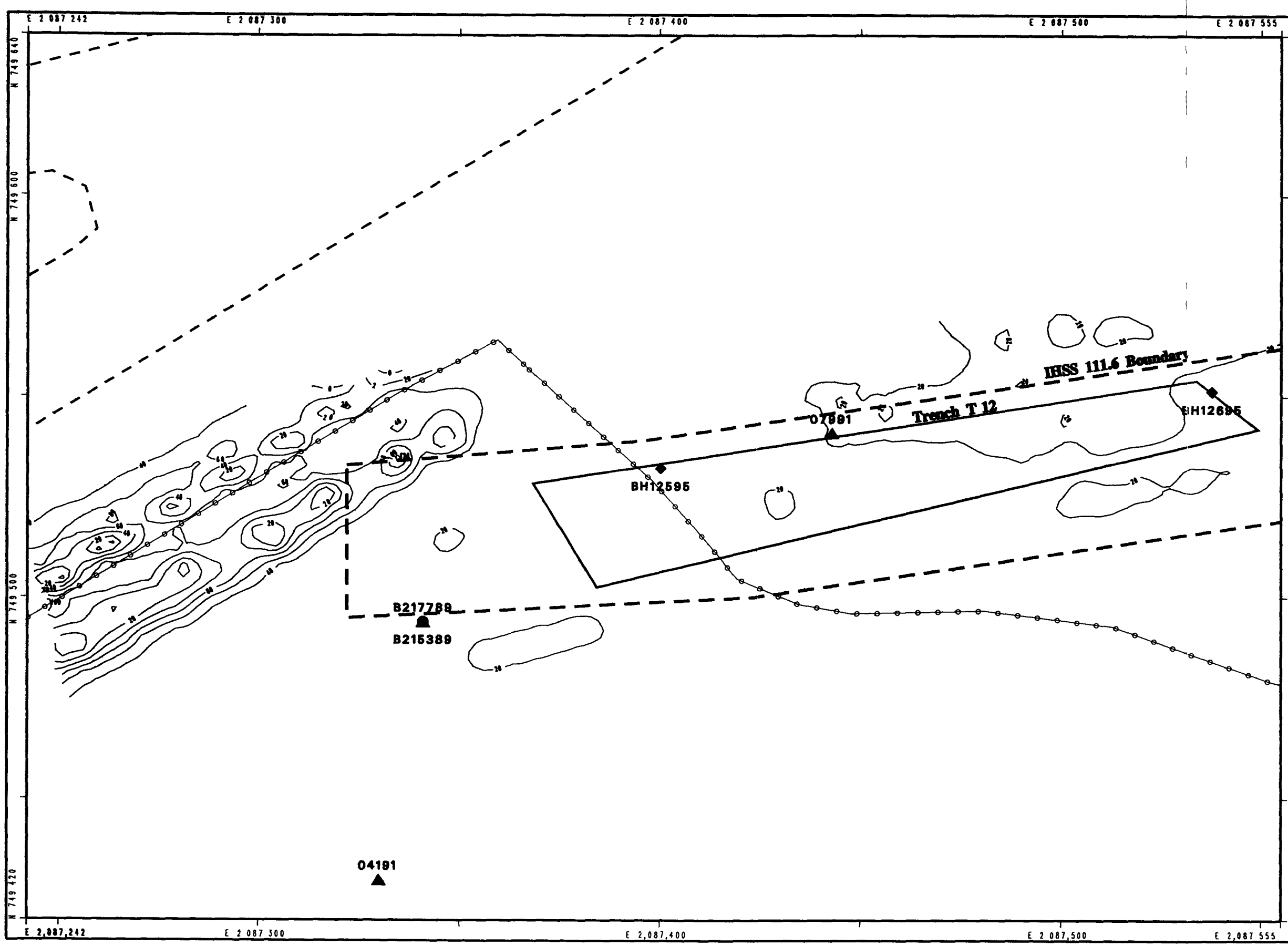
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD2

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench
October 0, 995

101



Operable Unit 2
IHSS 111.6 - Trench T 12

Electromagnetic Contour Map
EM 31 Data
Vertical Dipole Mode
Quadrature Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Quadrature Response Isopleth Contour Interval = 20 mmhos/meter
- Paved roads
- Fences
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Dept. EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde, June, 1996.
Characterization Boreholes provided by Woodward Clyde, May 1996.

Scale 300
Inch represents 25 feet

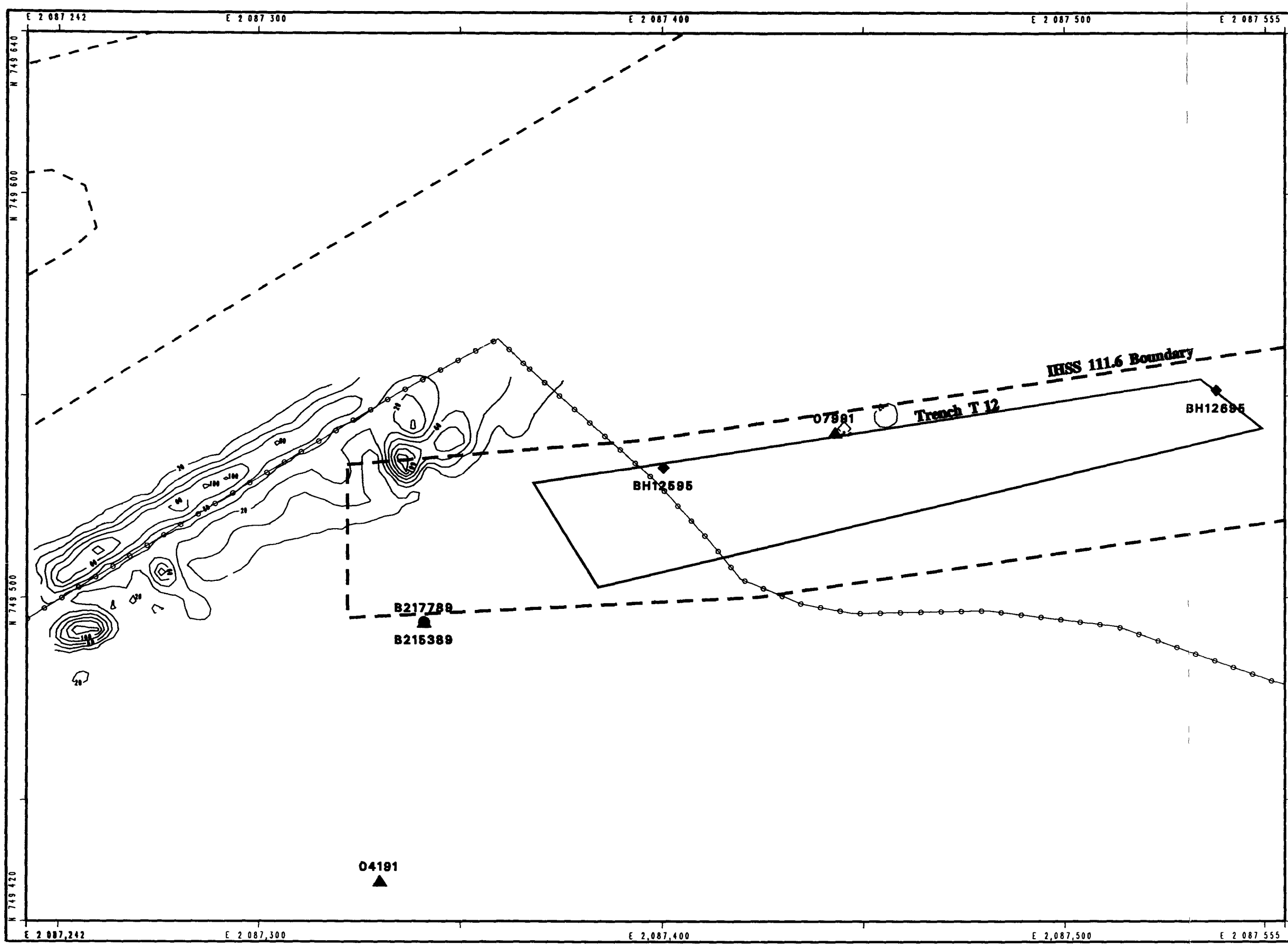
10 0 20 ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Tech ology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench
October 10, 1996



Operable Unit 2
IHSS 111.6 Trench T-12

Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Quadrature Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Quadrature Response Isopleth Contour Interval = 20 mmhos/meter
- Paved roads
- Fences
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr. EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward Clyde May 1995.

Scale 300
Inch represents 25 feet

10 0 20 ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

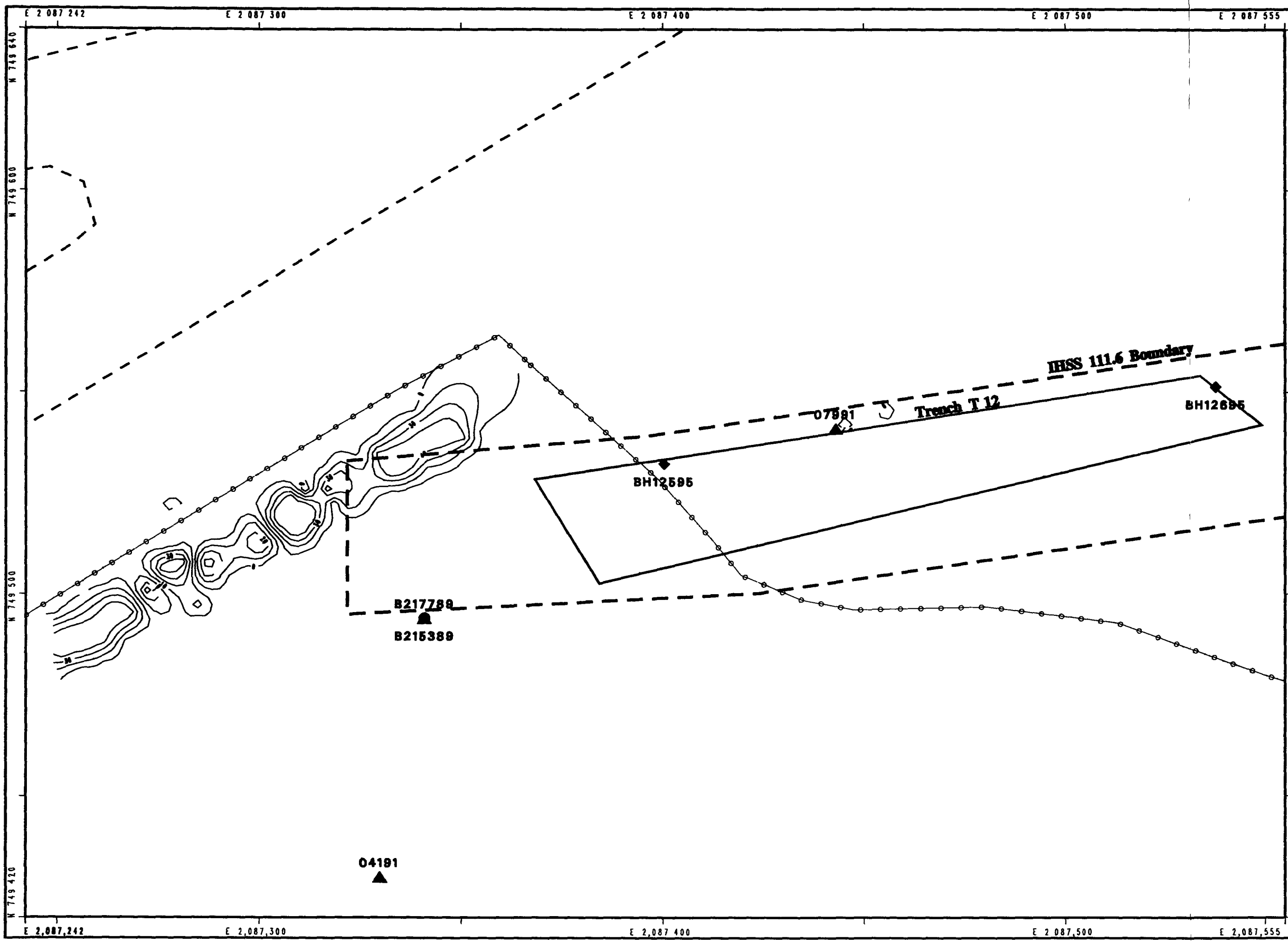
US Department of Energy
Rocky Flats Environmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information System Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench

October 10, 1995

503



Operable Unit 2
IHSS 111.6 Trench T 12

Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 10 parts/thousand
- Paved roads
- Fences
- Trench Boundary

EM31 SOURCE:
Buildings, roads, and fences provided by Facilities Engr. EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward Clyde May 1995.

Scale 300
Inch represents 25 feet

10 0 20 ft

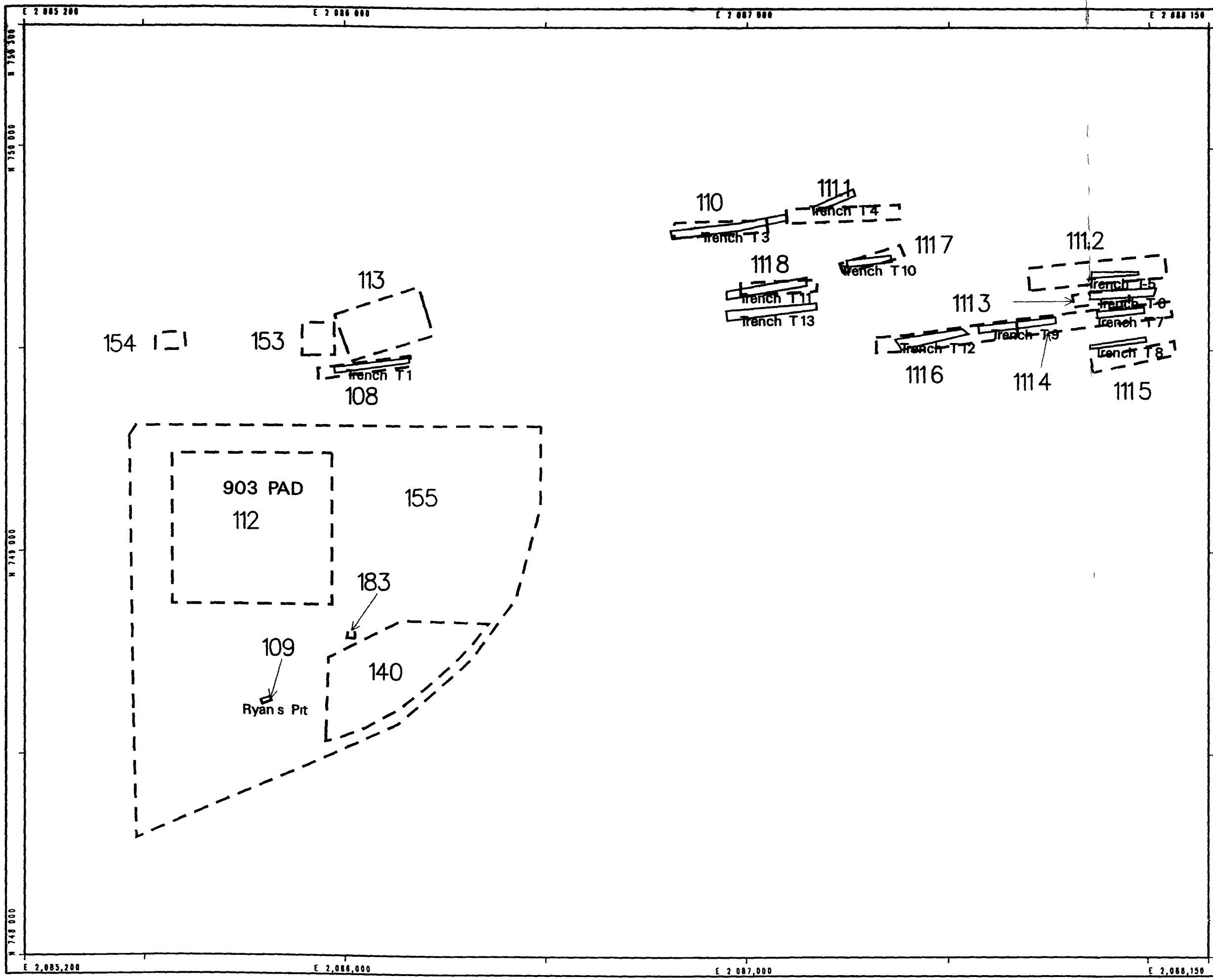
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench
October , 995

SD4



Operable Unit 2

EXPLANATION

IHSS Boundary

Trench Boundary

DATA SOURCE
Buildings, roads, and fences provided by Facilities Engr EG&G Rocky Flats, Inc.
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde; May 1996

Figure 3 12 1

Scale 2800
Inc presents approximately 3 3 fee

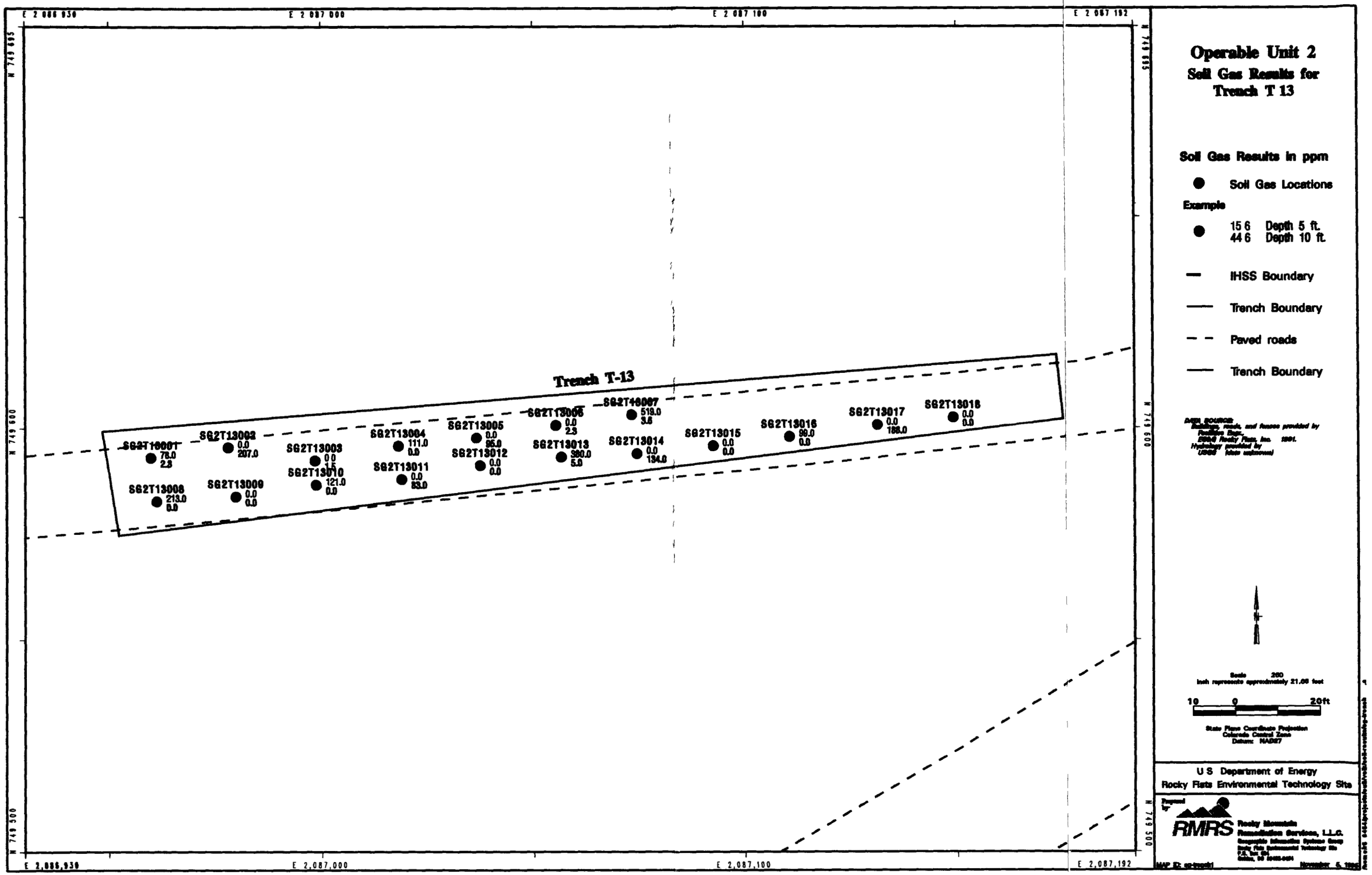
State Plane Coordina Projectio
Colorado Central one
Datum NAD

U S Dep rtm t of E gy
Rocky Flats E vi m t l T h l gy Ste

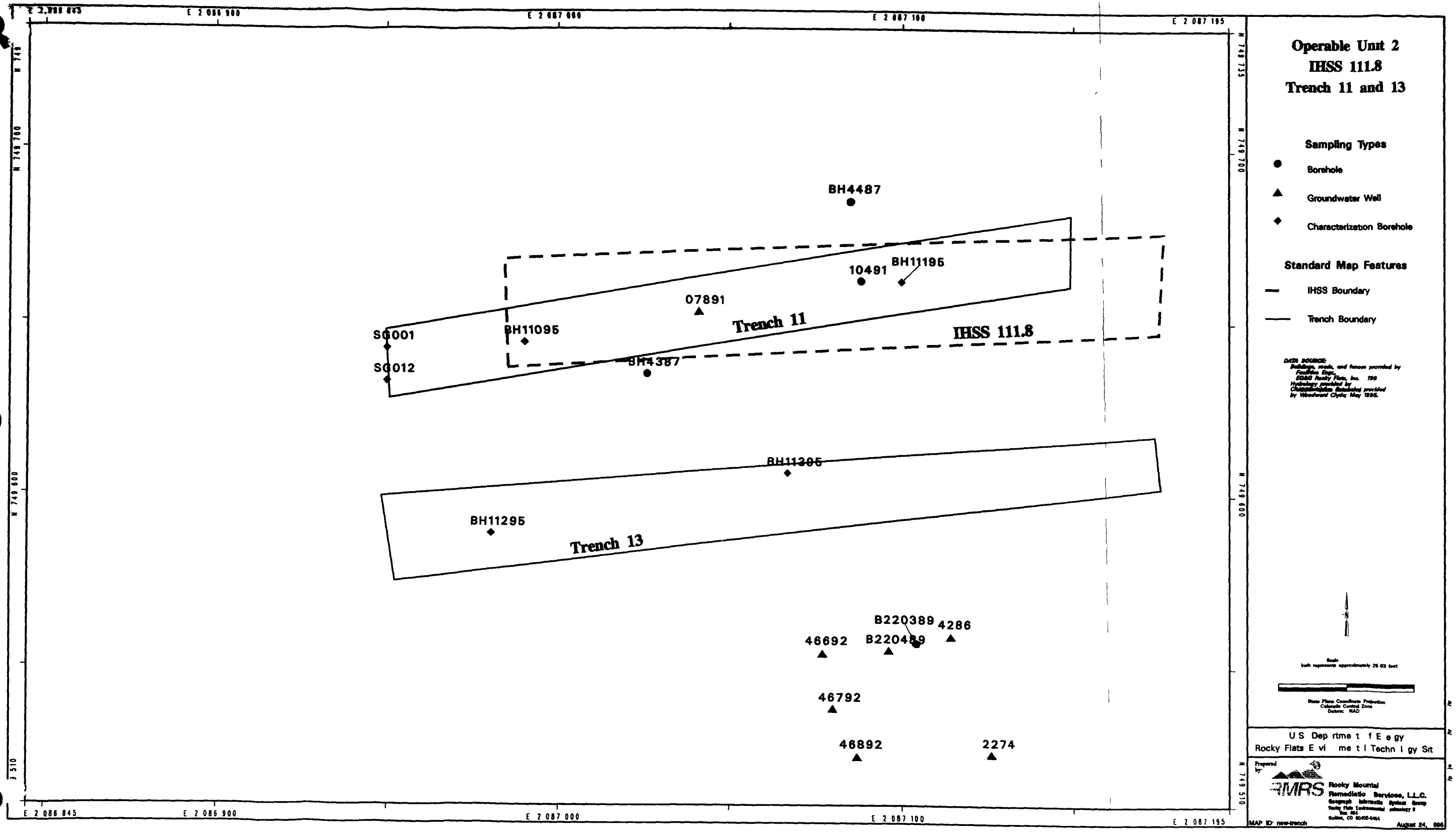
Prepared by
RMRS Rocky Mountai Remediatio Services L.L.C.
Geographic Information System resp
Rocky Flats nvironmental echnology Site
Box 464
Golden, CO 80402-0464

MAP ID: new-trench
August 25, 995

539

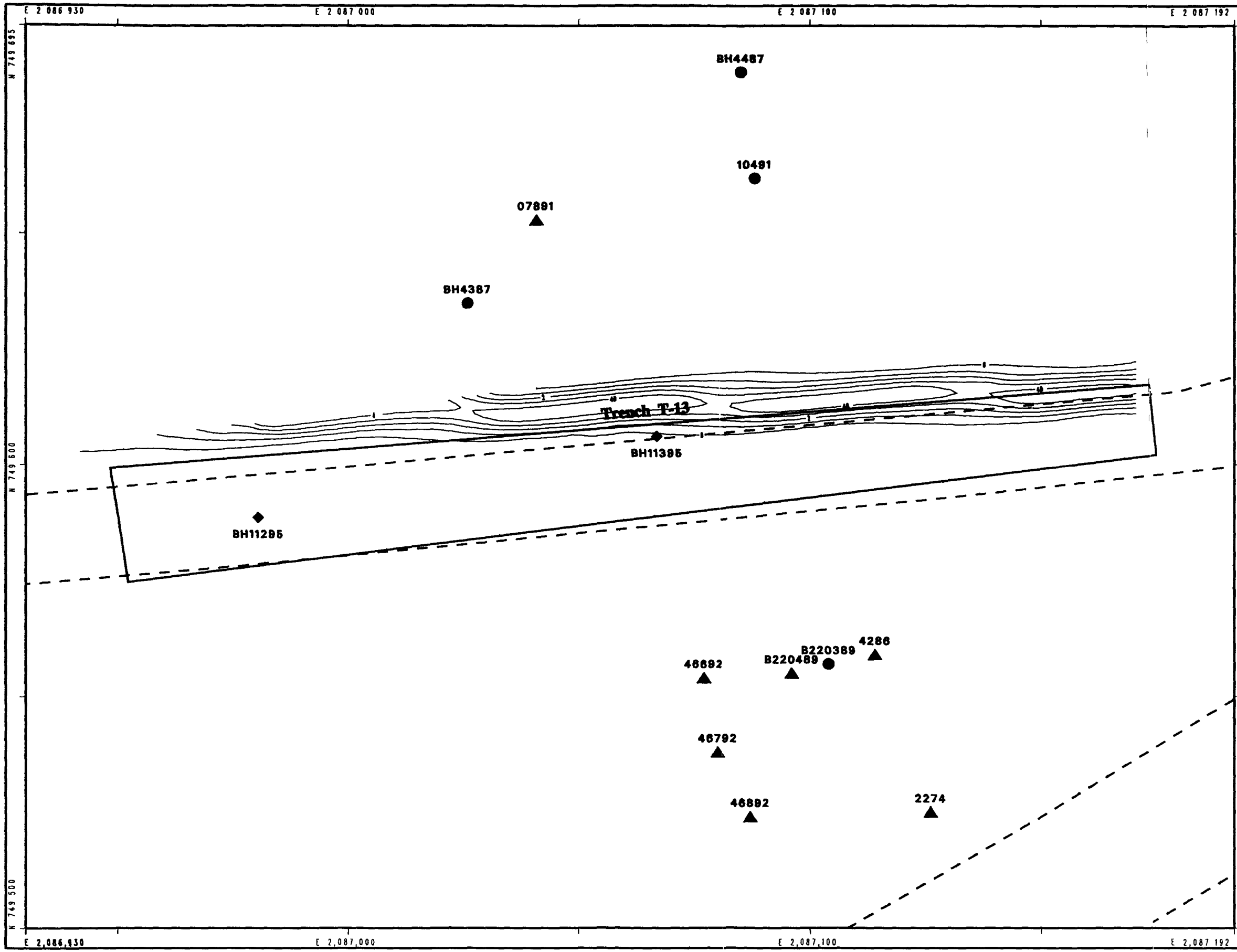

Operable Unit 2
Soil Gas Results for
Trench T 13
Soil Gas Results in ppm
Soil Gas Locations
Example
15 6 Depth 5 ft.
44 6 Depth 10 ft.
IHSS Boundary
Trench Boundary
Paved roads
Trench Boundary
Trench T-13
SG2T13001 78.0 2.3
SG2T13002 0.0 207.0
SG2T13003 0.0 1.5
SG2T13004 111.0 0.0
SG2T13005 0.0 95.0
SG2T13006 0.0 2.3
SG2T13007 519.0 3.6
SG2T13008 213.0 0.0
SG2T13009 0.0 0.0
SG2T13010 121.0 0.0
SG2T13011 0.0 83.0
SG2T13012 0.0 0.0
SG2T13013 380.0 5.0
SG2T13014 0.0 134.0
SG2T13015 0.0 0.0
SG2T13016 99.0 0.0
SG2T13017 0.0 188.0
SG2T13018 0.0 0.0
Scale 200
Inch represents approximately 21.66 feet
10 0 20ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.
E 2,086,930
E 2,087,000
E 2,087,100
E 2,087,192
N 749 695
N 749 600
N 749 500

540



Operable Unit 2
IHSS 111.8
Trench 11 and 13
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Standard Map Features
IHSS Boundary
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 199
Hydrology provided by Chlorofluorides Database provided by Woodward Clyde; May 1995.
Scale
Inch represents approximately 25 63 feet
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD
U S Dep rtme t f E e gy
Rocky Flats E vi me t l Techn l gy Sit
Prepared by:
RMRS
Rocky Mountai Remediatio Services, L.L.C.
Geograph Informatio System Group
Rocky Flats Environmental echnology 8
Box 464
Golden, CO 80402-0464
MAP ID: new-trench
August 24, 995
BH4487
10491
BH11195
07891
Trench 11
IHSS 111.8
SG001
SG012
BH11095
BH4387
BH11395
BH11295
Trench 13
B220389
4286
46692
B220489
46792
46892
2274
E 2 086 845
E 2 086 900
E 2 087 000
E 2 087 100
E 2 087 195
N 749 735
N 749 700
N 749 600
N 749 510

541



Operable Unit 2
Trench T-13

Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Inphase Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Inphase Response Isopleth Contour Interval = 8 parts/thousand
- Paved roads
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr
EG& Rocky Flats, Inc. 991
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde, June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 995.

Scale 200
Inch represent approximately 66 feet

1 0 0 2 0 f t

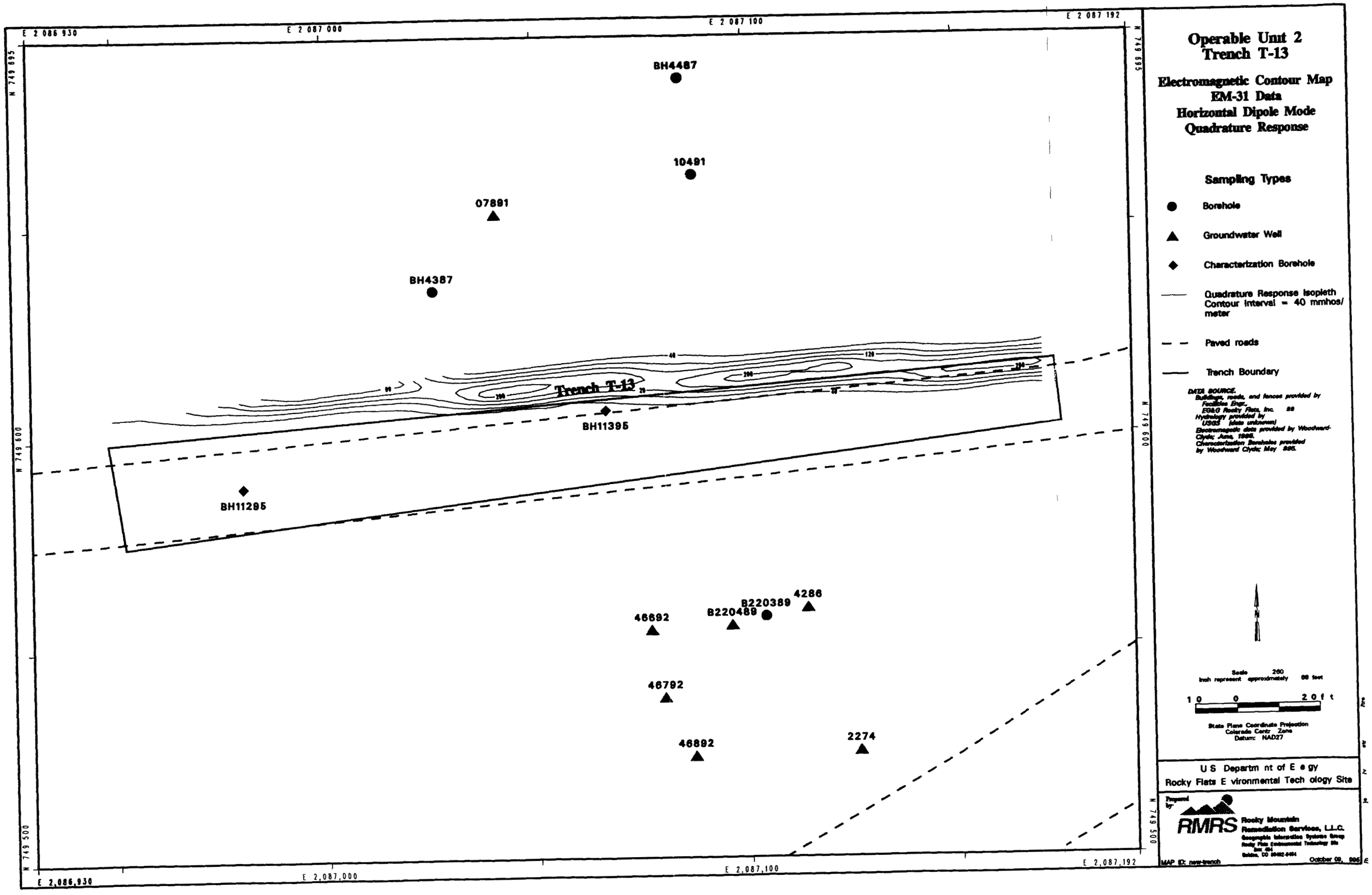
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of E ergy
Rocky Flats Envi onmental Tech ology Site

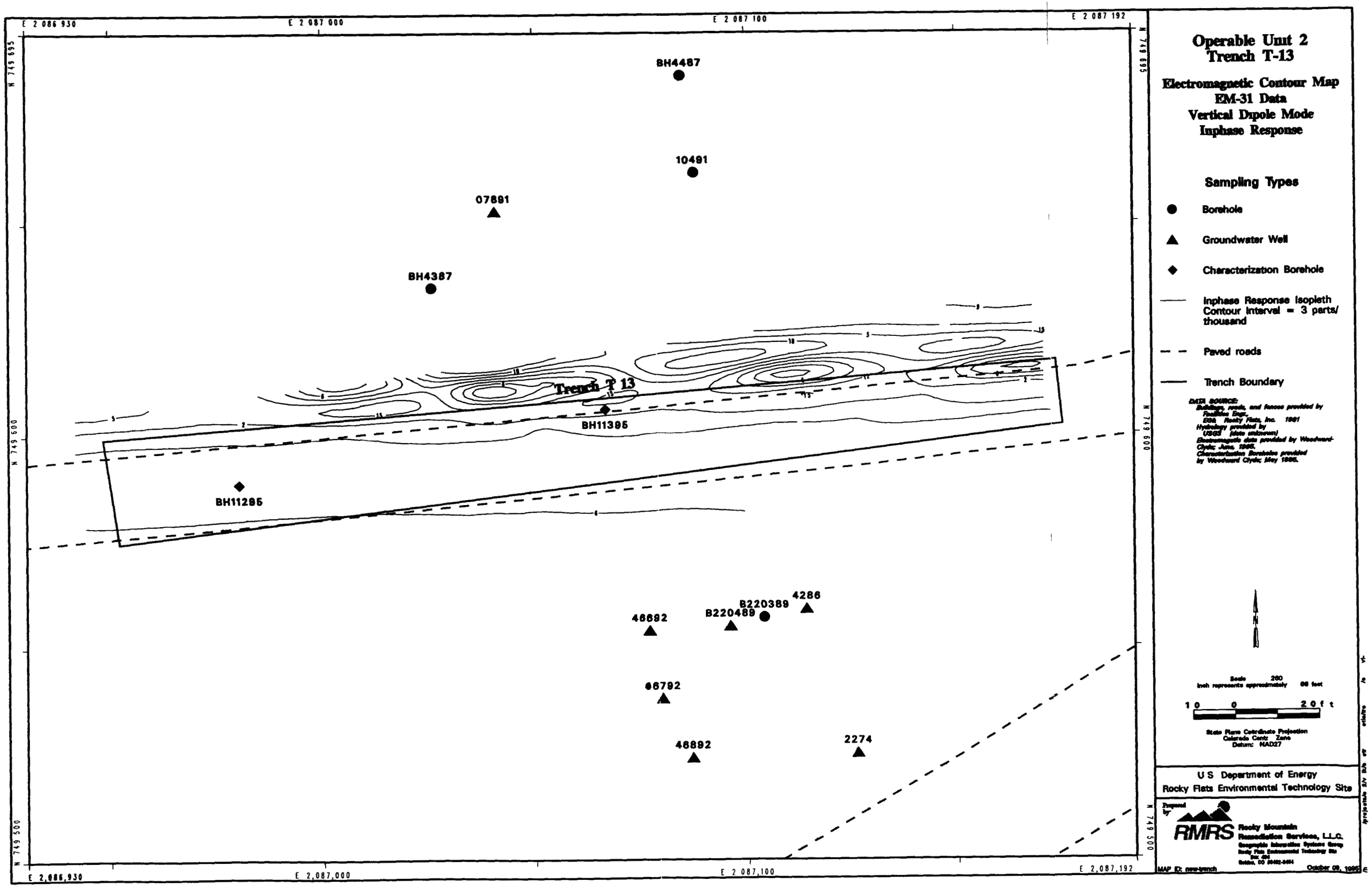
Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Box 464
Golden, CO 80402-0464

MAP ID: new-trench
October 09, 995

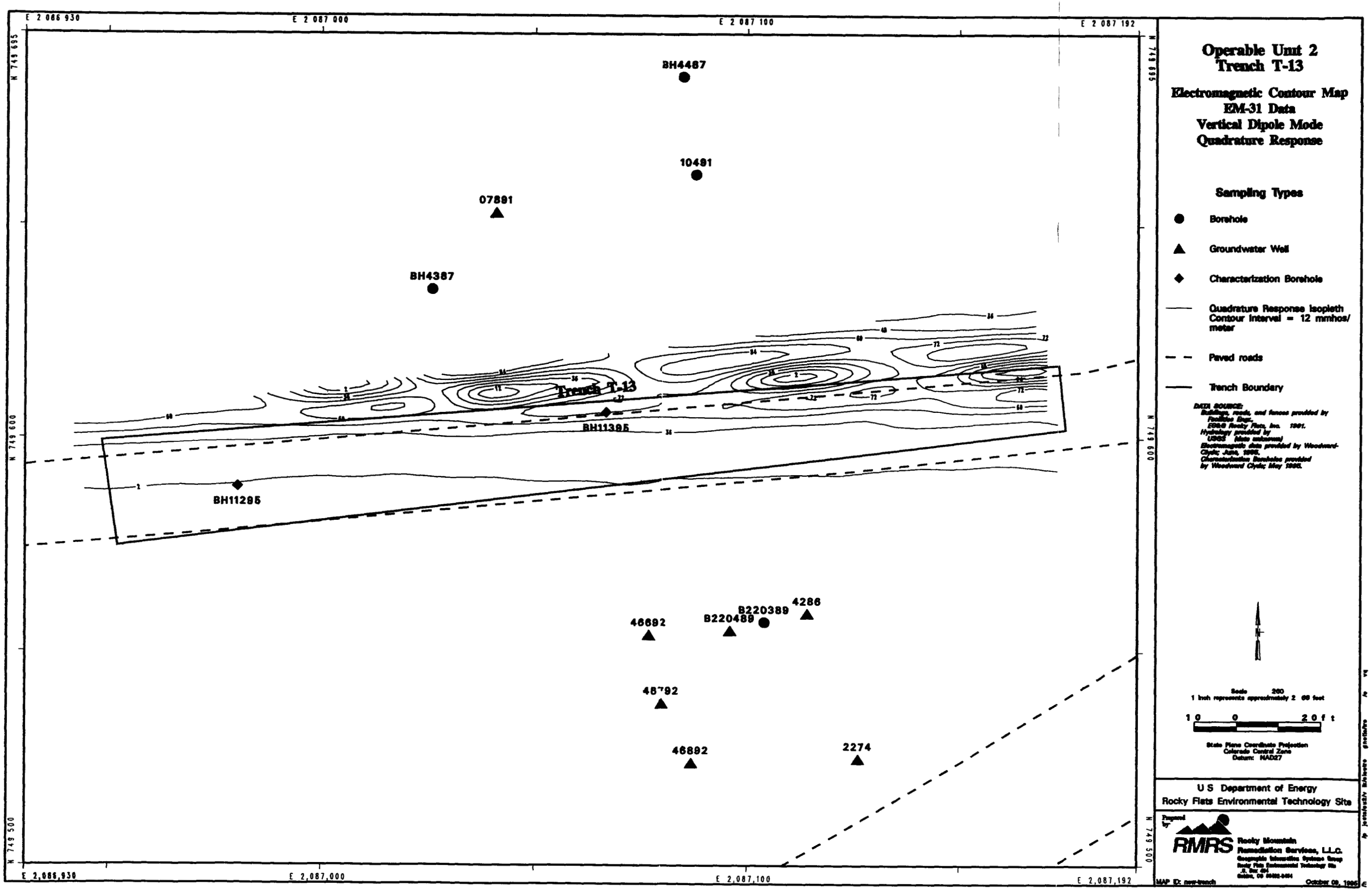
546


Operable Unit 2
Trench T-13
Electromagnetic Contour Map
EM-31 Data
Horizontal Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth Contour Interval = 40 mmhos/meter
Paved roads
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 88
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde, June, 1995.
Characterization Boreholes provided by Woodward Clyde May 1995.
Scale 200 inch represent approximately 66 feet
10 0 20 ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Box 464
Golden, CO 80402-0464
MAP ID: new-trench
October 09, 1995
BH4487
10491
07891
BH4387
Trench T-13
BH11395
BH11295
4286
B220389
B220489
46692
46792
46892
2274
E 2 086 930
E 2 087 000
E 2 087 100
E 2 087 192
N 749 695
N 749 600
N 749 500
E 2,086,930
E 2,087,000
E 2,087,100
E 2,087,192

54P

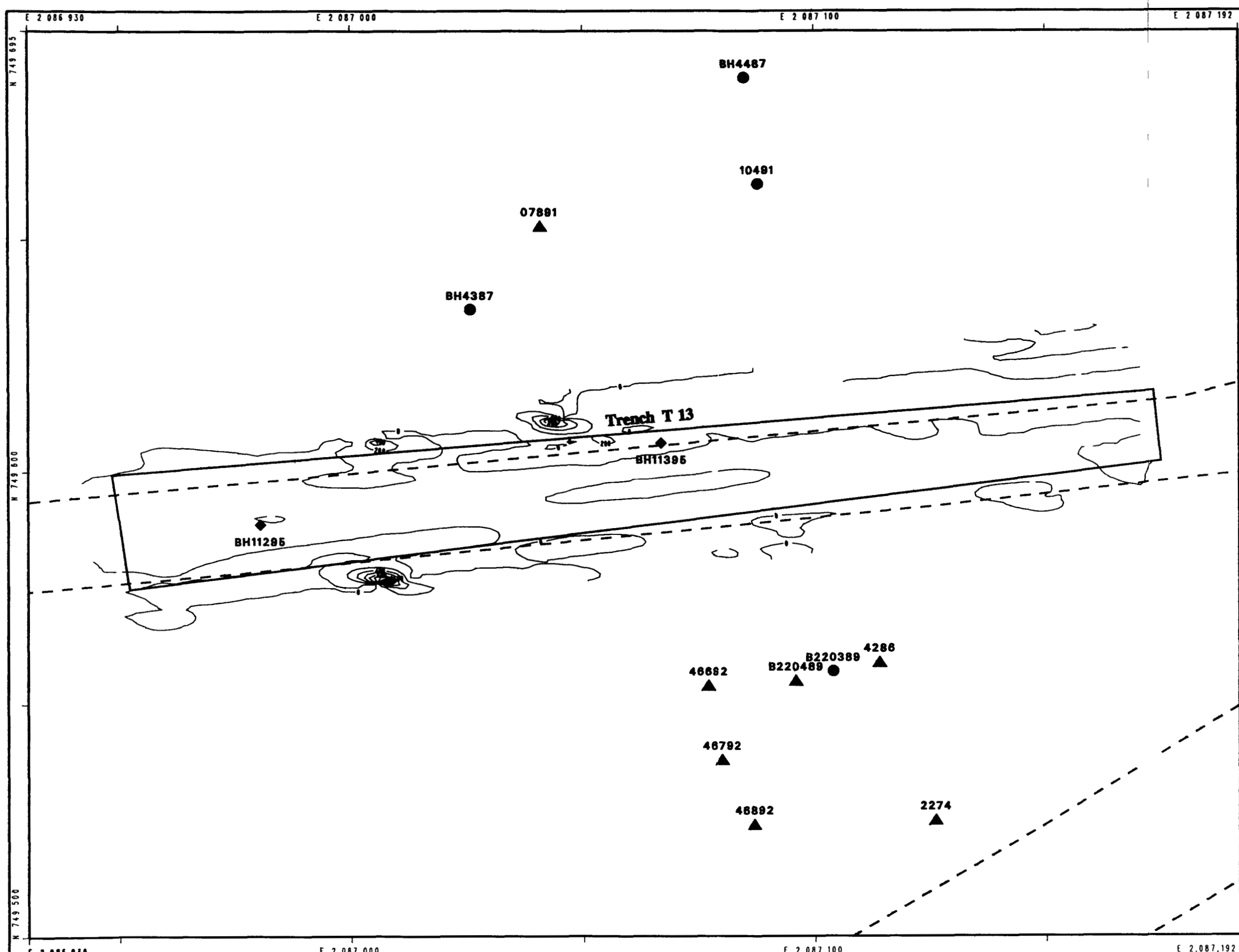

E 2 086 930
E 2 087 000
E 2 087 100
E 2 087 192
N 749 695
N 749 600
N 749 500
BH4487
10491
07891
BH4387
Trench T 13
BH11395
BH11295
46692
B220489
B220389
4286
66792
46892
2274
E 2,086,930
E 2,087,000
E 2 087,100
E 2,087,192
Operable Unit 2
Trench T-13
Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Inphase Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Inphase Response Isopleth Contour Interval = 3 parts/thousand
Paved roads
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Dept., EG&G Rocky Flats, Inc. 1991
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.
Scale 200 inch represents approximately 66 feet
10 0 20 ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Golden, CO 80402-0464
MAP ID: new-trench
October 09, 1995

548



E 2 086 930
E 2 087 000
E 2 087 100
E 2 087 192
N 749 695
N 749 600
N 749 500
BH4487
10491
07891
BH4387
Trench T-13
BH11395
BH11295
46692
B220489
B220389
4286
46792
46892
2274
Operable Unit 2
Trench T-13
Electromagnetic Contour Map
EM-31 Data
Vertical Dipole Mode
Quadrature Response
Sampling Types
Borehole
Groundwater Well
Characterization Borehole
Quadrature Response Isopleth Contour Interval = 12 mmhos/meter
Paved roads
Trench Boundary
DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.
Scale 1 inch represents approximately 2 60 feet
10 0 20 ft
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Environmental Technology Site
Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
MAP ID: new-trench
October 09, 1995

549



Operable Unit 2
Trench T 13

Electromagnetic Contour Map
EM-61 Data
Channel 2 Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Channel 2 Response Isopleth Contour Interval = 200 mv
- Paved roads
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Eng., EG&G Realty Plus, Inc. 1991.
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde; June, 1995.
Characterization Boreholes provided by Woodward Clyde; May 1995.

Scale 200
Inch represents approximately 66 feet

10 0 20 ft

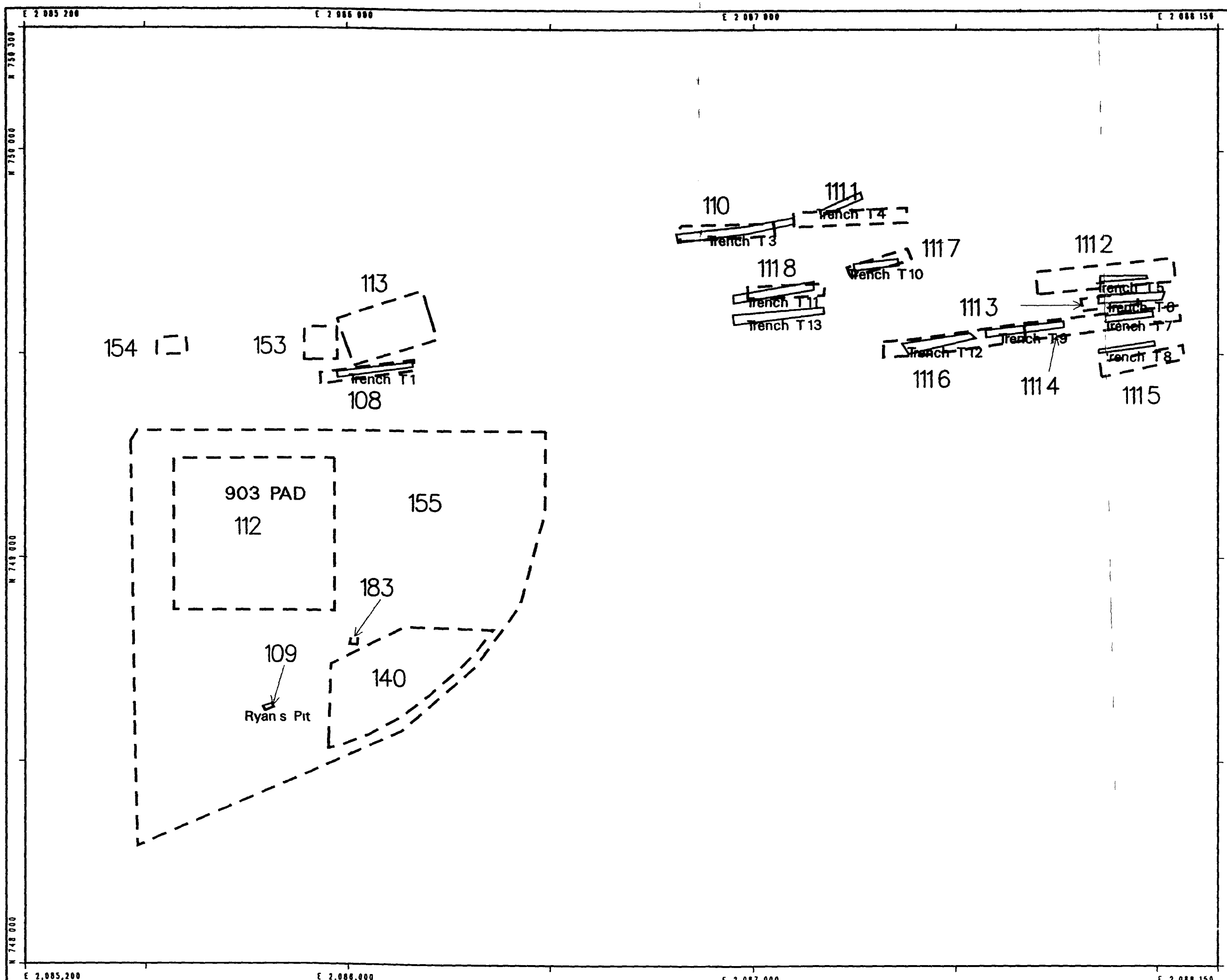
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
Box 464
Golden, CO 80402-0464

MAP ID: new-trench
October 09, 1995

5-1



Operable Unit 2

EXPLANATION

— IHSS Boundary

—— Trench Boundary

DATA SOURCE.
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 199
Hydrology provided by USGS (date unknown)
Characterization Boreholes provided by Woodward Clyde May 996

Figure 3 13 1

Scale 2800
Inc represents approximately 233.33 feet

State Plane Coordinate Projection
Colorado Central one
ation AD

U S Departm t f E gy
Ro ky Flats E o m t l Te h ol gy Sit

Prepared by
RMRS Rocky Mountai
Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental echnology Site
Box 464
Golden, 80402-0464

MAP ID: new-trench
August 28, 1996

575