AD-A272 090

89213R01
VOLUME II
EXTRA COPY

PROGRAM MANAGER
RMA CONTAMINATION CLEANUP

U.S. ARMY
MATERIEL COMMAND

— COMMITTED TO PROTECTION OF THE ENVIRONMENT —

COMPREHENSIVE MONITORING PROGRAM

Contract Number DAAA15-87-0095

ANNUAL GROUND WATER REPORT FOR 1988
JUNE 1989

FINAL REPORT

Volume II

DTIC
ELECTE
NOV 04 1993
S E D

R.L. STOLLAR & ASSOCIATES, INC.
Harding Lawson Associates
Ebasco Services Incorporated
DataChem, Inc.
Enseco-Cal Lab
Midwest Research Institute

93-26639

REQUESTS FOR COPIES OF THIS DOCUMENT
SHOULD BE REFERRED TO THE PROGRAM MANAGER
FOR THE ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP,
AMXRM ABERDEEN PROVING GROUND, MARYLAND

RTIC
05090

89213R01
VOLUME II
EXTRA COPY

2

COMPREHENSIVE MONITORING PROGRAM

Contract Number DAAA15-87-0095

ANNUAL GROUND WATER REPORT FOR 1988
JUNE 1989

FINAL REPORT

Volume II

Prepared by:

R. L. STOLLAR & ASSOCIATES INC.
HARDING LAWSON ASSOCIATES
EBASCO SERVICES INC.
DATACHEM, INC.
ENSECO-CAL LAB
MIDWEST RESEARCH INSTITUTE

Accesion For
NTIS CRA&I
DTIC TAB
Unannounced
Justification
By
Distribution
Availability Codes
Dist | Avail and/or Special
A-1

Prepared for:

PROGRAM MANAGER FOR
ROCKY MOUNTAIN ARSENAL

DTIC QUALITY INSPECTED 5

THE VIEWS, OPINIONS, AND/OR FINDINGS CONTAINED IN THIS REPORT ARE THOSE OF THE AUTHOR(S) AND SHOULD NOT BE CONSTRUED AS AN OFFICIAL DEPARTMENT OF THE ARMY POSITION, POLICY, OR DECISION, UNLESS SO DESIGNATED BY OTHER DOCUMENTATION.

THE USE OF TRADE NAMES IN THIS REPORT DOES NOT CONSTITUTE AN OFFICIAL ENDORSEMENT OR APPROVAL OF THE USE OF SUCH COMMERCIAL PRODUCTS. THE REPORT MAY NOT BE CITED FOR PURPOSES OF ADVERTISEMENT.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE
06/00/89

3. REPORT TYPE AND DATES COVERED

4. TITLE AND SUBTITLE
COMPREHENSIVE MONITORING PROGRAM, FINAL ANNUAL GROUNDWATER REPORT FOR 1988

5. FUNDING NUMBERS
DAAA15 87 0095

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
ROBERT L. STOLLAR AND ASSOCIATES

8. PERFORMING ORGANIZATION REPORT NUMBER
89213R01

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
ROCKY MOUNTAIN ARSENAL (CO.). PMRMA

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

THIS REPORT PRESENTS DATA COLLECTED DURING FY88. THE WATER LEVEL NETWORK HAS 1,119 WELLS THAT ARE MONITORED ON A QUARTERLY BASIS. THE WATER QUALITY NETWORK HAS 467 WELLS THAT MAY BE MONITORED ANNUALLY, SEMIANNUALLY, OR QUARTERLY.

THE FOLLOWING ARE INCLUDED IN THIS FIRST ANNUAL REPORT:

1. SUMMARY OF GEOTECHNICAL INFORMATION
2. DISCUSSION OF ALL WORK PERFORMED DURING THE PREVIOUS YEAR
3. DESCRIPTION OF THE WELL NETWORKS
4. INTERPRETATION OF THE DATA
5. MAPS - WATER TABLE, POTENTIOMETRIC SURFACE, PLUMES
6. WATER LEVEL AND QUALITY DATA (ON COMPUTER DISK).

14. SUBJECT TERMS
SAMPLING, CHEMICAL

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT
UNCLASSIFIED

18. SECURITY CLASSIFICATION OF THIS PAGE

19. SECURITY CLASSIFICATION OF ABSTRACT

20. LIMITATION OF ABSTRACT

TABLE OF CONTENTS

VOLUME II

PLATES

Plate 4.1-1 Water Table Elevation Map of the Unconfined Flow System, Winter 1987/88

Plate 4.1-2 Water Table Elevation Map of the Unconfined Flow System, Spring 1988

Plate 4.1-3 Water Table Elevation Map of the Unconfined Flow System, Summer 1988

APPENDIX A MAPS SHOWING DISTRIBUTIONS OF CONTAMINANTS IN THE CONFINED FLOW SYSTEM

FIGURES

Figure A-1 Dieldrin Detections Denver Zones B/VC Winter 1987/88

Figure A-2 Dieldrin Detections Denver Zones A & 1U Winter 1987/88

Figure A-3 Dieldrin Detections Denver Zone 1 Winter 1987/88

Figure A-4 Dieldrin Detections Denver Zone 2 Winter 1987/88

Figure A-5 Dieldrin Detections Denver Zones 3, 4 & 5 Winter 1987/88

Figure A-6 Dieldrin Detections Denver Zone A Spring 1988

Figure A-7 Dieldrin Detections Denver Zone 1U Spring 1988

Figure A-8 Dieldrin Detections Denver Zones 2 & 7 Spring 1988

Figure A-9 Endrin Detections Denver Zones A & 1U Winter 1987/88

Figure A-10 Endrin Detections Denver Zones 1 & 2 Winter 1987/88

Figure A-11 Endrin Detections Denver Zones 3 & 4 Winter 1987/88

Figure A-12 Dithiane/Oxathiane Detections Denver Zone A Winter 1987/88

Figure A-13 Dithiane/Oxathiane Detections Denver Zone 1U Winter 1987/88

Figure A-14 Dithiane/Oxathiane Detections Denver Zone 1 Winter 1987/88

Figure A-15 Dithiane/Oxathiane Detections Denver Zones 2 & 5 Winter 1987/88

Figure A-16 Benzothiazole Detections Denver Zone A Winter 1987/88

Figure A-17 Benzothiazole Detections Denver Zone 1U Winter 1987/88

Figure A-18 Benzothiazole Detections Denver Zones 1 & 2 Winter 1987/88

Figure A-19 Benzothiazole Detections Denver Zones 4 & 5 Winter 1987/88

Figure A-20 Summed Organosulfur Compound Detections Denver Zone B/VC Winter 1987/88

Figure A-21 Summed Organosulfur Compound Detections Denver Zone Winter 1987/88

Figure A-22 Summed Organosulfur Compound Detections Denver Zone 1U Winter 1987/88

Figure A-23 Summed Organosulfur Compound Detections Denver Zones 2, 3, 4, 5, 6 & 7 Winter 1987/88

Figure A-24 Summed Volatile Aromatic Compound Detections Denver Zone B/VC Winter 1987/88

Figure A-25 Summed Volatile Aromatic Detections Denver Zone A Winter 1987/88

Figure A-26 Summed Volatile Aromatic Compound Detections Denver Zone 1U Winter 1987/88

Figure A-27 Summed Volatile Aromatic Compound Detections Denver Zone 1 Winter 1987/88

Figure A-28 Summed Volatile Aromatic Compound Detections Denver Zone 2 Winter 1987/88

Figure A-29 Summed Volatile Aromatic Compound Detections Denver Zone 3 Winter 1987/88

Figure A-30 Summed Volatile Aromatic Compound Detections Denver Zone 4 Winter 1987/88

Figure A-31 Summed Volatile Aromatic Compound Detections Denver Zones 5, 6 & 7 Winter 1987/88

Figure A-32 Summed Volatile Aromatic Compound Detections Denver Zone A Spring 1988

Figure A-33 Summed Volatile Aromatic Compound Detections Denver Zone 1U Spring 1988

Figure A-34 Summed Volatile Aromatic Compound Detections Denver Zone 1 Spring 1988

Figure A-35 Summed Volatile Aromatic Compound Detections Denver Zone 2 Spring 1988

Figure A-36 Summed Volatile Aromatic Compound Detections Denver Zone 3 Spring 1988

TABLE OF CONTENTS (continued)

Figure A-37 Summed Volatile Aromatic Compound Detections Denver Zone 4 Spring 1988

Figure A-38 Summed Volatile Aromatic Compound Detections Denver Zones 5 & 6 Spring 1988

Figure A-39 Benzene Detections Denver Zone B/VC Winter 1987/88

Figure A-40 Benzene Detections Denver Zone A Winter 1987/88

Figure A-41 Benzene Detections Denver Zone 1U Winter 1987/88

Figure A-42 Benzene Detections Denver Zones 1 & 2 Winter 1987/88

Figure A-43 Benzene Detections Denver Zone 3 Winter 1987/88

Figure A-44 Benzene Detections Denver Zones 4, 5 & 7 Winter 1987/88

Figure A-45 Chlorobenzene Detections Denver Zone B/VC Winter 1987/88

Figure A-46 Chlorobenzene Detections Denver Zones A & 1U Winter 1987/88

Figure A-47 Chlorobenzene Detections Denver Zones 1 & 2 Winter 1987/88

Figure A-48 Chlorobenzene Detections Denver Zone 3 Winter 1987/88

Figure A-49 Chlorobenzene Detections Denver Zones 4, 5, 6 & 7 Winter 1987/88

Figure A-50 Summed Organohalogen Compound Detections Denver Zone B/VC Winter 1987/88

Figure A-51 Summed Organohalogen Compound Detections Denver Zone A Winter 1987/88

Figure A-52 Summed Organohalogen Compound Detections Denver Zone 1U Winter 1987/88

Figure A-53 Summed Organohalogen Compound Detections Denver Zone 1 Winter 1987/88

Figure A-54 Summed Organohalogen Compound Detections Denver Zone 2 Winter 1987/88

Figure A-55 Summed Organohalogen Compound Detections Denver Zone 3 Winter 1987/88

Figure A-56 Summed Organohalogen Compound Detections Denver Zone 4 Winter 1987/88

Figure A-57 Summed Organohalogen Compound Detections Denver Zone 5 Winter 1987/88

Figure A-58 Summed Organohalogen Compound Detections Denver Zone A Spring

TABLE OF CONTENTS (continued)

1988

Figure A-59 Summed Organohalogen Compound Detections Denver Zone 1U Spring 1988

Figure A-60 Summed Organohalogen Compound Detections Denver Zone 1 Spring 1988

Figure A-61 Summed Organohalogen Compound Detections Denver Zone 2 Spring 1988

Figure A-62 Summed Organohalogen Compound Detections Denver Zone 3 Spring 1988

Figure A-63 Summed Organohalogen Compound Detections Denver Zone 4 Spring 1988

Figure A-64 Summed Organohalogen Compound Detections Denver Zones 5, 6 & 7 Spring 1988

Figure A-65 Chloroform Detections Denver Zones B/VC Winter 1987/88

Figure A-66 Chloroform Detections Denver Zones A & 1U Winter 1987/88

Figure A-67 Chloroform Detections Denver Zones 1, 2 & 3 Winter 1987/88

Figure A-68 Chloroform, Detections Denver Zones 4, 5, 6 & 7 Winter 1987/88

Figure A-69 Trichloroethene Detections Denver Zones B/VC Winter 1987/88

Figure A-70 Trichloroethene Detections Denver Zone 1U Winter 1987/88

Figure A-71 Trichloroethene Detections Denver Zones 1 & 2 Winter 1987/88

Figure A-72 Trichloroethene Detections Denver Zone 3 Winter 1987/88

Figure A-73 Trichloroethene Detections Denver Zones 4, 5, 6 & 7 Winter 1987/88

Figure A-74 Tetrachloroethene Detections Denver Zones A & VC Winter 1987/88

Figure A-75 Tetrachloroethene Detections Denver Zones 1U, 1, 2, 5 & 7 Winter 1987/88

Figure A-76 Dibromochloropropane Detections Denver Zone A Winter 1987/88

Figure A-77 Dibromochloropropane Detections Denver Zone 1 Winter 1987/88

Figure A-78 Dibromochloropropane Detections Denver Zones 2 & 3 Winter 1987/88

Figure A-79 Dibromochloropropane Detections Denver Zone A Spring 1988

Figure A-80 Dibromochloropropane Detections Denver Zone 1U Spring 1988

TABLE OF CONTENTS (continued)

Figure A-81 Dibromochloropropane Detections Denver Zone 1 Spring 1988

Figure A-82 Dibromochloropropane Detections Denver Zone 2 Spring 1988

Figure A-83 Dicyclopentadiene Detections Denver Zone B/VC Winter 1987/88

Figure A-84 Dicyclopentadiene Detections Denver Zone 2 Winter 1987/88

Figure A-85 Dicyclopentadiene Detections Denver Zone 5 Winter 1987/88

Figure A-86 Diisopropylmethylphosphonate Detections Denver Zone A Winter 1987/88

Figure A-87 Diisopropylmethylphosphonate Detections Denver Zone 1U Winter 1987/88

Figure A-88 Diisopropylmethylphosphonate Detections Denver Zones 1 & 2 Winter 1987/88

Figure A-89 Diisopropylmethylphosphonate Detections Denver Zones 3 & 4 Winter 1987/88

Figure A-90 Diisopropylmethylphosphonate Detections Denver Zone A Spring 1988

Figure A-91 Diisopropylmethylphosphonate Detections Denver Zone 1U Spring 1988

Figure A-92 Diisopropylmethylphosphonate Detections Denver Zone 3 Spring 1988

Figure A-93 Arsenic Detections Denver Zones A & 1U Winter 1987/88

Figure A-94 Arsenic Detections Denver Zones 1, 2, and 3 Winter 1987/88

Figure A-95 Arsenic Detections Denver Zone 5 Winter 1987/88

Figure A-96 Fluoride Detections Denver Zones A & VC Winter 1987/88

Figure A-97 Fluoride Detections Denver Zone 1U Winter 1987/88

Figure A-98 Fluoride Detections Denver Zone 1 Winter 1987/88

Figure A-99 Fluoride Detections Denver Zone 2 Winter 1987/88

Figure A-100 Fluoride Detections Denver Zone 3 Winter 1987/88

Figure A-101 Fluoride Detections Denver Zone 4 Winter 1987/88

Figure A-102 Fluoride Detections Denver Zones 5, 6 & 7 Winter 1987/88

Figure A-103 Fluoride Detections Denver Zones A & VC Spring 1988

Figure A-104 Fluoride Detections Denver Zone 1U Spring 1988

TABLE OF CONTENTS (continued)

Figure A-105 Fluoride Detections Denver Zone 1 Spring 1988

Figure A-106 Fluoride Detections Denver Zones 2 & 3 Spring 1988

Figure A-107 Fluoride Detections Denver Zone 4 Spring 1988

Figure A-108 Fluoride Detections Denver Zones 5, 6 & 7 Spring 1988

Figure A-109 Chloride Detections Denver Zones A & VC Winter 1987/88

Figure A-110 Chloride Detections Denver Zone 1U Winter 1987/88

Figure A-111 Chloride Detections Denver Zone 1 Winter 1987/88

Figure A-112 Chloride Detections Denver Zone 2 Winter 1987/88

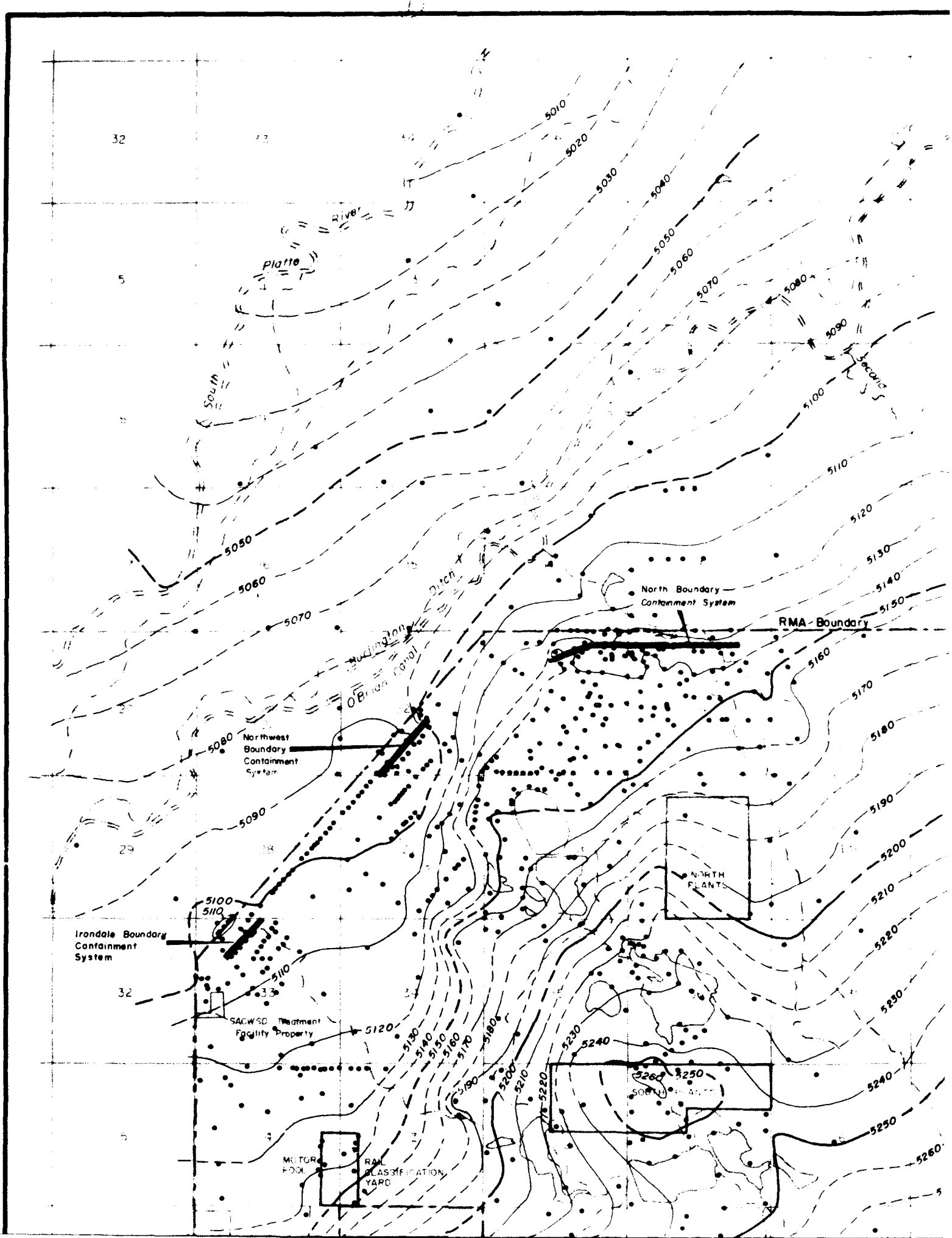
Figure A-113 Chloride Detections Denver Zone 3 Winter 1987/88

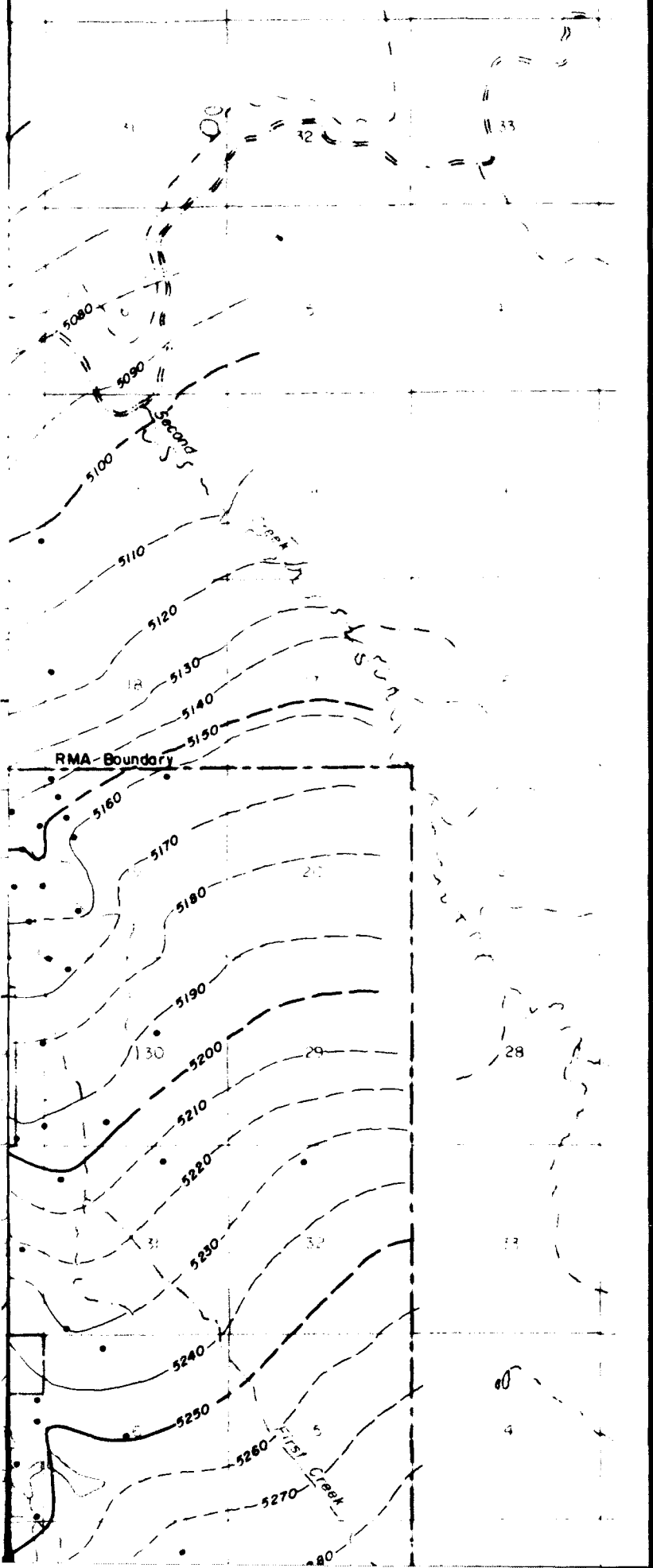
Figure A-114 Chloride Detections Denver Zone 4 Winter 1987/88

Figure A-115 Chloride Detections Denver Zone 5 Winter 1987/88

APPENDIX B HYDROLOGIC DATA COLLECTED DURING FY88 (on diskette - enclosed)

APPENDIX C ANALYTICAL DATA COLLECTED DURING FY88 (on diskette - enclosed)


South Platte River
Second
Buckington Ditch
O'Brian Canal
North Boundary Containment System
RMA Boundary
Northwest Boundary Containment System
Irondale Boundary Containment System
SACWSD Treatment Facility Property
NORTH PLANTS
SOUTH PLANTS
MOTOR POOL
RAIL CLASSIFICATION YARD
5010
5020
5030
5040
5050
5060
5070
5080
5090
5100
5110
5120
5130
5140
5150
5160
5170
5180
5190
5200
5210
5220
5230
5240
5250
5260



Explanation

Contour Interval Equals 10 Feet

Elevations in Feet

Datum Mean Sea Level

5120 Equipotential Contour, Dashed where Inferred

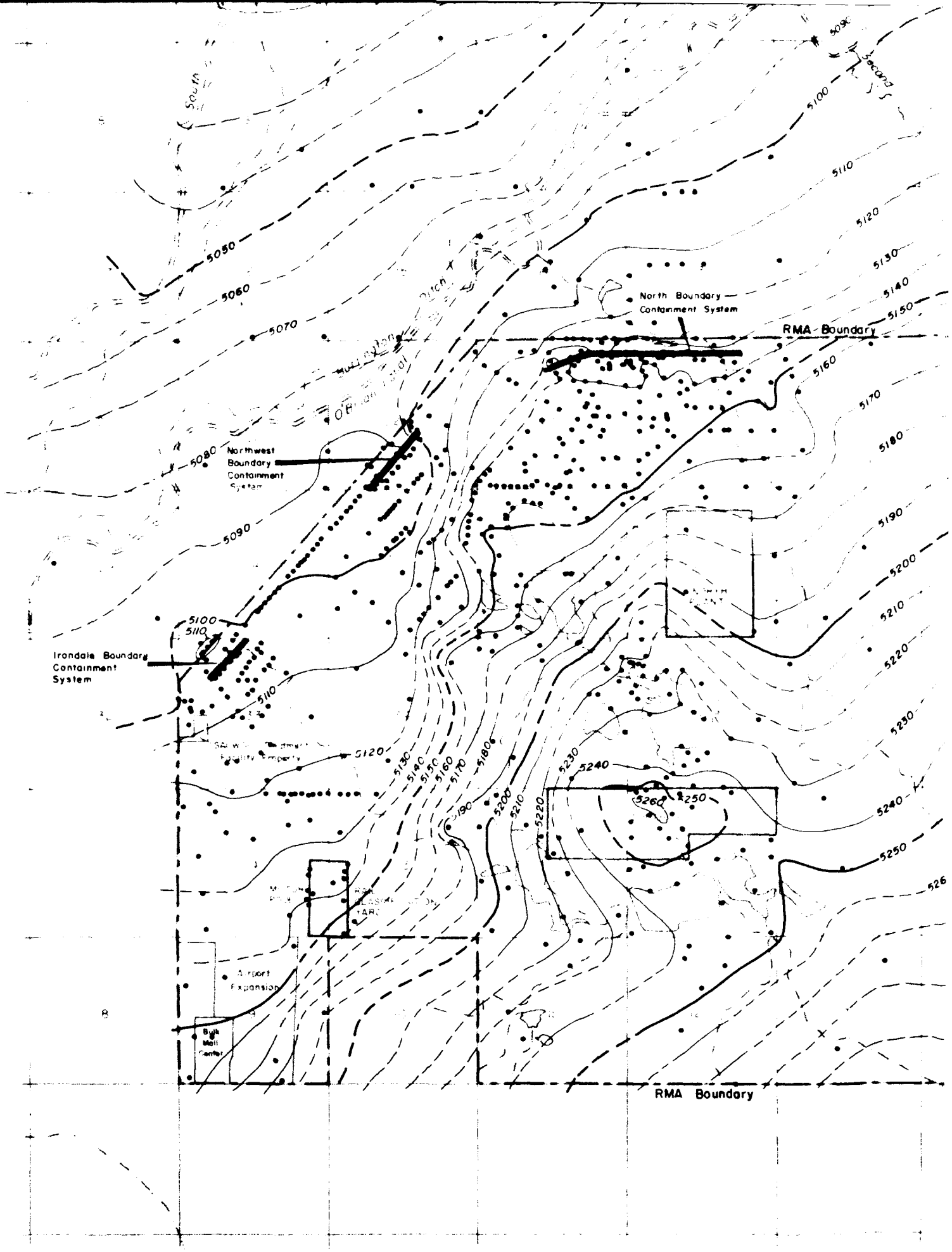
• Well or Piezometer Location yielding Unconfined Water Level Elevations

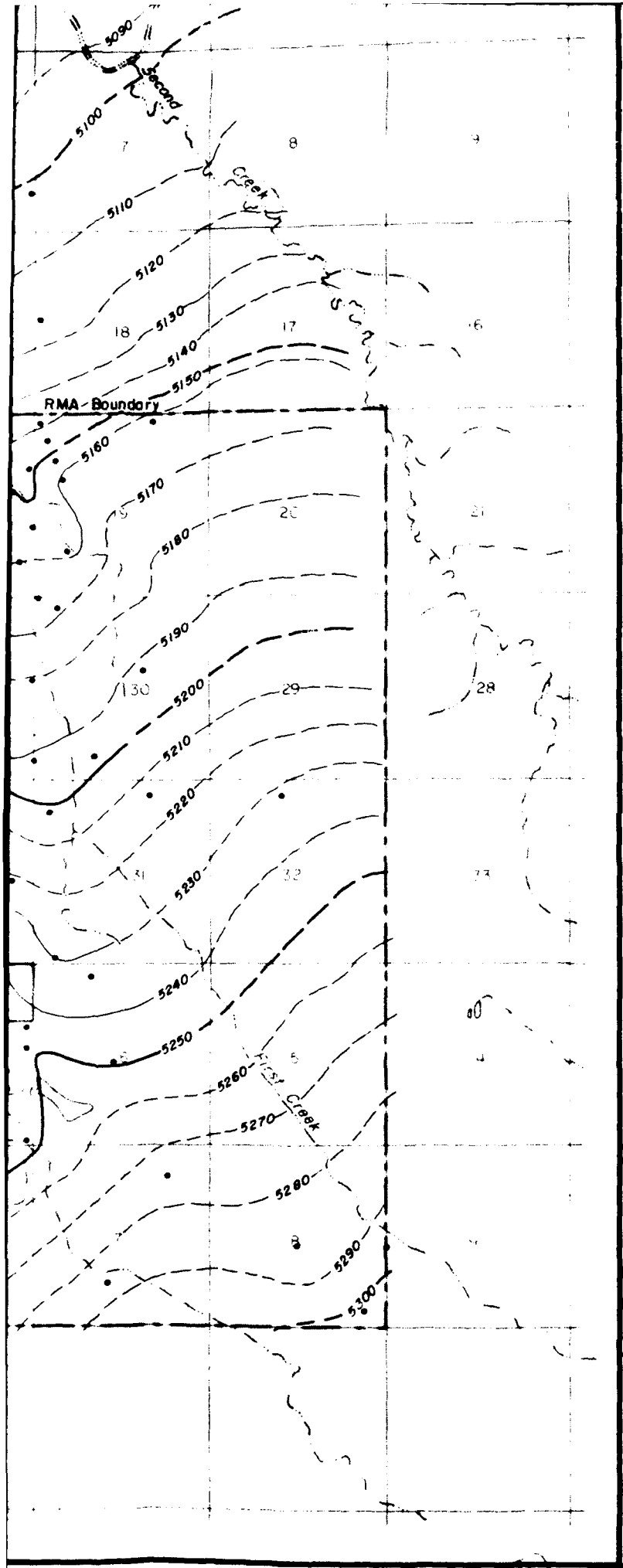
N

0 4000 8000 Feet

0 1000 2000 Meters

Prepared for


North Boundary — Containment System
RMA Boundary
Northwest Boundary Containment System
Irondale Boundary Containment System
Airport Expansion
Bulk Mail Center
RMA Boundary
5050
5060
5070
5080
5090
5100
5110
5120
5130
5140
5150
5160
5170
5180
5190
5200
5210
5220
5230
5240
5250
5260



• Well or Piezometer Location yielding Unconfined Water Level Elevations

N

0 4000 8000 Feet

0 1000 2000 Meters

Prepared for:

Program Manager's Office for

Rocky Mountain Arsenal

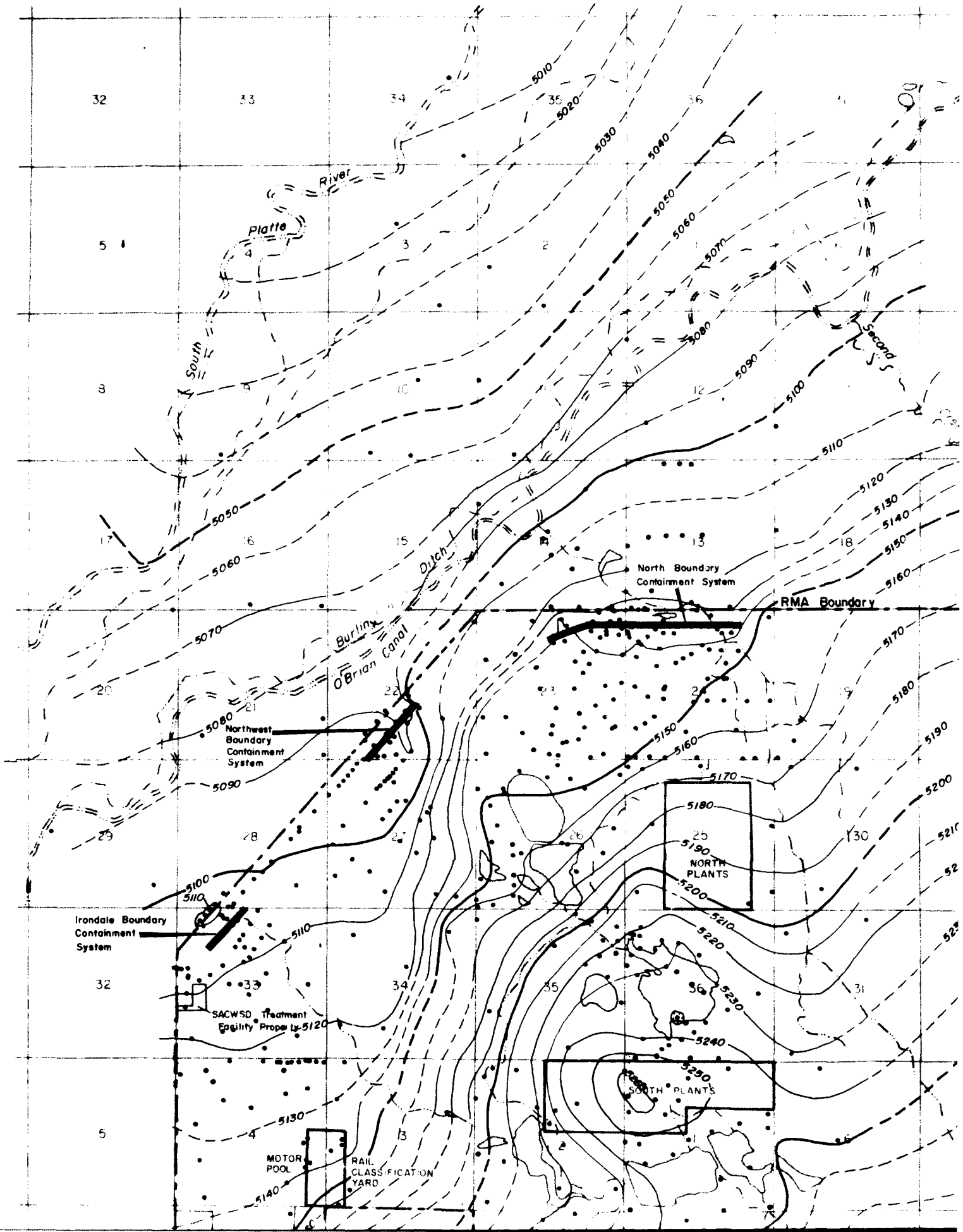
Aberdeen Proving Ground, Maryland

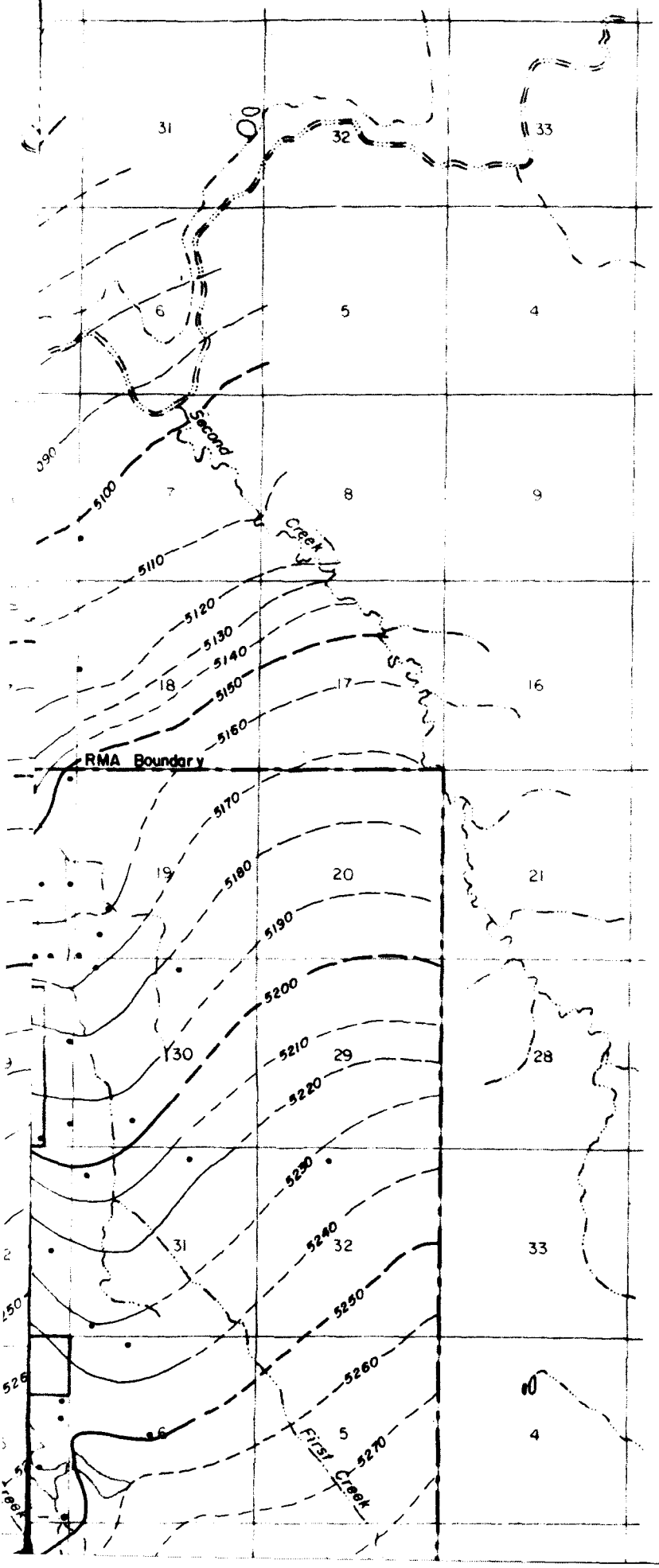
PLATE 4.1-1

Water Table Elevation Map of the Unconfined Flow System, Winter 1987/88

CMP Ground-Water Monitoring Annual Report

Prepared by: R.L. Stollar & Associates Inc.
Harding Lawson Associates


South Platte River
Second
Burlington Ditch
O'Brian Canal
North Boundary Containment System
RMA Boundary
Northwest Boundary Containment System
Irondale Boundary Containment System
SACWSD Treatment Facility Property
NORTH PLANTS
SOUTH PLANTS
MOTOR POOL
RAIL CLASSIFICATION YARD
5010
5020
5030
5040
5050
5060
5070
5080
5090
5100
5110
5120
5130
5140
5150
5160
5170
5180
5190
5200
5210
5220
5230
5240
5250



Explanation

Contour Interval Equals 10 Feet

Elevations in Feet

Datum Mean Sea Level

5120 Equipotential Contour, Dashed where Inferred

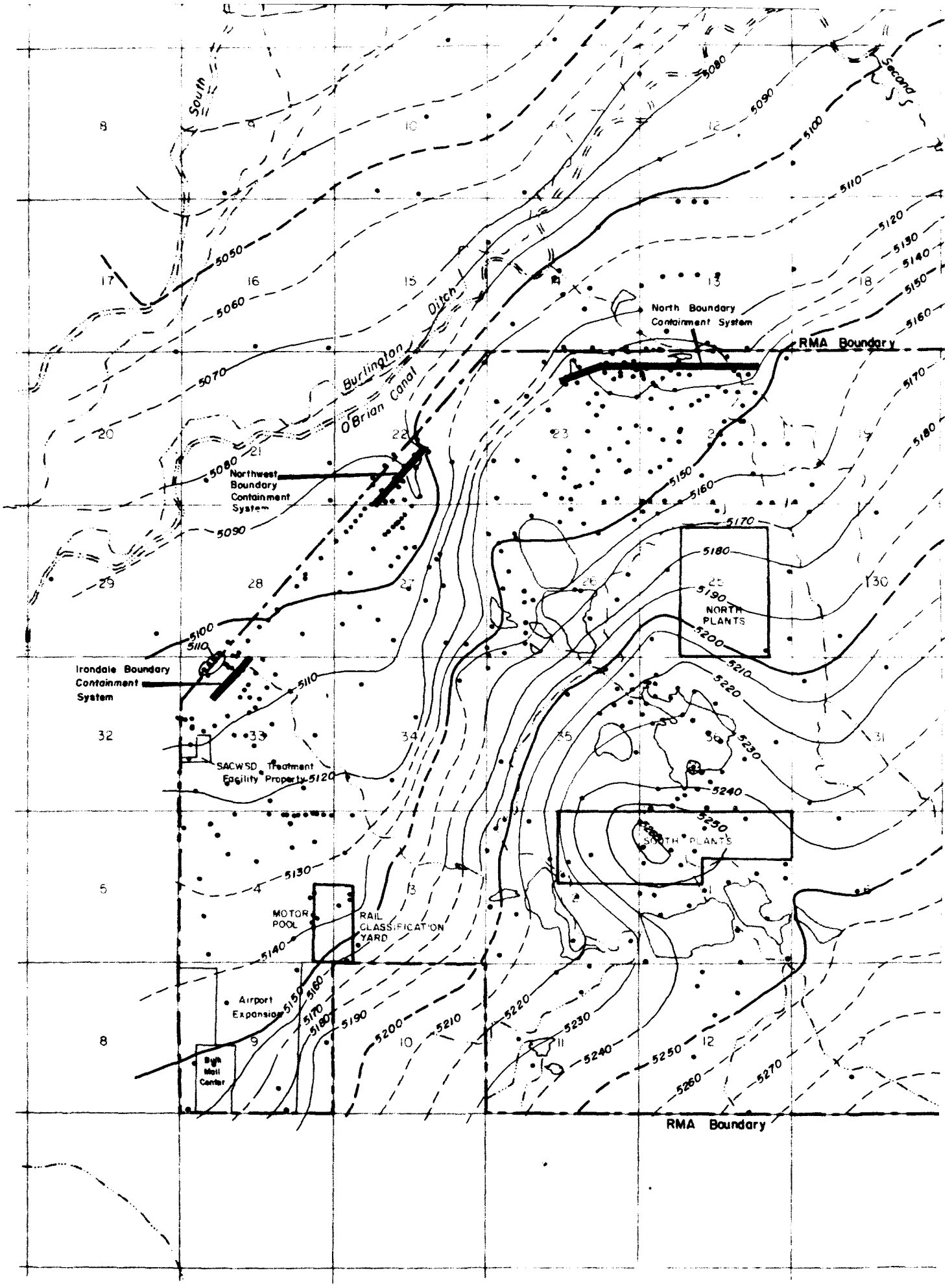
• Well or Piezometer Location yielding Unconfined Water Level Elevations

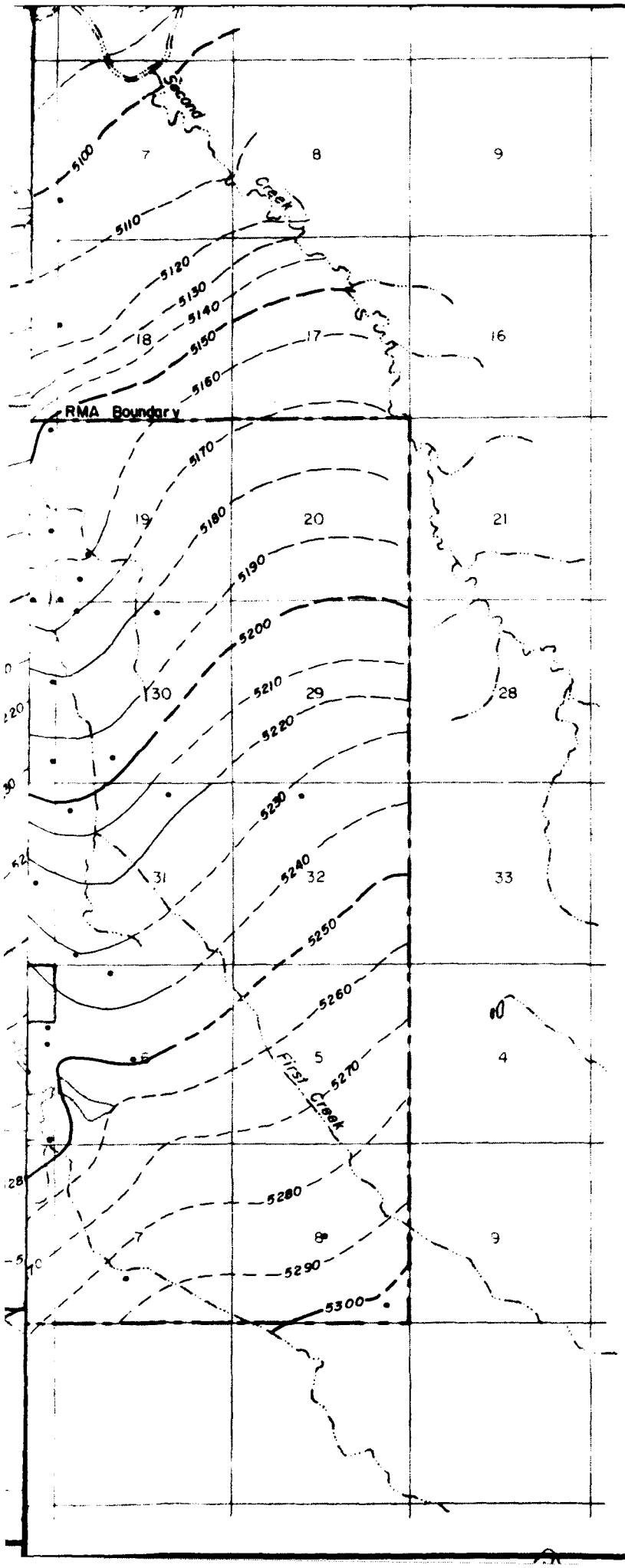
N

0 4000 8000 Feet

0 1000 2000 Meters

Prepared for:


South
Second
Burlington
Ditch
O'Brian Canal
North Boundary
Containment System
RMA Boundary
Northwest
Boundary
Containment
System
Irondale Boundary
Containment
System
SACWSD Treatment
Facility Property
NORTH
PLANTS
SOUTH PLANTS
MOTOR
POOL
RAIL
CLASSIFICATION
YARD
Airport
Expansion
Byh
Mall
Center
RMA Boundary
5050
5060
5070
5080
5090
5100
5110
5120
5130
5140
5150
5160
5170
5180
5190
5200
5210
5220
5230
5240
5250
5260
5270



• Well or Piezometer Location yielding Uncontined Water Level Elevations

N

0 4000 8000 Feet

0 1000 2000 Meters

Prepared for:

Program Manager's Office for

Rocky Mountain Arsenal

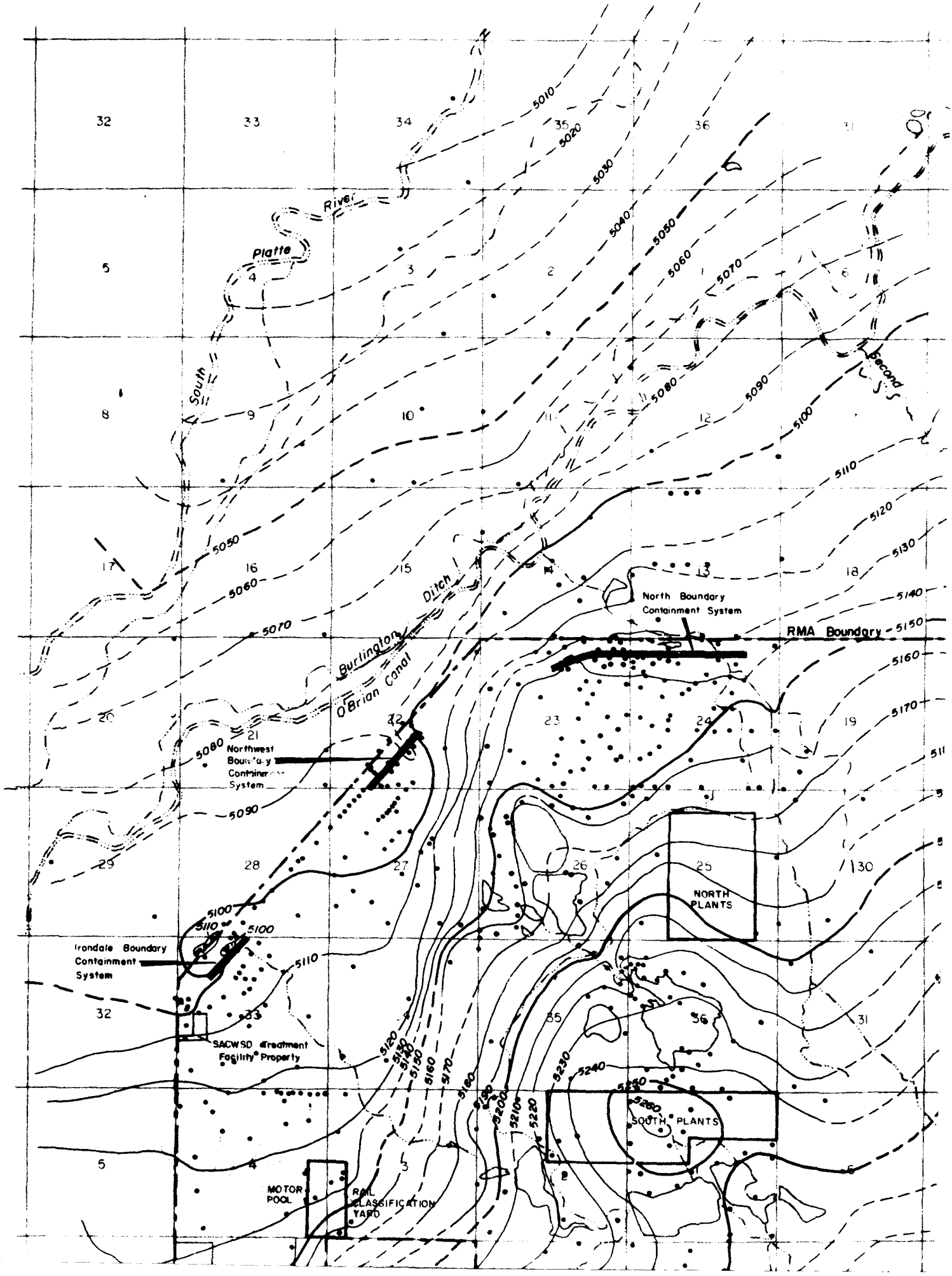
Aberdeen Proving Ground, Maryland

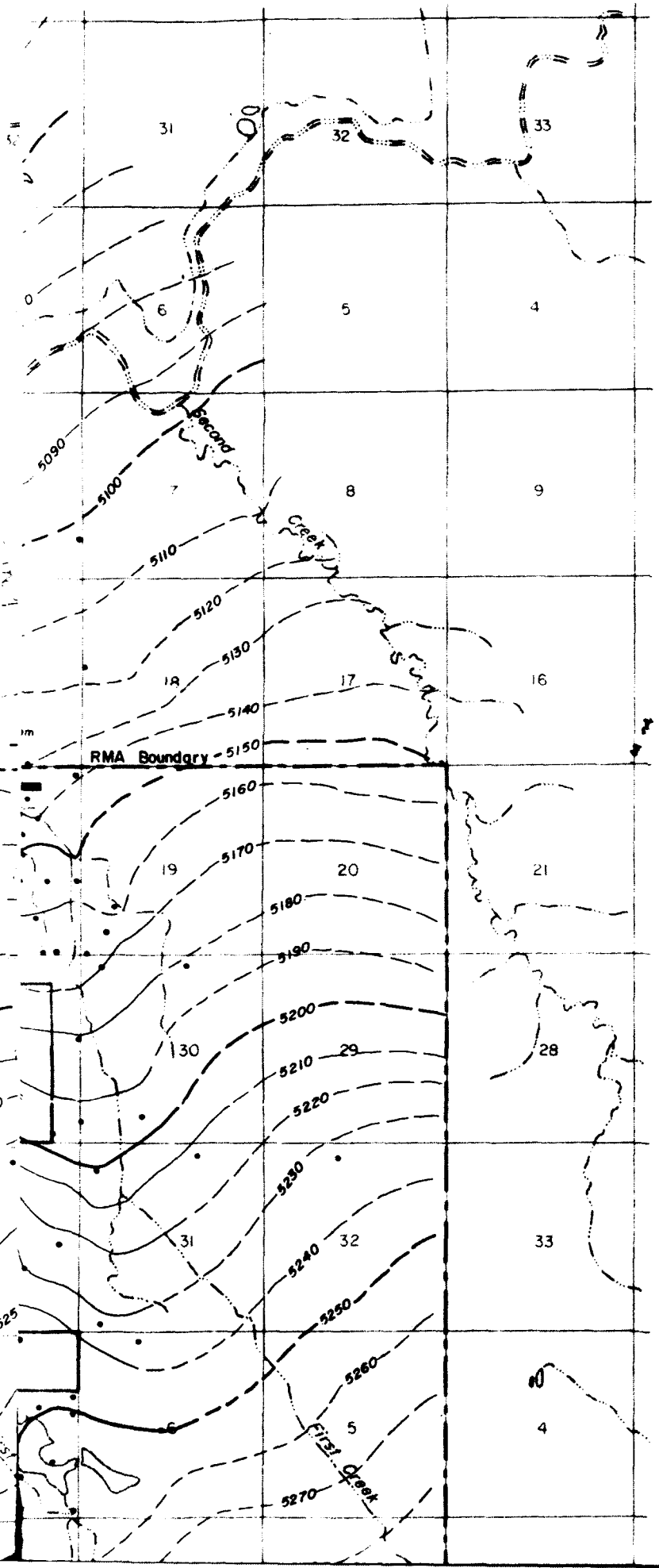
PLATE 4.1-2

Water Table Elevation Map of the Unconfined Flow System, Spring 1988

CMP Ground-Water Monitoring Annual Report

Prepared by: R.L. Stollar & Associates Inc.
Harding Lawson Associates


South Platte River
Second
Burlington Ditch
O'Brian Canal
North Boundary Containment System
RMA Boundary
Northwest Boundary Containment System
Irondale Boundary Containment System
SACWSD Treatment Facility Property
NORTH PLANTS
SOUTH PLANTS
MOTOR POOL
RAIL CLASSIFICATION YARD
5010
5020
5030
5040
5050
5060
5070
5080
5090
5100
5110
5120
5130
5140
5150
5160
5170
5200
5210
5220
5230
5240
5250
5260



Explanation

Contour Interval Equals 10 Feet

Elevations in Feet

Datum Mean Sea Level

5120 Equipotential Contour, Dashed where Inferred

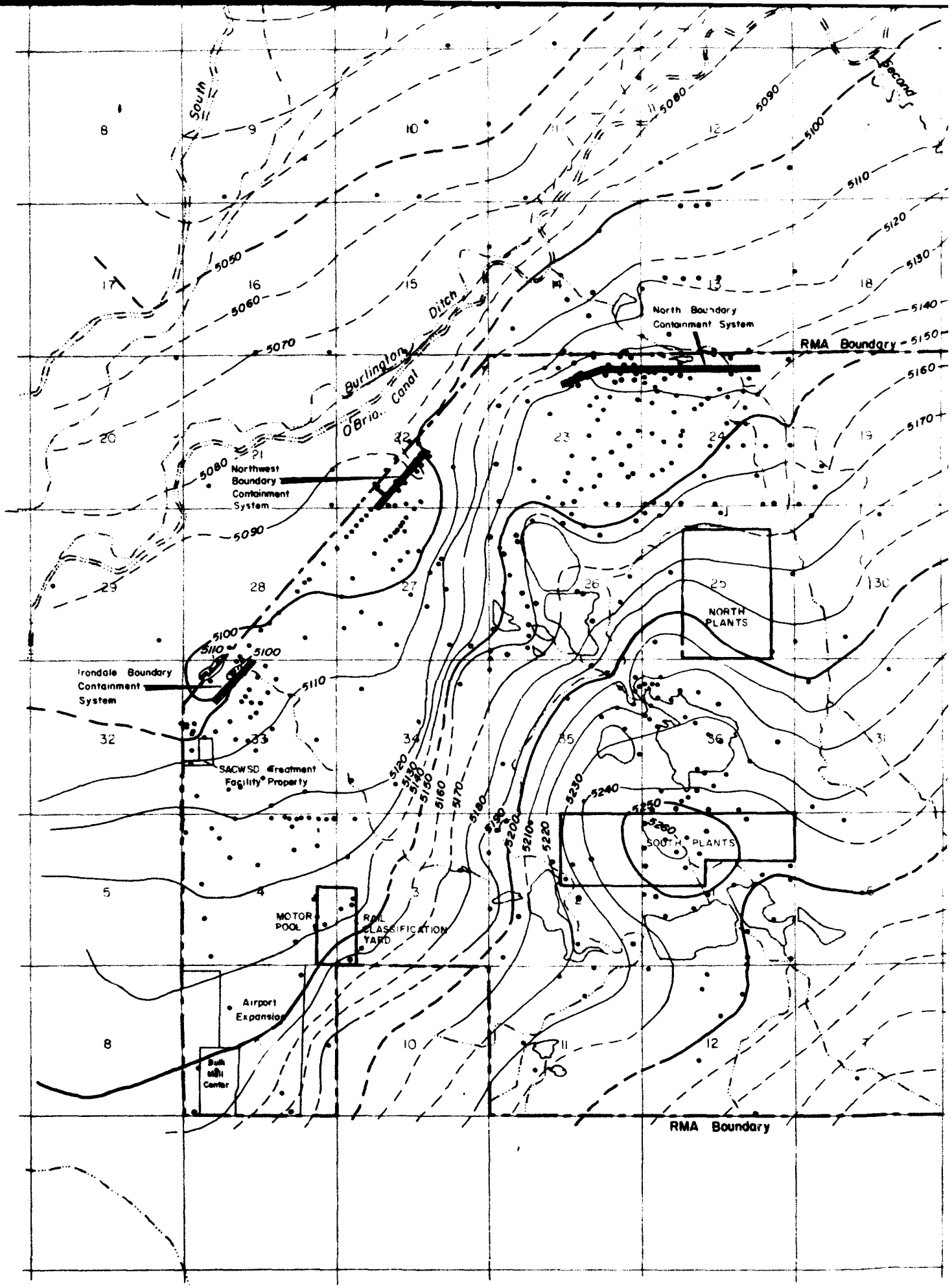
• Well or Piezometer Location yielding Unconfined Water Level Elevations

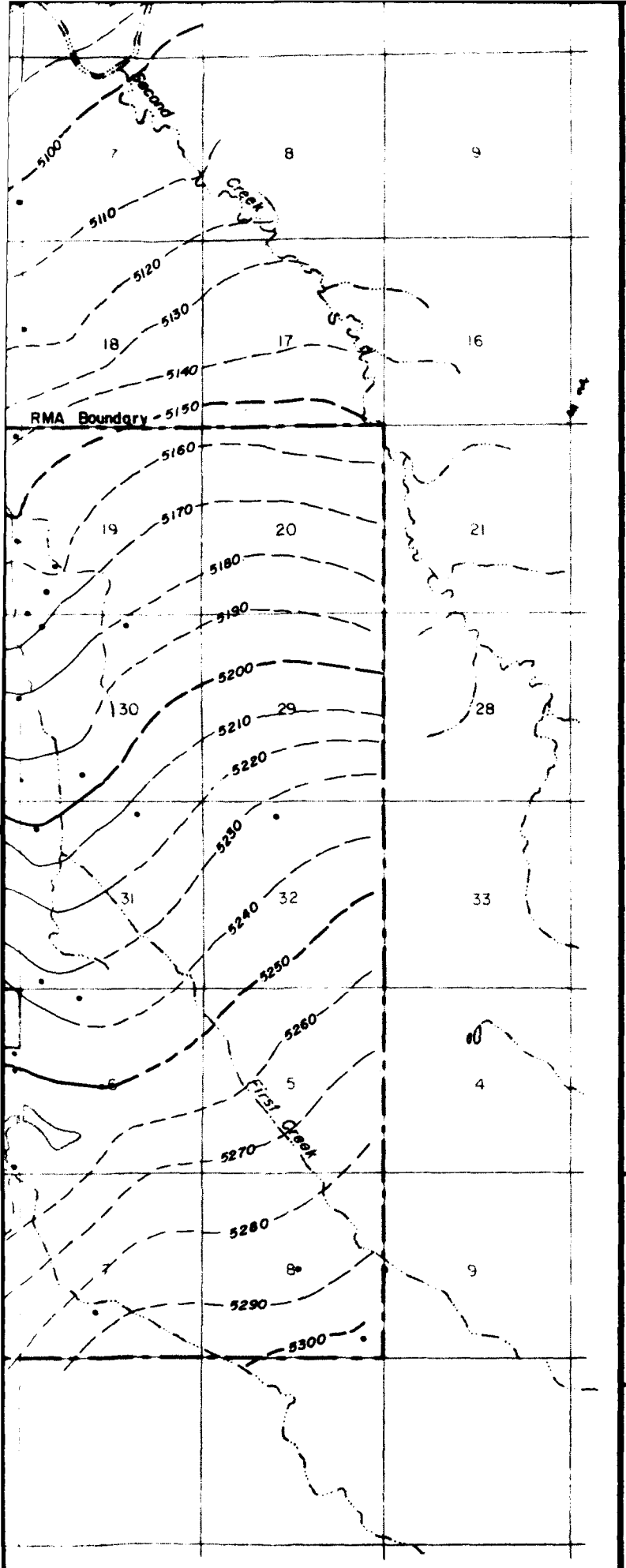
N

0 4000 8000 Feet

0 1000 2000 Meters

Prepared for :


South
Second
Burlington Ditch
O'Brian Canal
North Boundary Containment System
RMA Boundary
Northwest Boundary Containment System
Irondale Boundary Containment System
SACWSD Treatment Facility Property
NORTH PLANTS
SOUTH PLANTS
MOTOR POOL
RAIL CLASSIFICATION YARD
Airport Expansion
Bulk Mail Center
RMA Boundary
5050
5060
5070
5080
5090
5100
5110
5120
5130
5140
5150
5160
5170
5180
5190
5200
5210
5220
5230
5240
5250
5260



• Well or Piezometer Location yielding Unconfined Water Level Elevations

N

0 4000 8000 Feet

0 1000 2000 Meters

Prepared for:

Program Manager's Office for

Rocky Mountain Arsenal

Aberdeen Proving Ground, Maryland

PLATE 4.1-3

Water Table Elevation Map of the Unconfined Flow System, Summer 1988

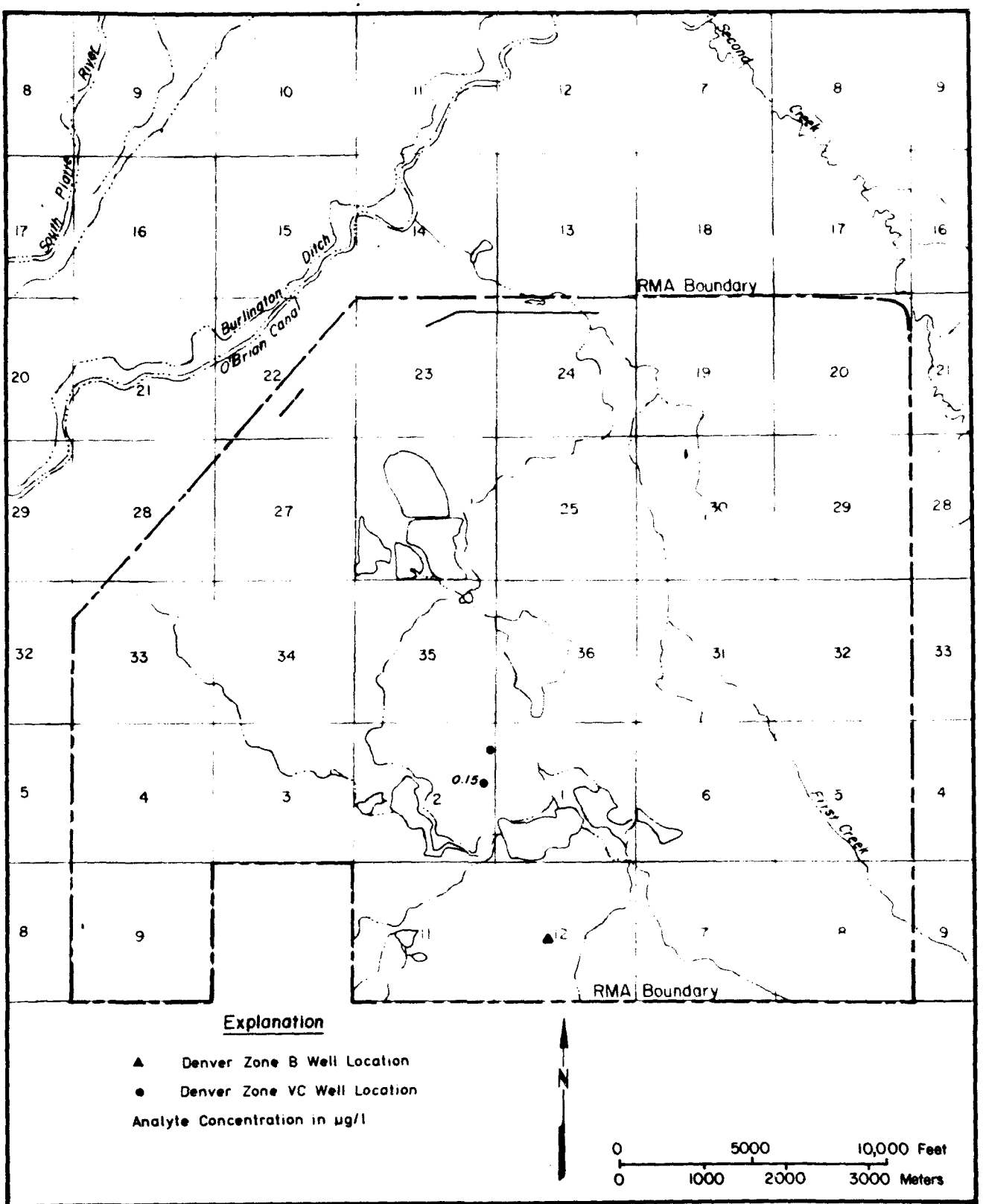
CMP Ground-Water Monitoring Annual Report

Prepared by: R.L. Stollar & Associates Inc.
Harding Lawson Associates

APPENDIX A

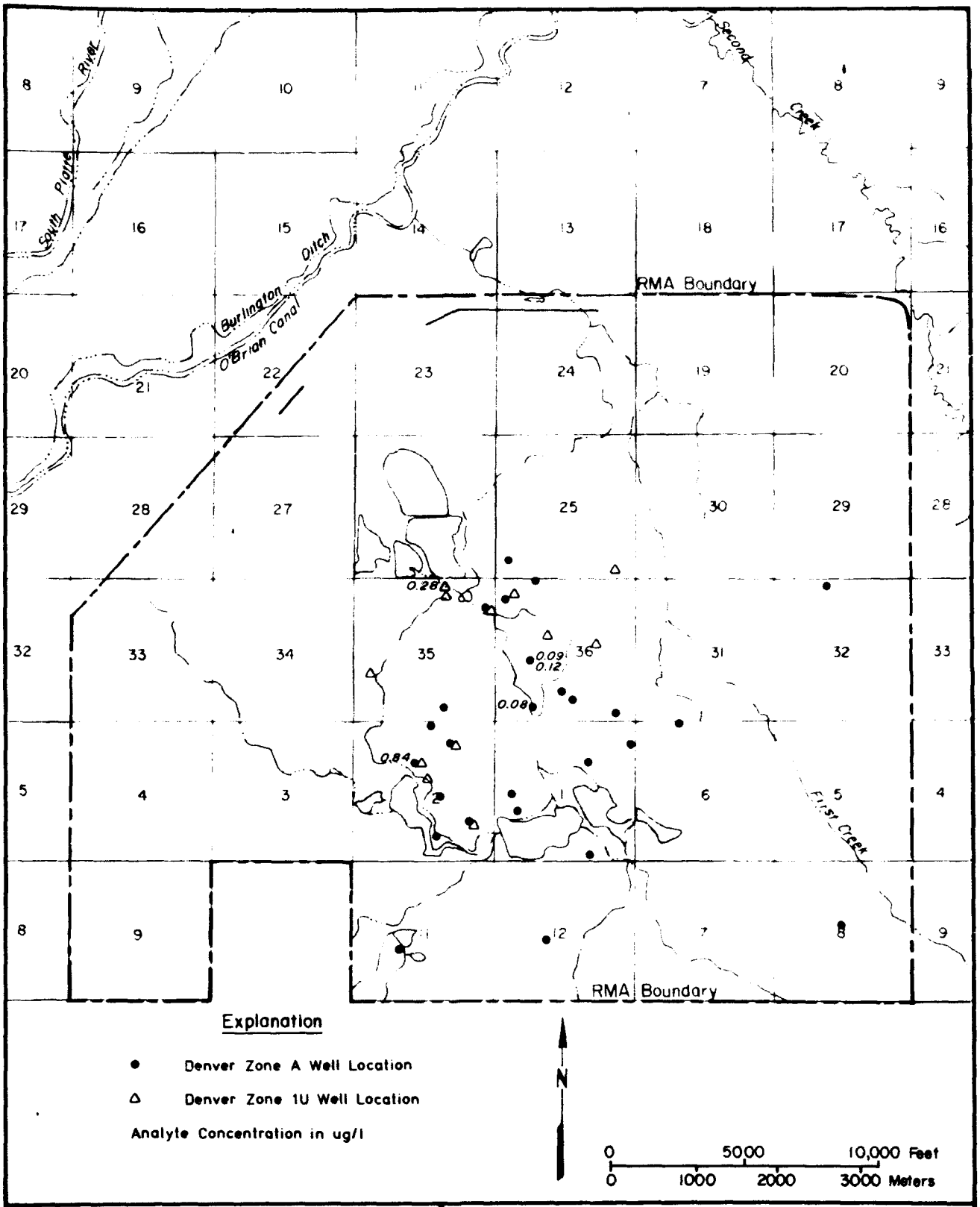
MAPS SHOWING DISTRIBUTIONS OF CONTAMINANTS

IN THE CONFINED FLOW SYSTEM



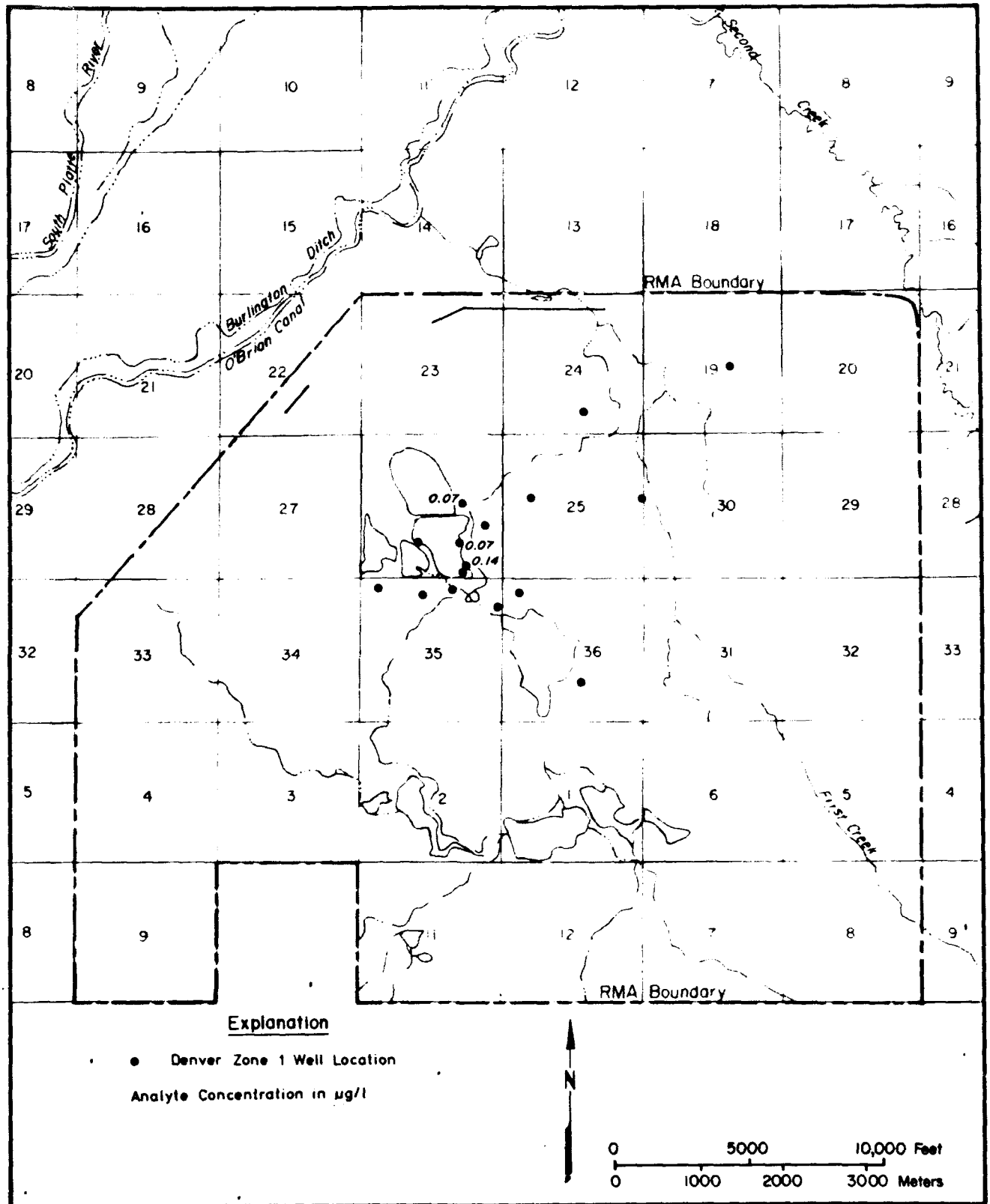
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-1
Dieldrin Detections
Denver Zones B & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



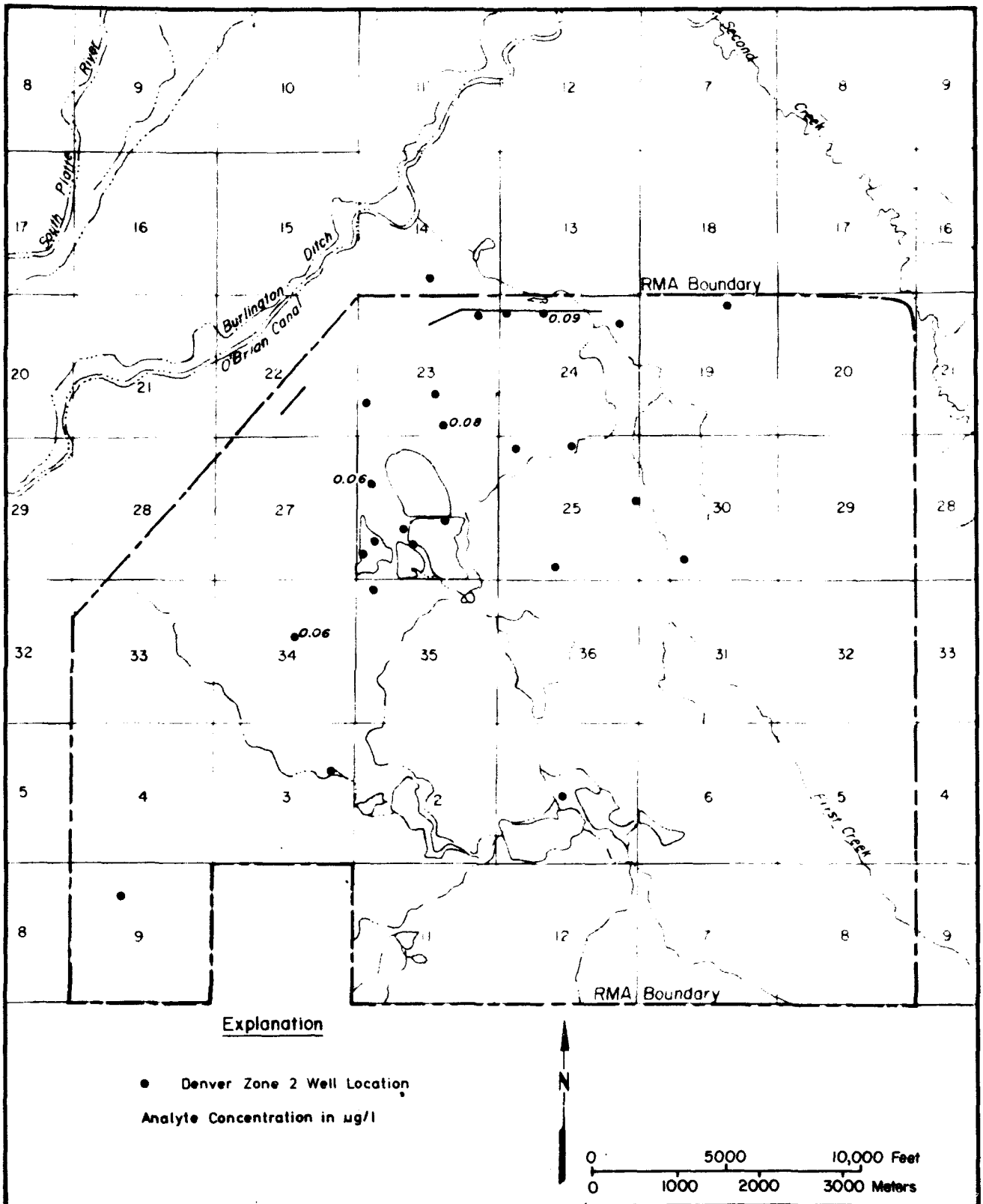
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-2
Dieldrin Detections
Denver Zones A & 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



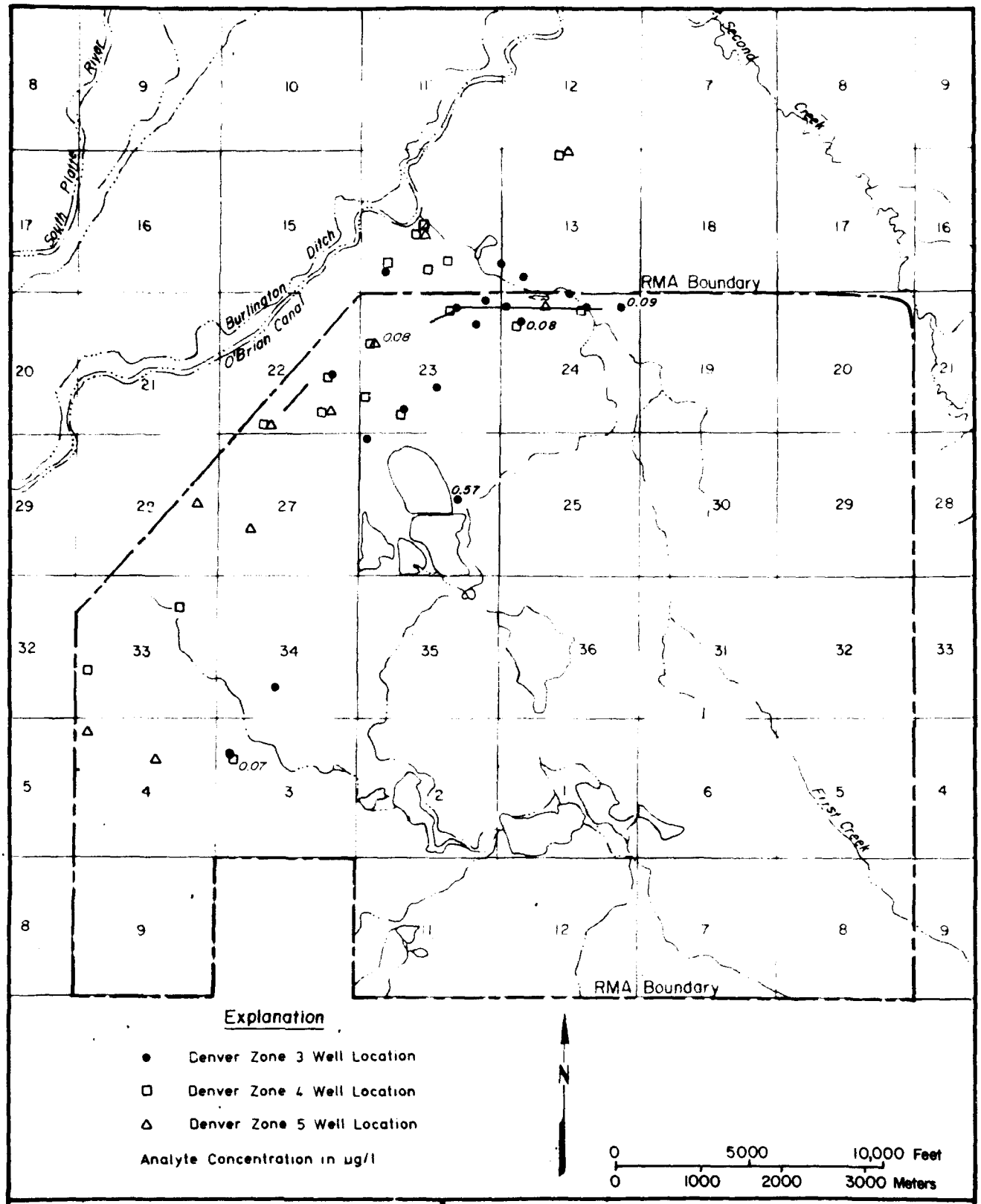
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-3
Dieldrin Detections
Denver Zone 1
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



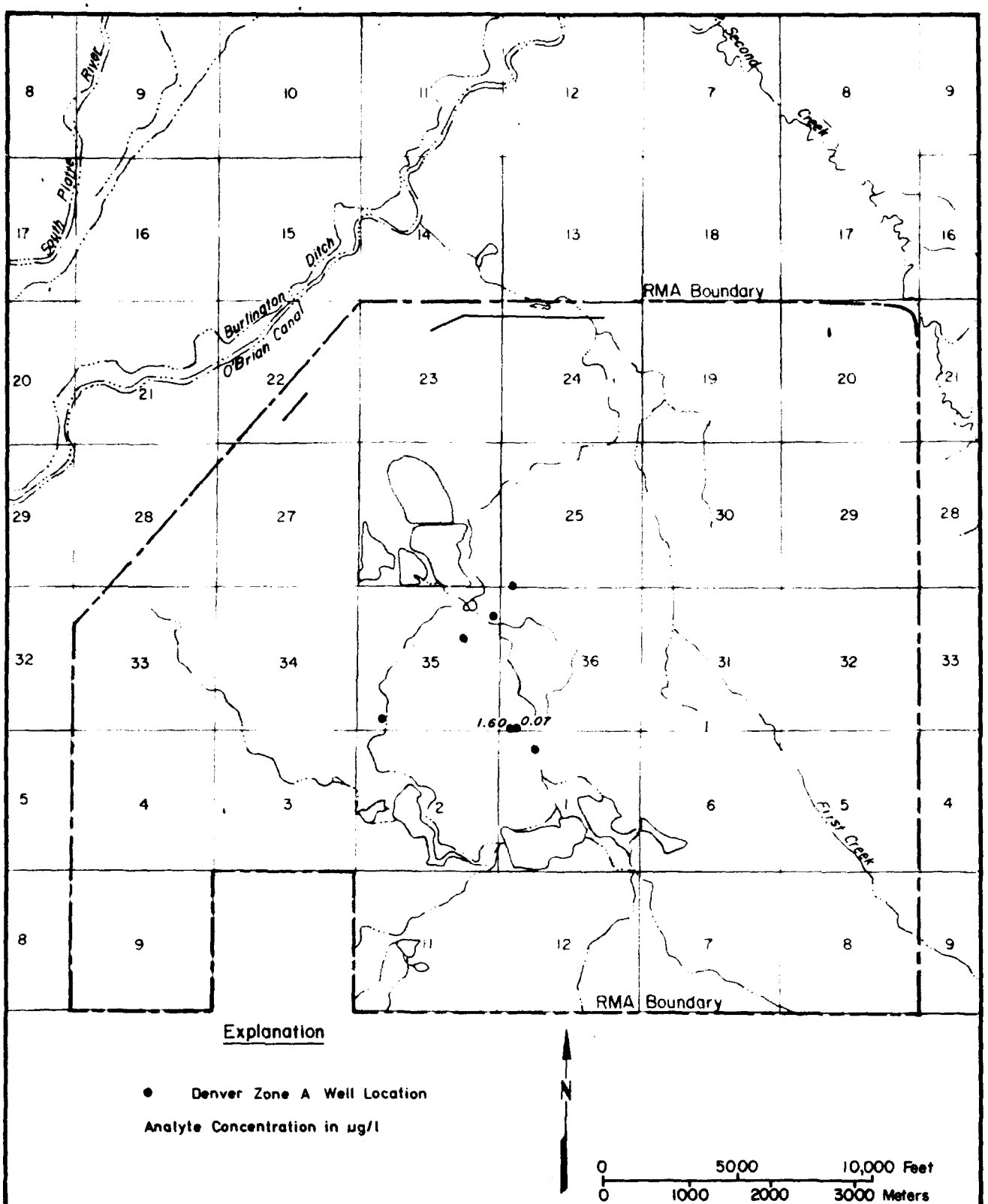
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-4
Dieldrin Detections
Denver Zone 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



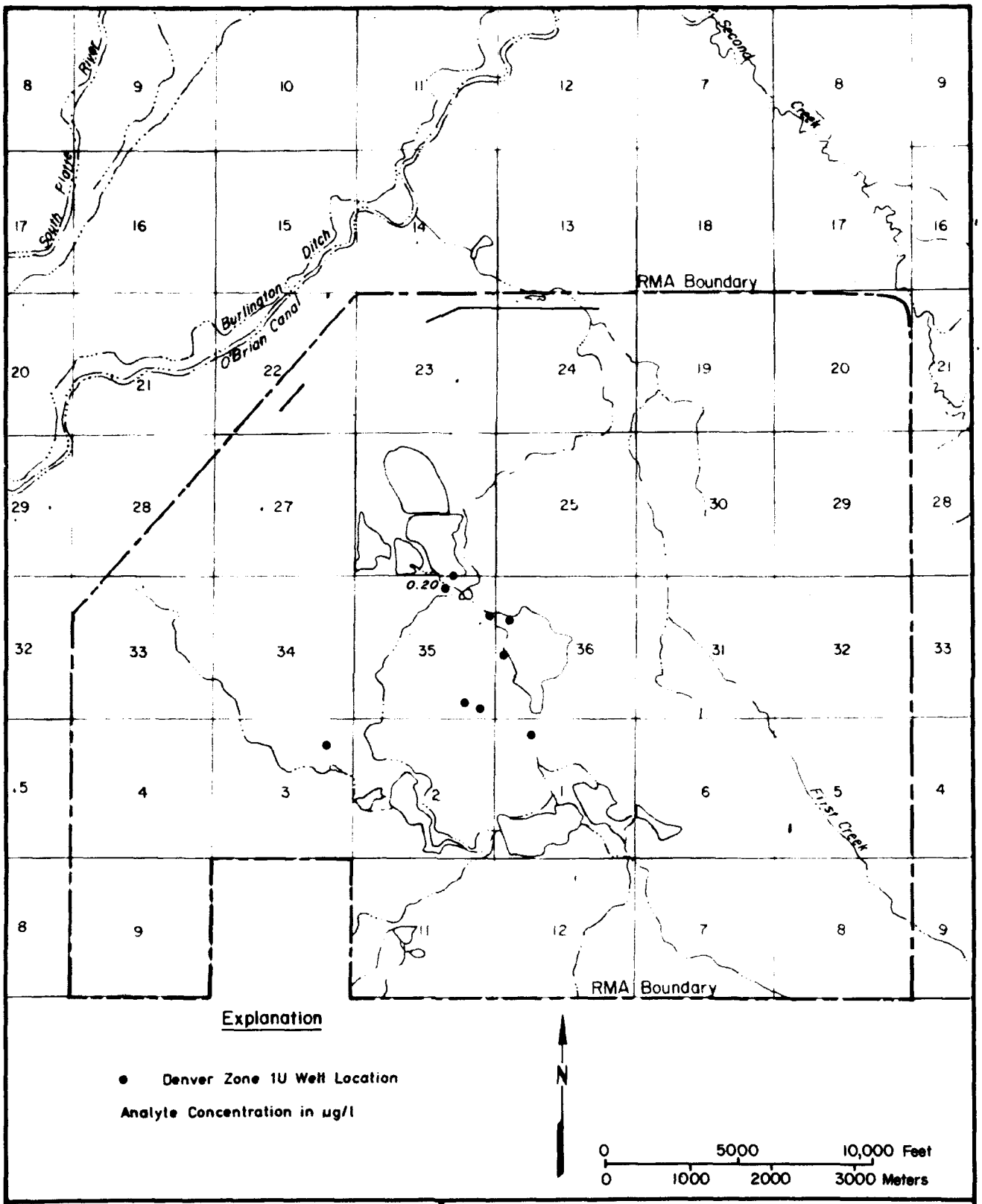
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A–5
Dieldrin Detections
Denver Zone 3, 4 & 5
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



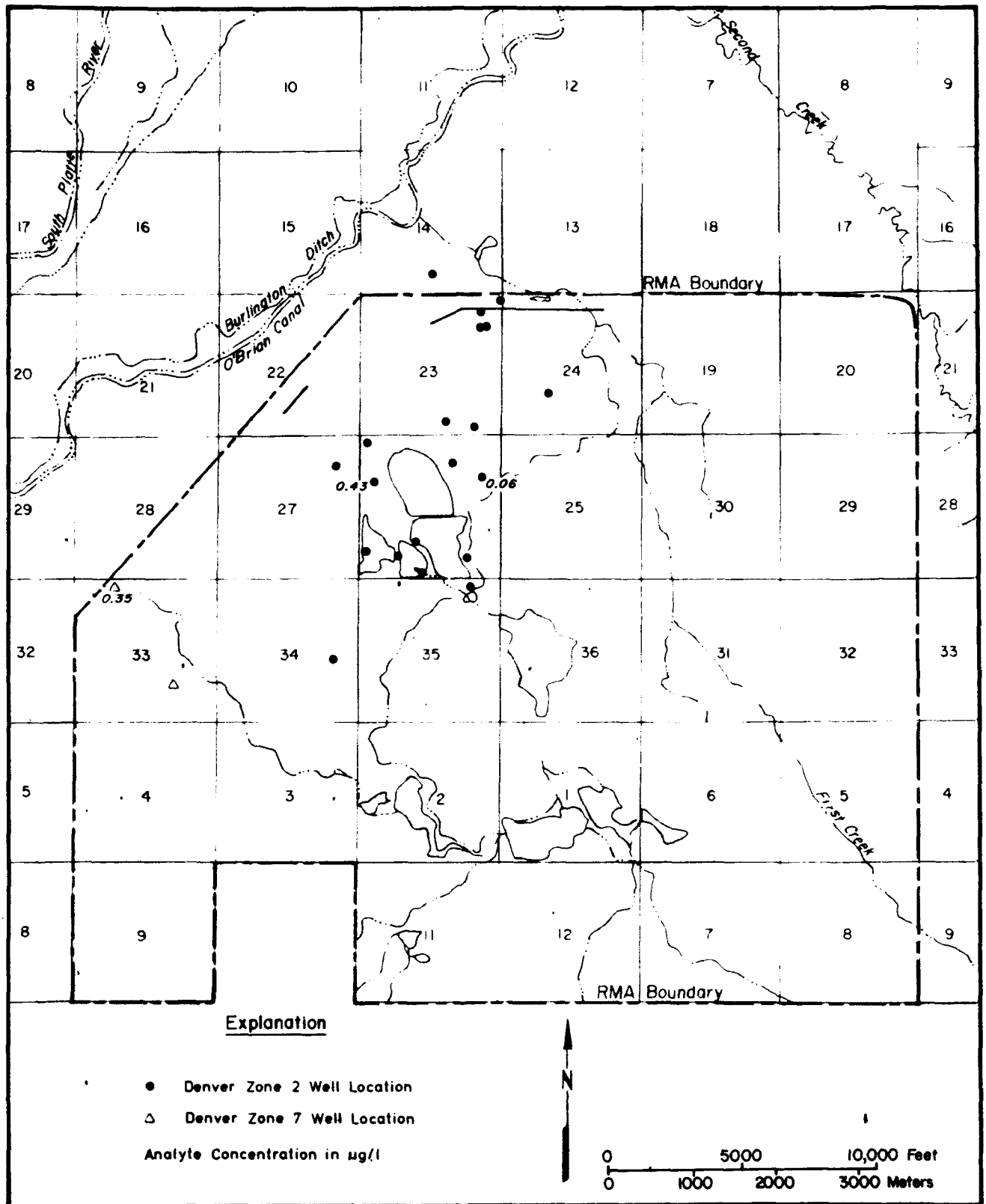
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-6
Dieldrin Detections
Denver Zone A
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



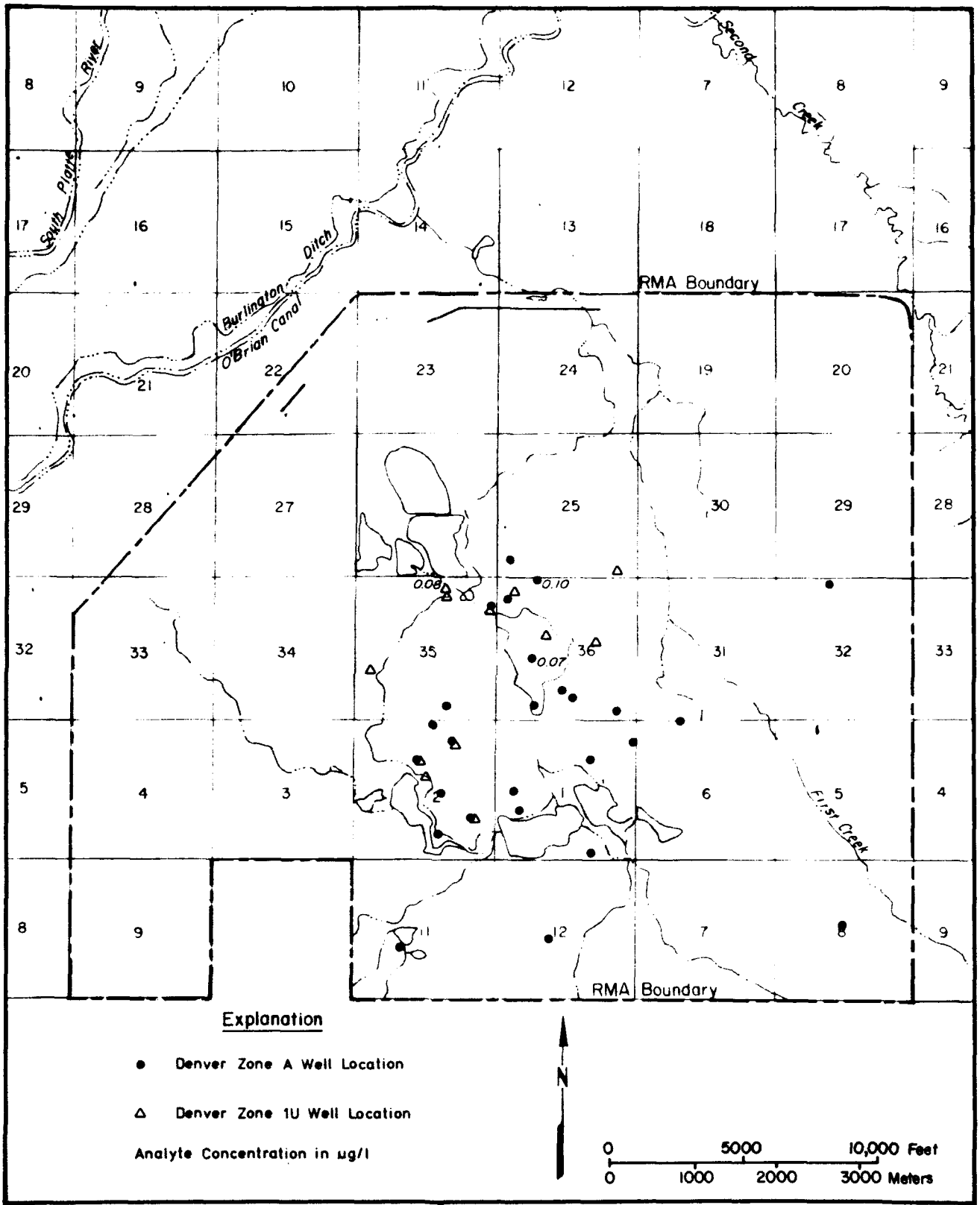
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-7
Dieldrin Detections
Denver Zone 1U
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



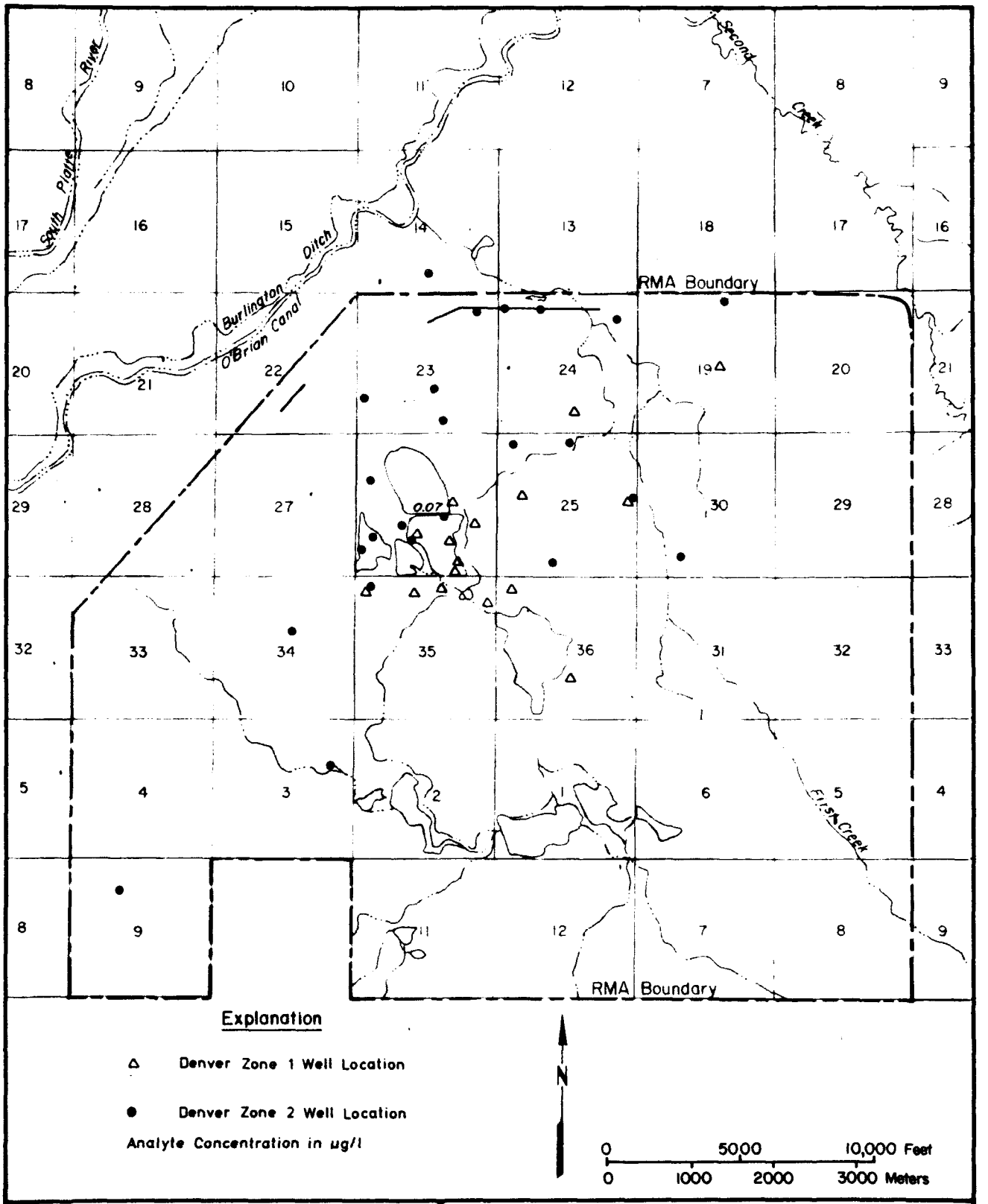
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-8
Dieldrin Detections
Denver Zones 2 & 7
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



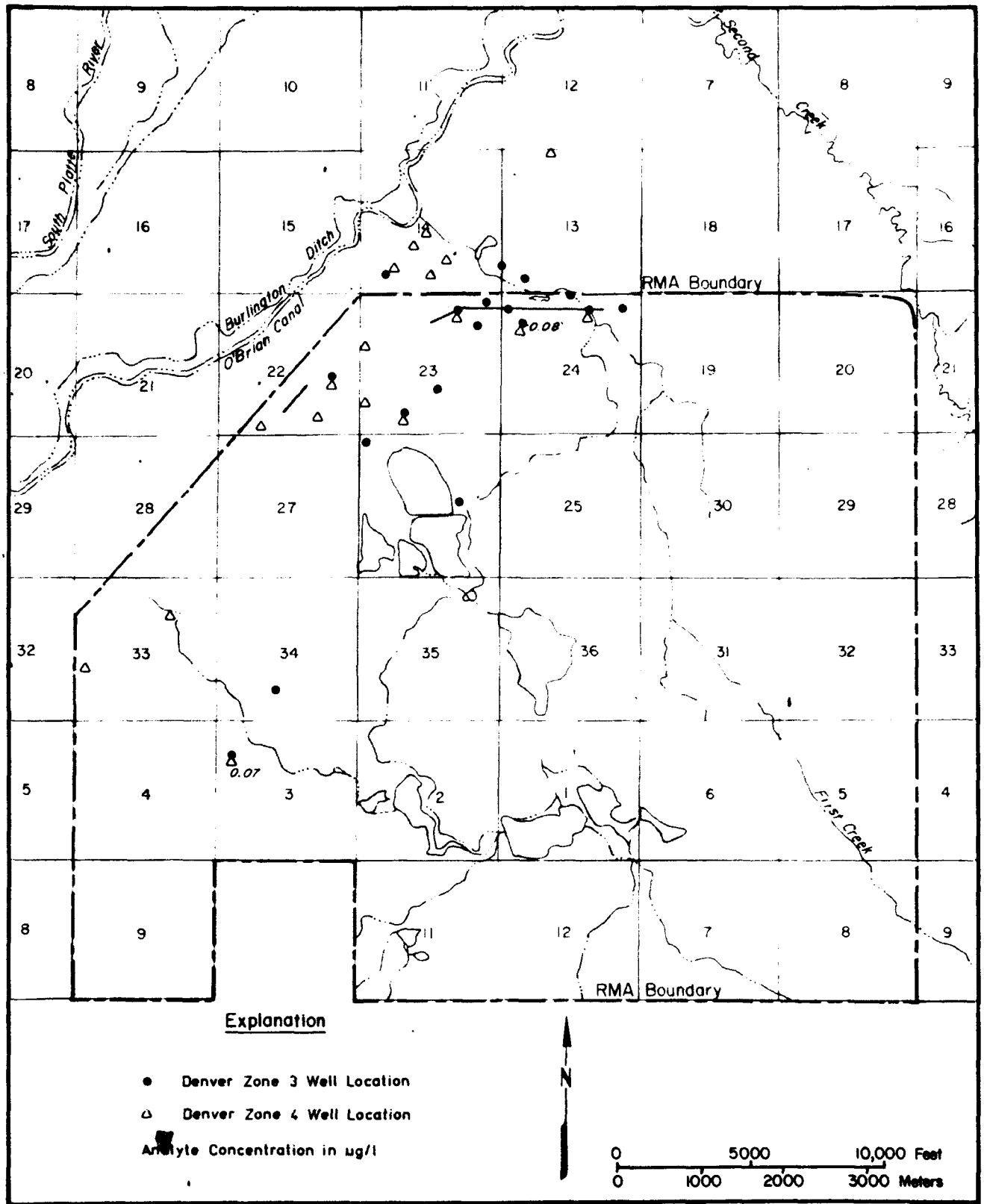
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-9
Endrin Detections
Denver Zones A & 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



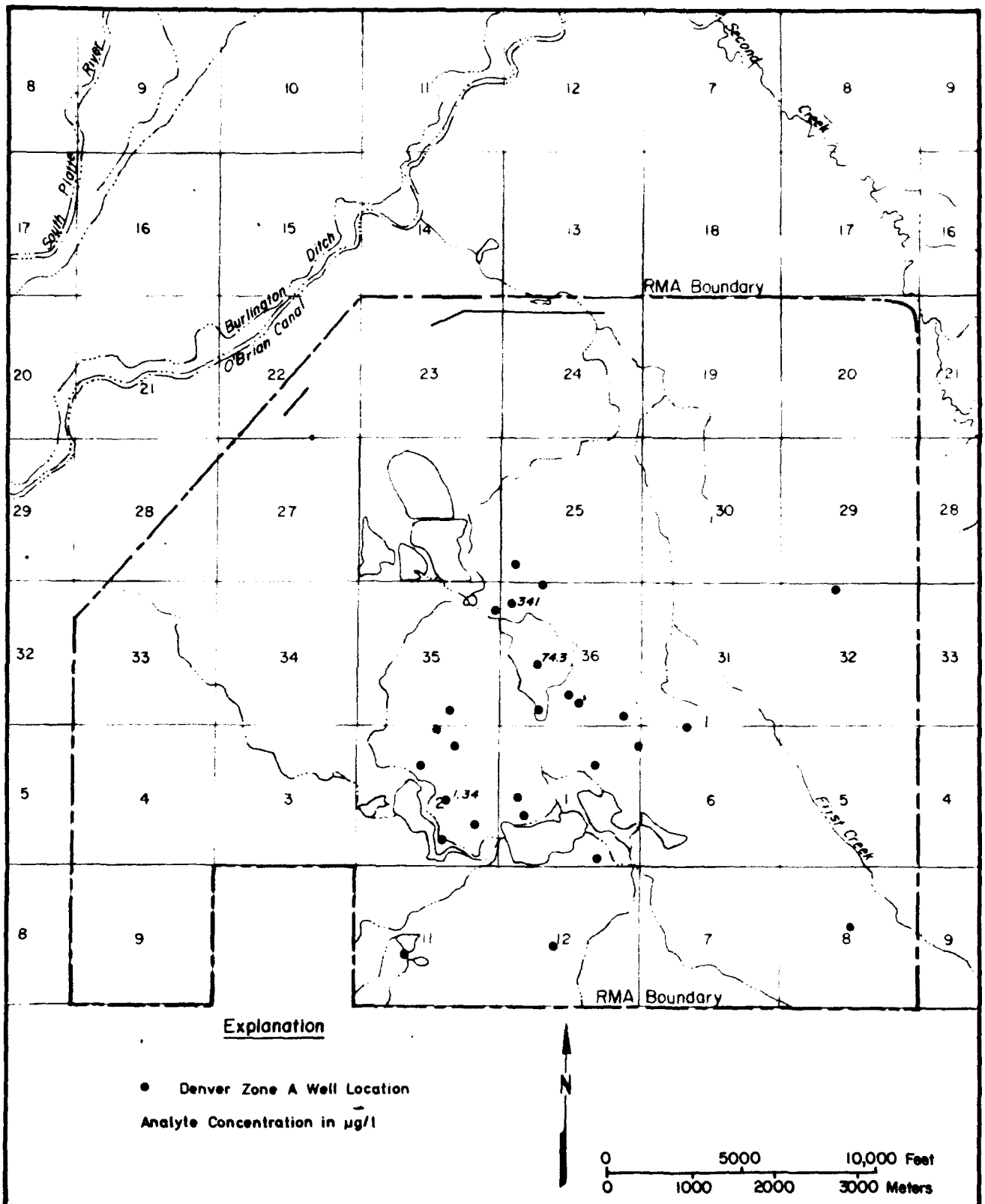
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-10
Endrin Detections
Denver Zones 1 & 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



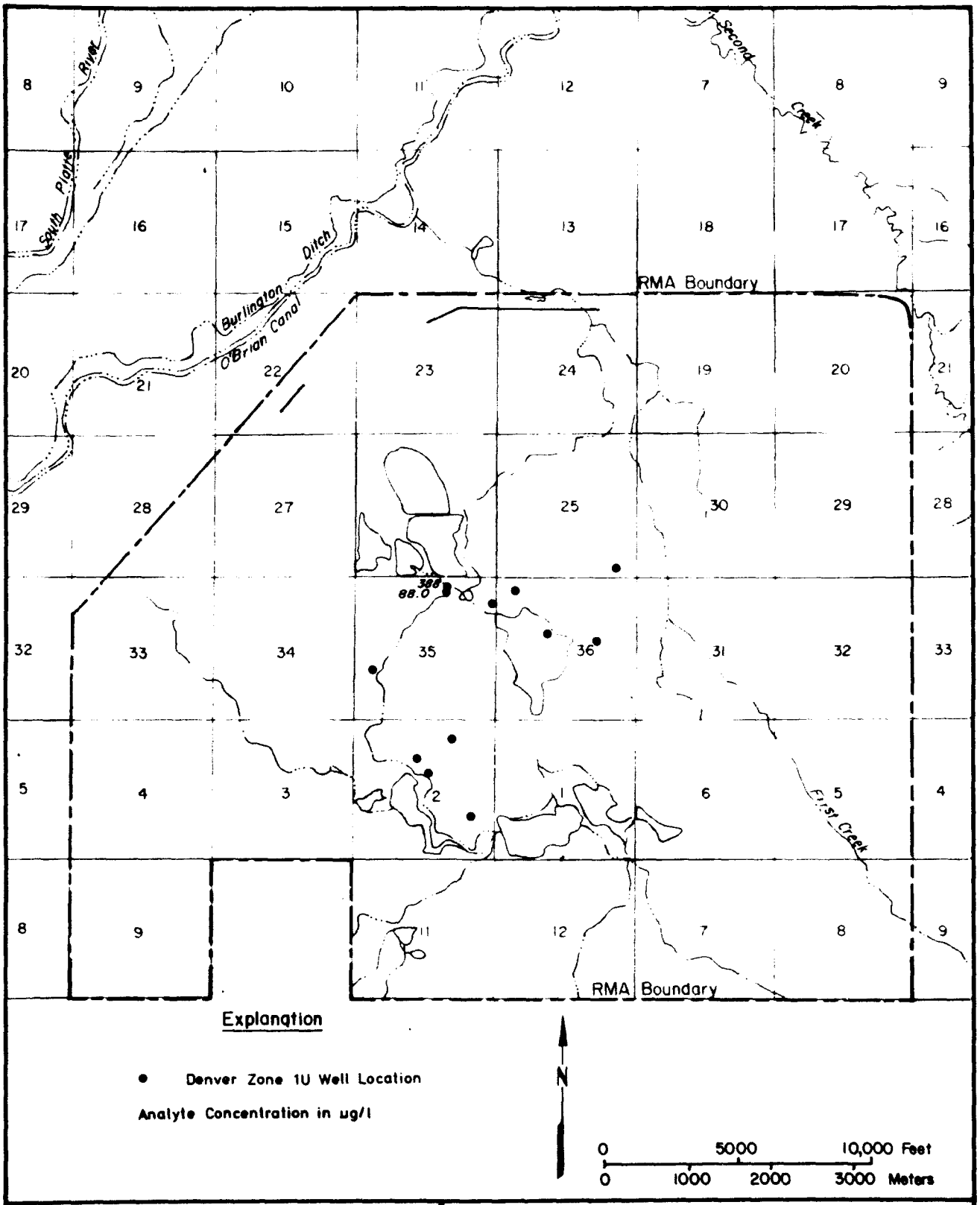
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-11
Endrin Detections
Denver Zones 3 & 4
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



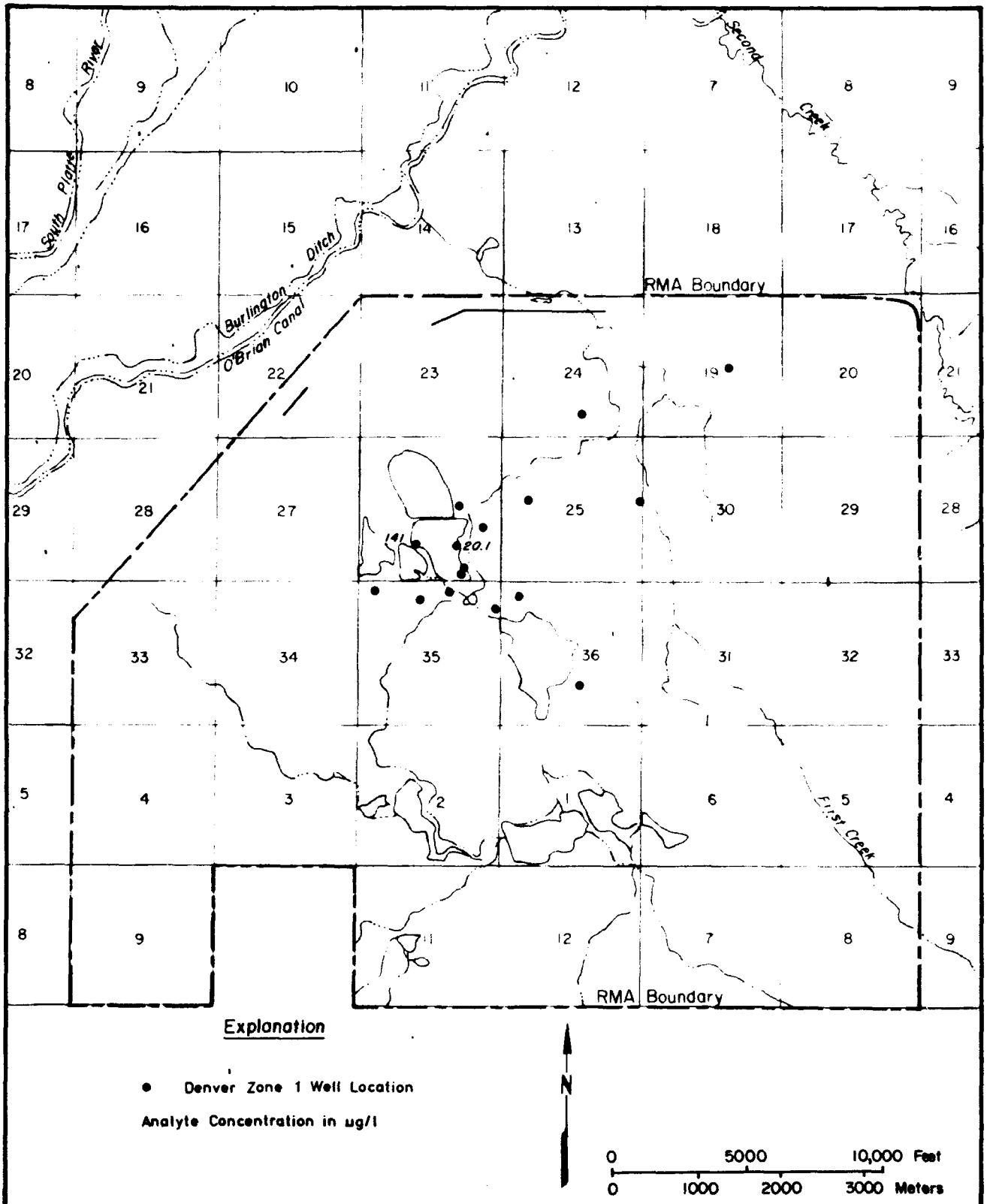
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-12
Dithiane/Oxathiane Detections
Denver Zone A
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



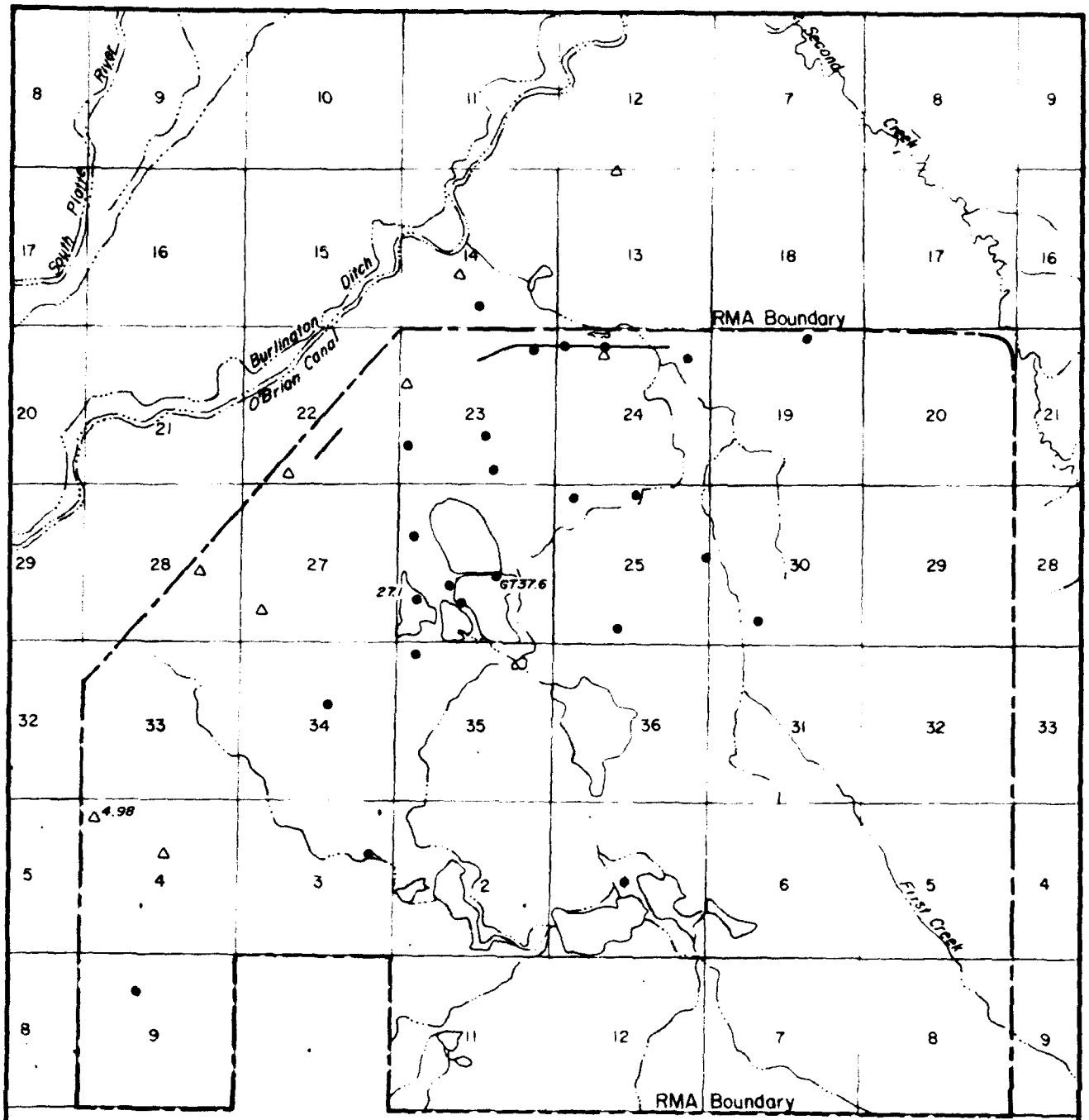
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-13
Dithiane/Oxathiane Detections
Denver Zone 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-14
Dithiane/Oxathiane Detections
Denver Zone 1
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

● Denver Zone 2 Well Location

△ Denver Zone 5 Well Location

Analyte Concentration in µg/l

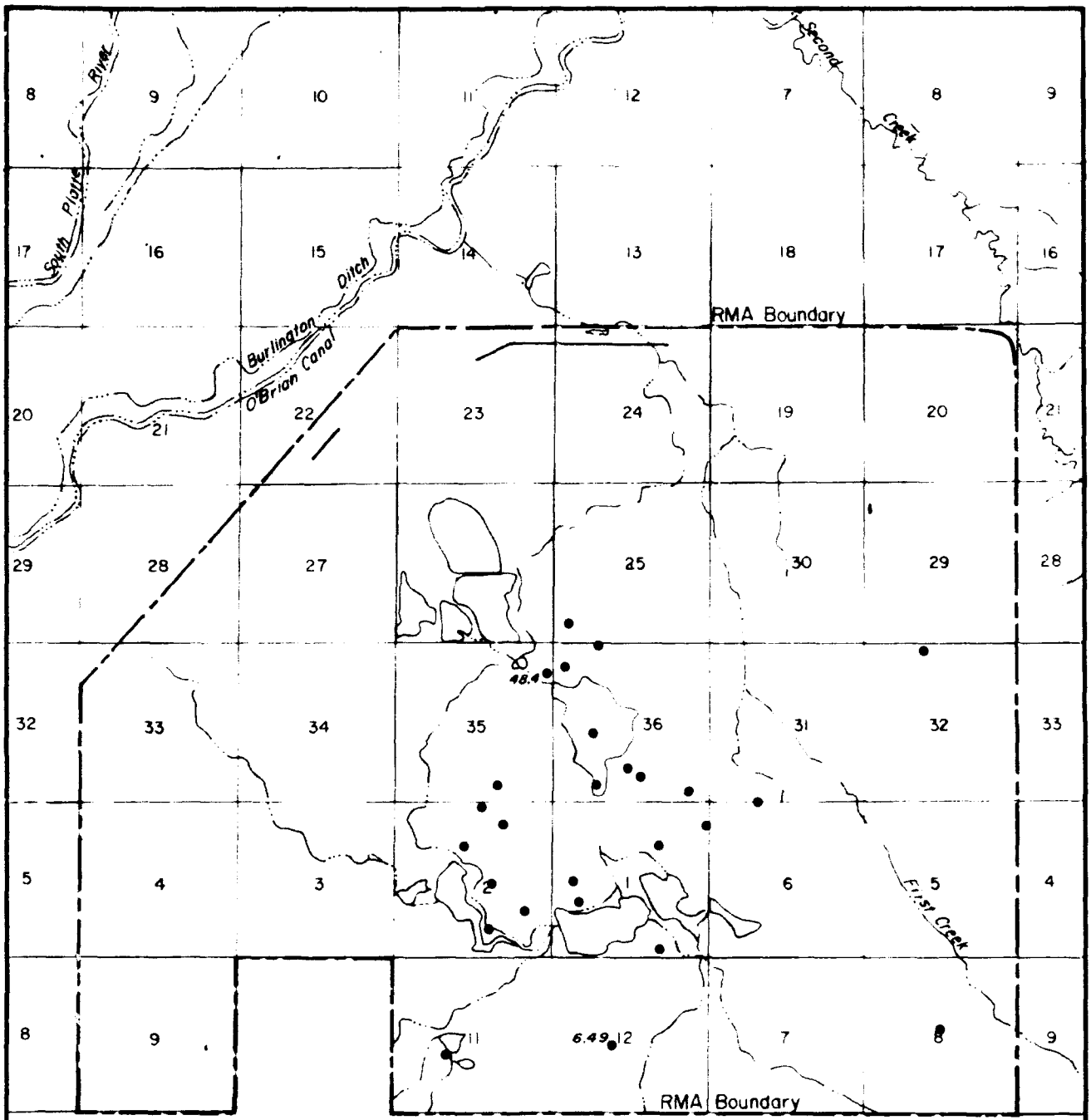
N

0 5000 10,000 Feet

0 1000 2000 3000 Meters

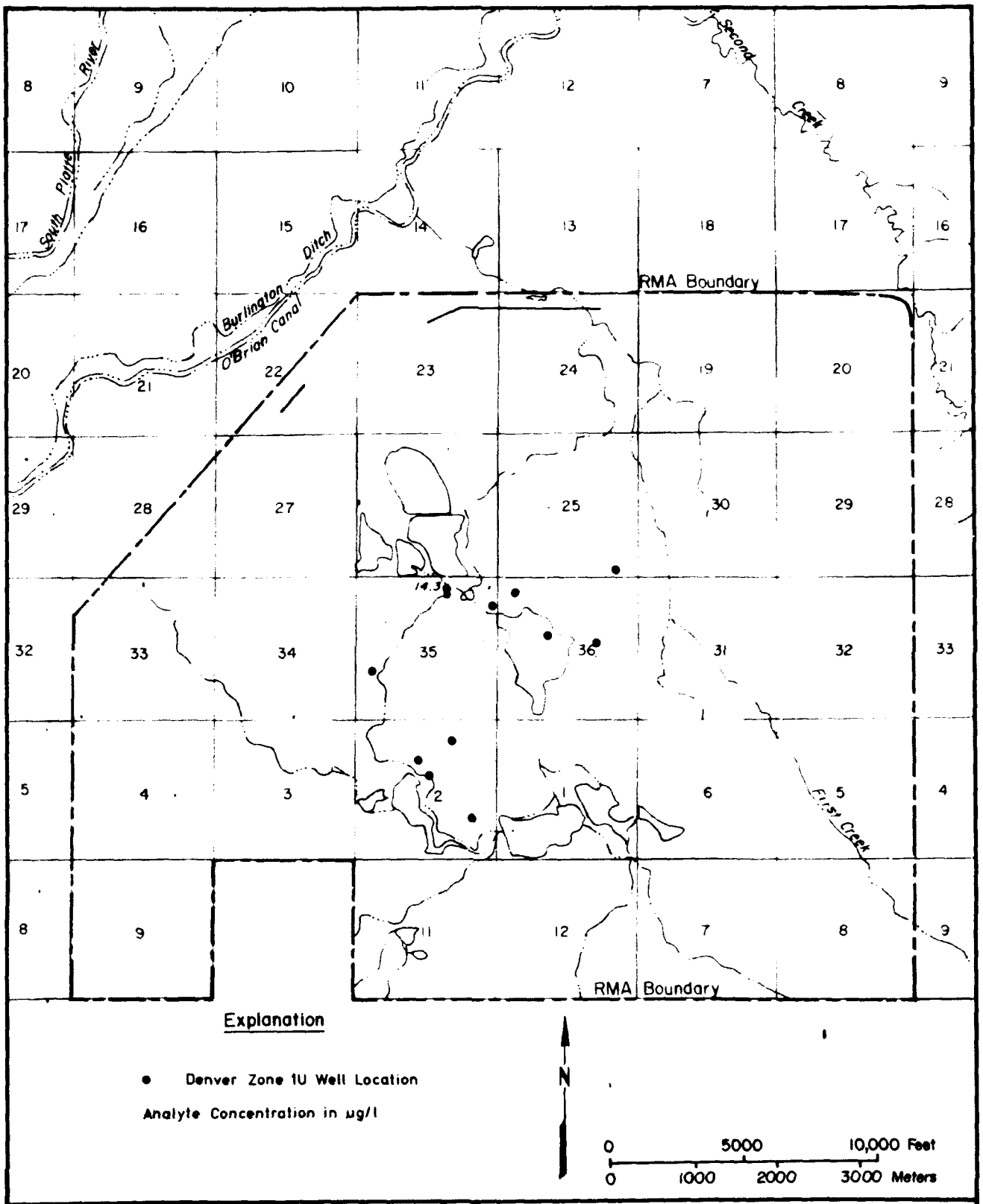
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-15
Dithiane/Oxathiane Detections
Denver Zones 2 & 5
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



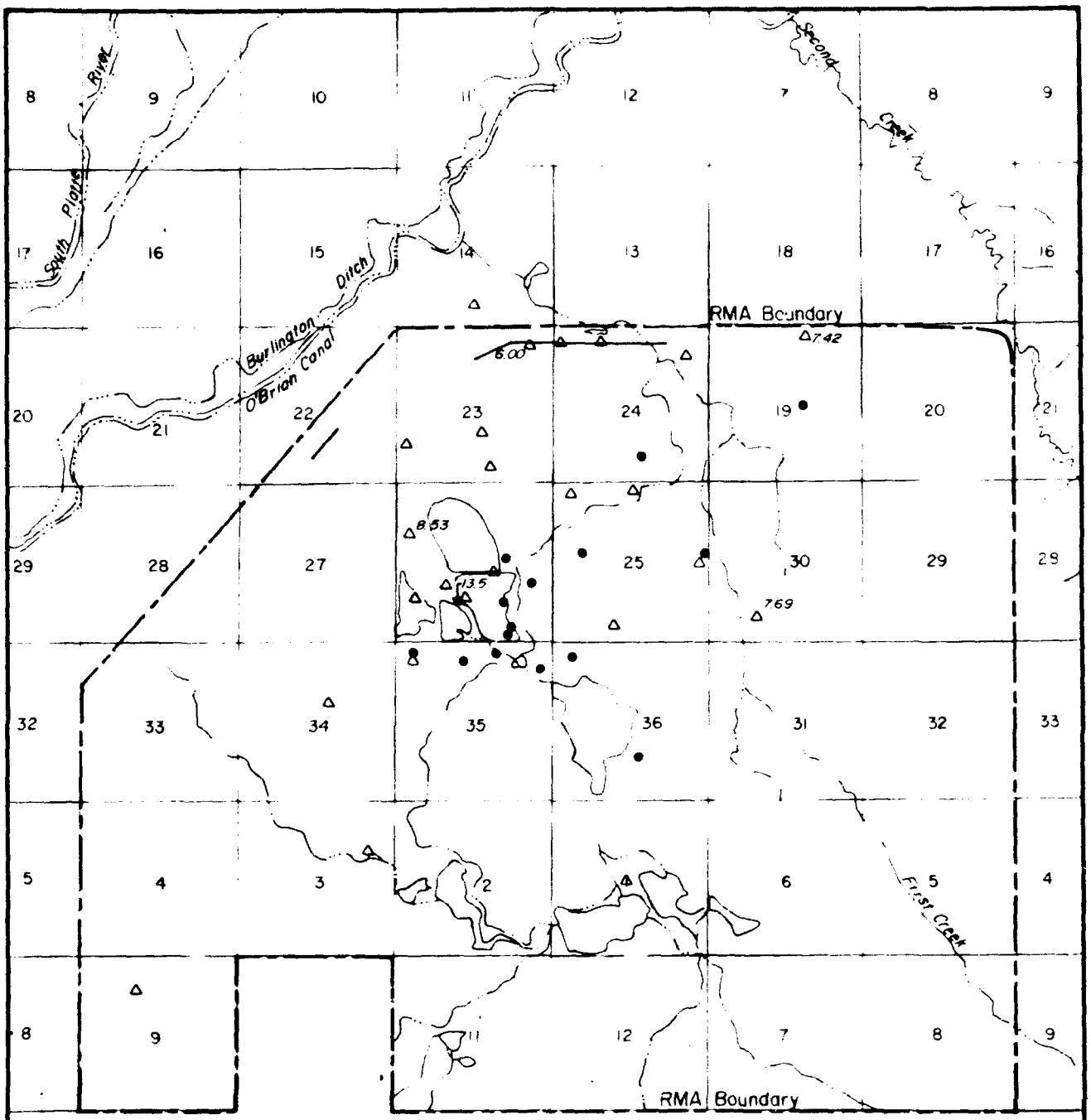
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-16
Benzothiazole Detections
Denver Zone A
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-17
Benzothiazole Detections
Denver Zone 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

● Denver Zone 1 Well Location

△ Denver Zone 2 Well Location

Analyte Concentration in µg/l

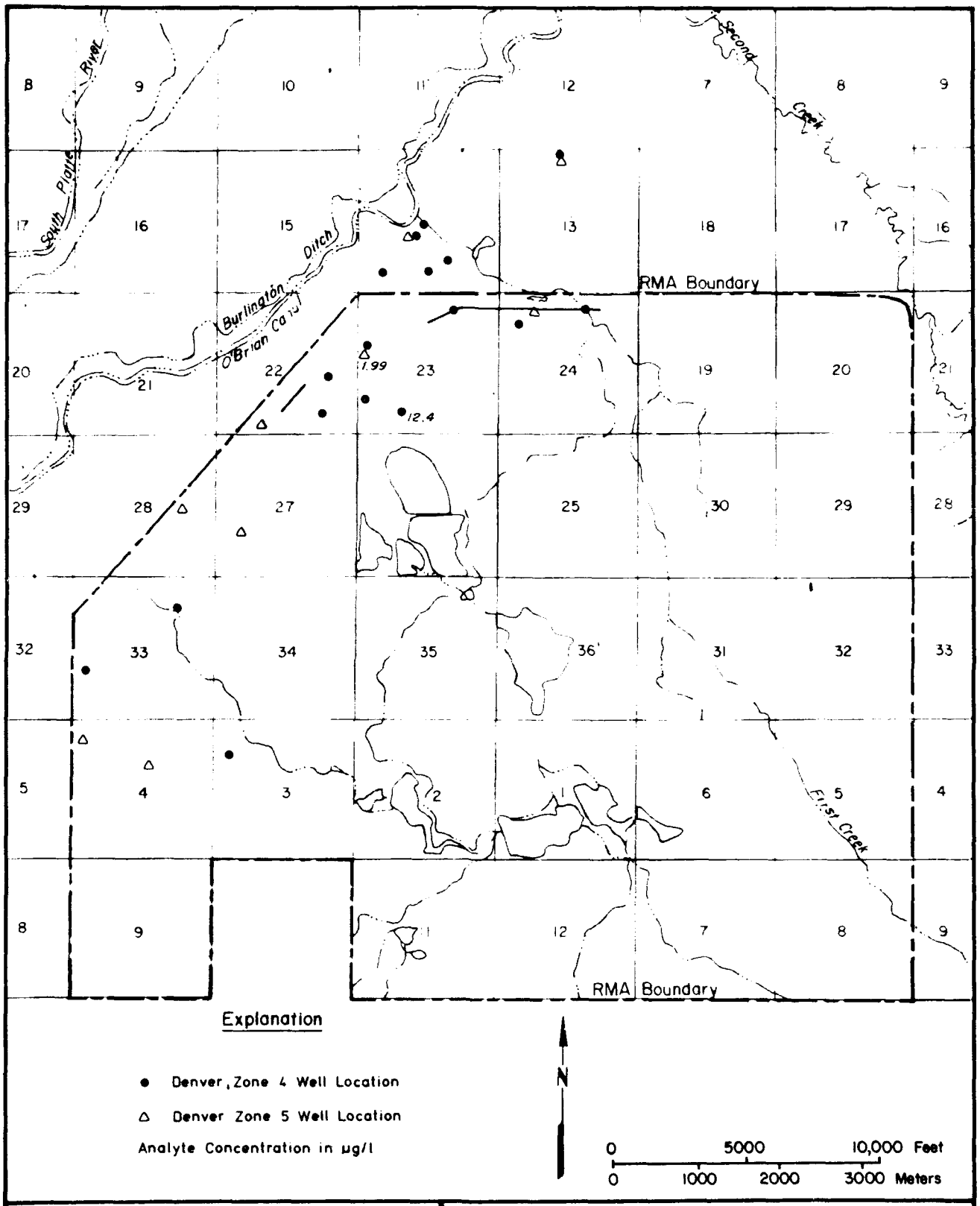
N

0 5000 10,000 Feet

0 1000 2000 3000 Meters

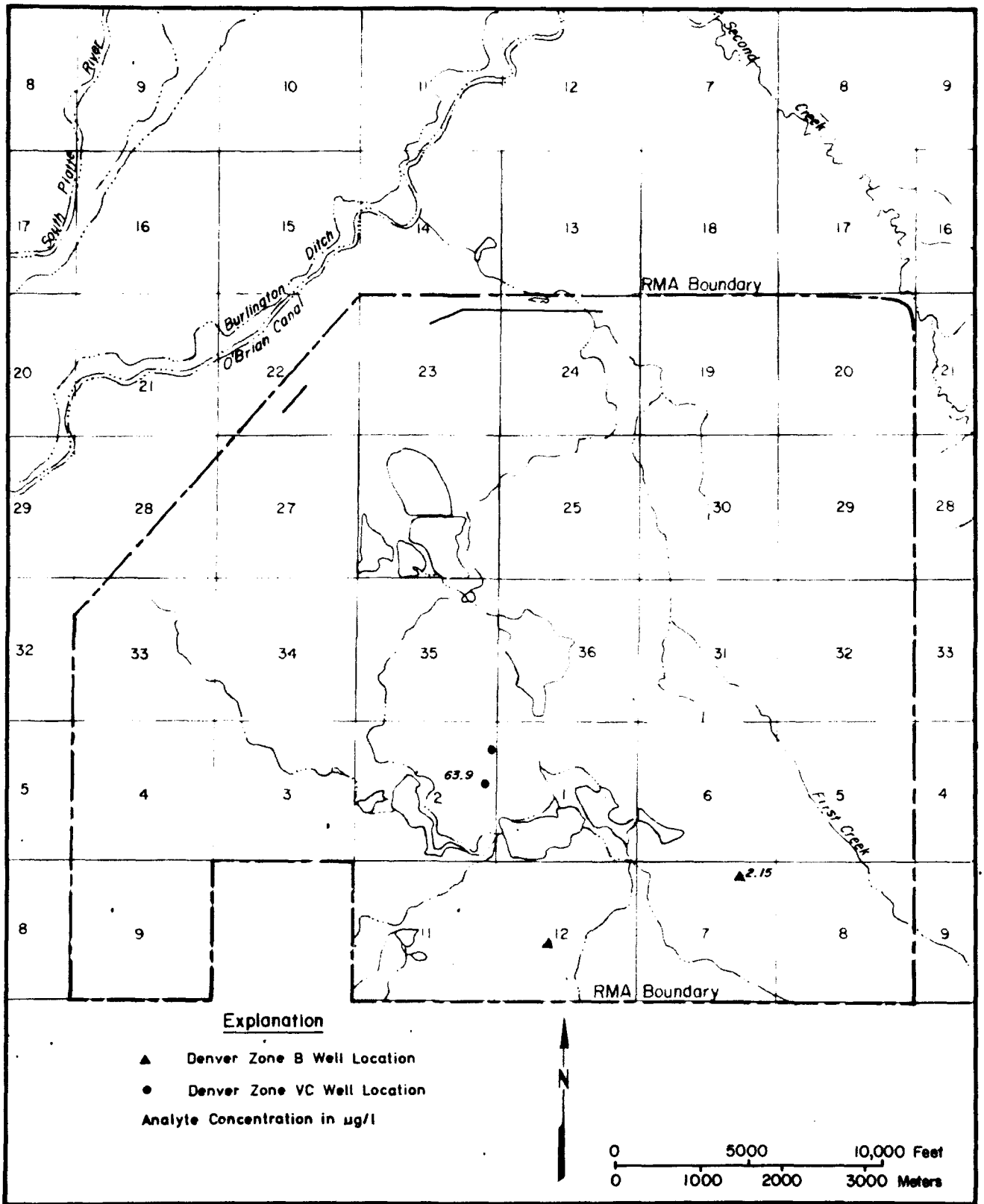
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-18
Benzothiazole Detections
Denver Zones 1 & 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



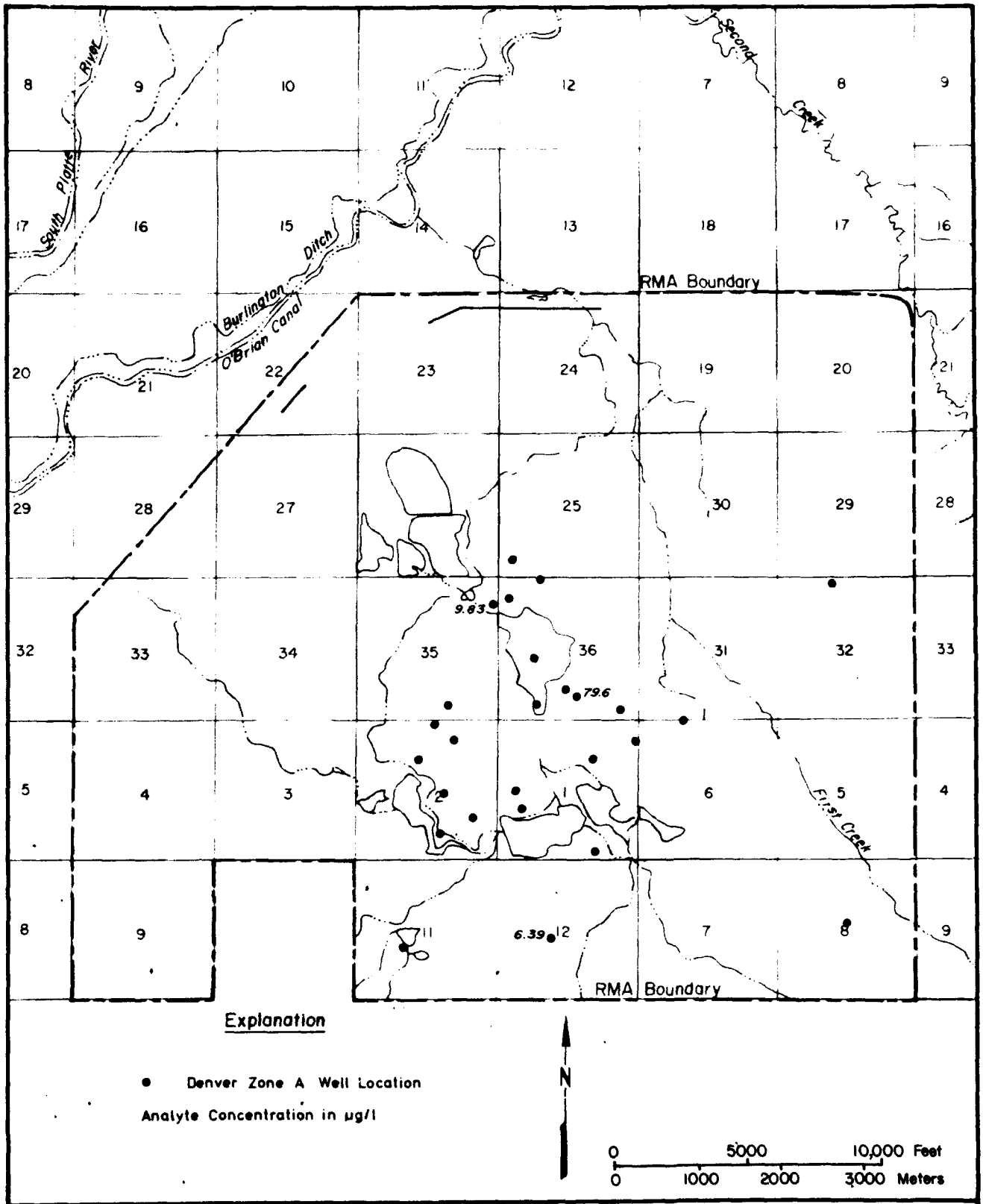
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-19
Benzothiazole Detections
Denver Zones 4 & 5
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



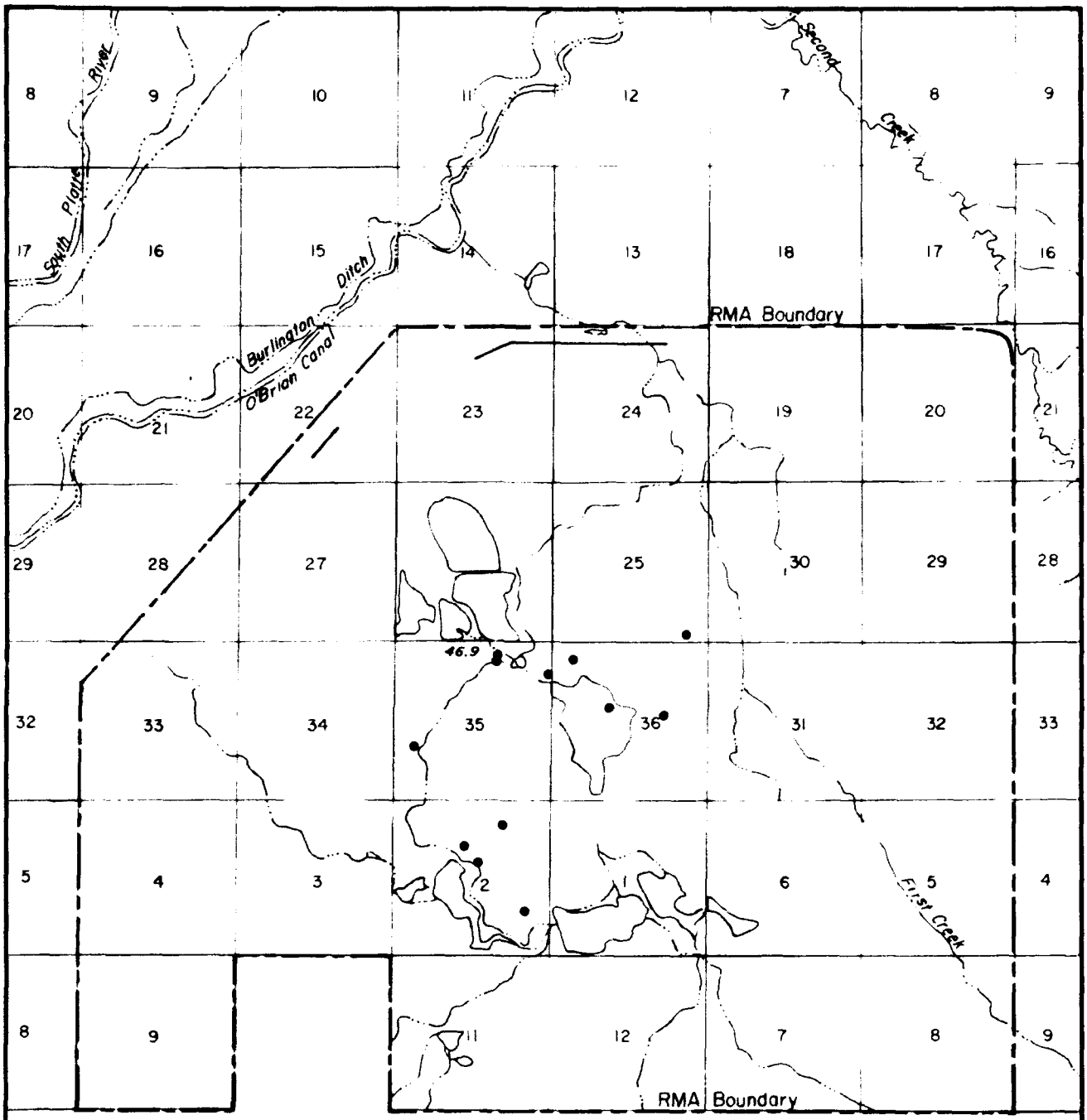
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-20
Summed Organosulfur Compound Detections
Denver Zones B & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-21
Summed Organosulfur Compound Detections
Denver Zone A
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

● Denver Zone 1U Well Location

Analyte Concentration in µg/l

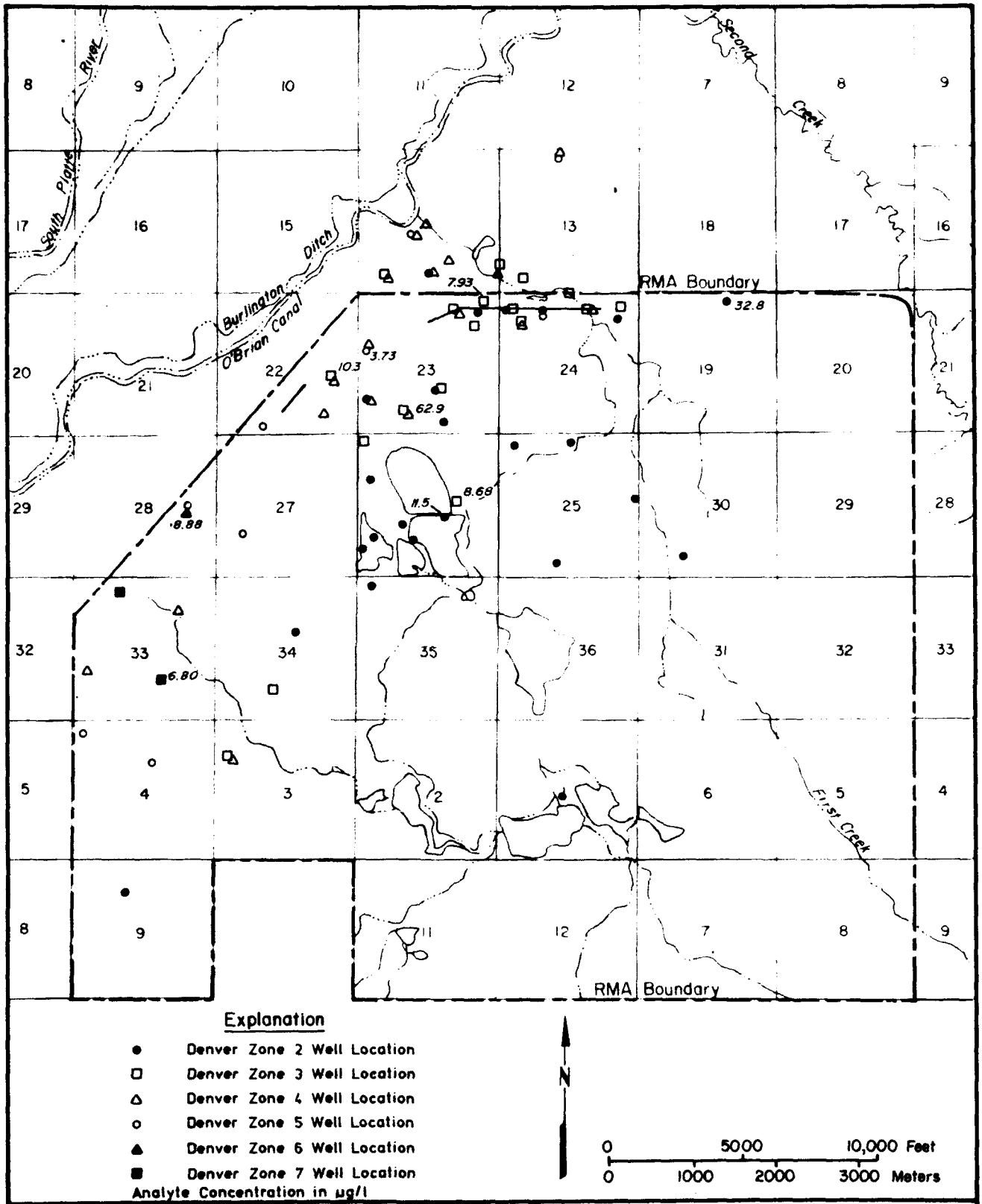
N

0 5000 10,000 Feet

0 1000 2000 3000 Meters

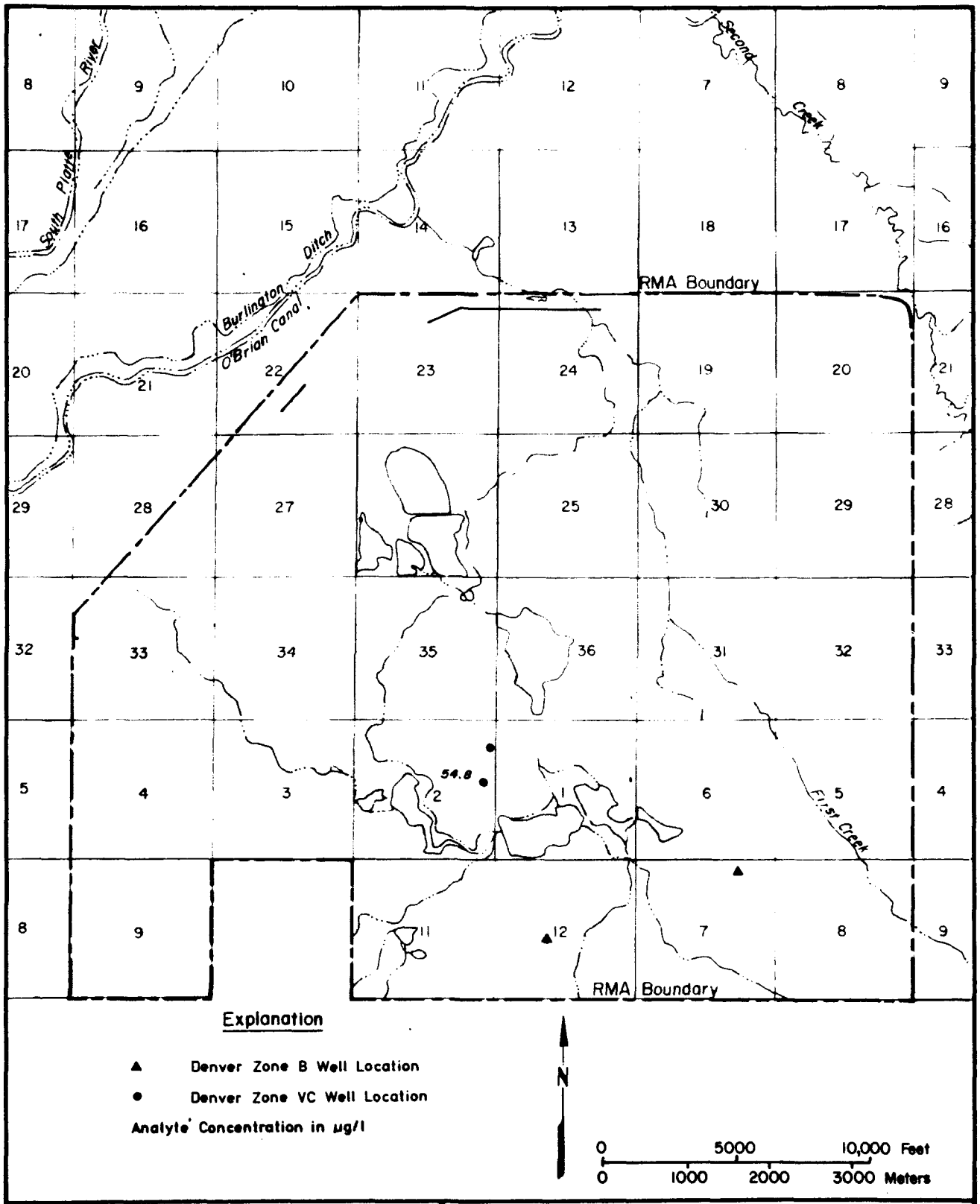
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-22
Summed Organosulfur Compound Detections
Denver Zone 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



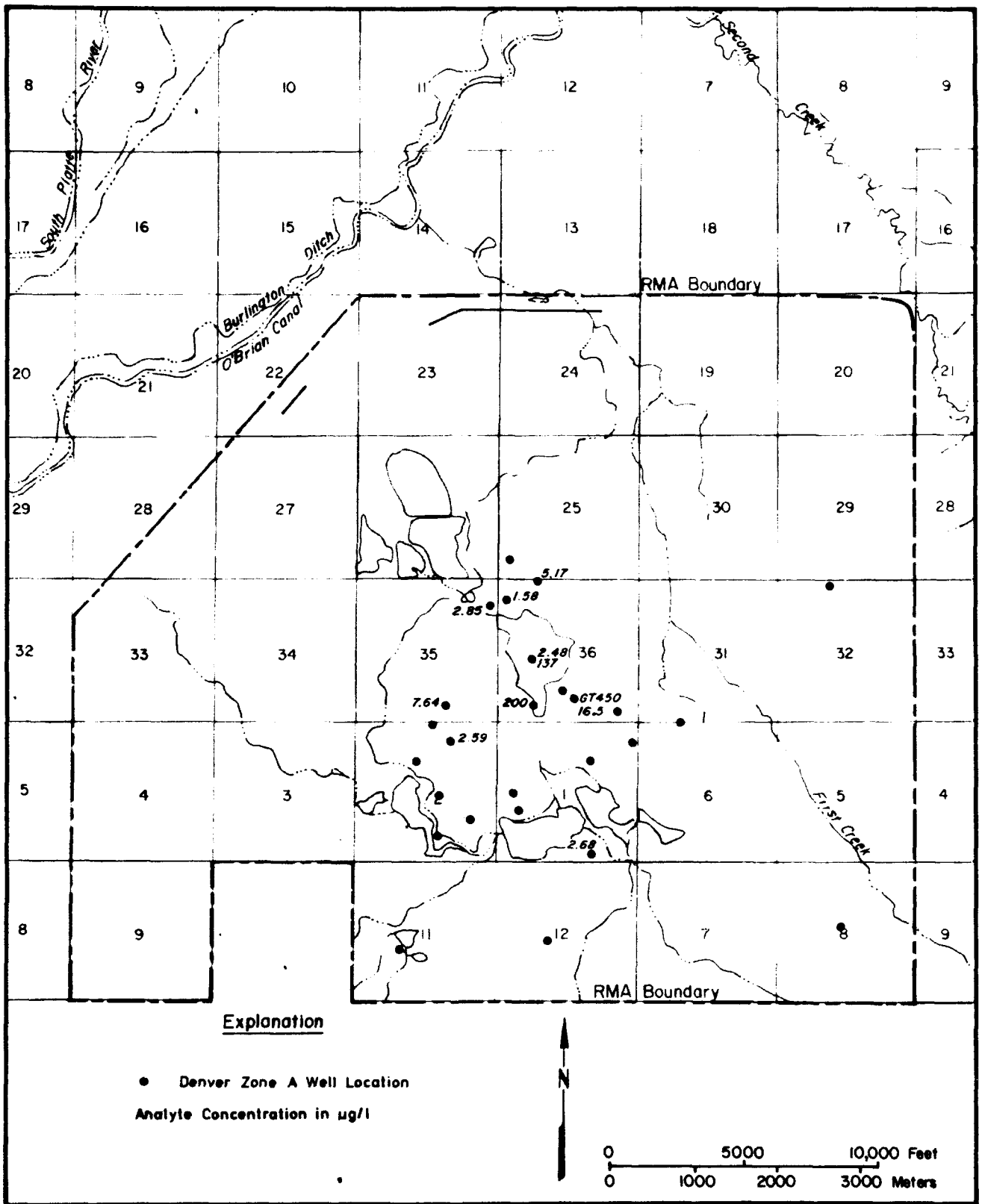
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-23
Summed Organosulfur Compound Detections
Denver Zones 2, 3, 4, 5, 6, & 7
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



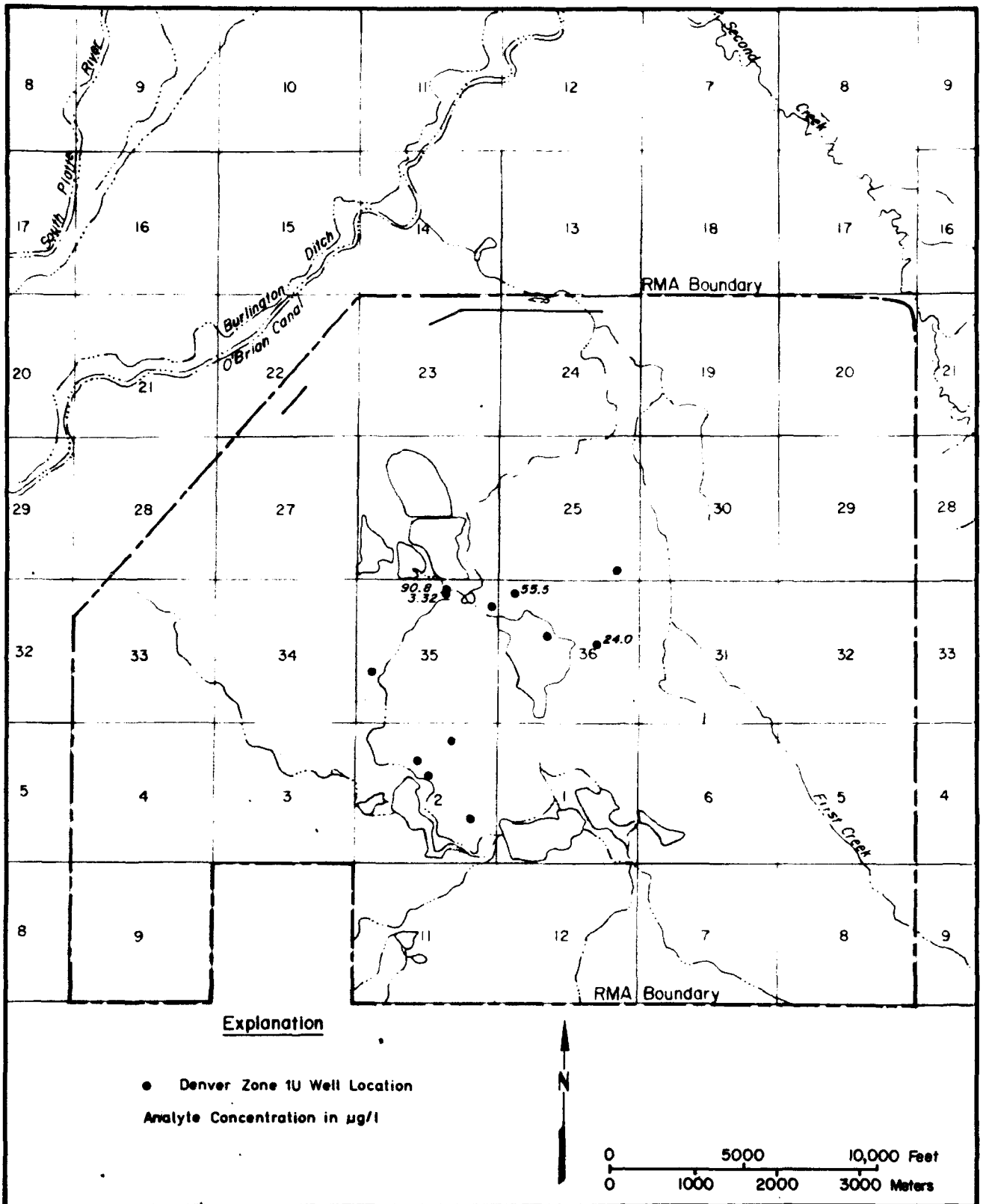
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-24
Summed Volatile Aromatic Compound Detections
Denver Zones B & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



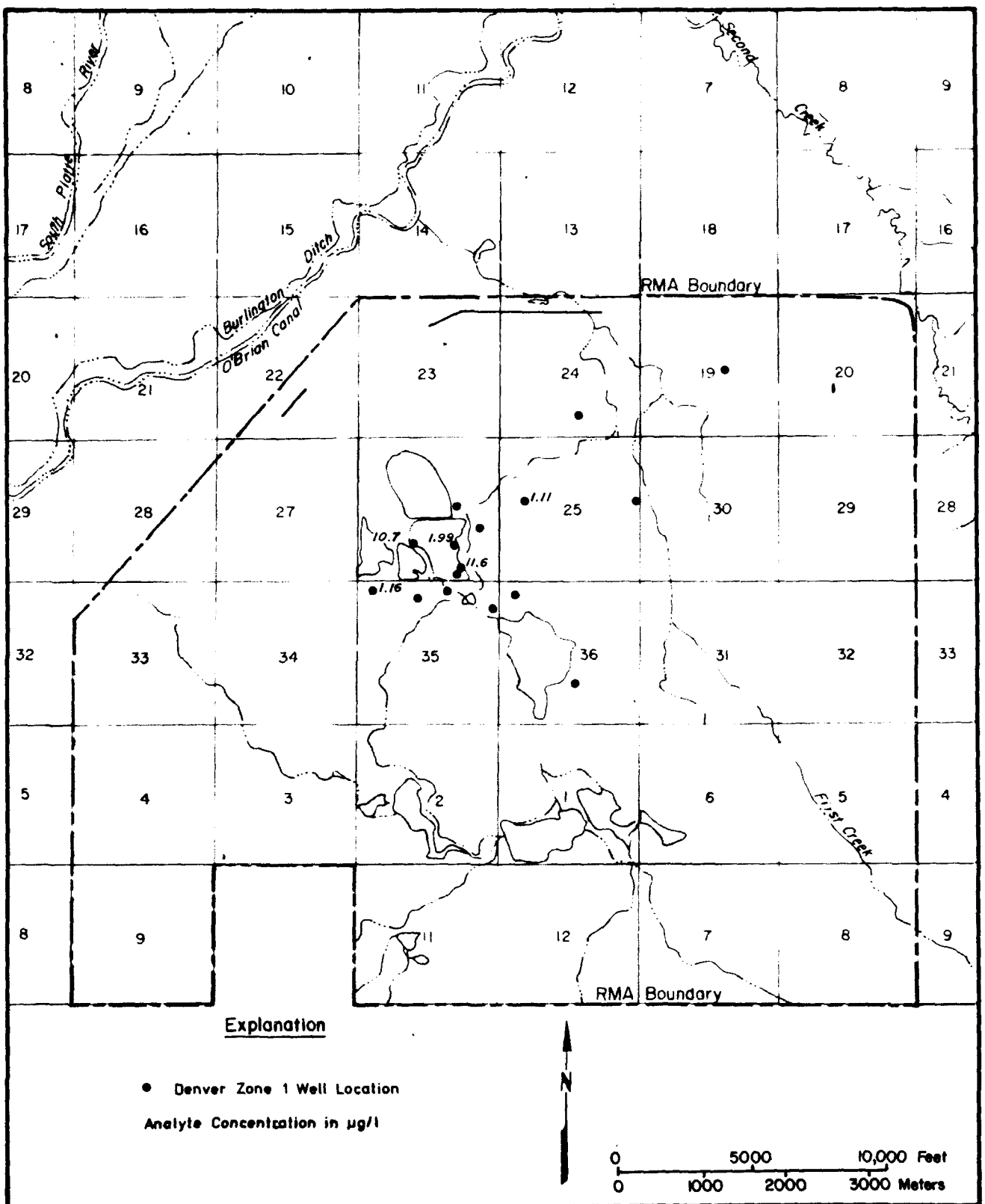
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-25
Summed Volatile Aromatic Compound Detections
Denver Zone A
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



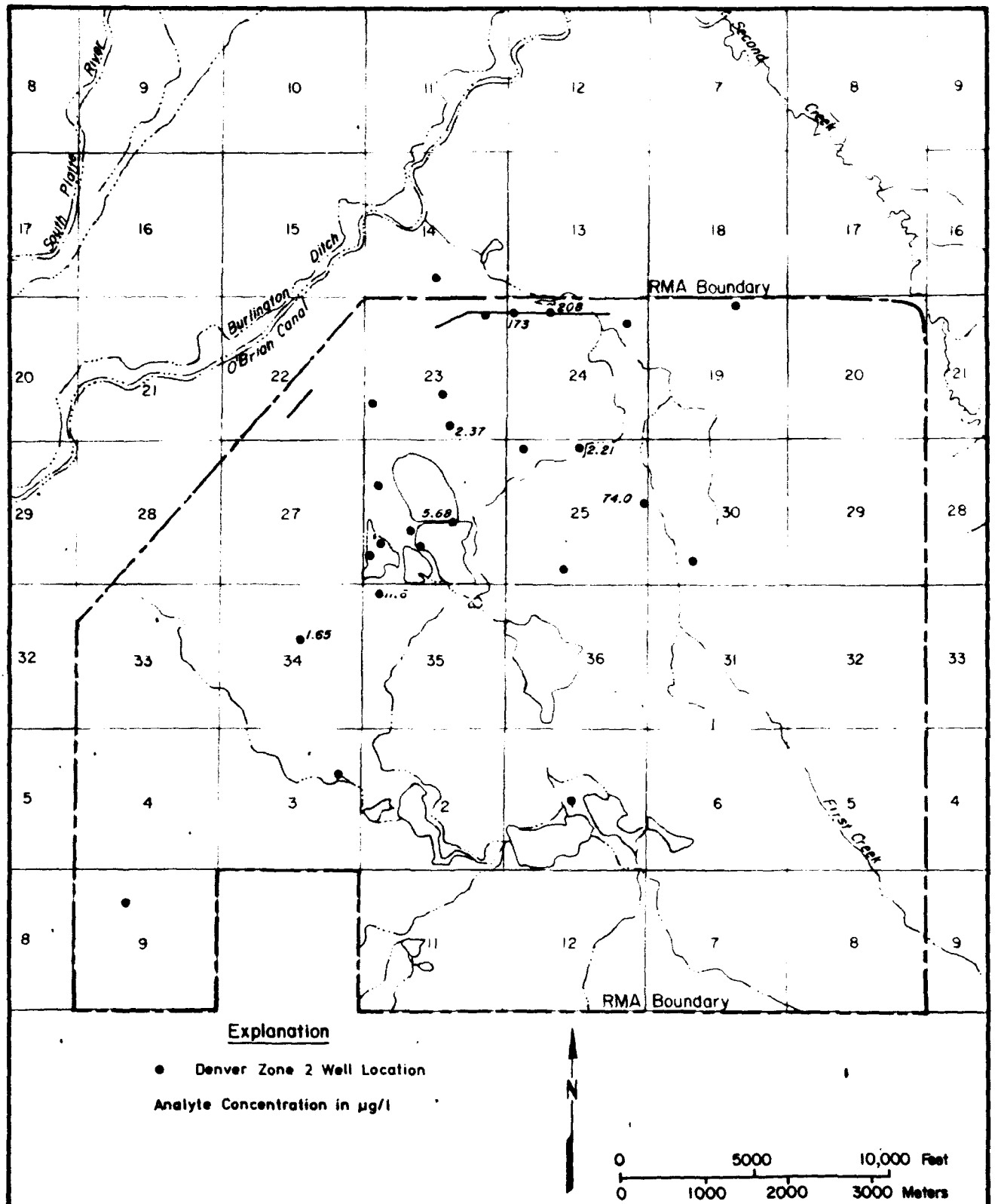
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-26
Summed Volatile Aromatic Compound Detections
Denver Zone 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



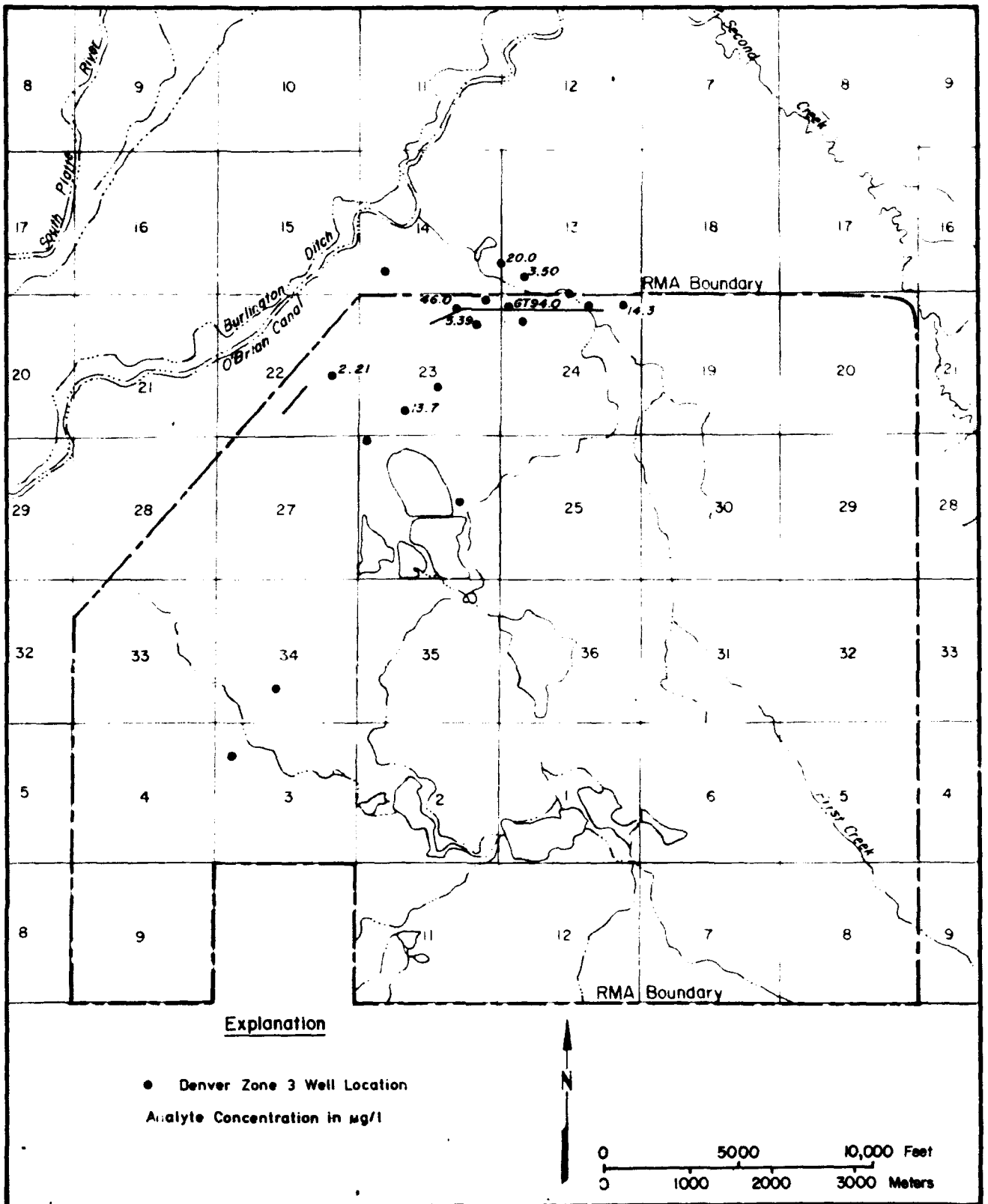
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-27
Summed Volatile Aromatic Compound Detections
Denver Zone 1
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



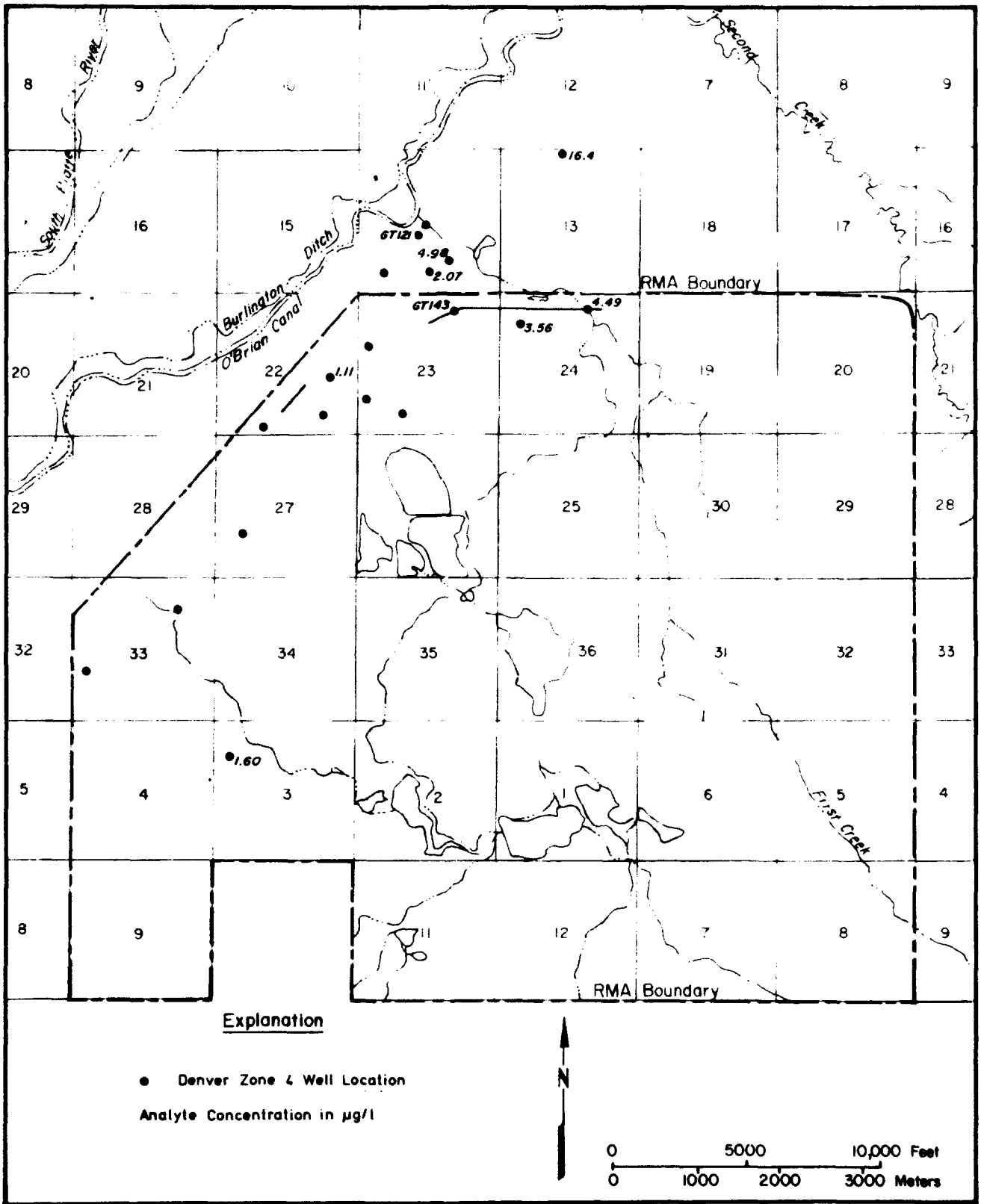
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-28
Summed Volatile Aromatic Compound Detections
Denver Zone 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



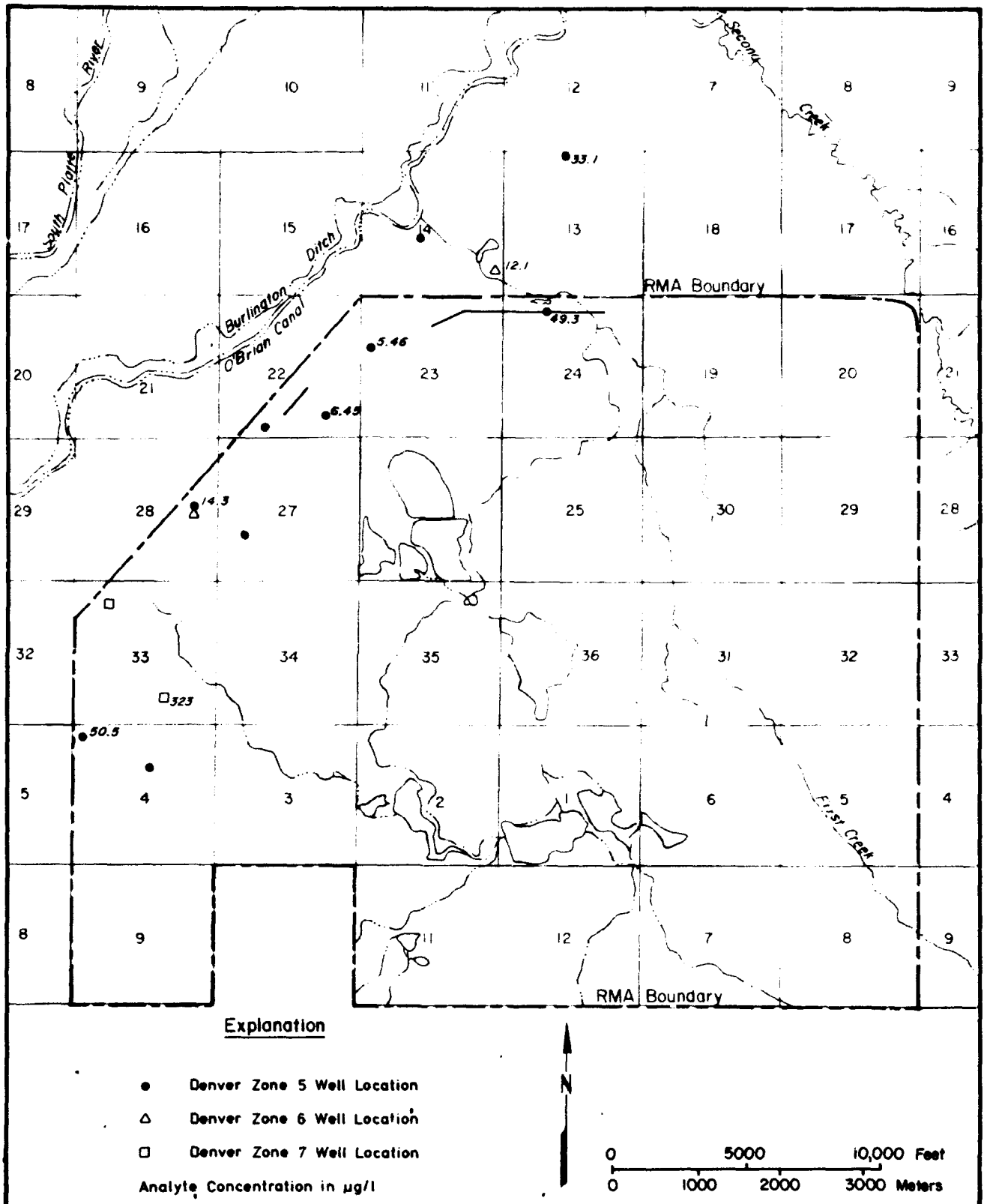
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-29
Summed Volatile Aromatic Compound Detections
Denver Zone 3
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



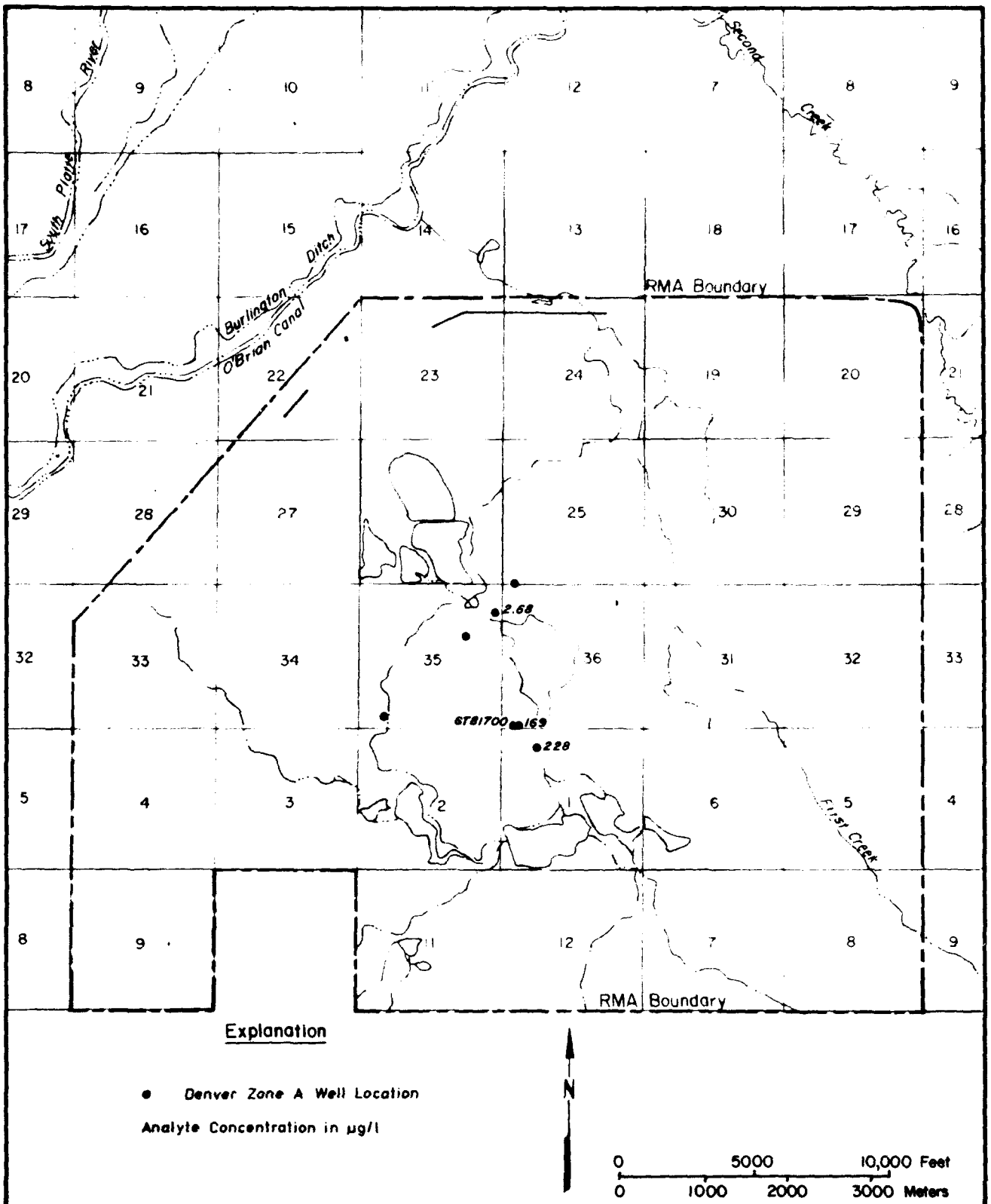
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-30
Summed Volatile Aromatic Compound Detections
Denver Zone 4
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



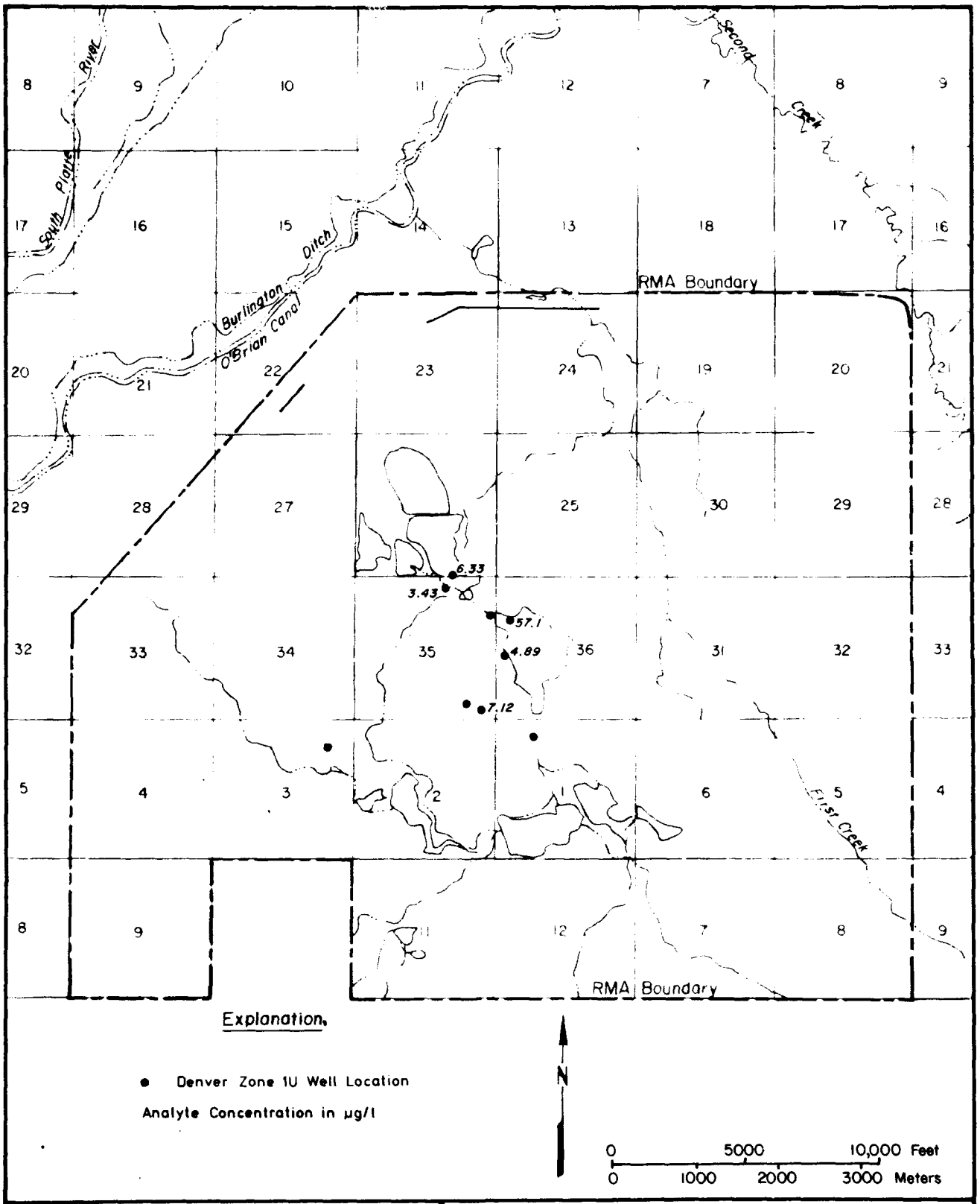
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-31
Summed Volatile Aromatic Compound Detections
Denver Zones 5, 6, & 7
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



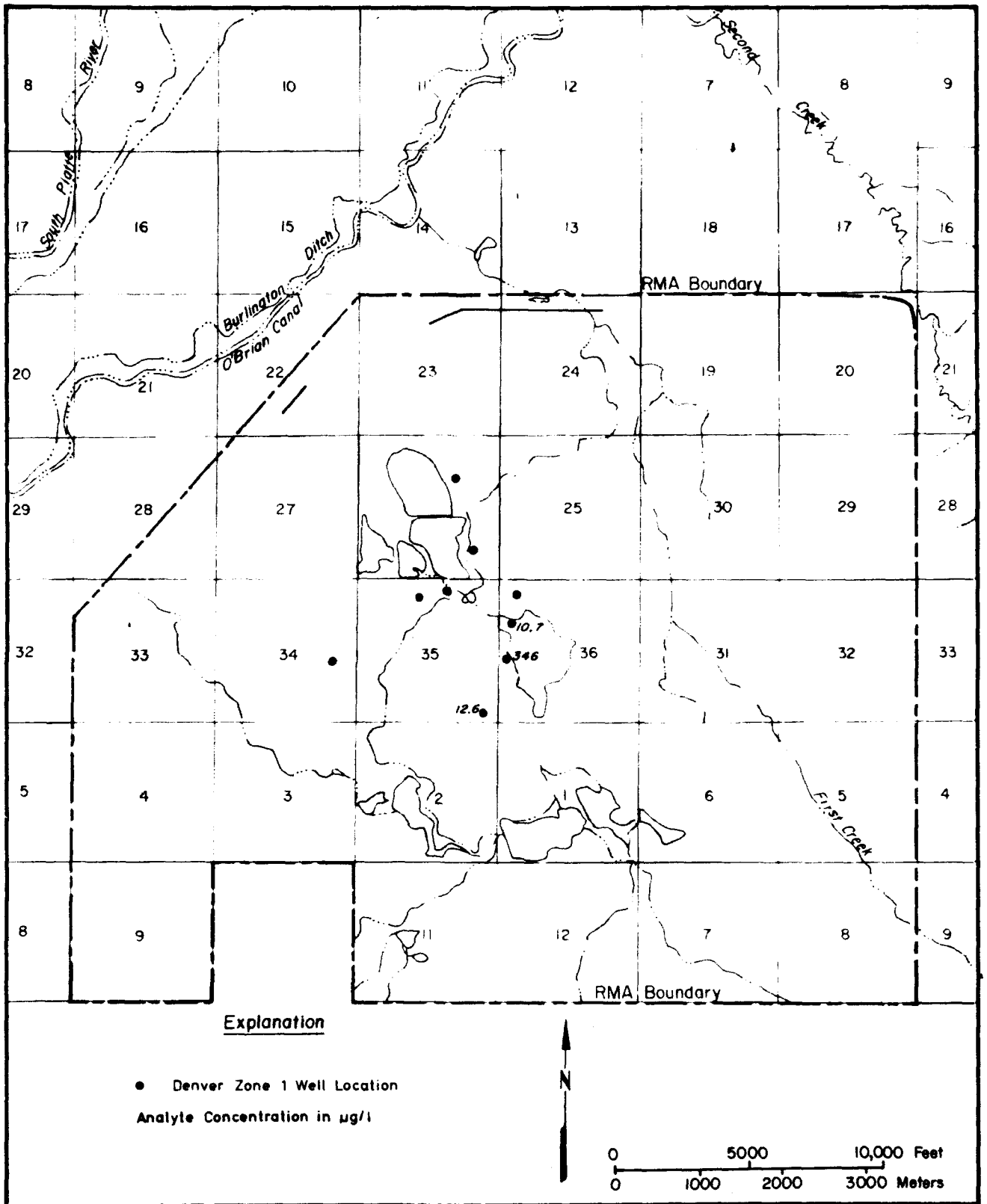
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-32
Summed Volatile Aromatic Compound Detections
Denver Zone A
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



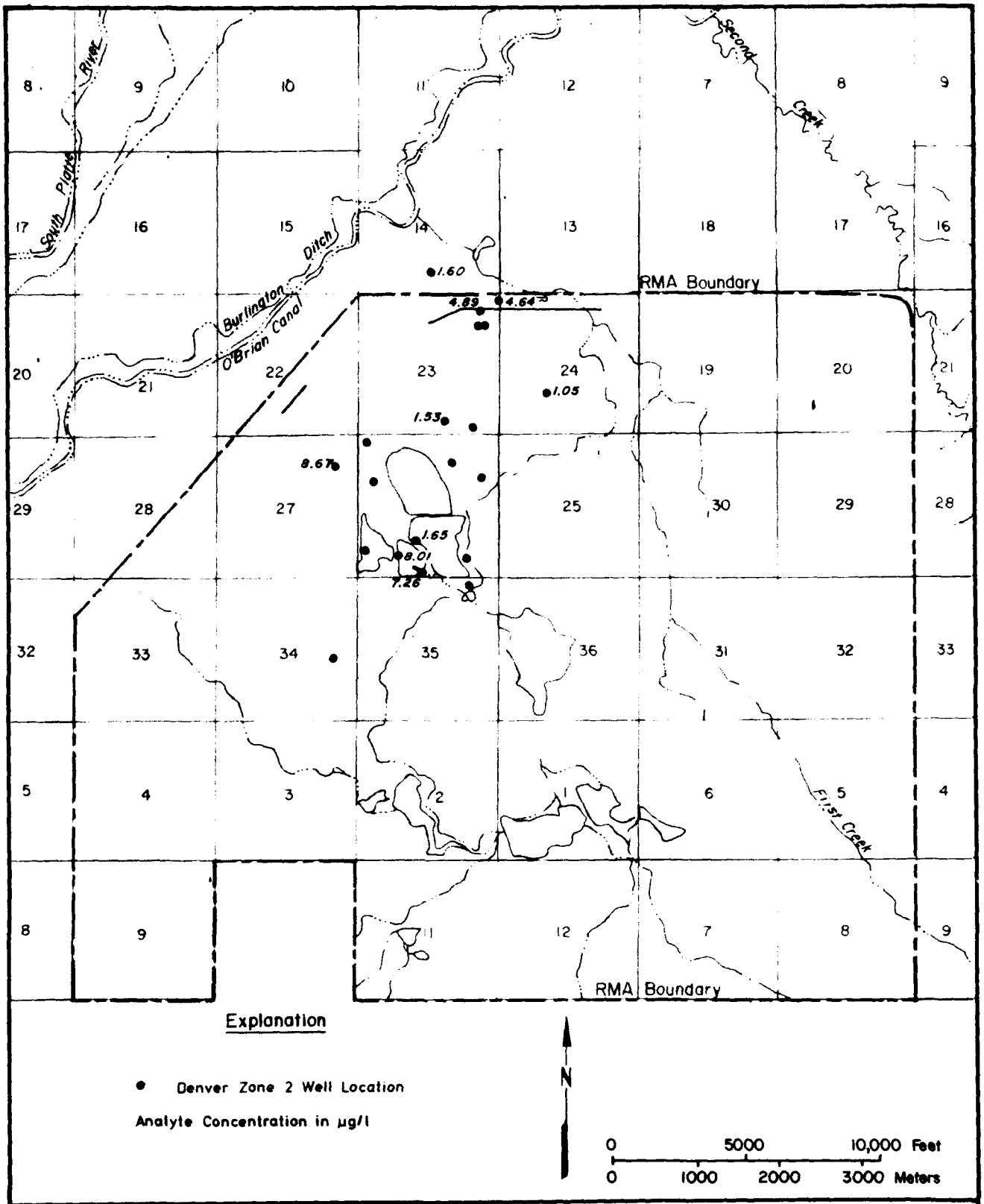
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A—33
Summed Volatile Aromatic Compound Detections
Denver Zone 1U
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



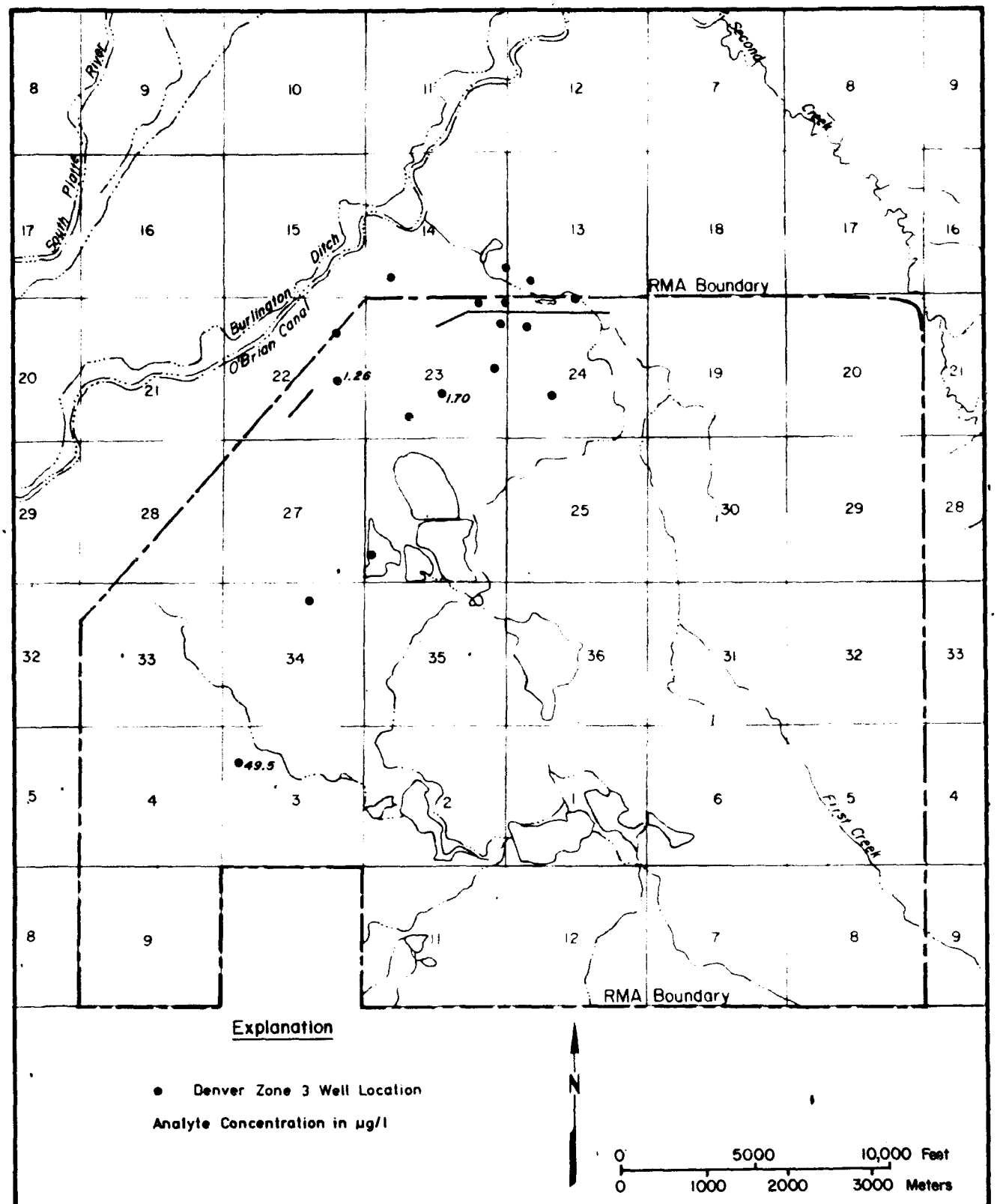
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-34
Summed Volatile Aromatic Compound Detections
Denver Zone 1
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



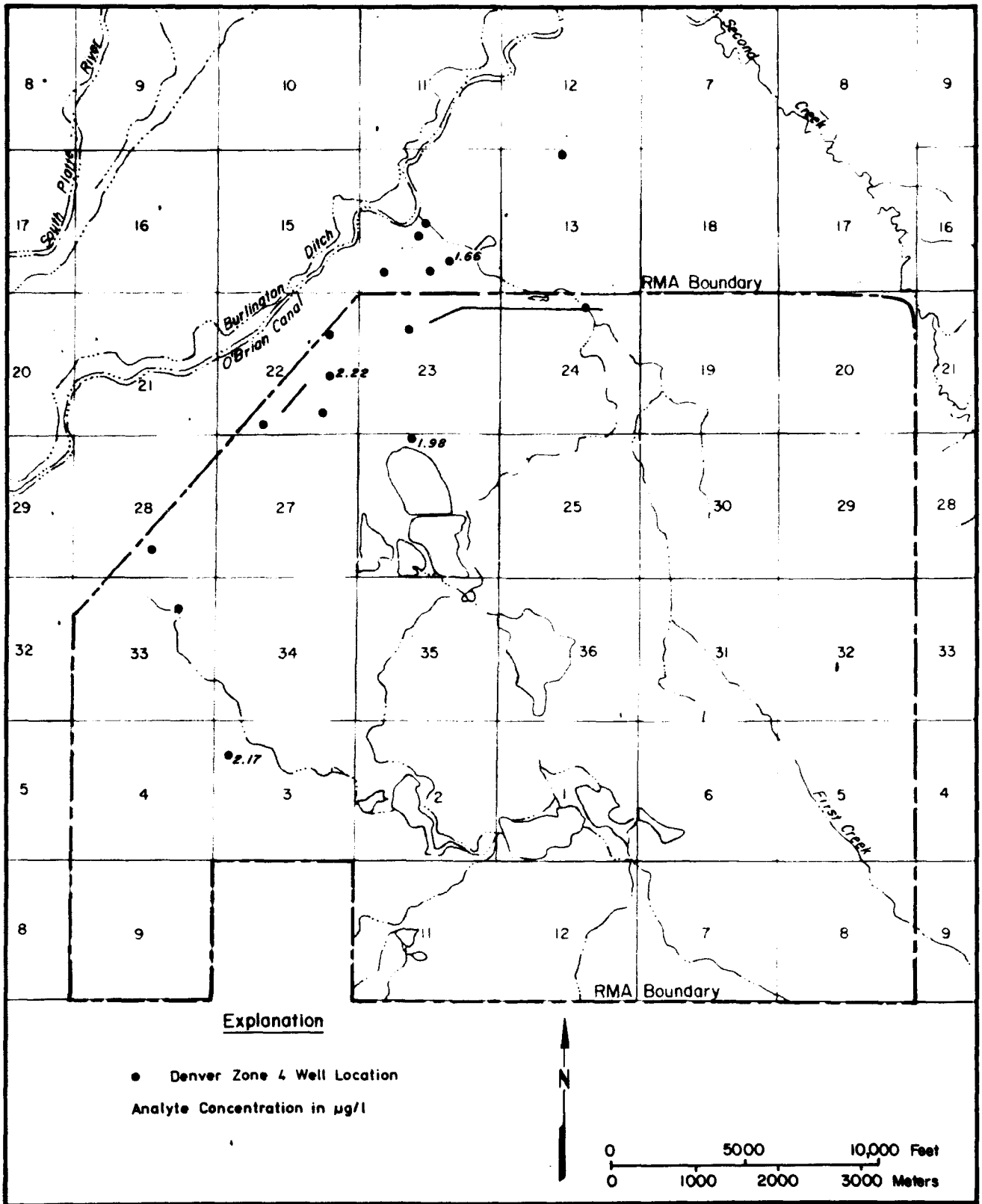
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-35
Summed Volatile Aromatic Compound Detections
Denver Zone 2
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



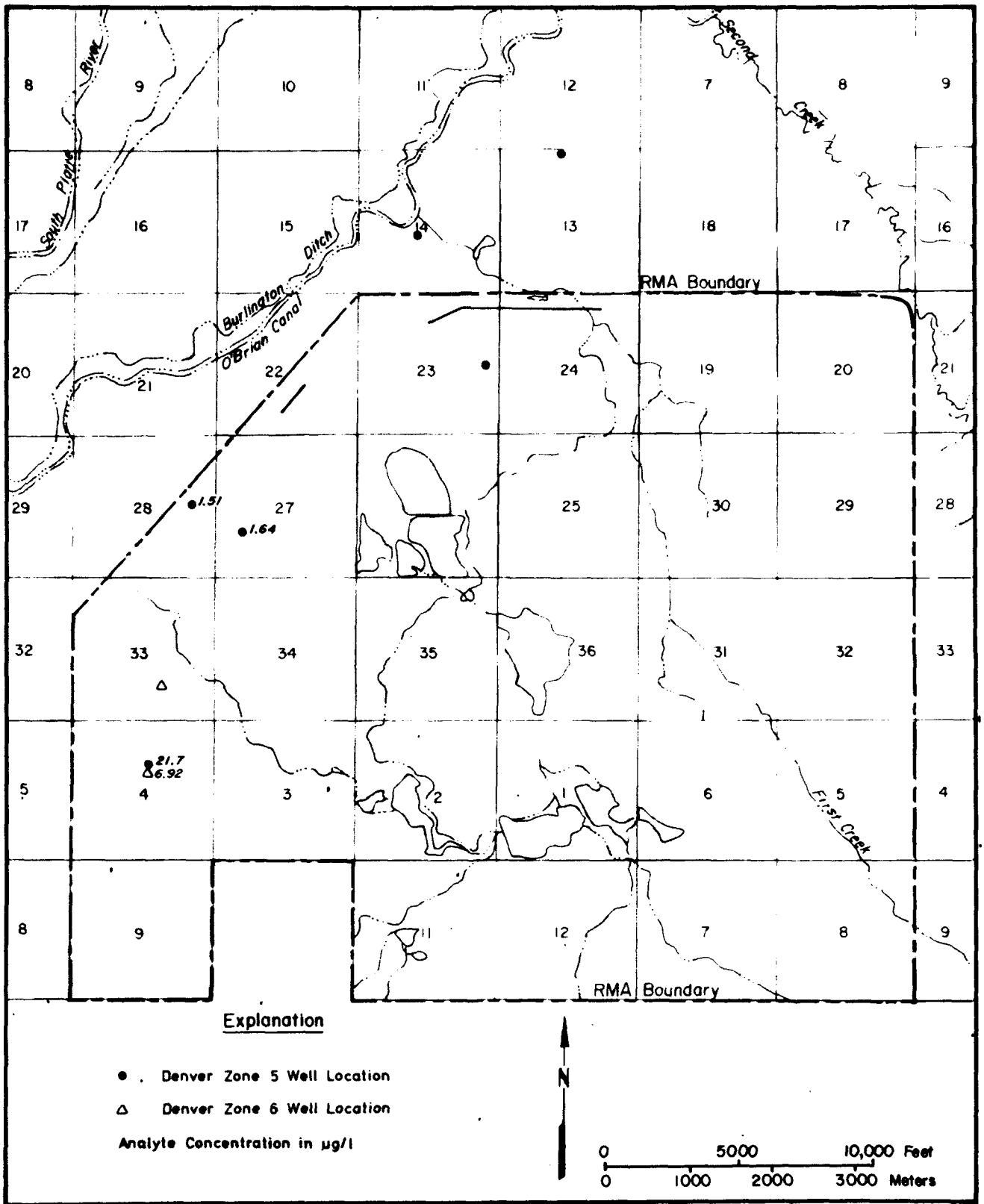
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-36
Summed Volatile Aromatic Compound Detections
Denver Zone 3
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



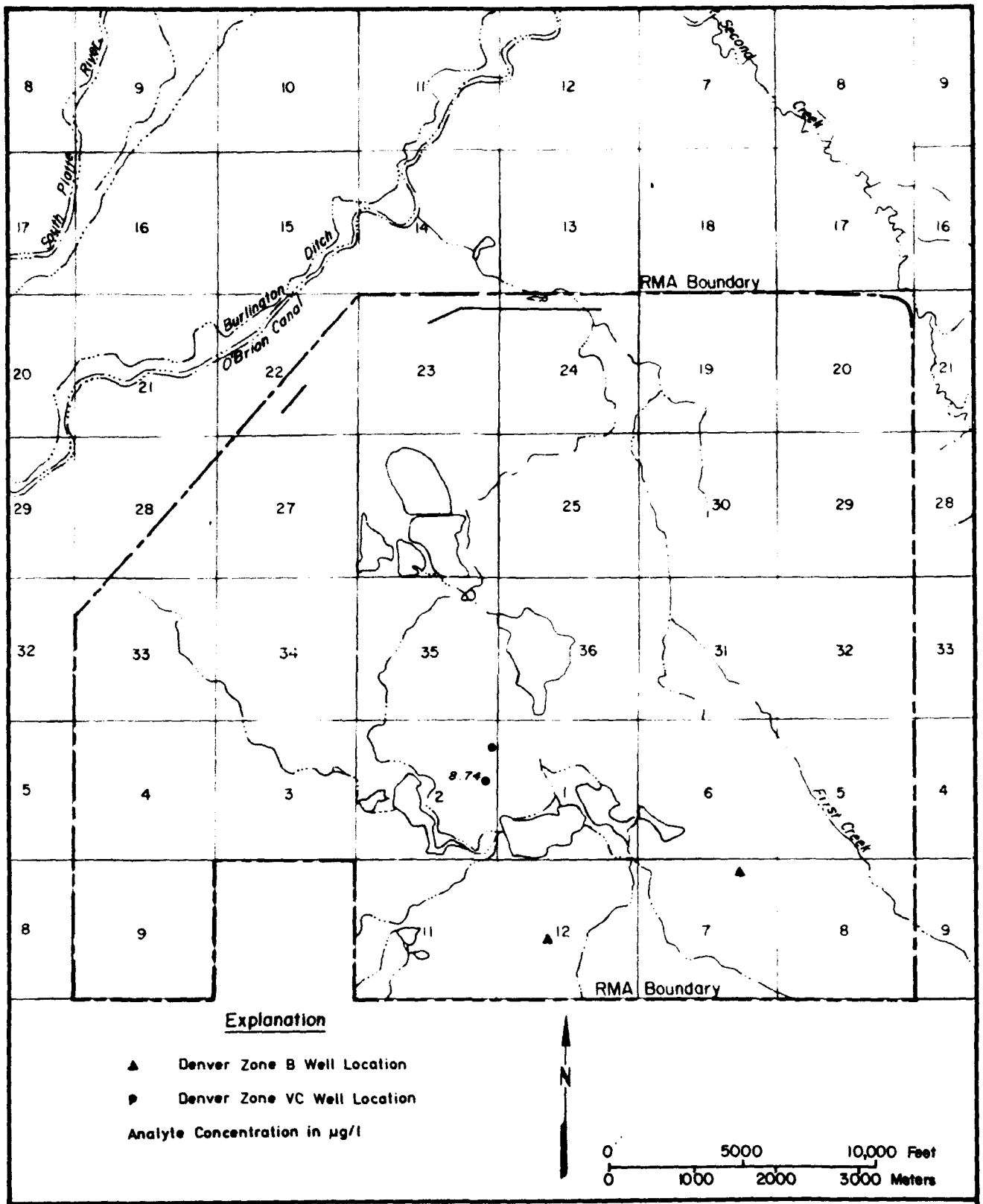
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-37
Summed Volatile Aromatic Compound Detections
Denver Zone 4
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



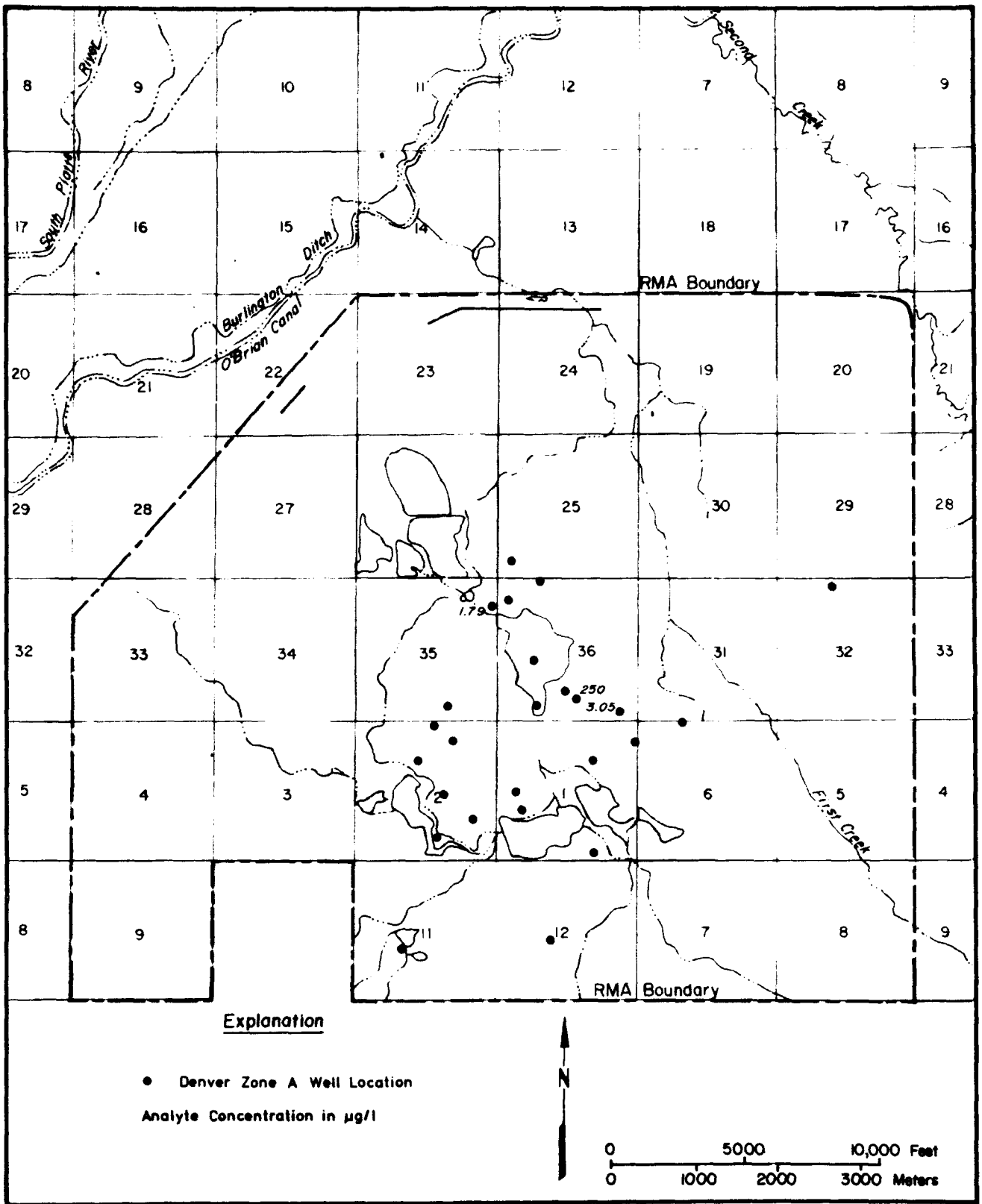
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-38
Summed Volatile Aromatic Compound Detections
Denver Zones 5 & 6
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



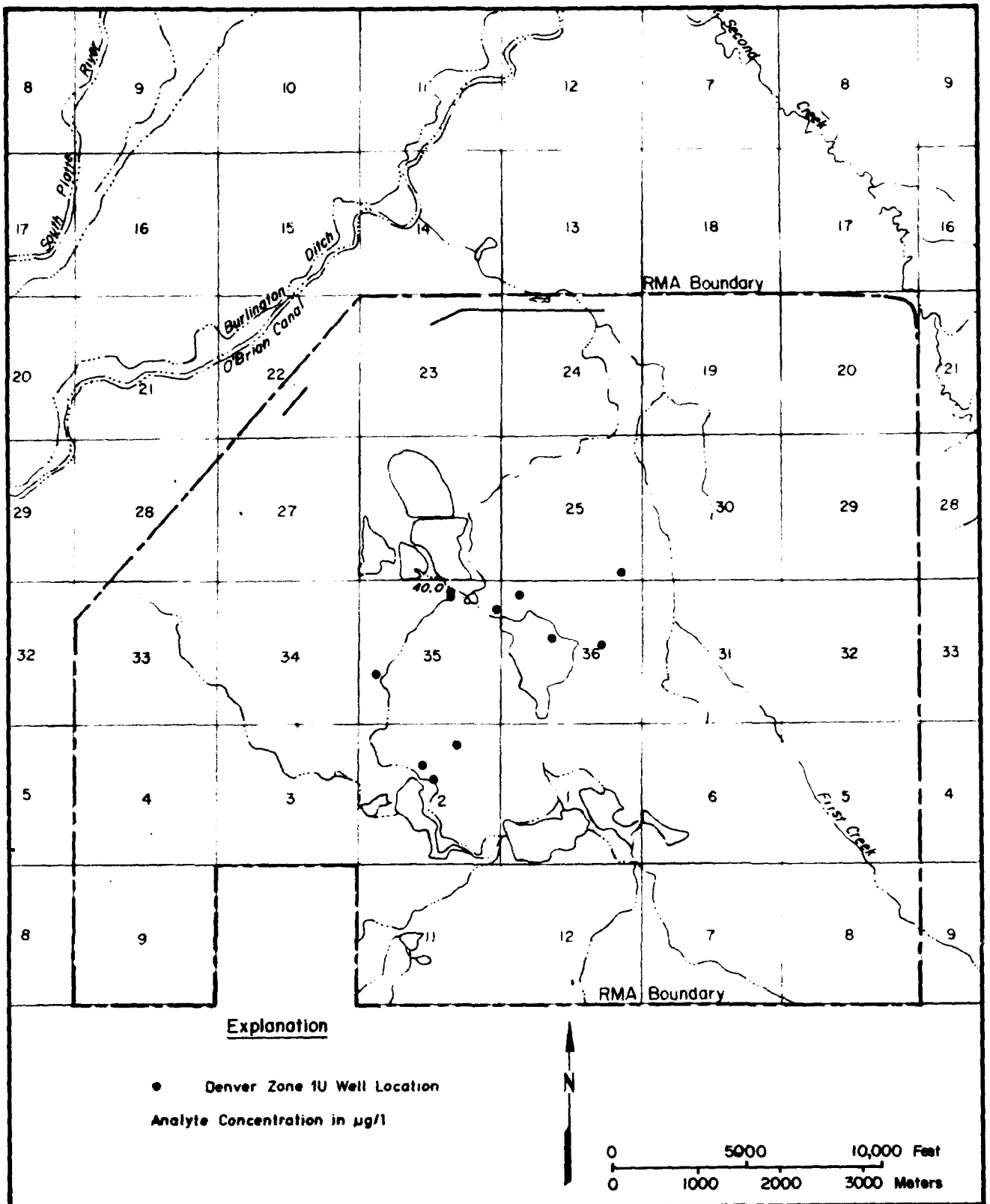
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-39
Benzene Detections
Denver Zones B & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



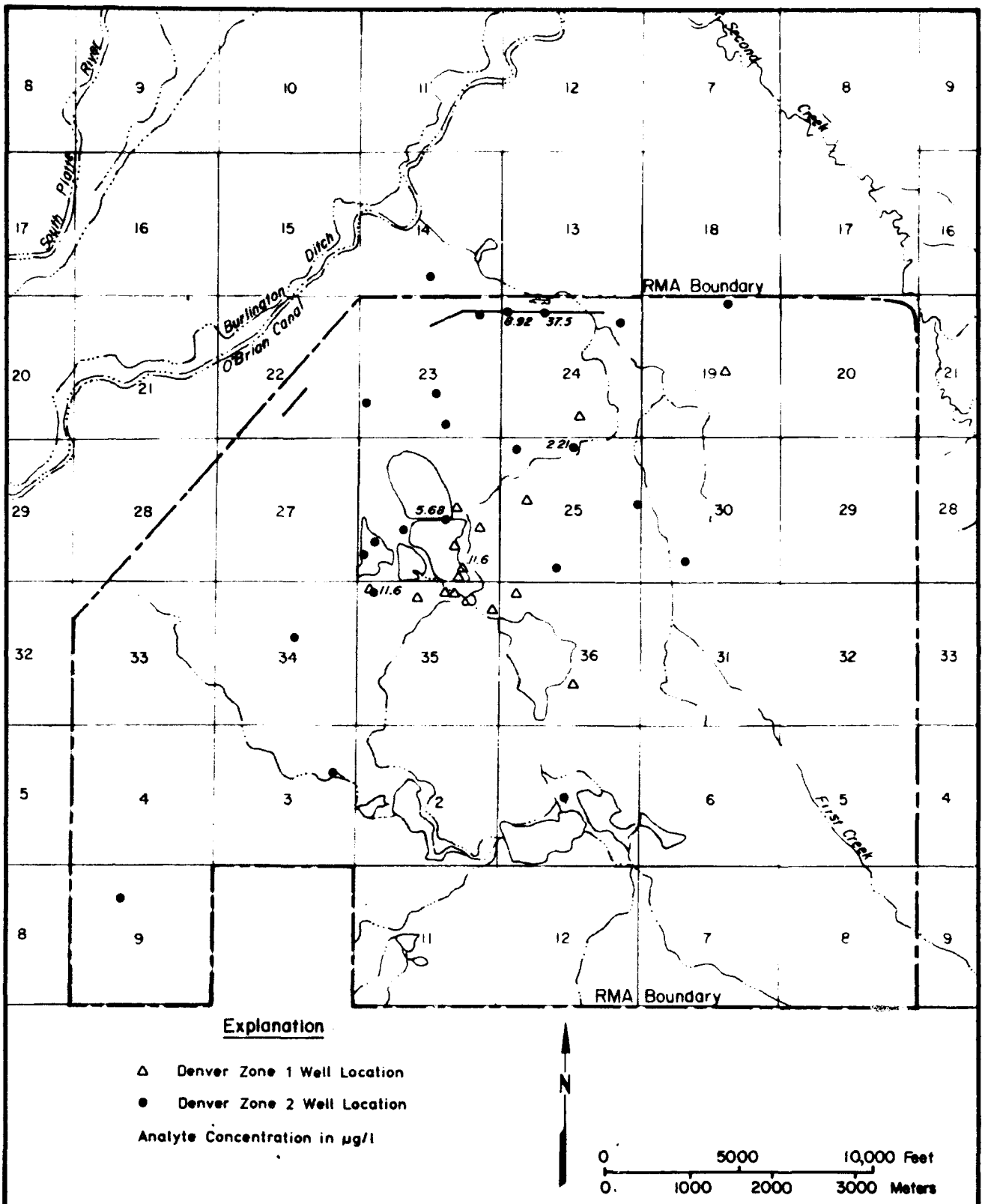
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-40
Benzene Detections
Denver Zone A
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



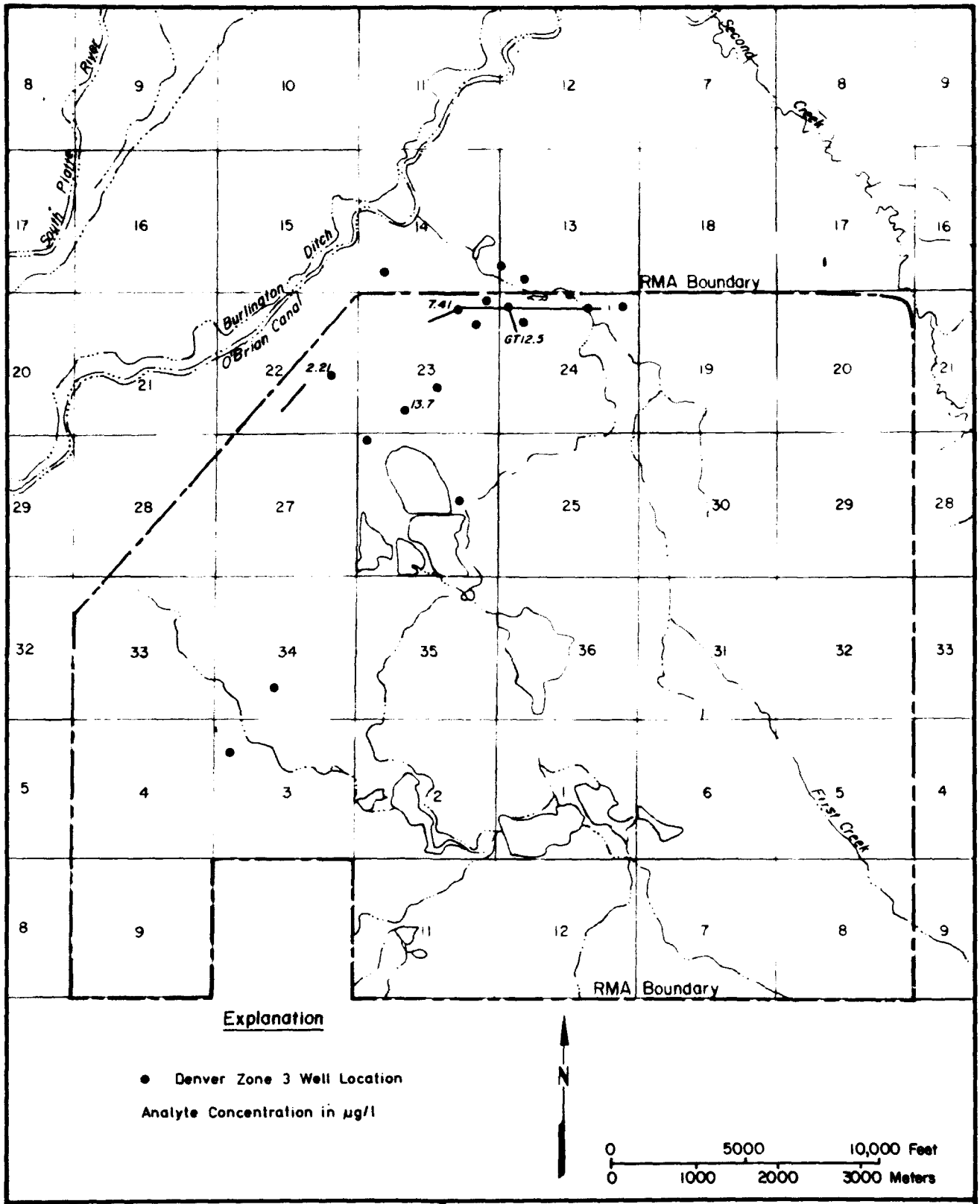
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-41
Benzene Detections
Denver Zone 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



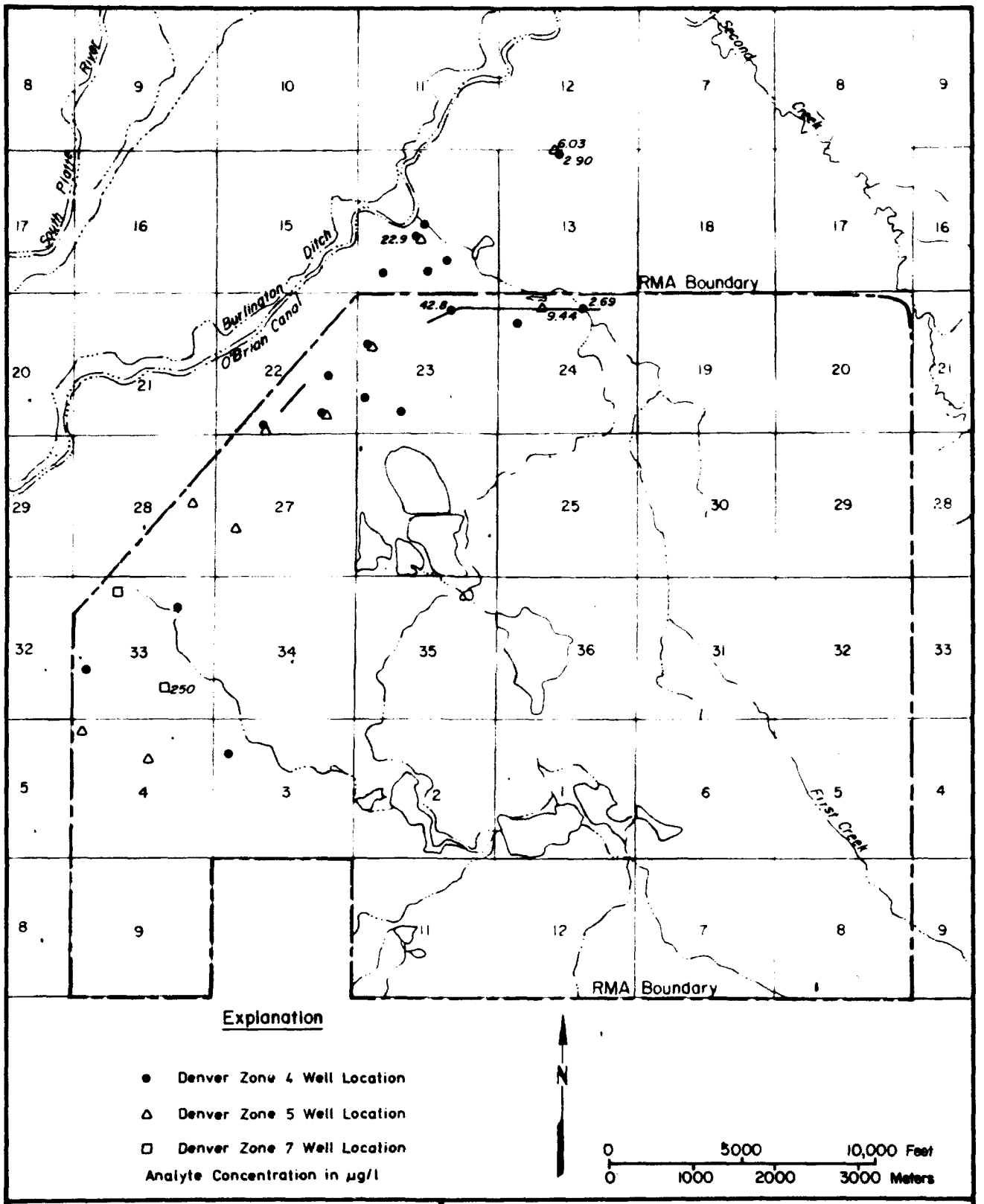
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-42
Benzene Detections
Denver Zones 1 & 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



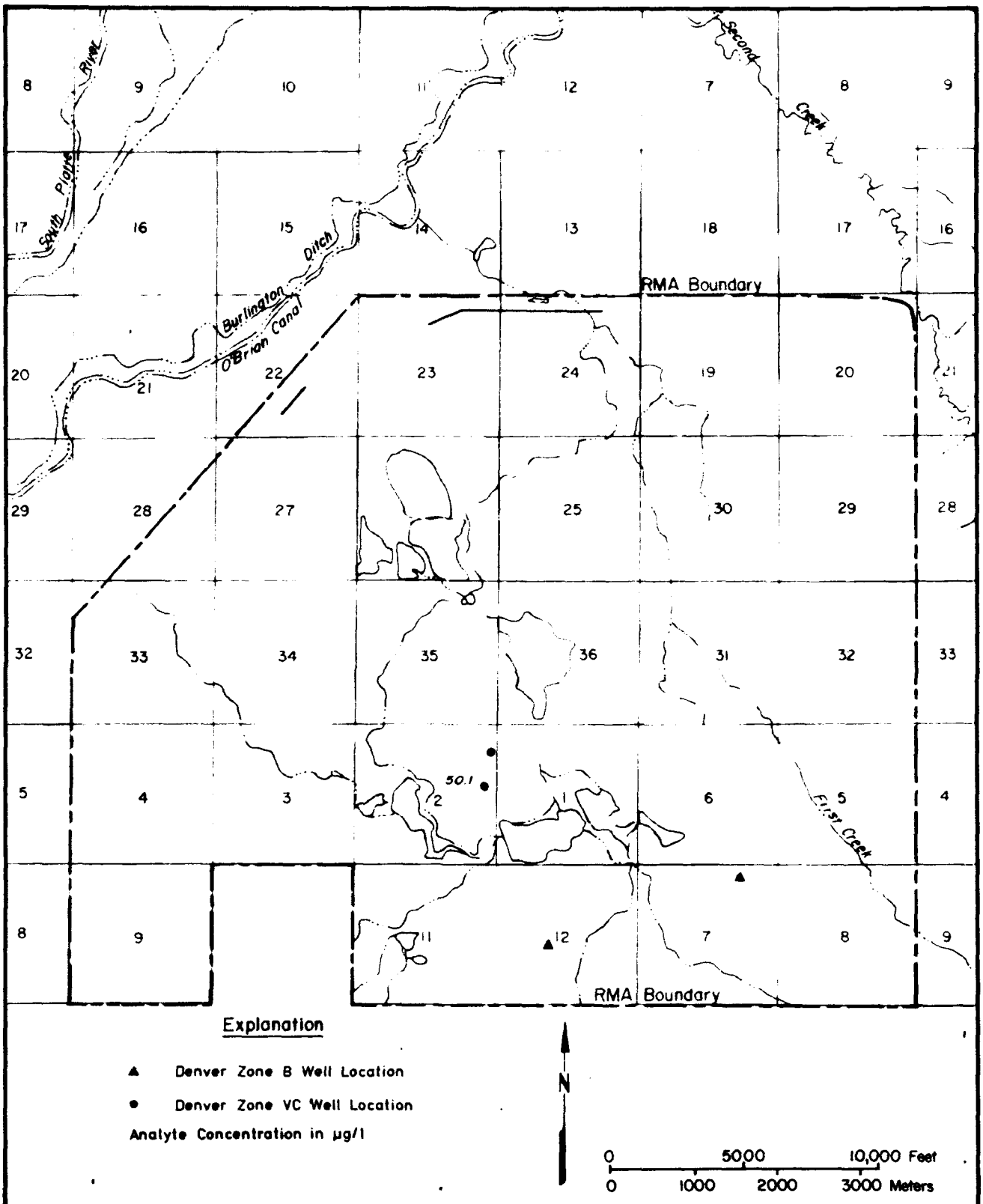
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-43
Benzene Detections
Denver Zone 3
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



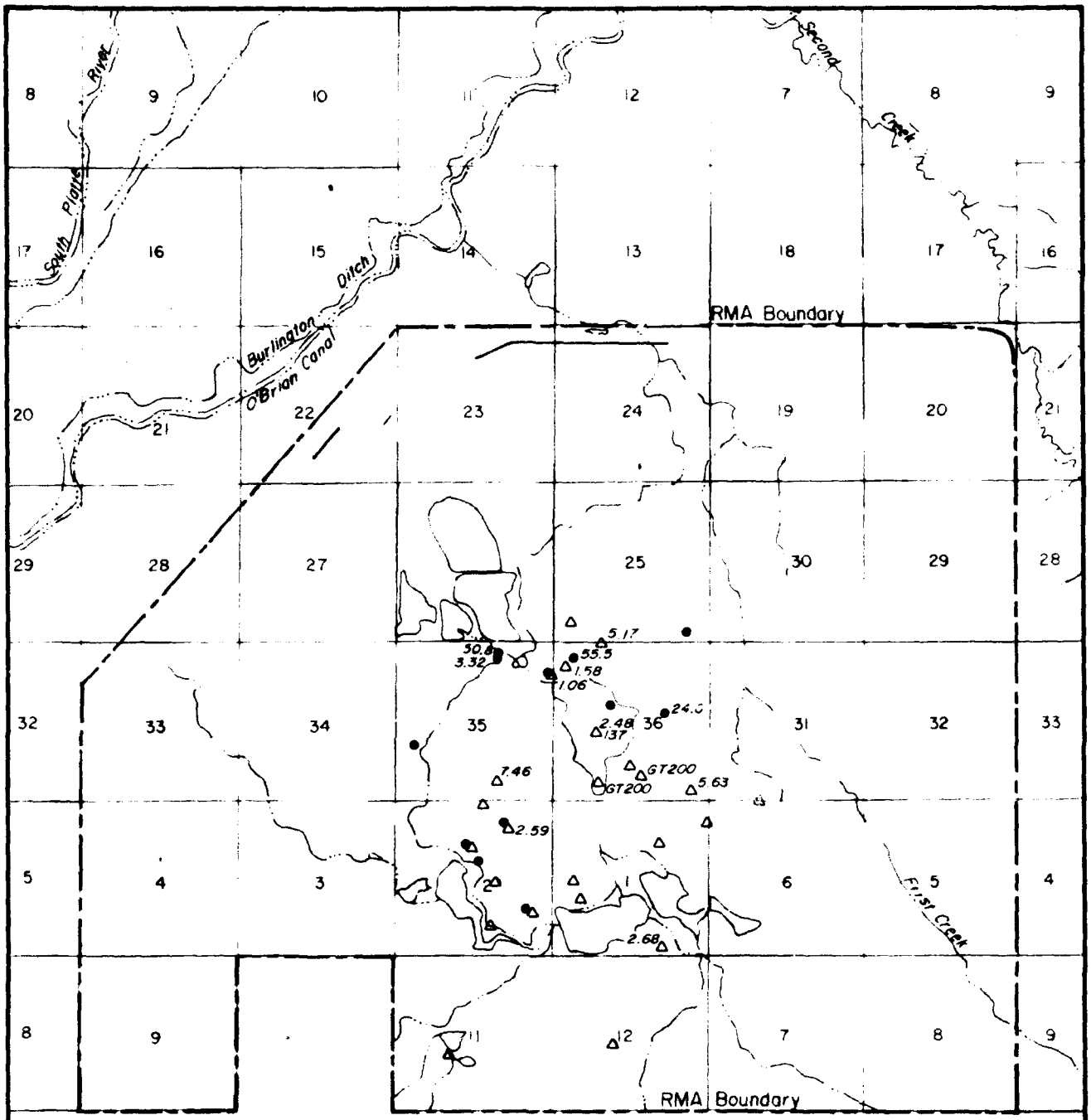
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-44
Benzene Detections
Denver Zones 4, 5, & 7
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-45
Chlorobenzene Detections
Denver Zones B & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

△ Denver Zone A Well Location

● Denver Zone 1U Well Location

Analyte Concentration in µg/l

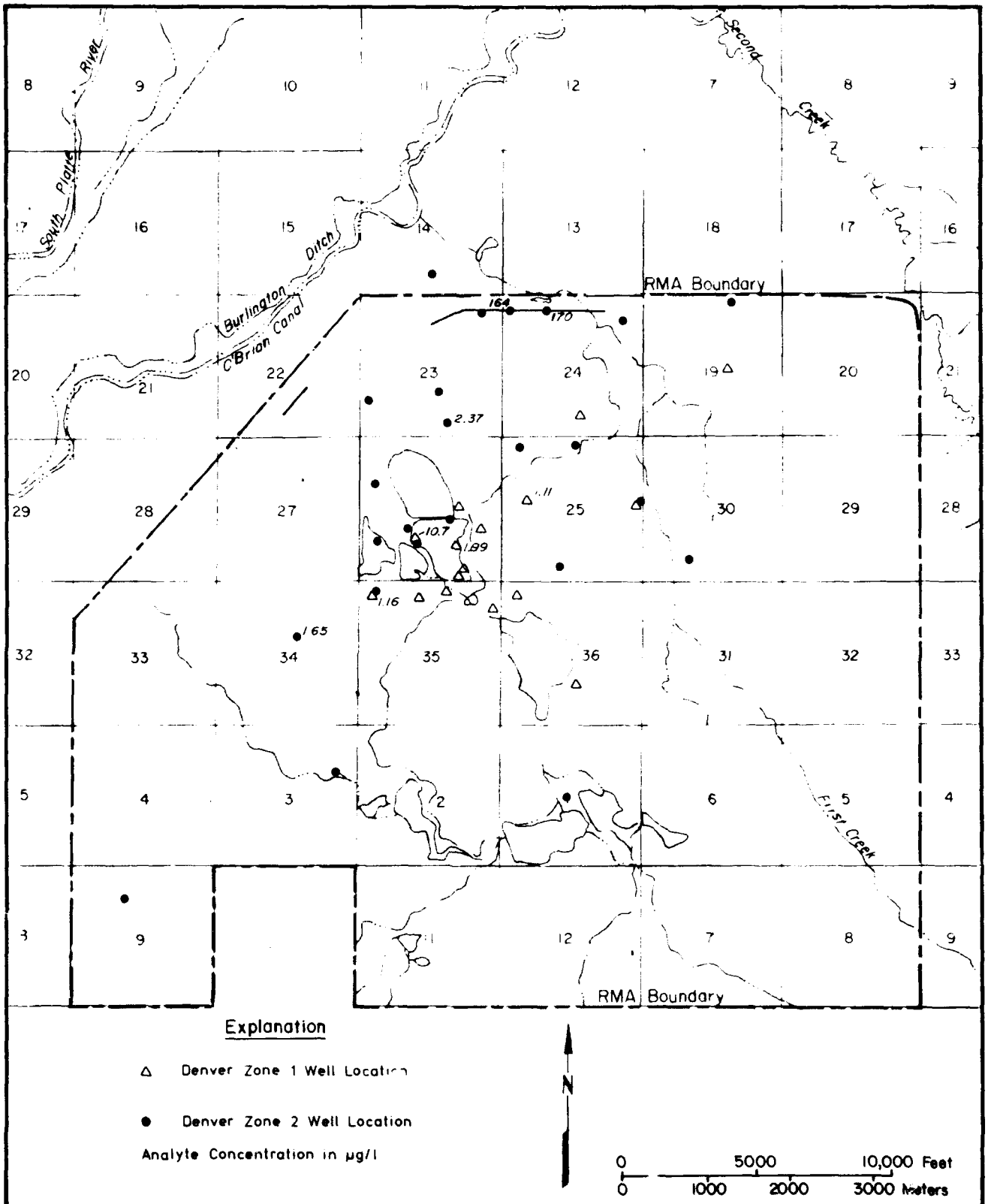
N

0 5000 10,000 Feet

0 1000 2000 3000 Meters

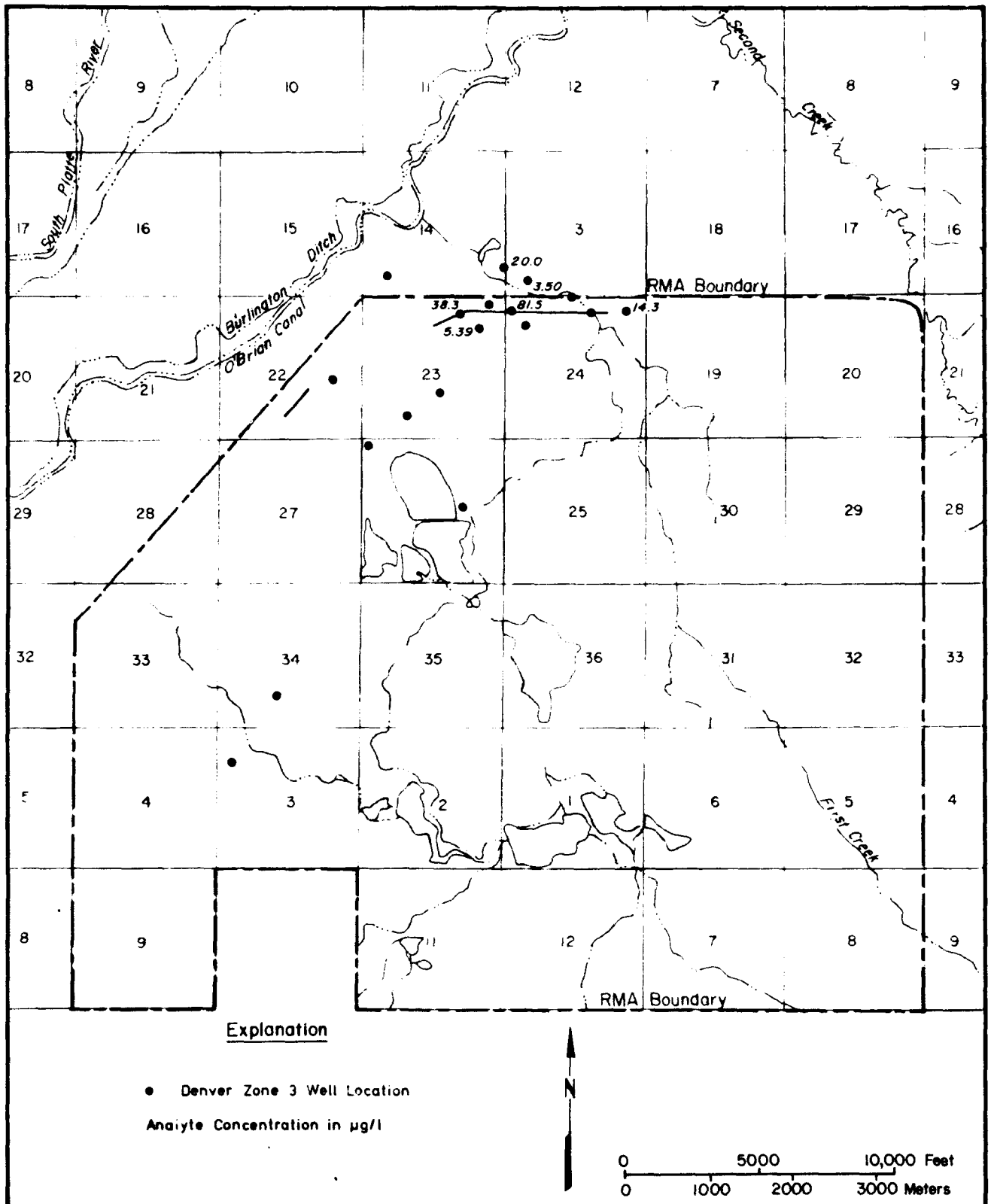
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A–46
Chlorobenzene Detections
Denver Zones A & 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



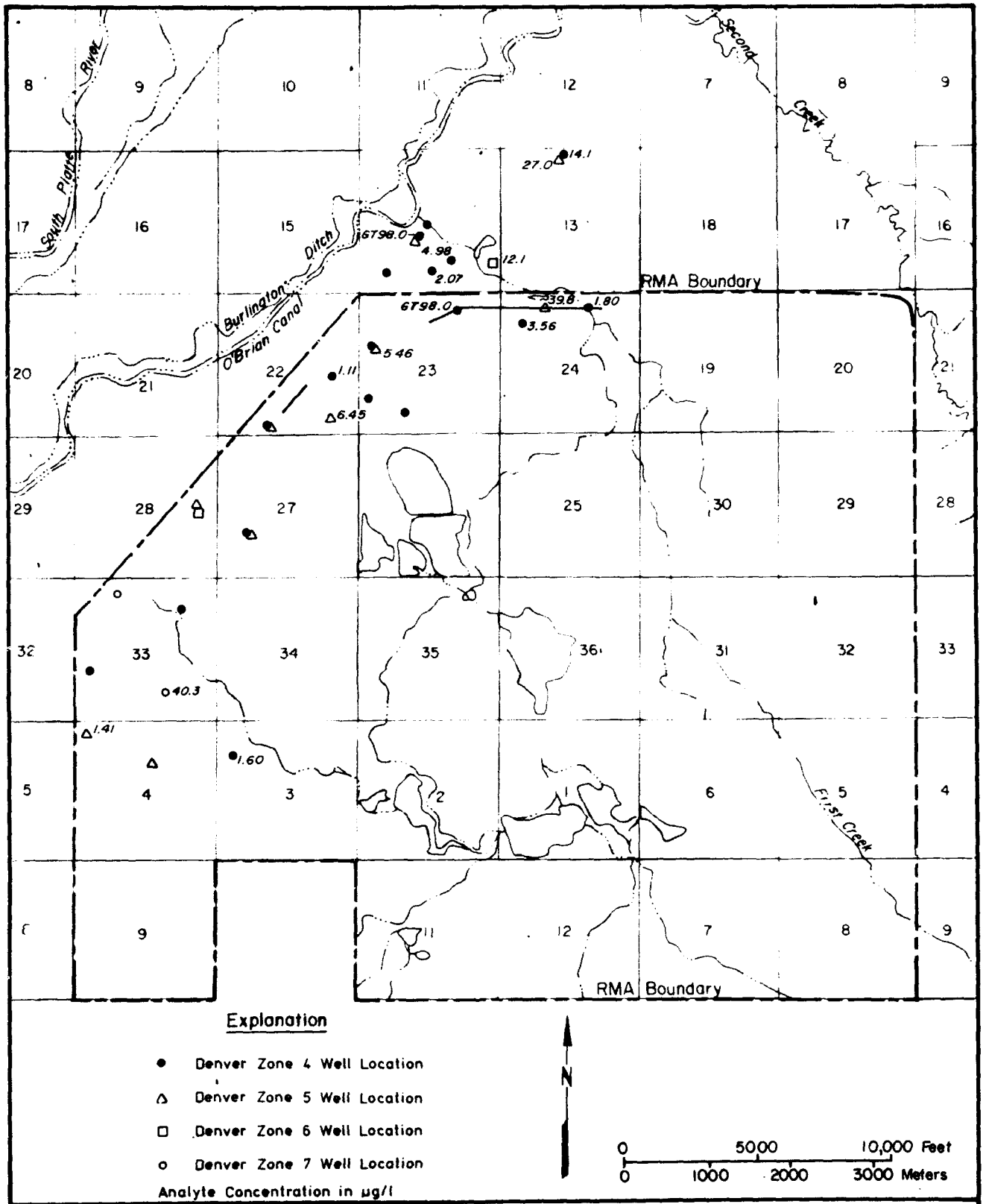
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-47
Chlorobenzene Detections
Denver Zones 1 & 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



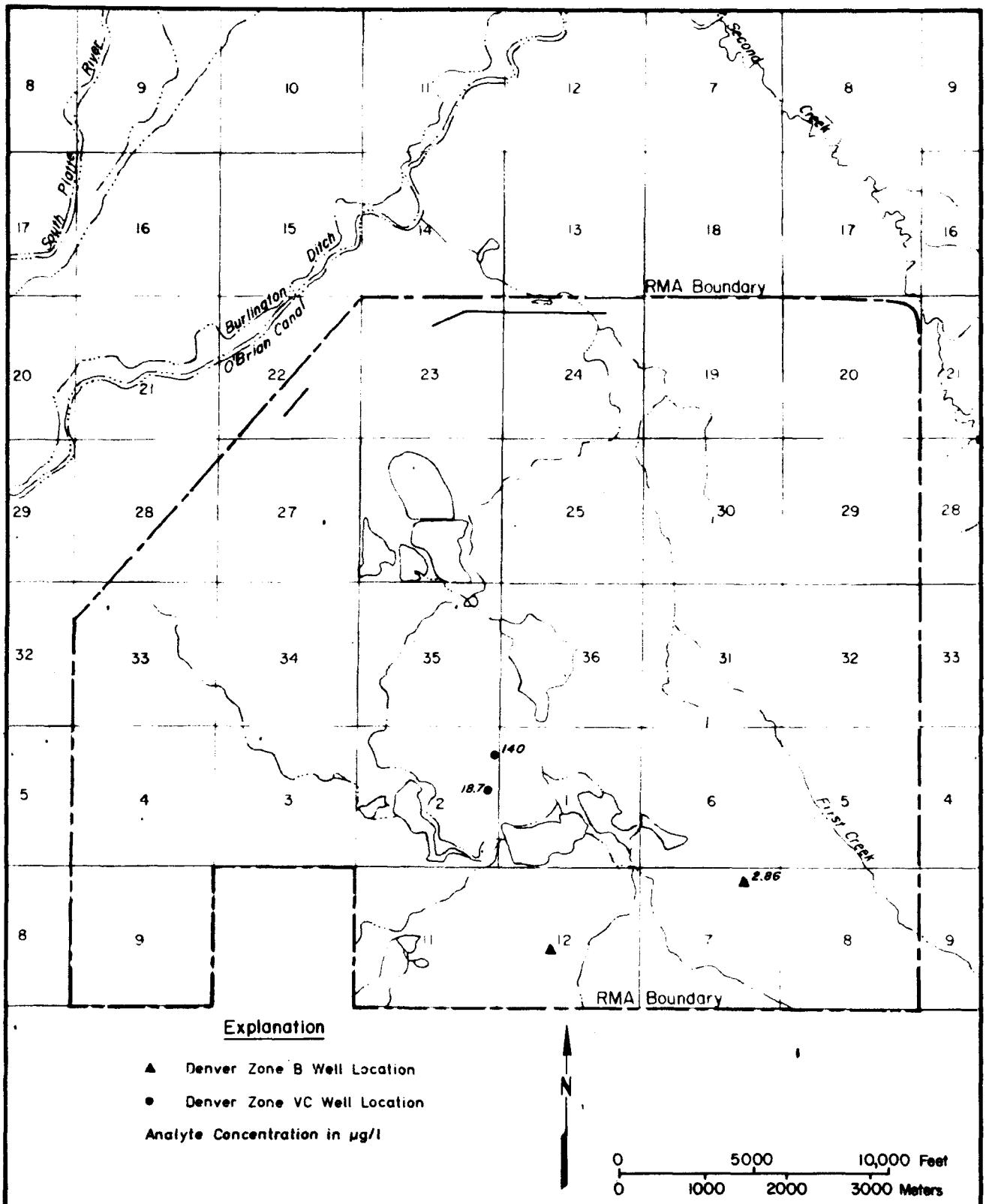
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-48
Chlorobenzene Detections
Denver Zone 3
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



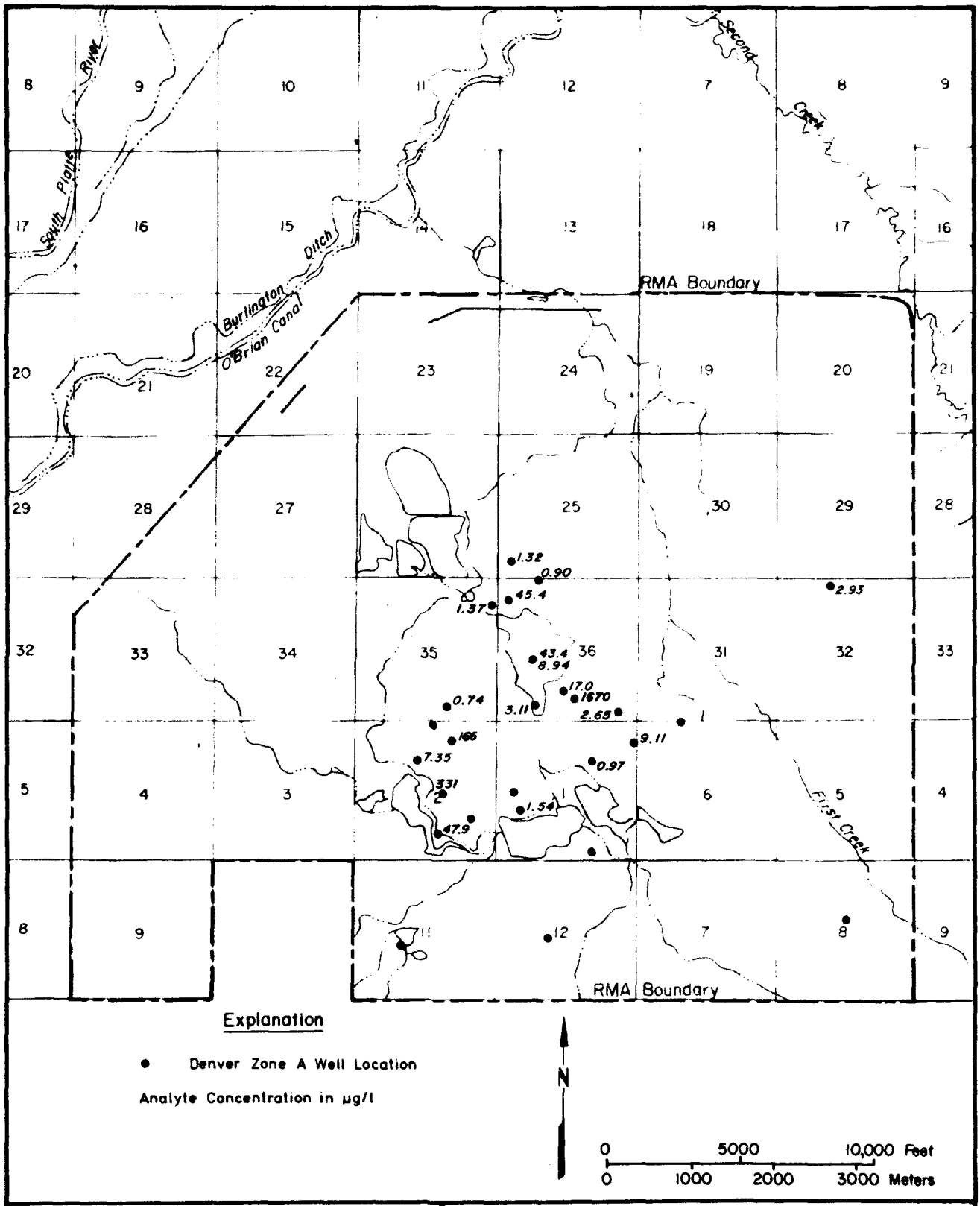
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-49
Chlorobenzene Detections
Denver Zones 4, 5, 6, & 7
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



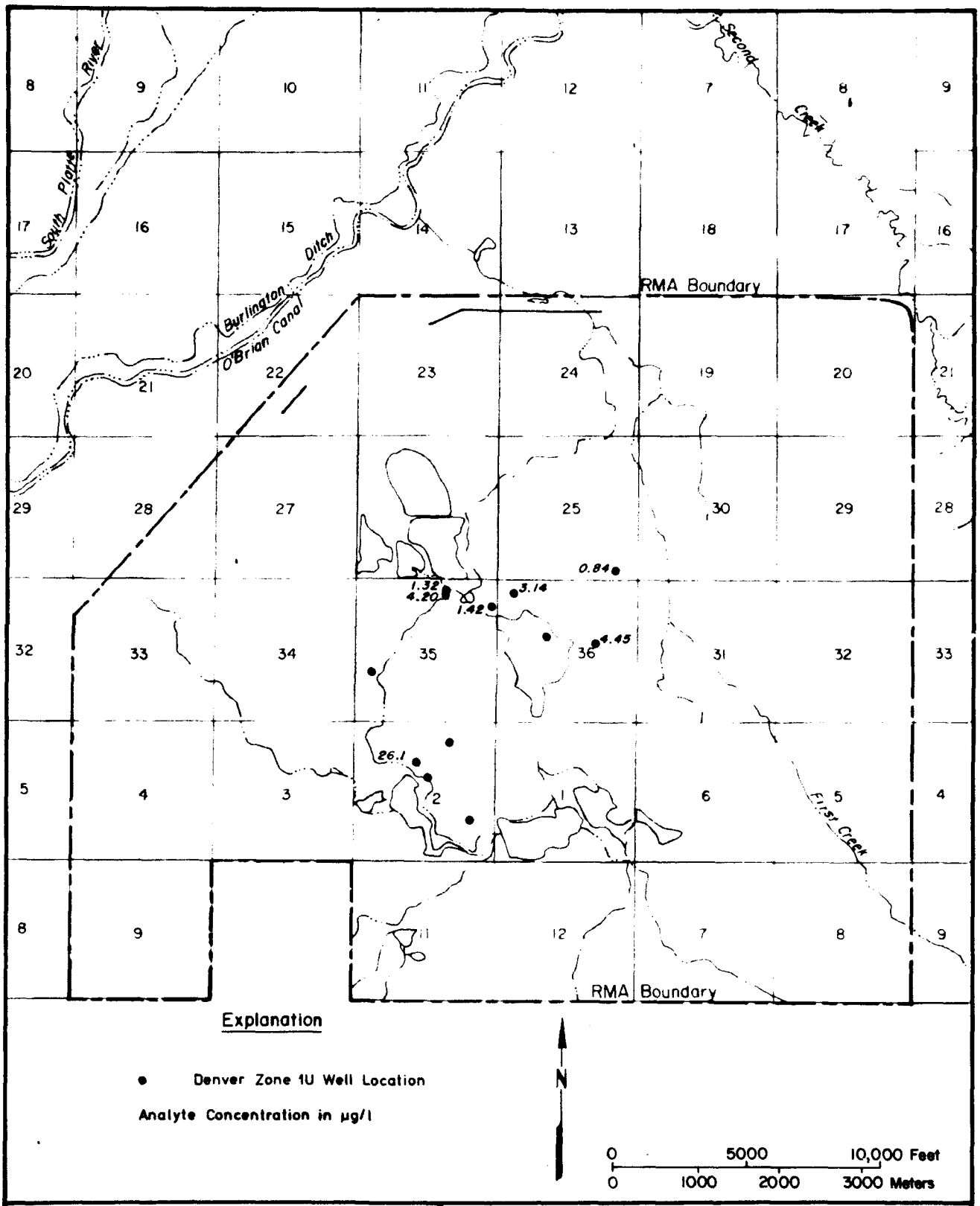
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-50
Summed Organohalogen Compound Detections
Denver Zones B & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



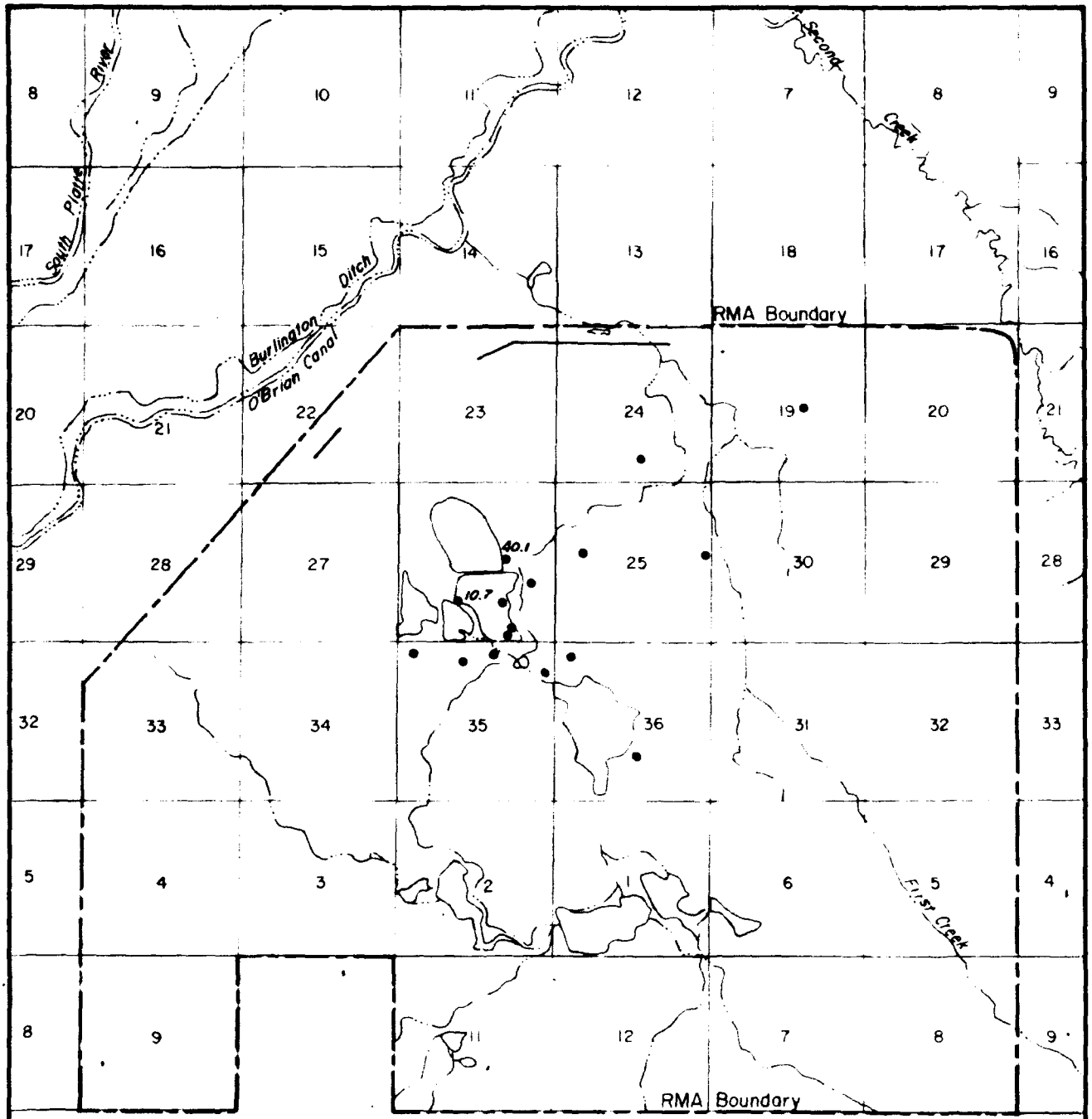
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-51
Summed Organohalogen Compound Detections
Denver Zone A
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



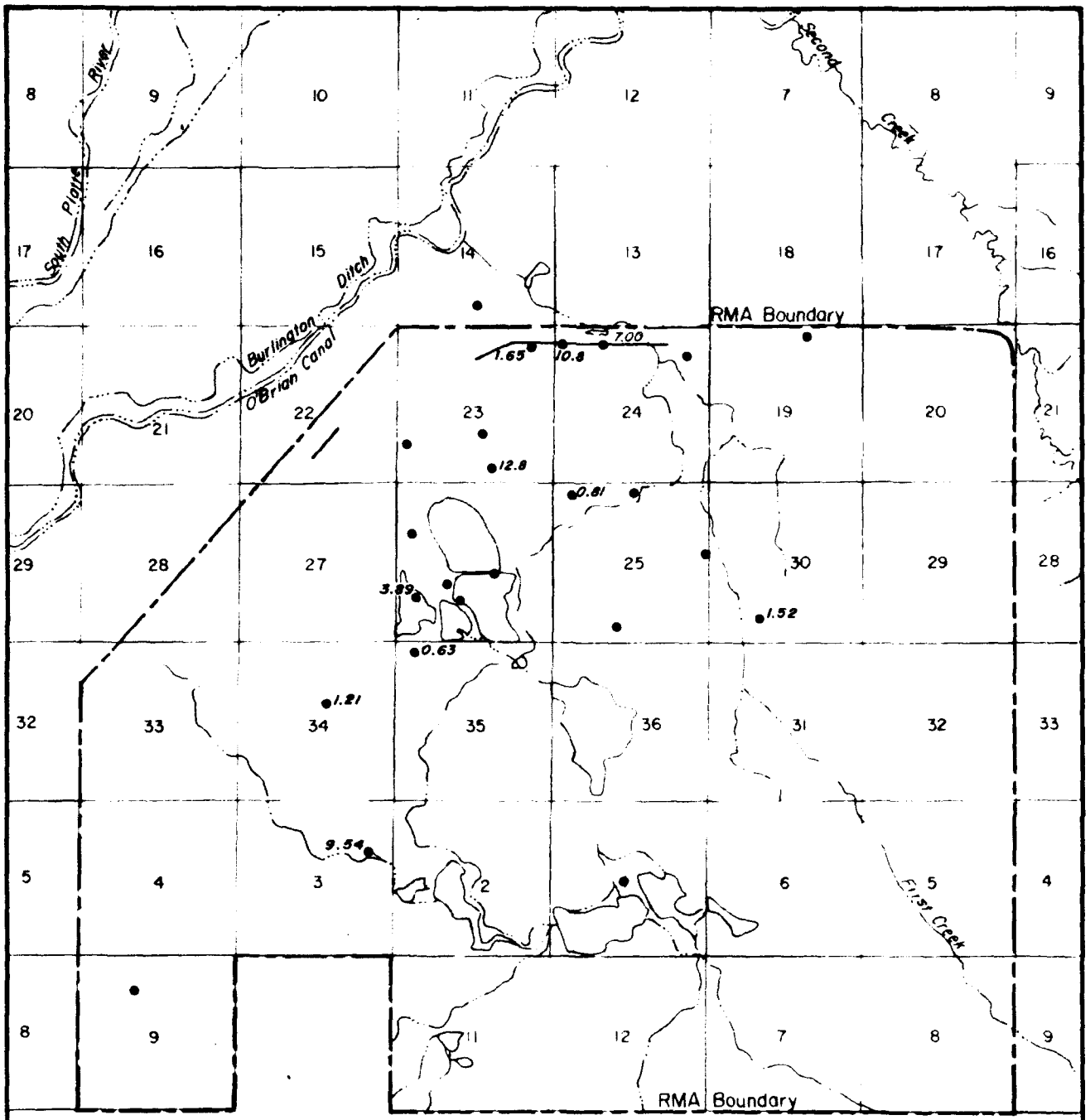
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-52
Summed Organohalogen Compound Detections
Denver Zone 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-53
Summed Organohalogen Compound Detections
Denver Zone 1
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

● Denver Zone 2 Well Location

Analyte Concentration in µg/l

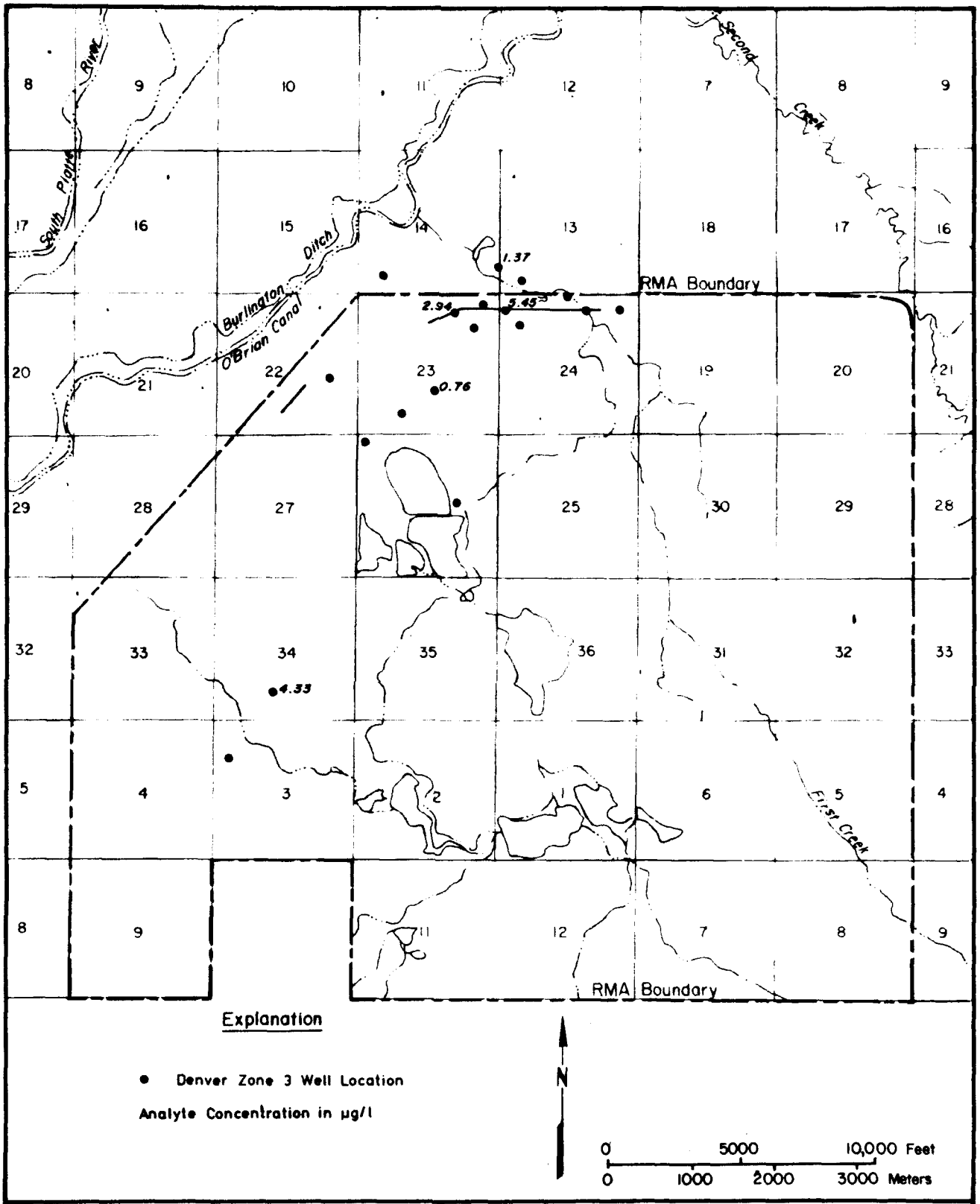
N

0 5000 10,000 Feet

0 1000 2000 3000 Meters

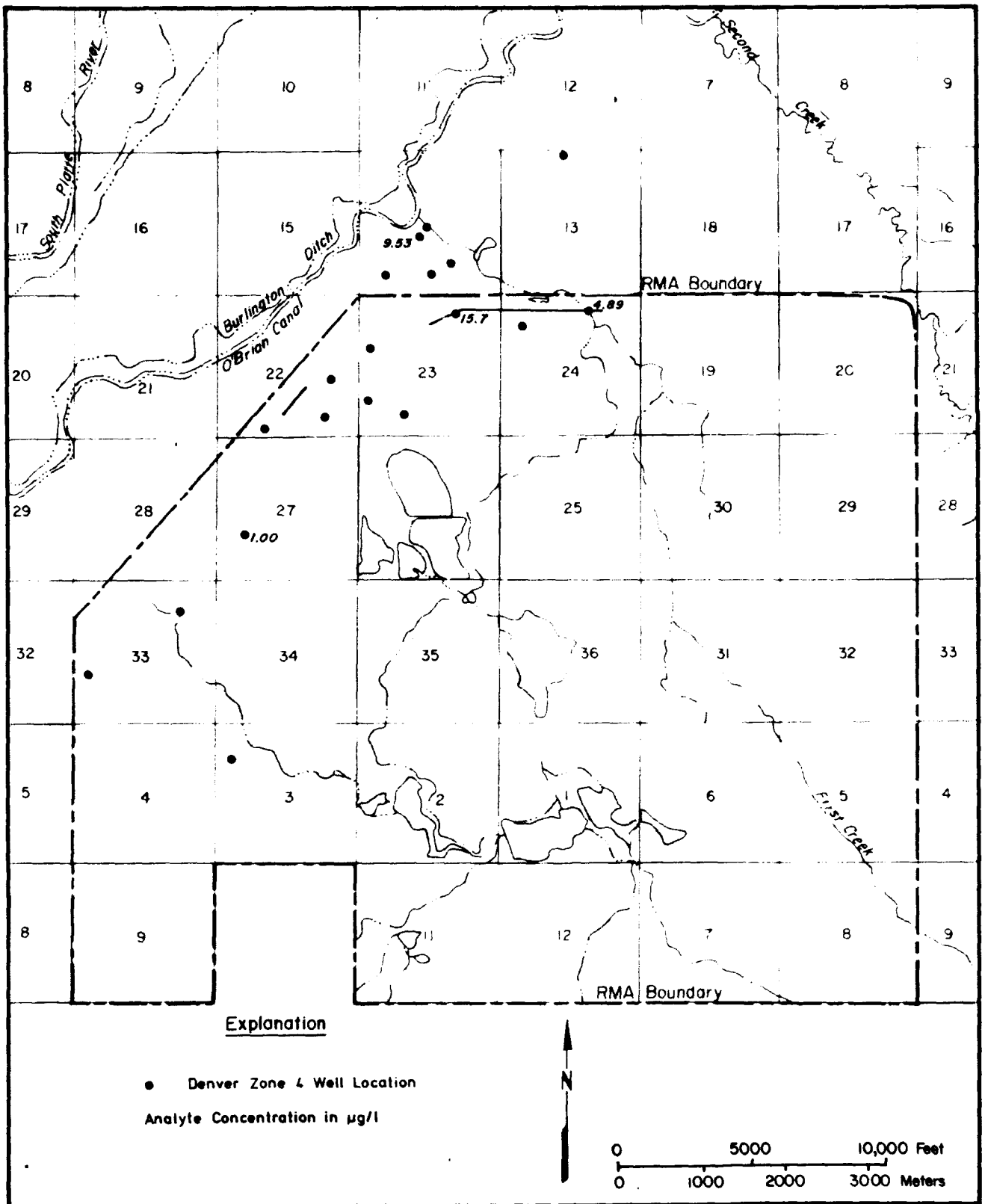
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-54
Summed Organohalogen Compound Detections
Denver Zone 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



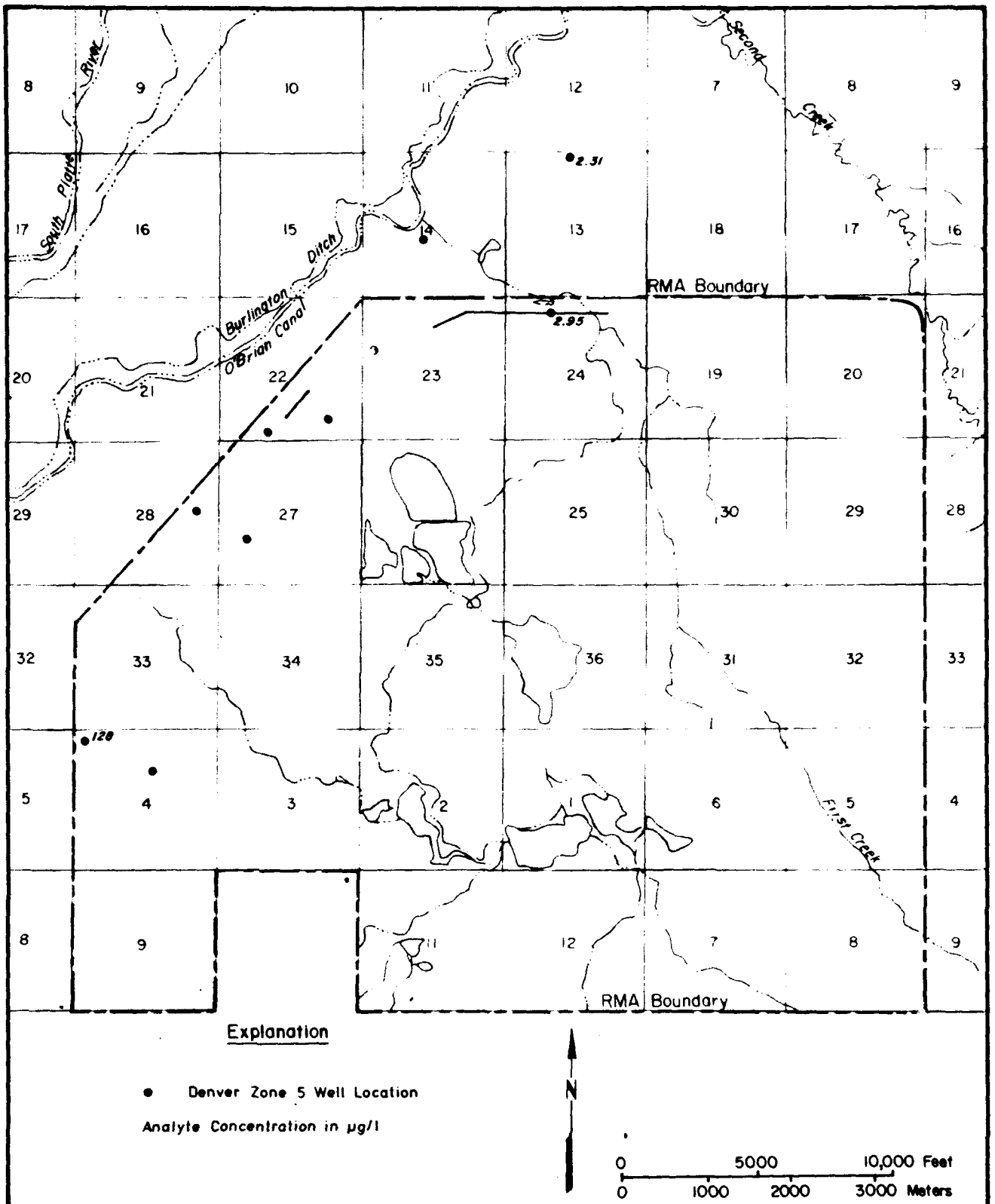
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-55
Summed Organohalogen Compound Detections
Denver Zone 3
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



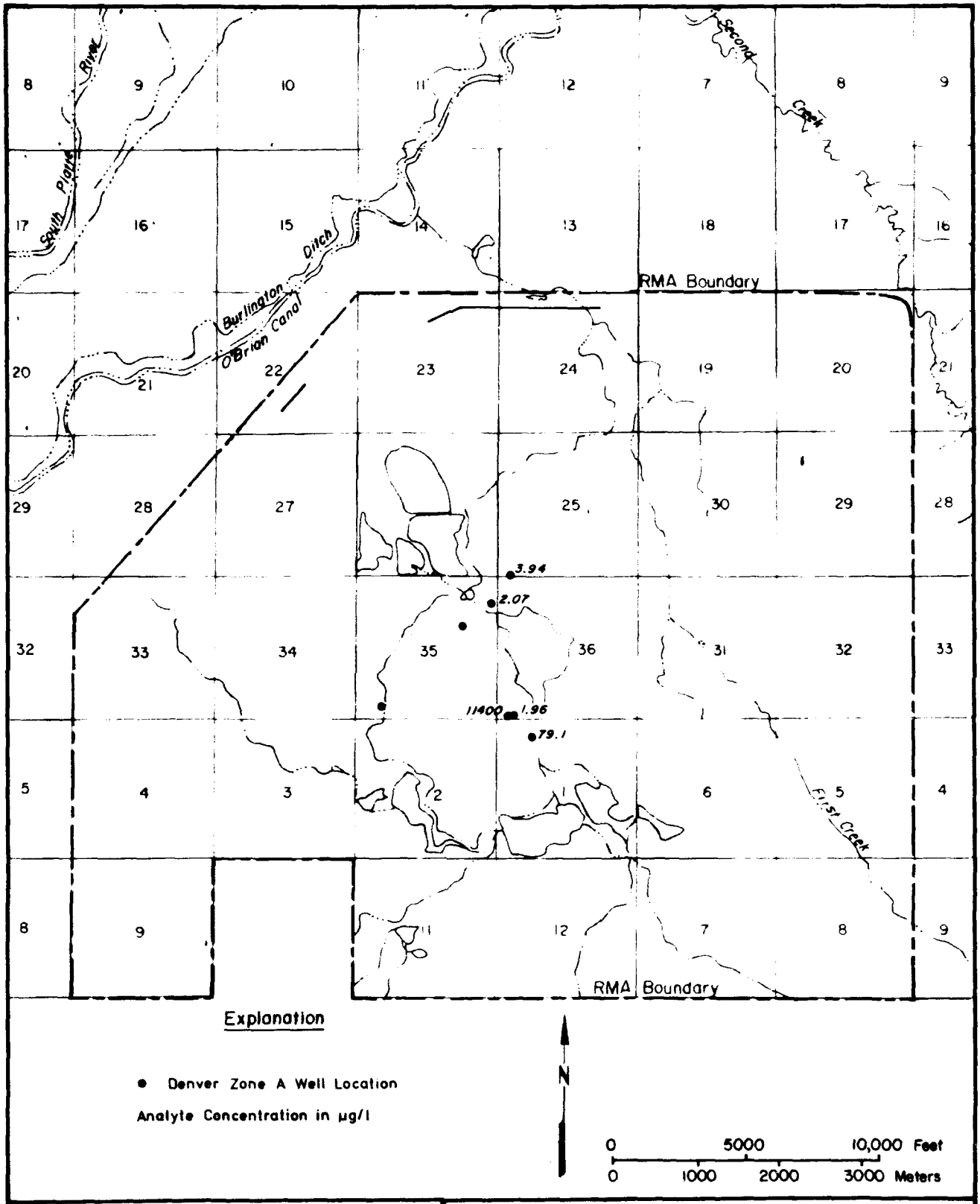
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-56
Summed Organohalogen Compound Detections
Denver Zone 4
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



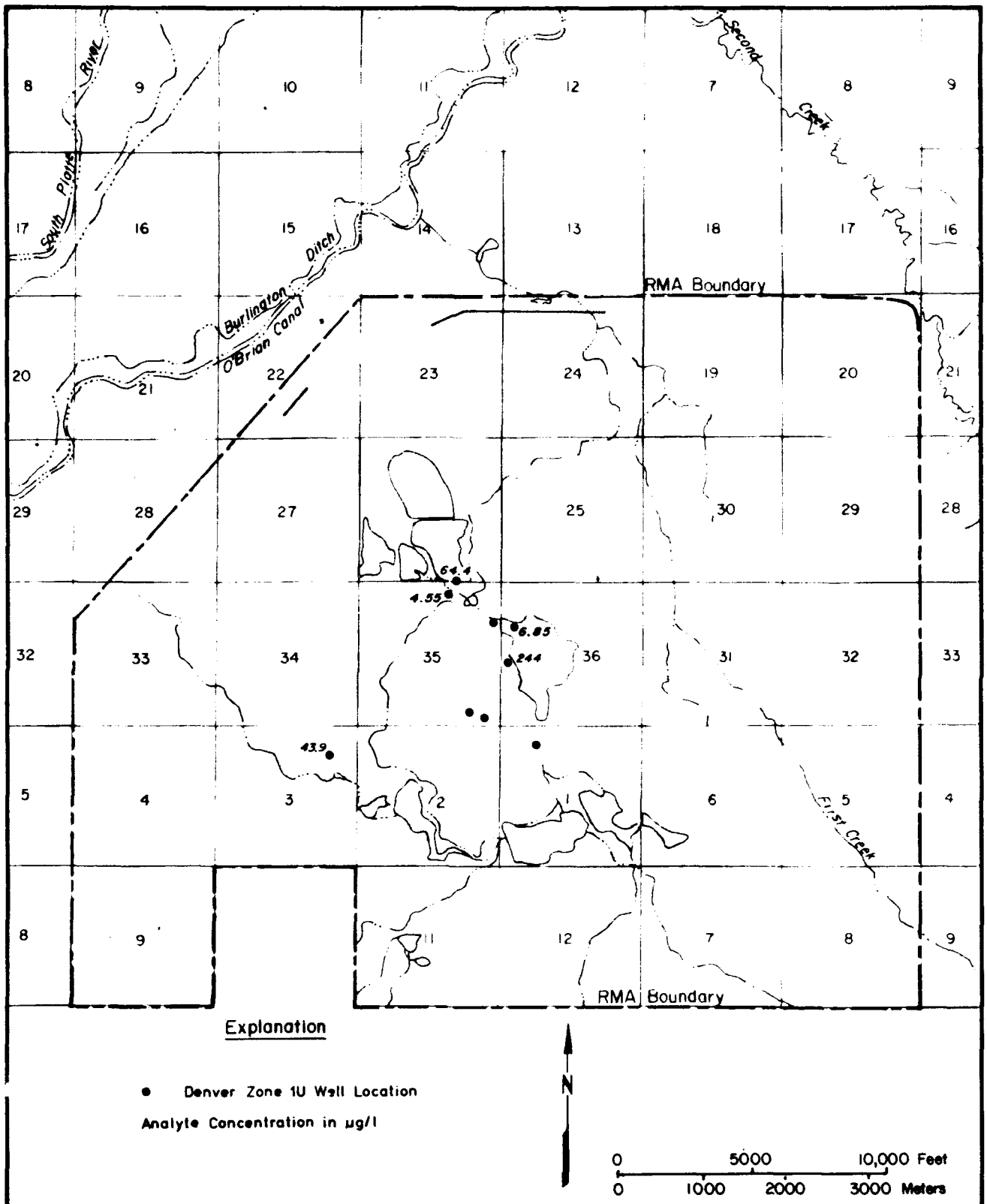
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-57
Summed Organohalogen Compound Detections
Denver Zone 5
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



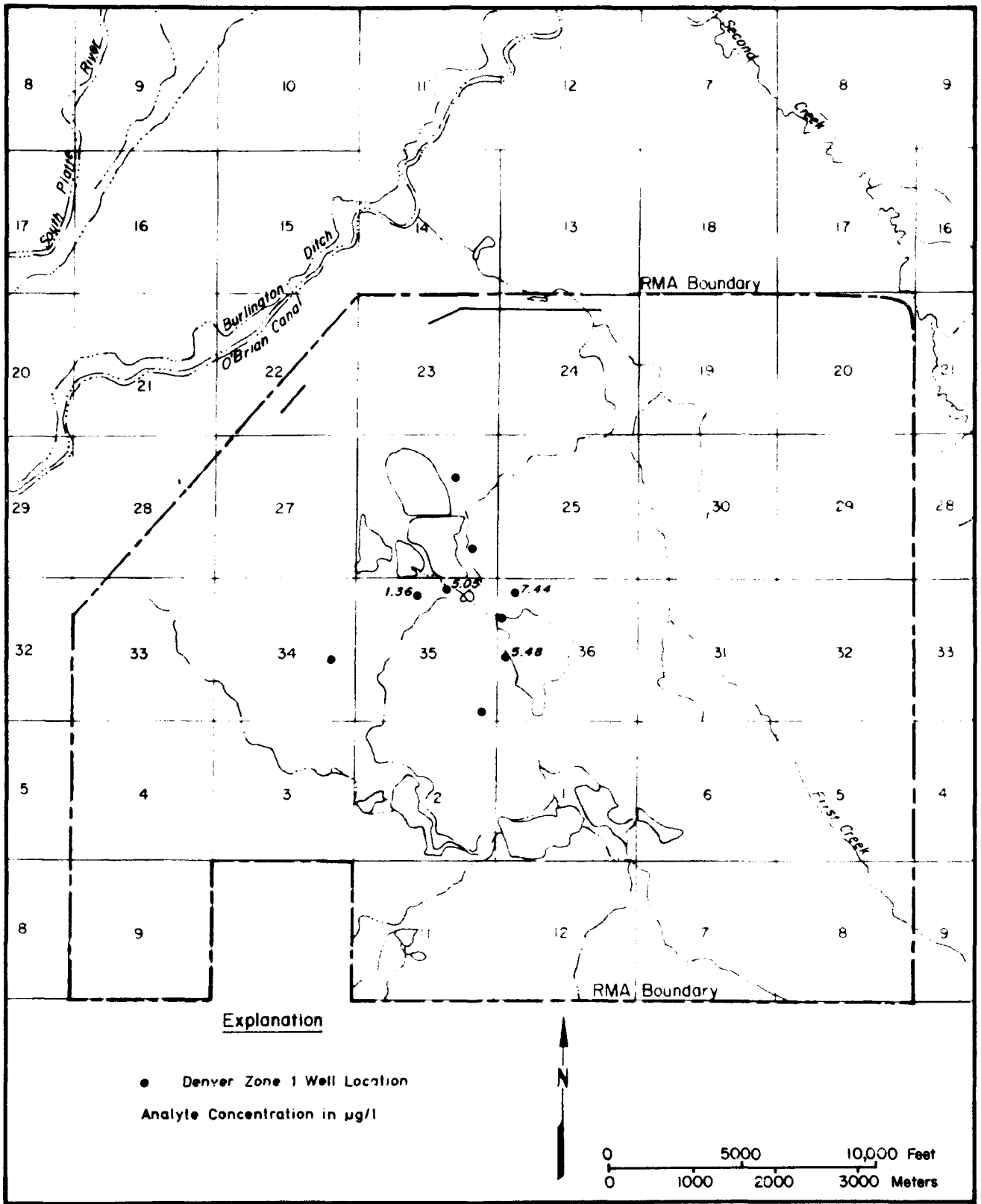
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-58
Summed Organohalogen Compound Detections
Denver Zone A
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



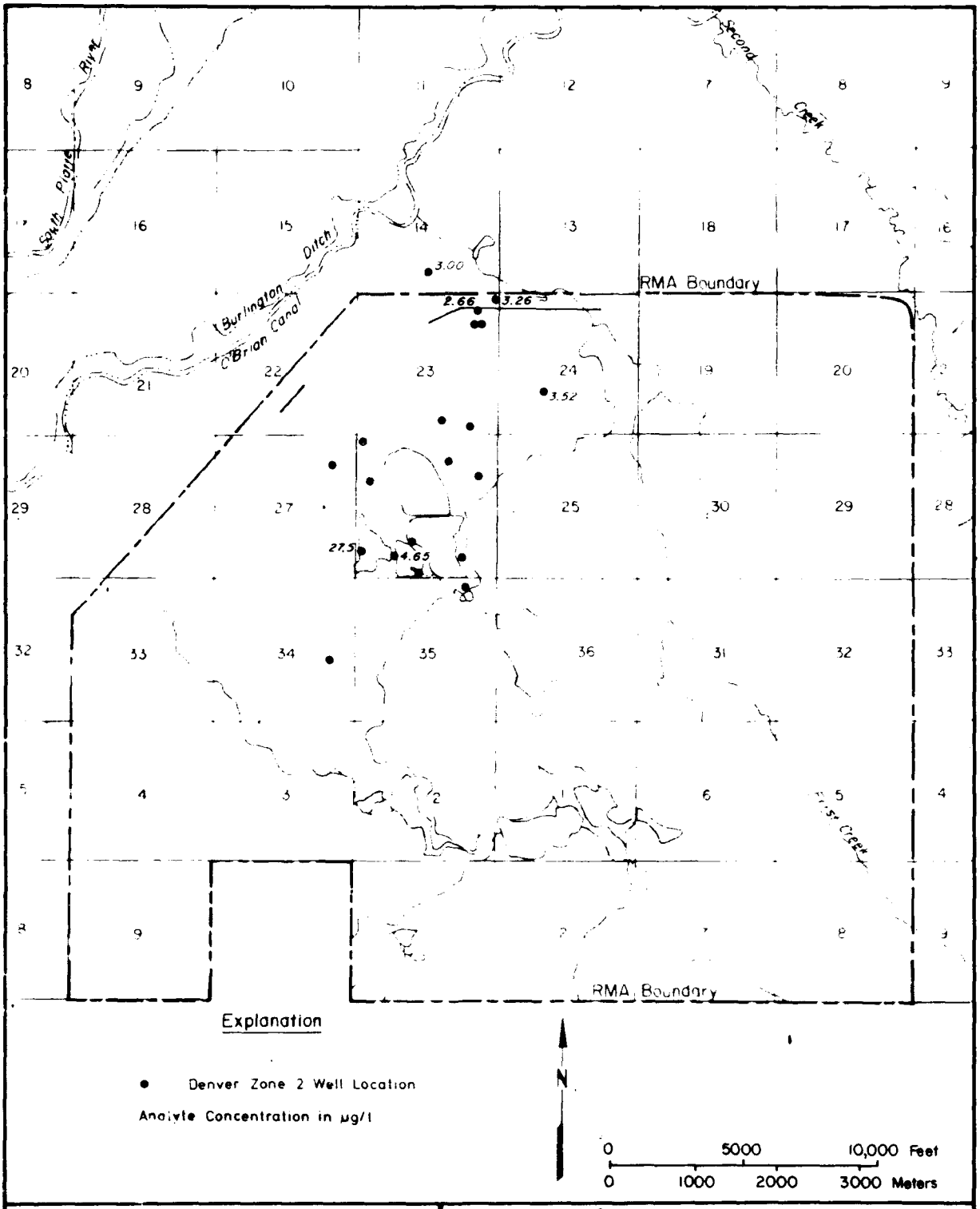
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-59
Summed Organohalogen Compound Detections
Denver Zone 1U
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



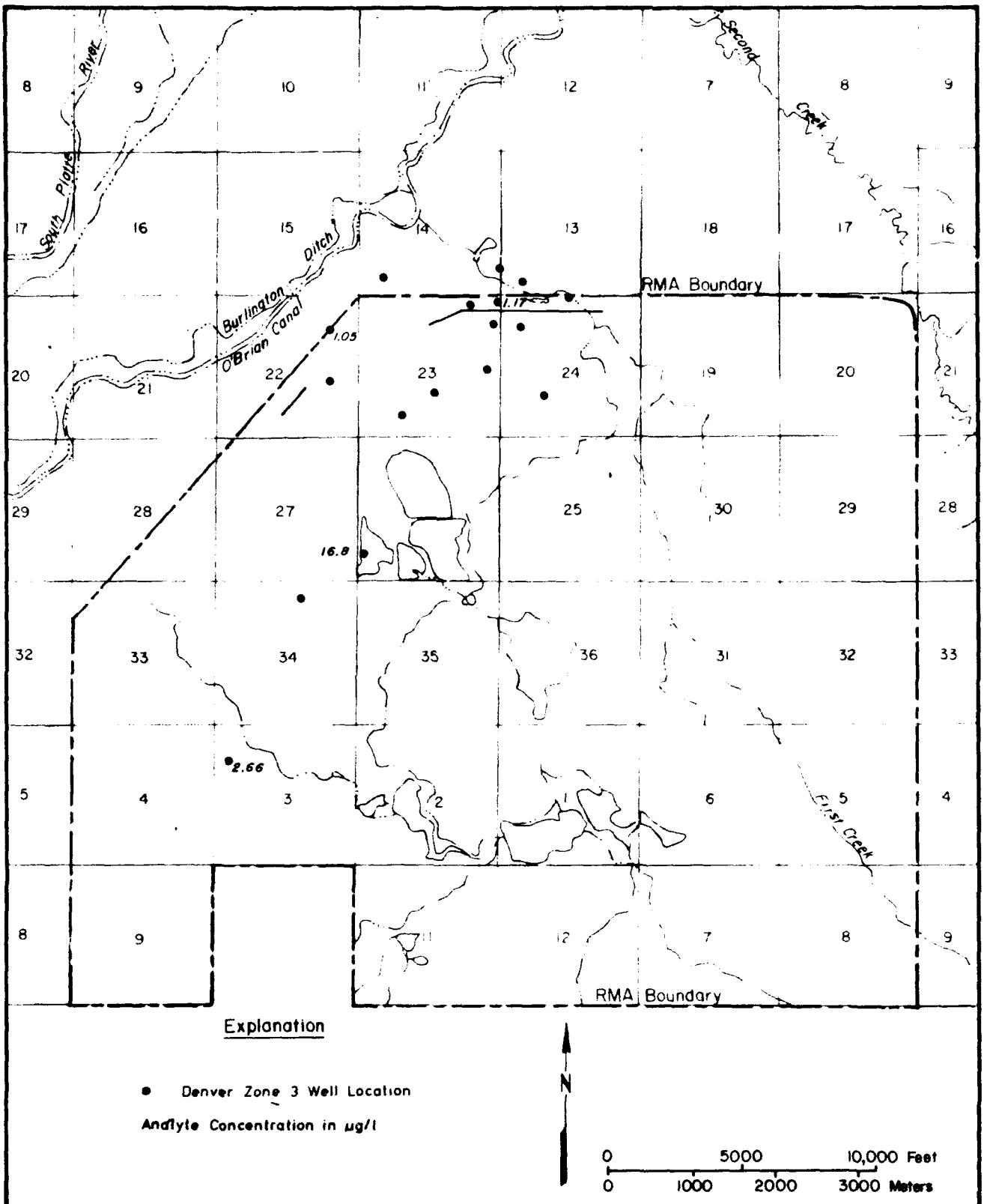
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-60
Summed Organohalogen Compound Detections
Denver Zone 1
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



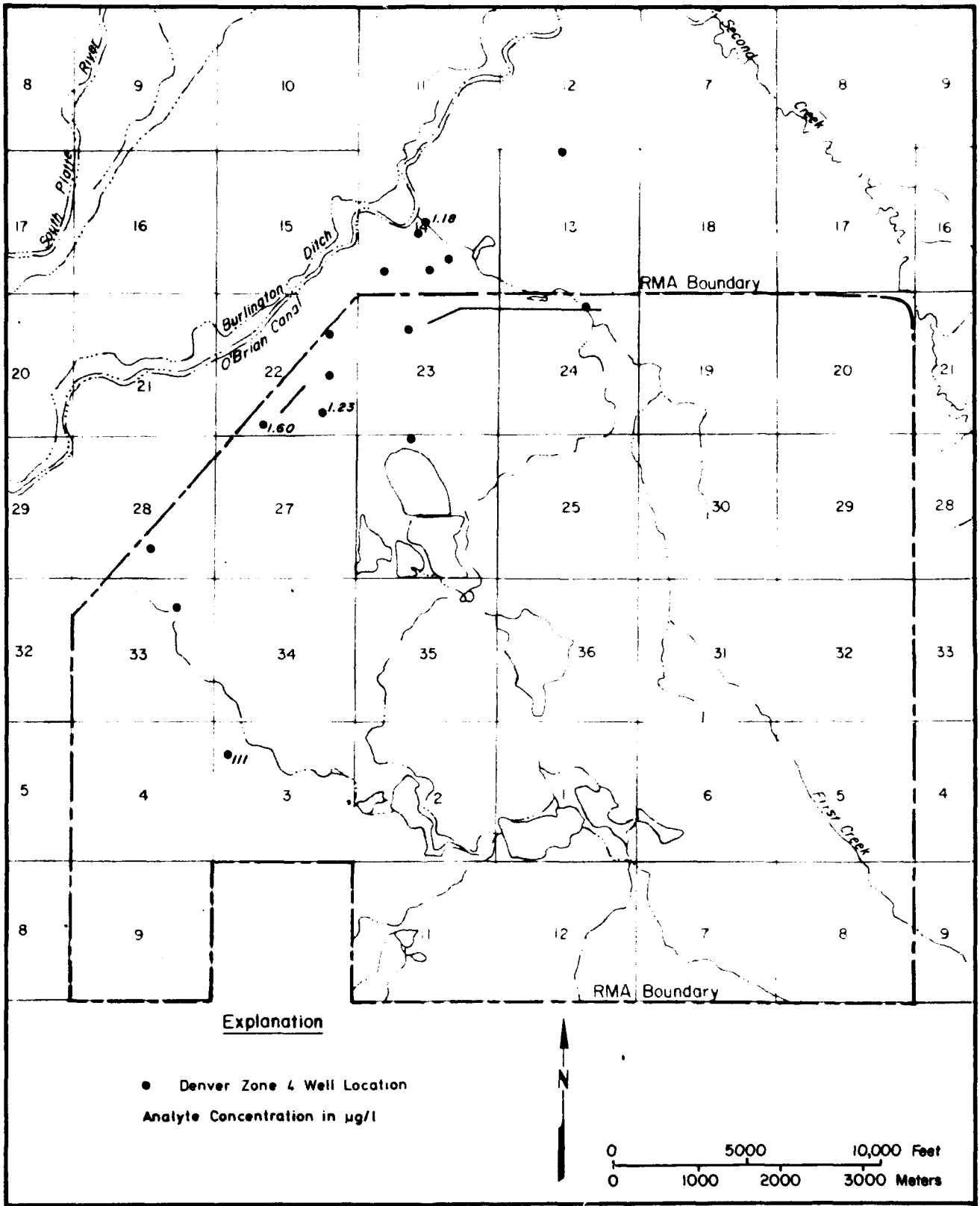
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-61
Summed Organohalogen Compound Detections
Denver Zone 2
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc
Harding Lawson Associates



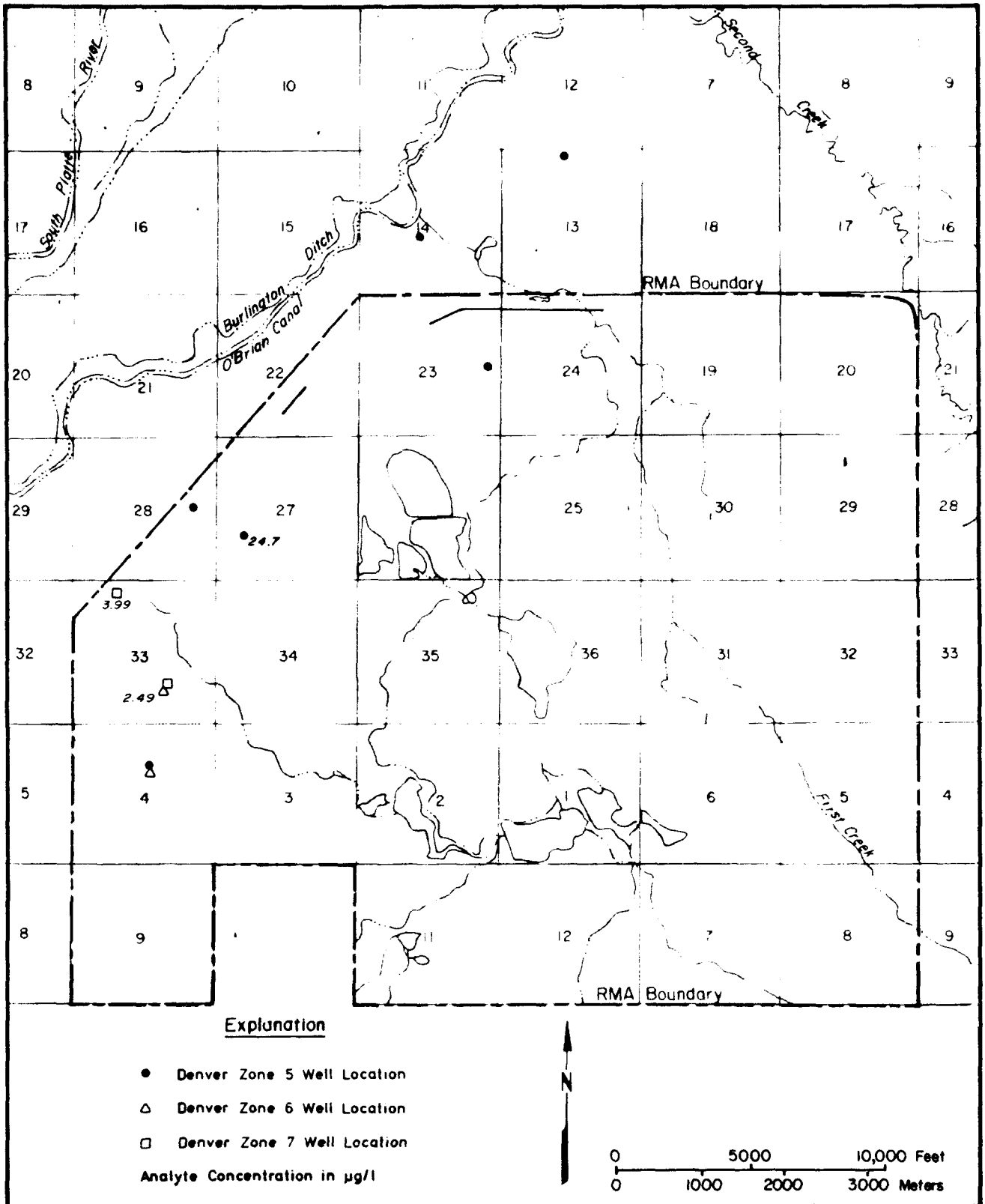
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-62
Summed Organohalogen Compound Detections
Denver Zone 3
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



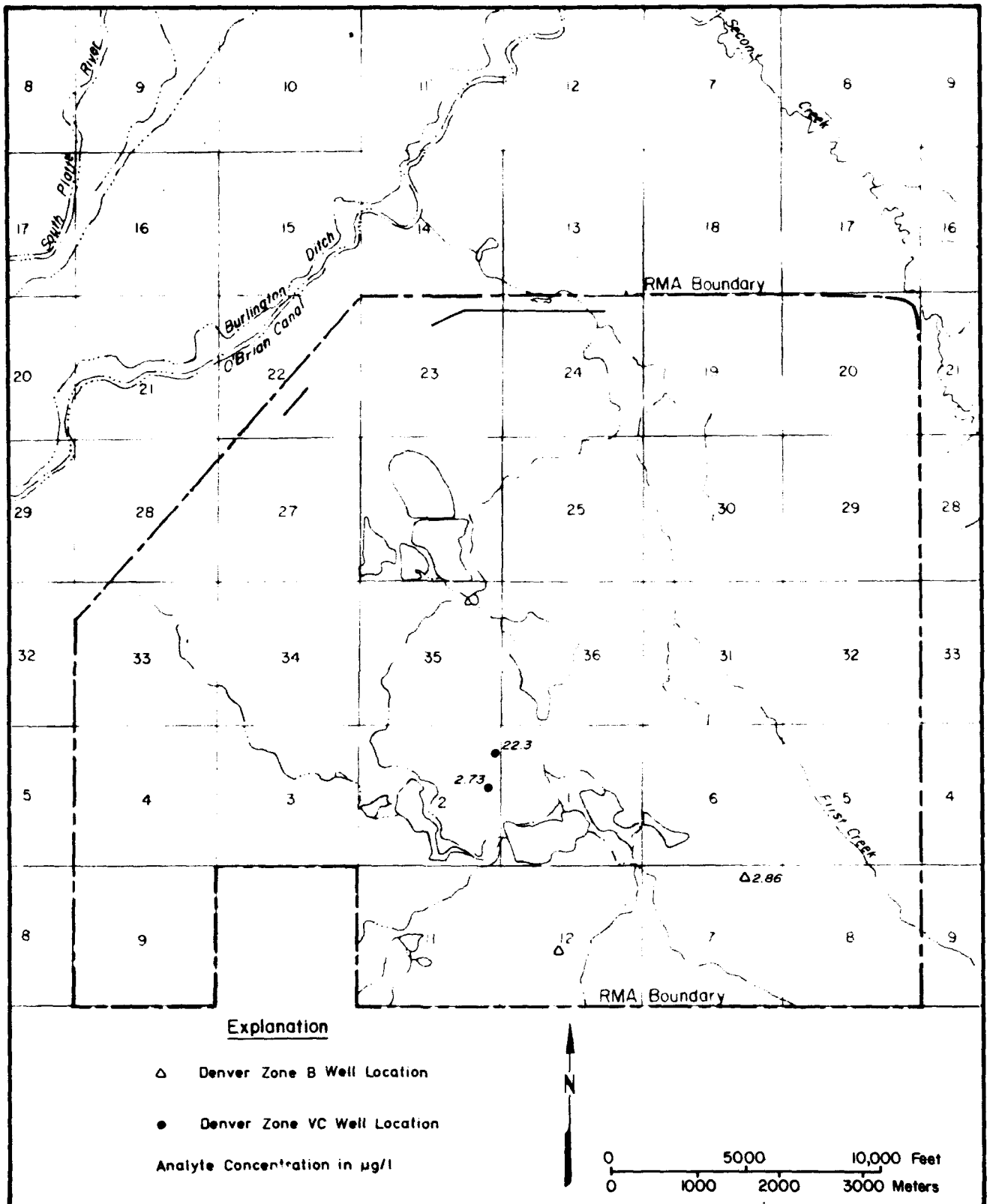
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-63
Summed Organohalogen Compound Detections
Denver Zone 4
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



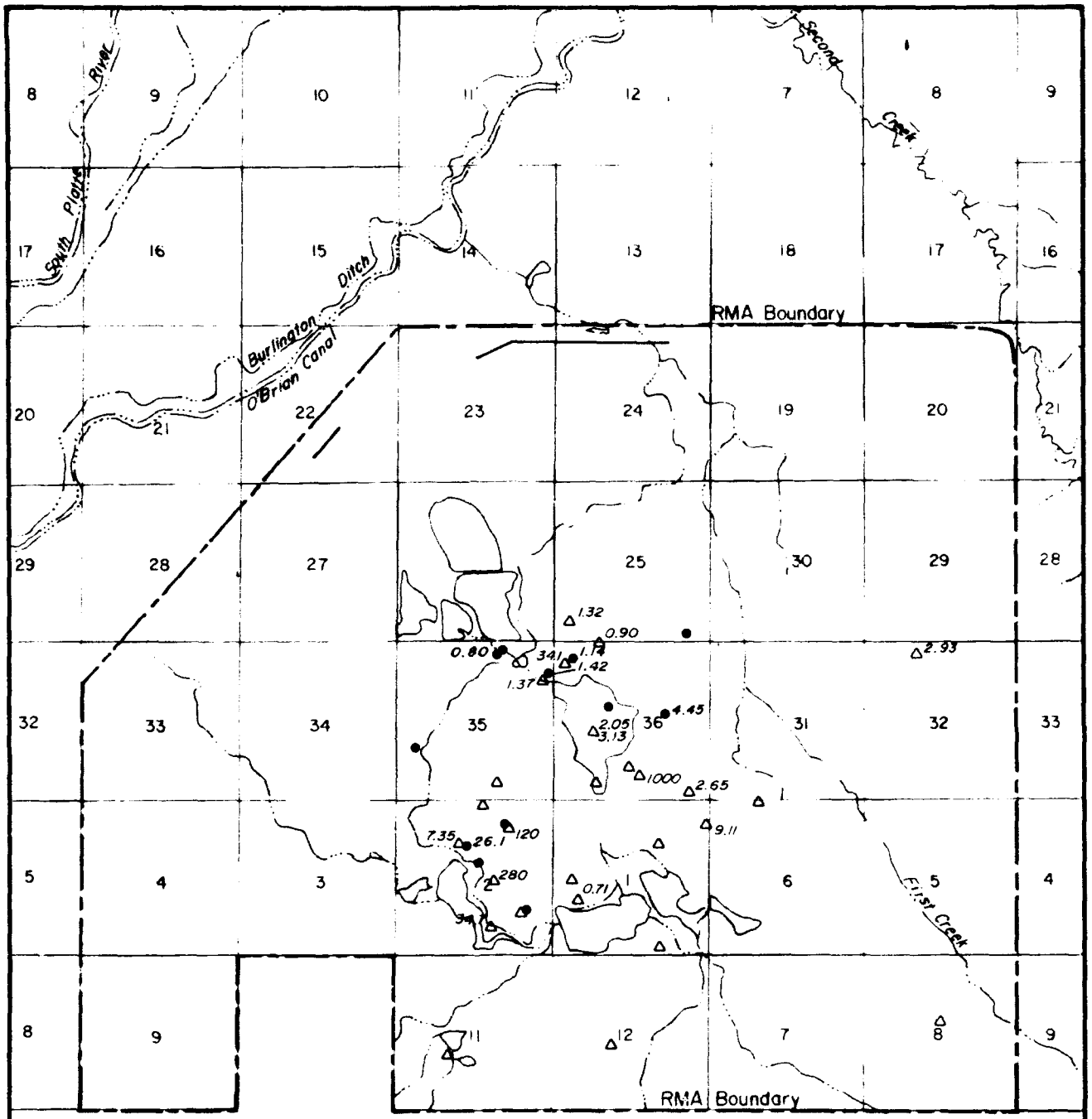
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-64
Summed Organohalogen Compound Detections
Denver Zones 5, 6, & 7
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-65
Chloroform Detections
Denver Zones B & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

△ Denver Zone A Well Location

● Denver Zone 1U Well Location

Analyte Concentration in µg/l

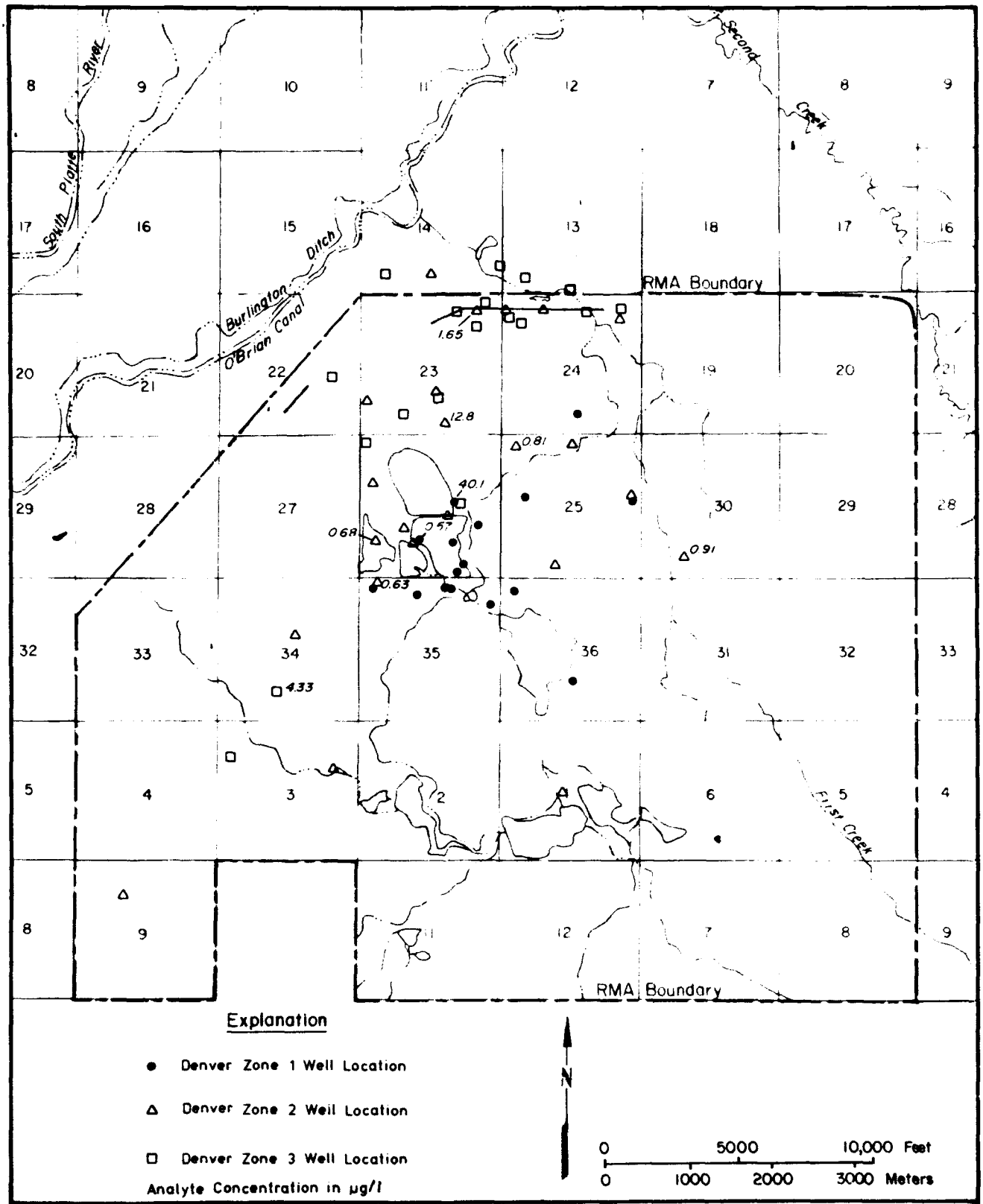
N

0 5000 10,000 Feet

0 1000 2000 3000 Meters

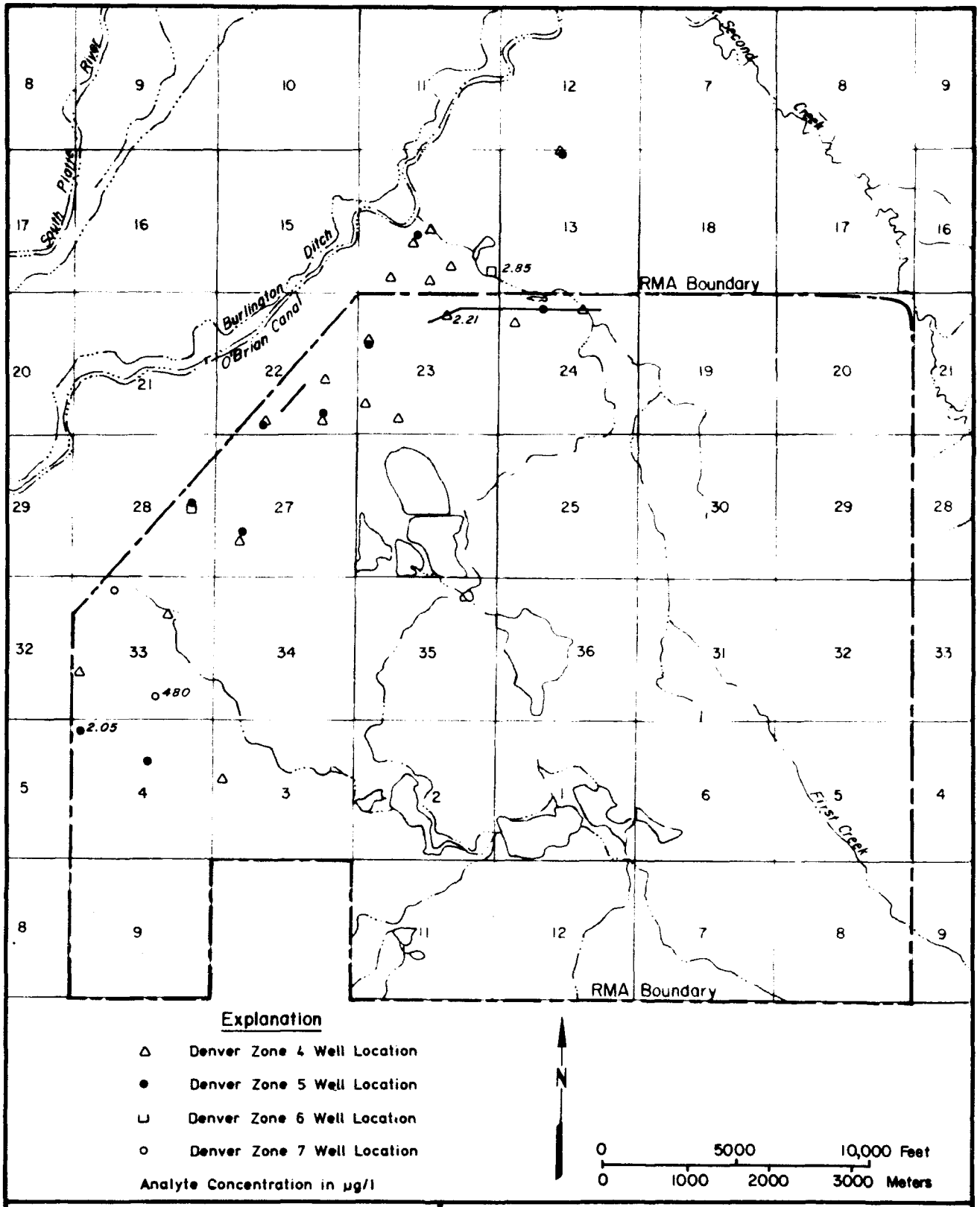
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-66
Chloroform Detections
Denver Zones A & 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



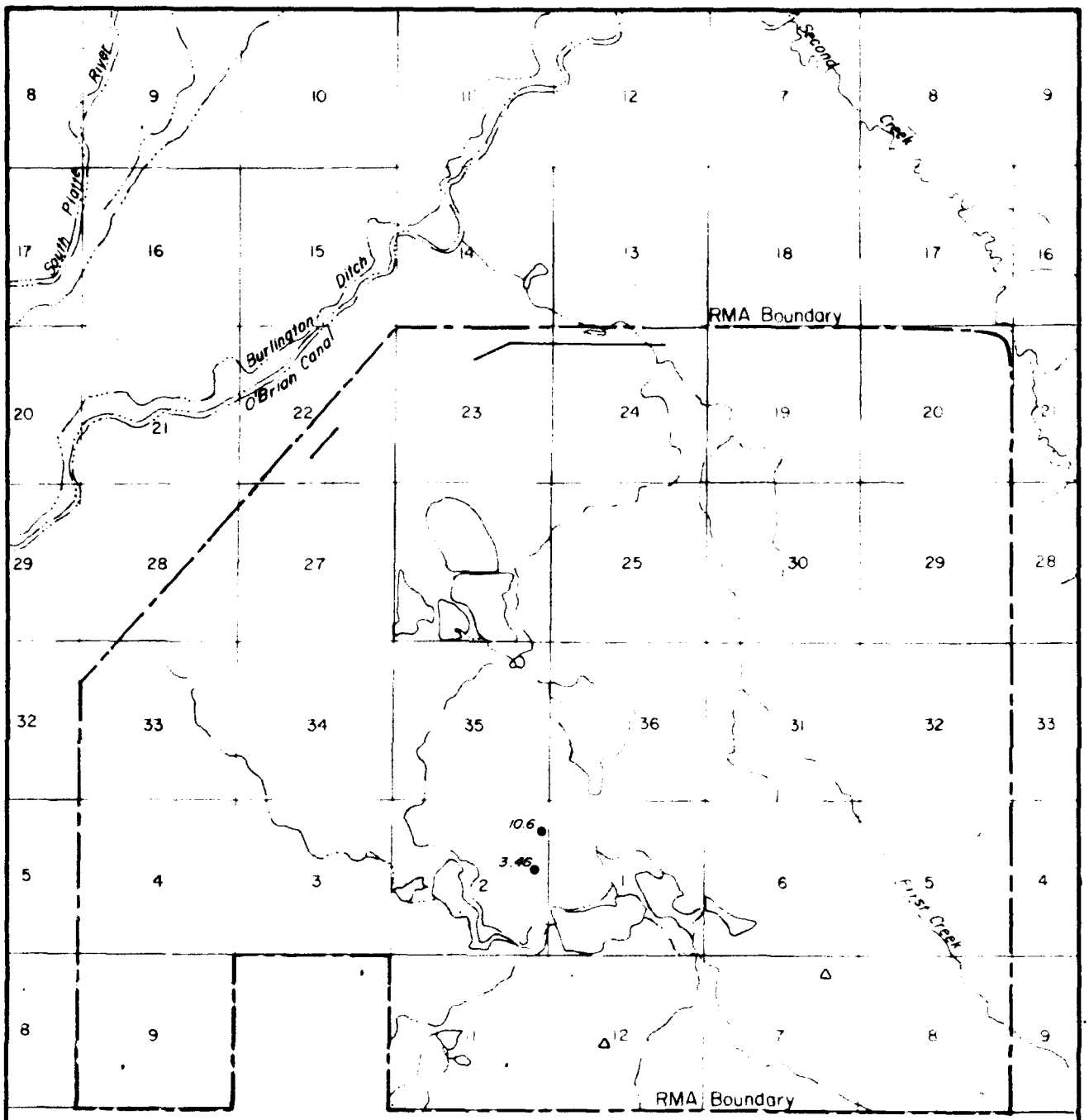
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-67
Chloroform Detections
Denver Zones 1, 2, & 3
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



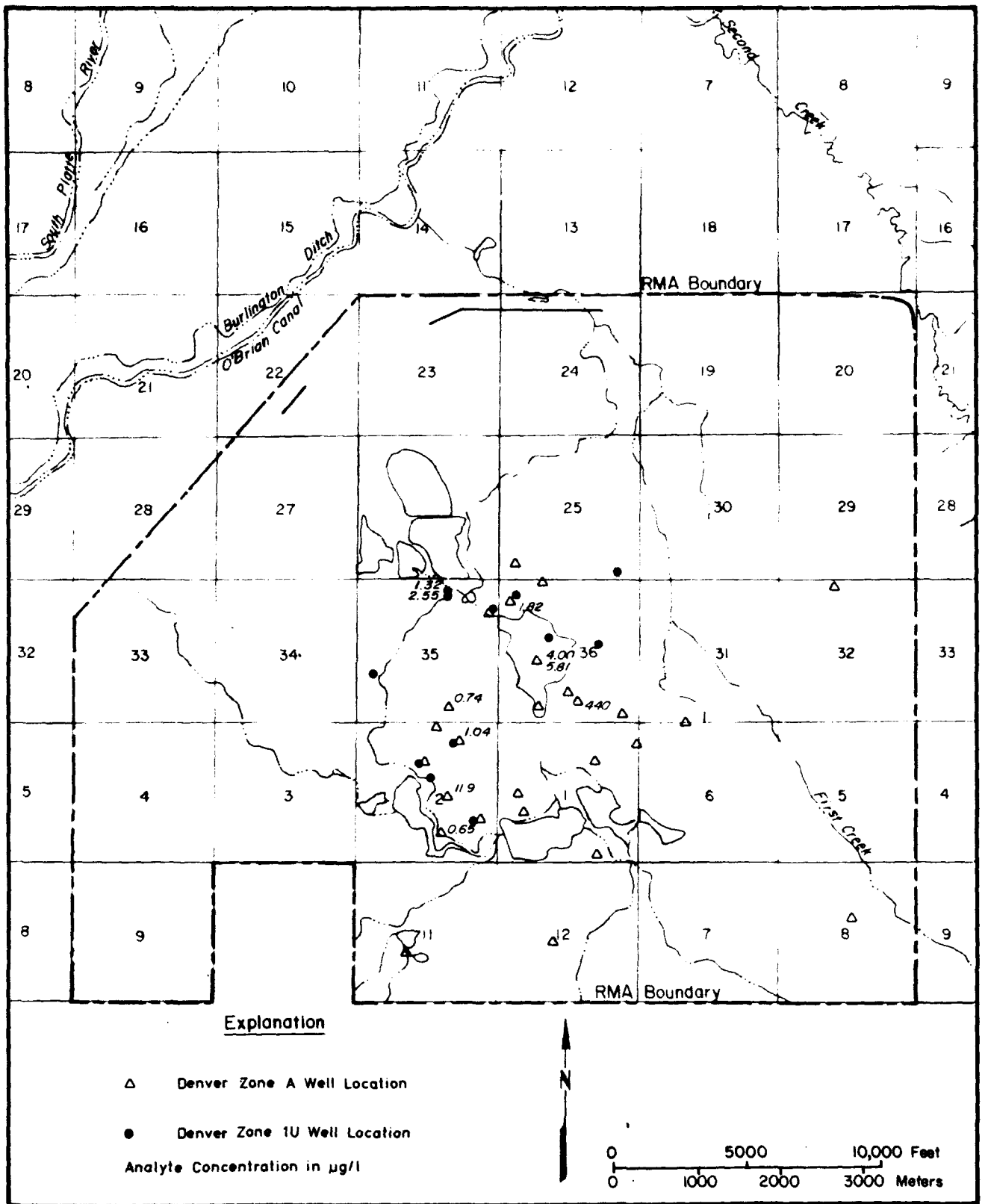
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-68
Chloroform Detections
Denver Zones 4, 5, 6, & 7
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



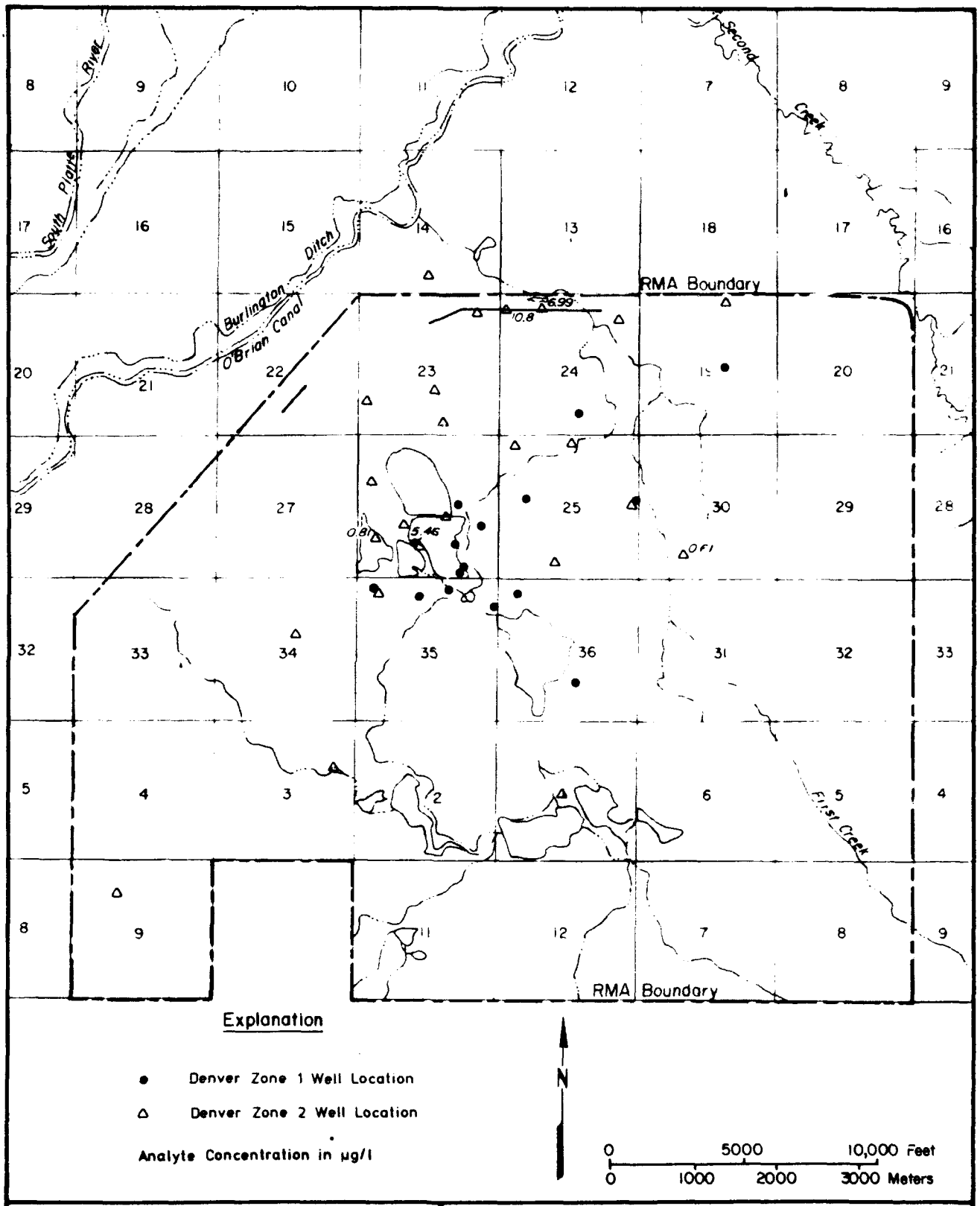
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-69
Trichloroethene Detections
Denver Zones B & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



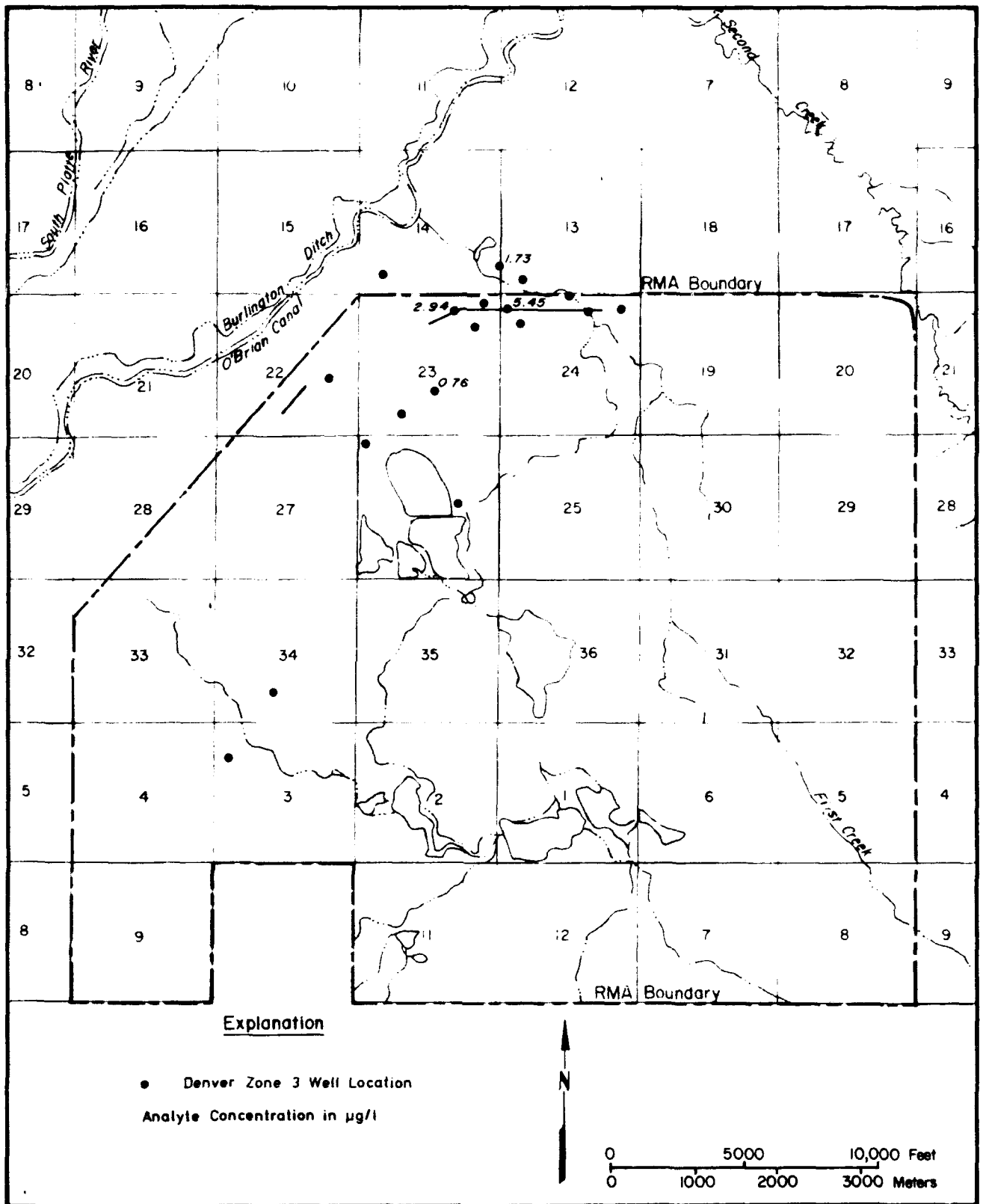
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-70
Trichloroethene Detections
Denver Zones A & 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



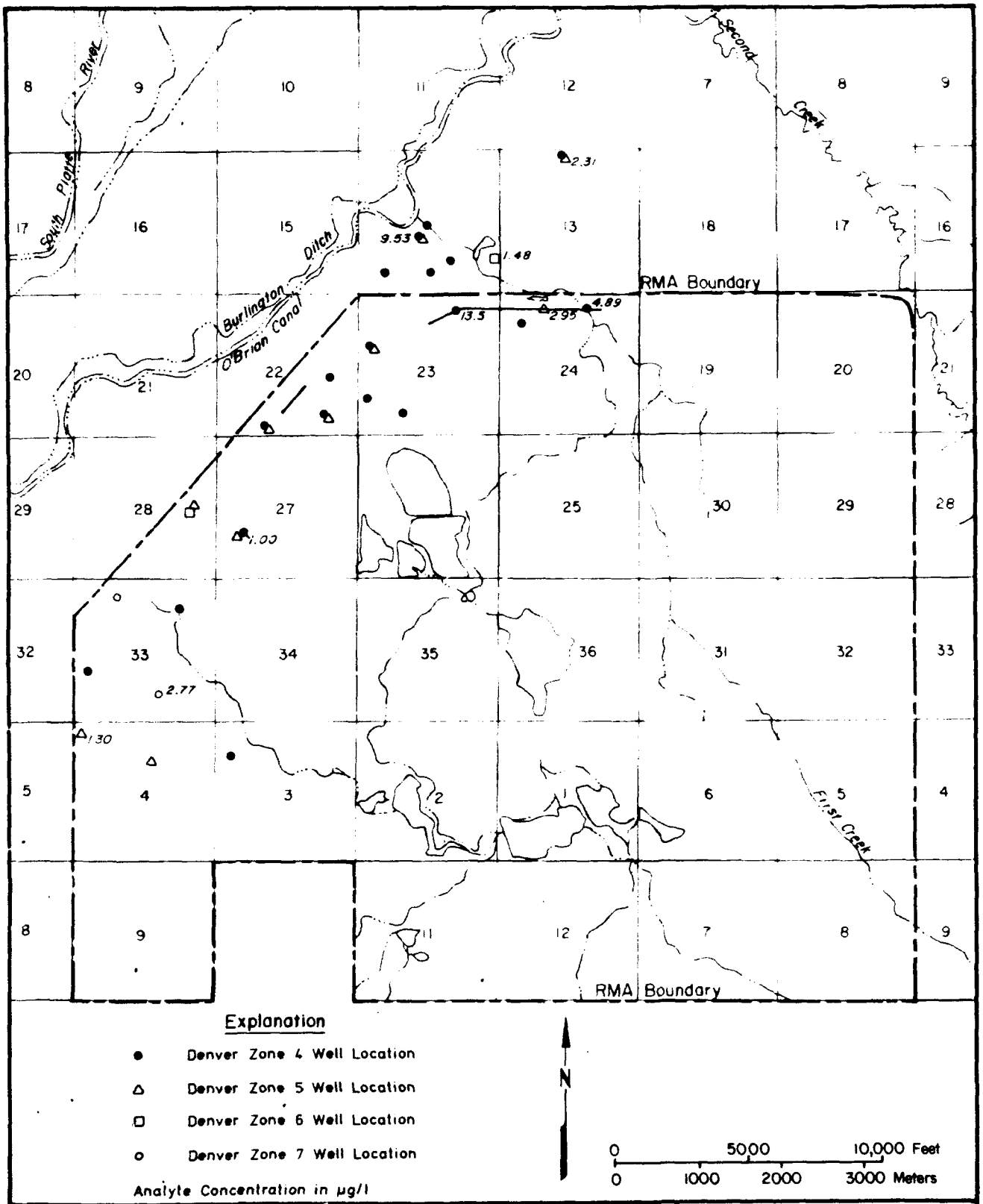
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-71
Trichloroethene Detections
Denver Zones 1 & 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



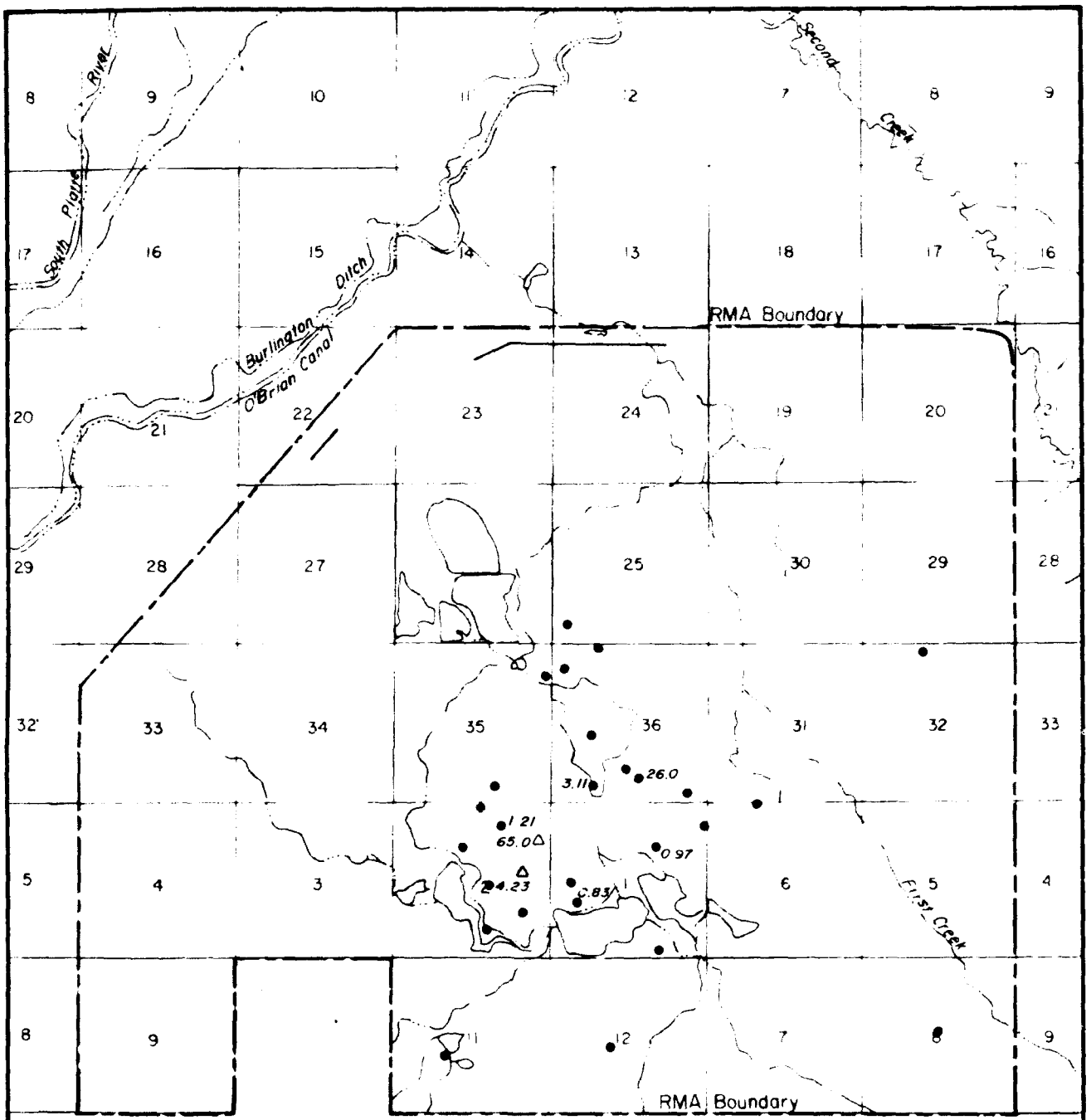
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-72
Trichloroethene Detections
Denver Zone 3
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Hardinn Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-73
Trichloroethene Detections
Denver Zones 4, 5, 6, & 7
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

● Denver Zone A Well Location

△ Denver Zone VC Well Location

Analyte Concentration in µg/l

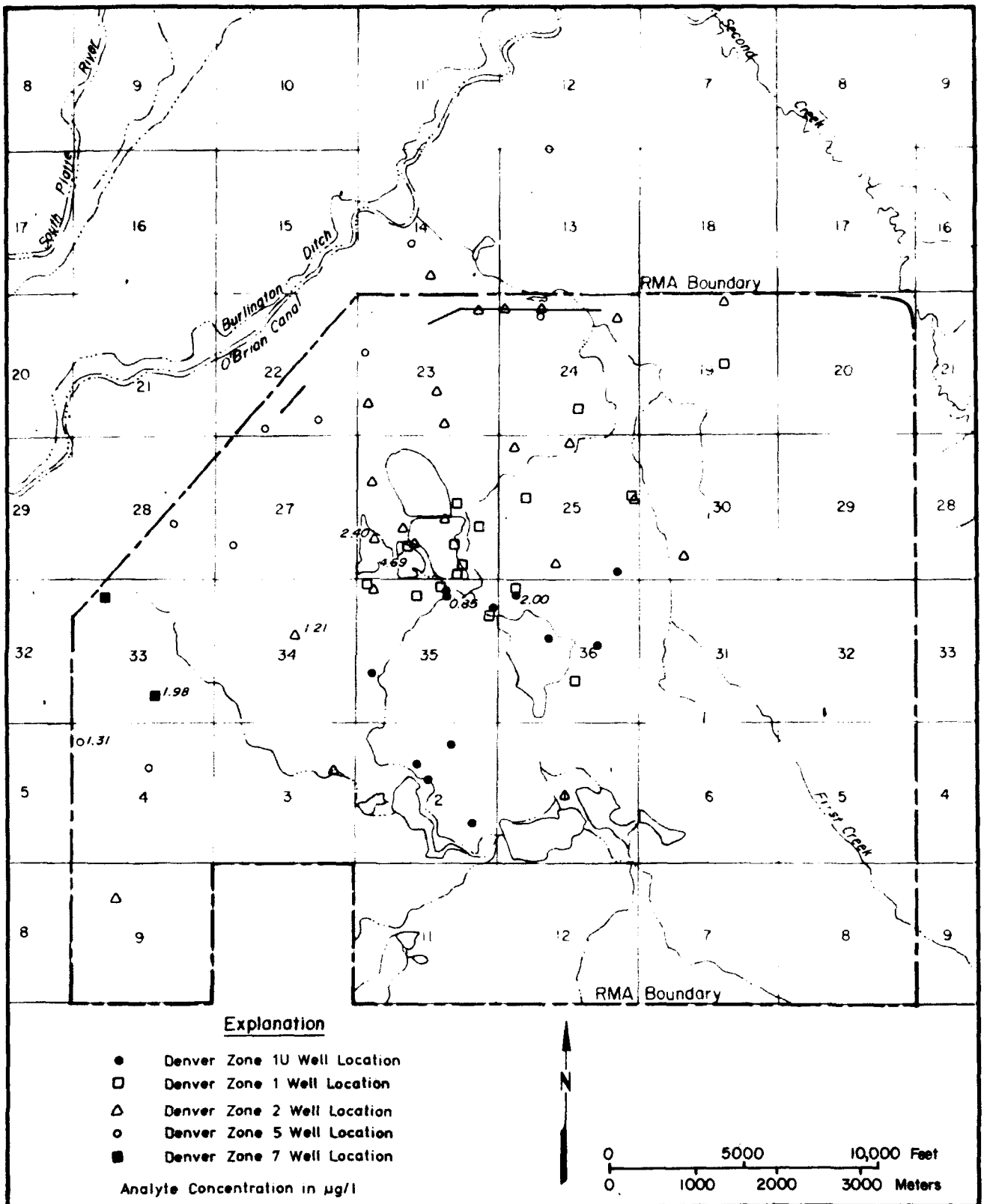
N

0 5000 10,000 Feet

0 1000 2000 3000 Meters

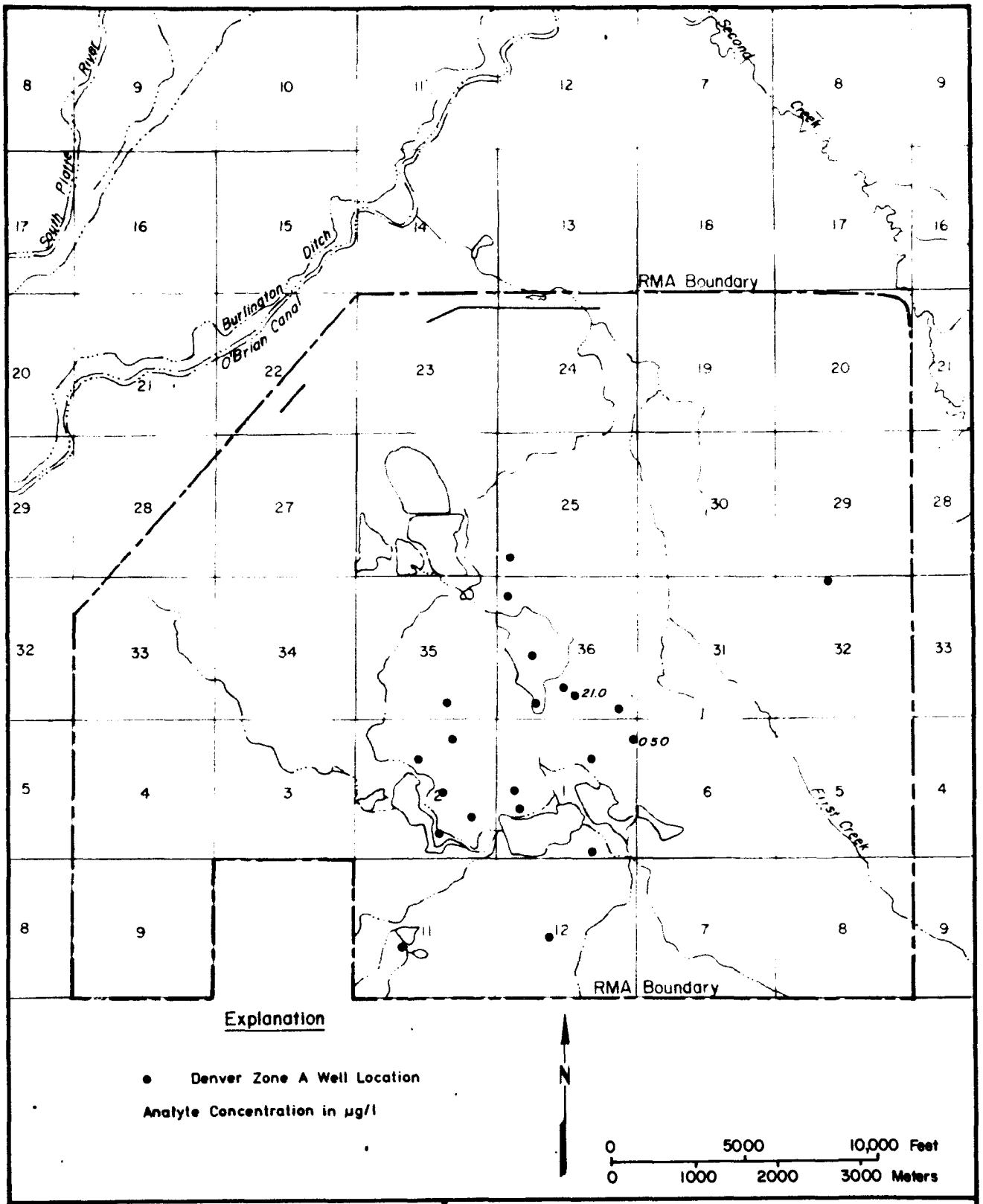
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-74
Tetrachloroethene Detections
Denver Zones A & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



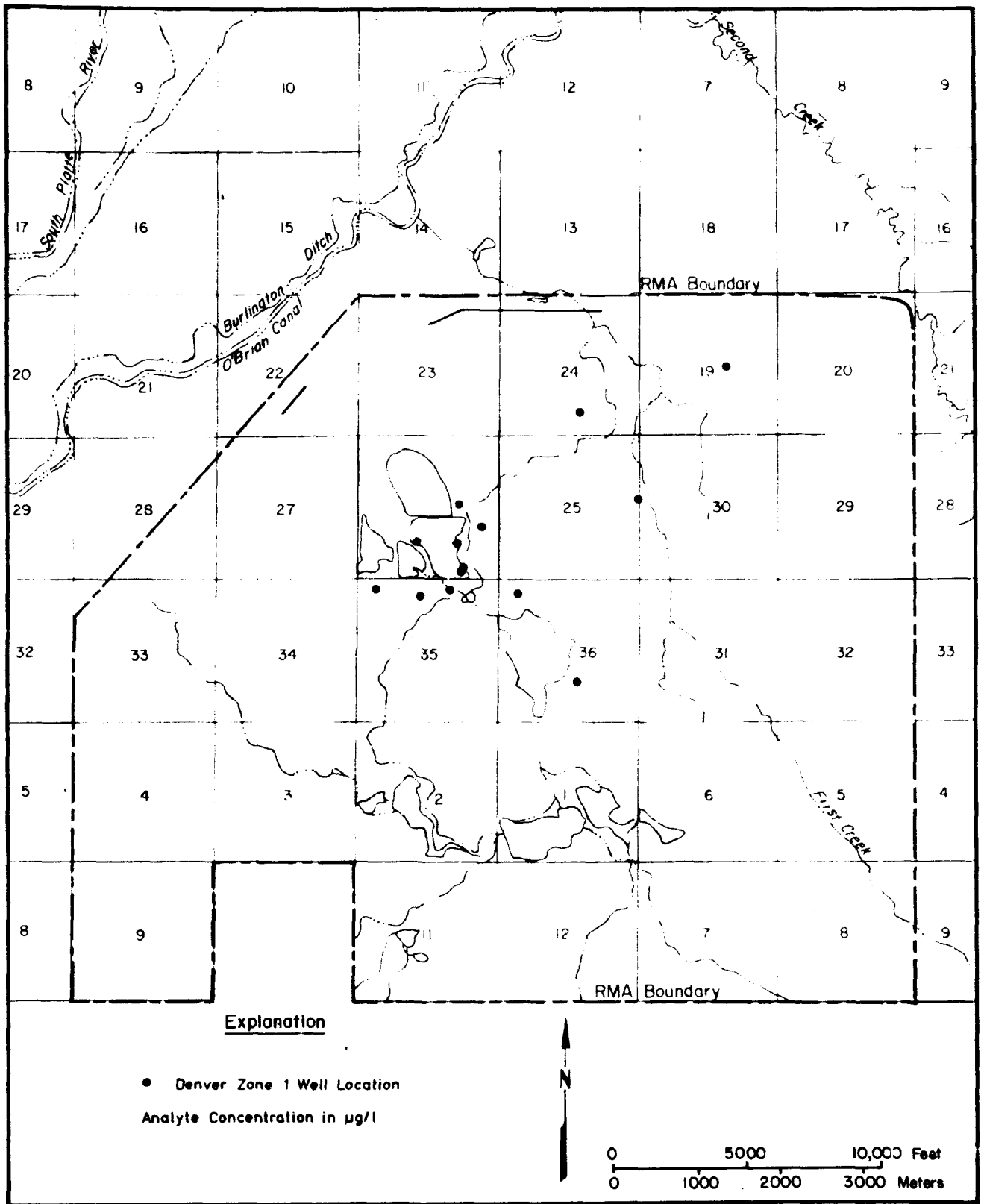
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-75
Tetrachloroethene Detections
Denver Zones 1U, 1, 2, 5, & 7
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



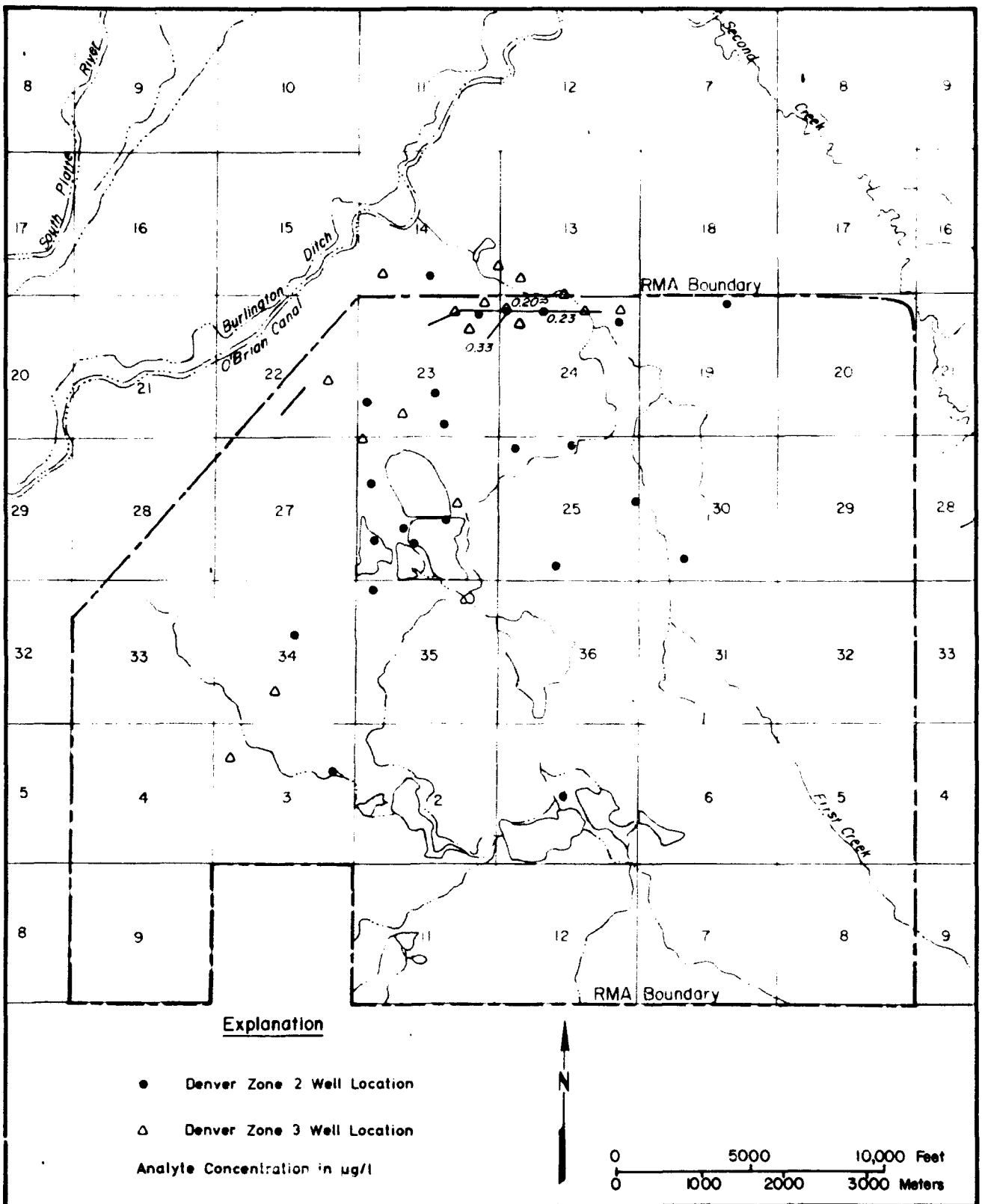
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-76
Dibromochloropropane Detections
Denver Zone A
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc
Harding Lawson Associates



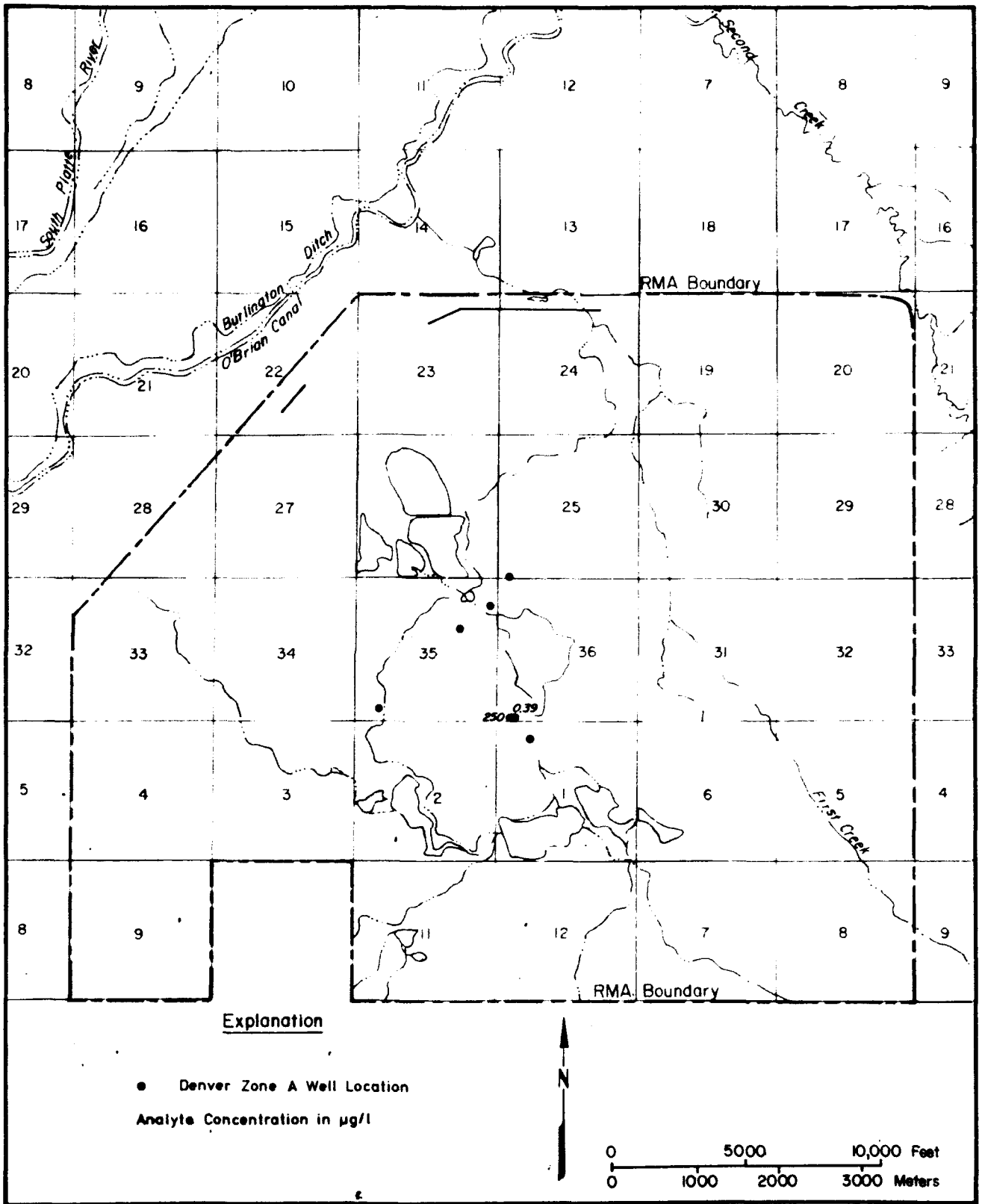
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-77
Dibromochloropropane Detections
Denver Zone 1
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



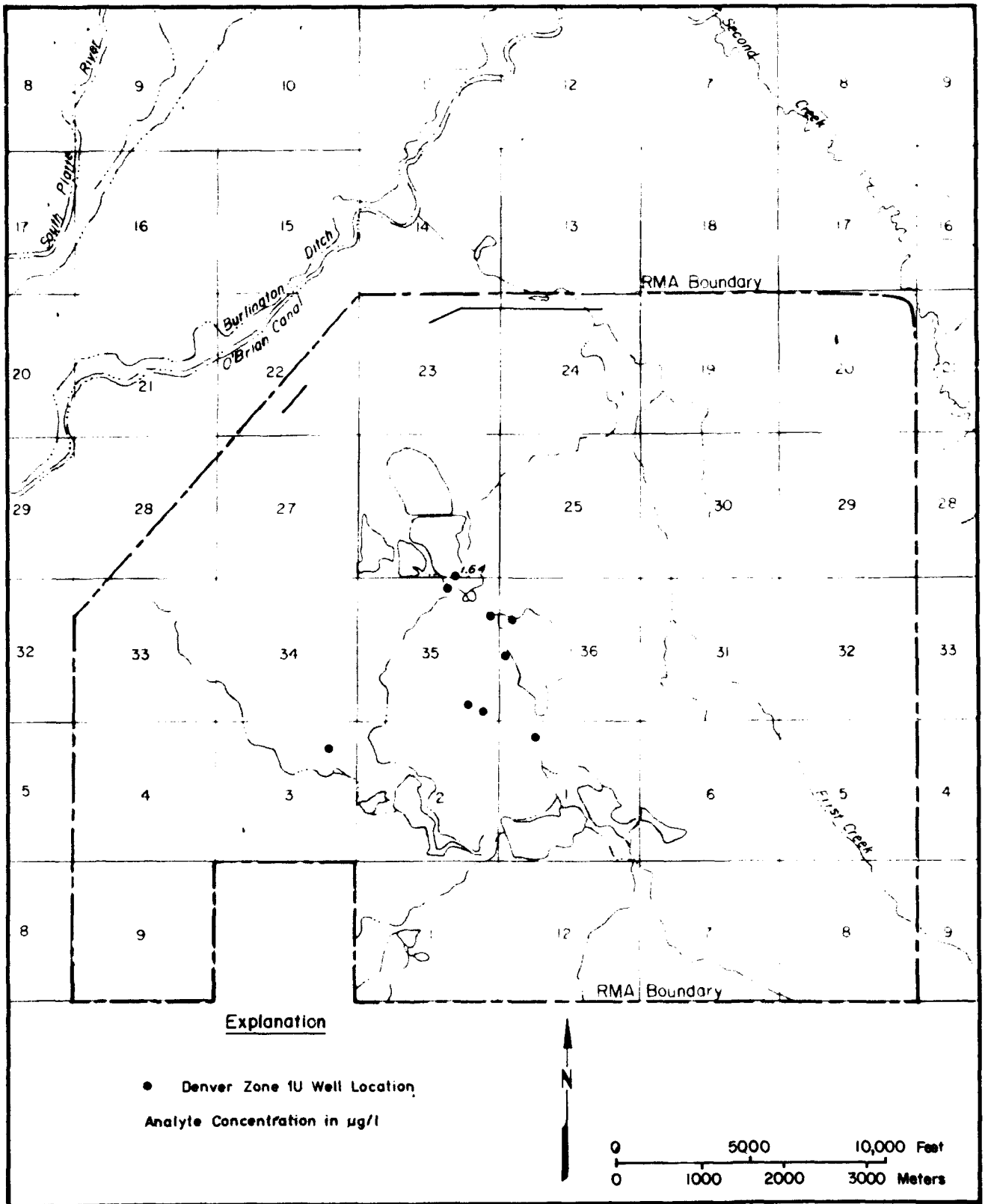
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-78
Dibromochloropropane Detections
Denver Zones 2 & 3
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



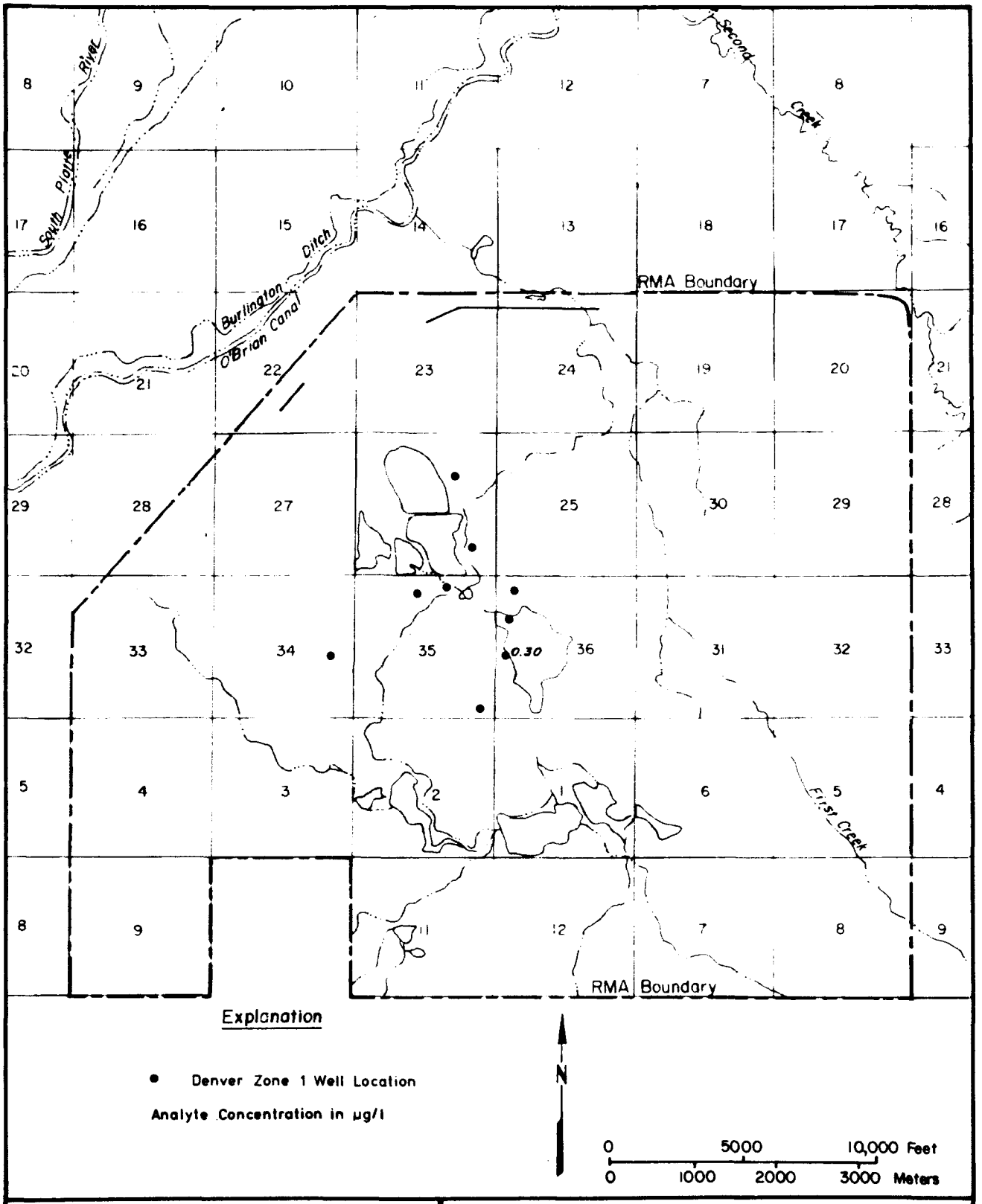
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A–79
Dibromochloropropane Detections
Denver Zone A
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



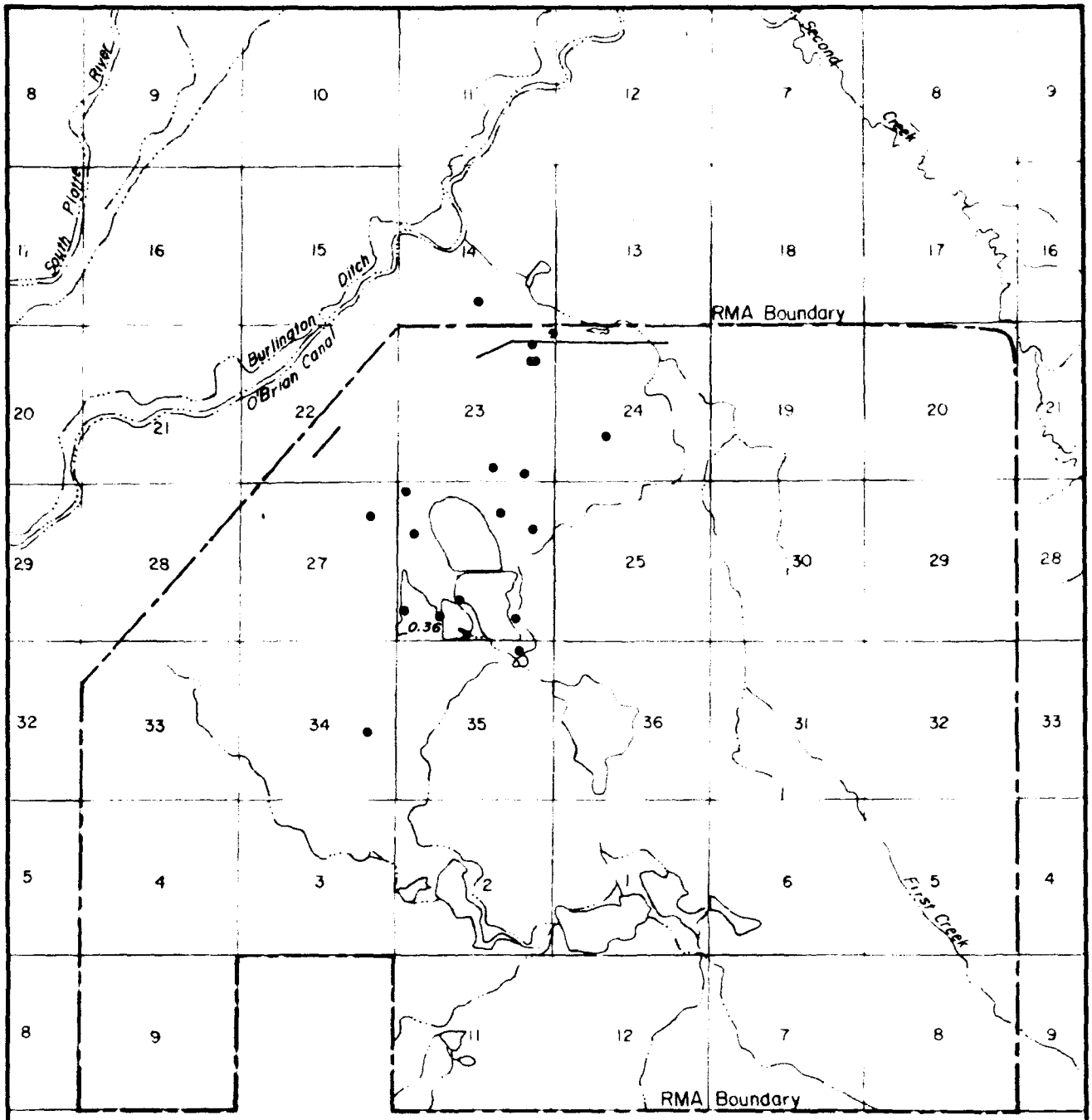
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-80
Dibromochloropropane Detections
Denver Zone 1U
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



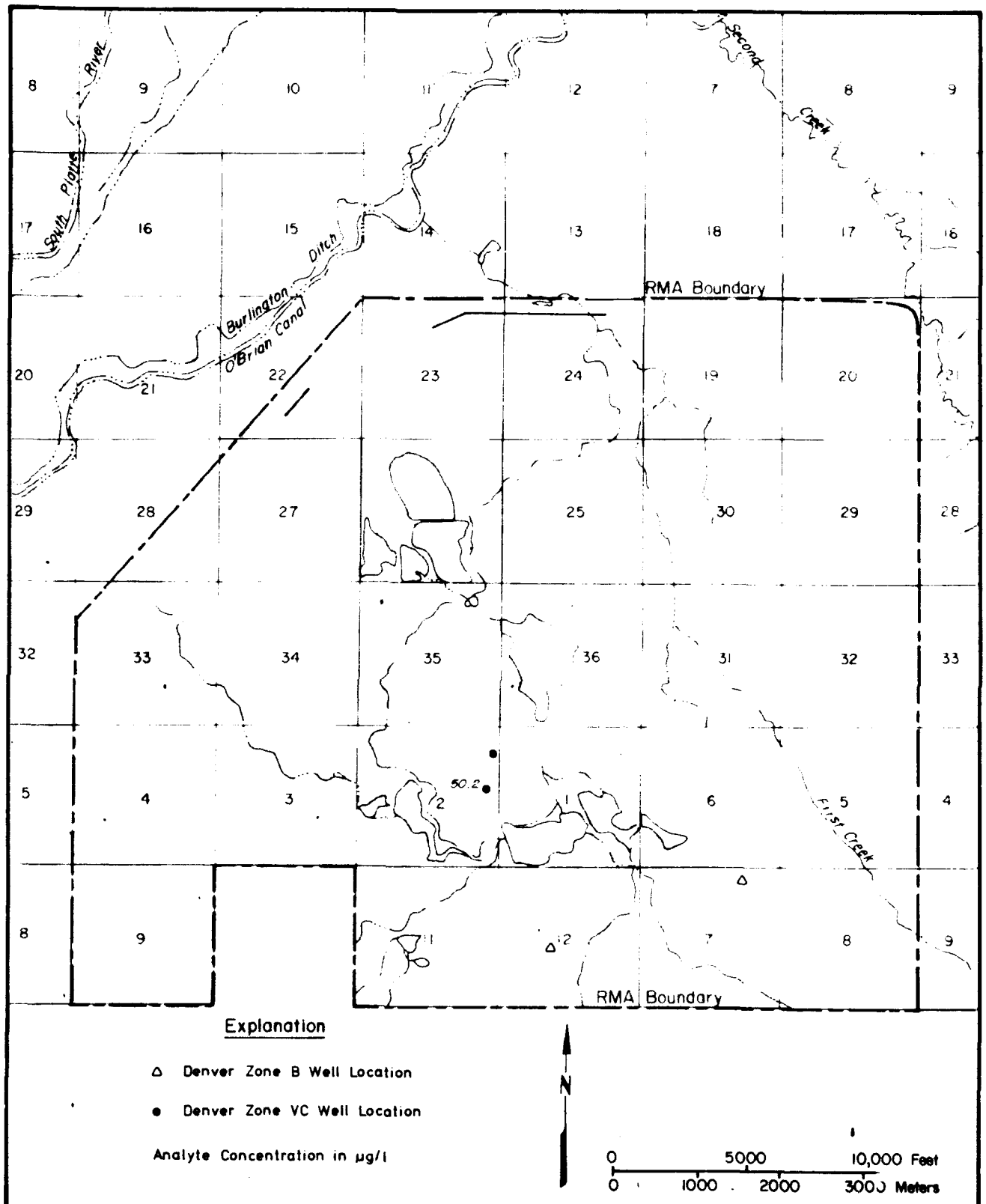
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-81
Dibromochloropropane Detections
Denver Zone 1
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



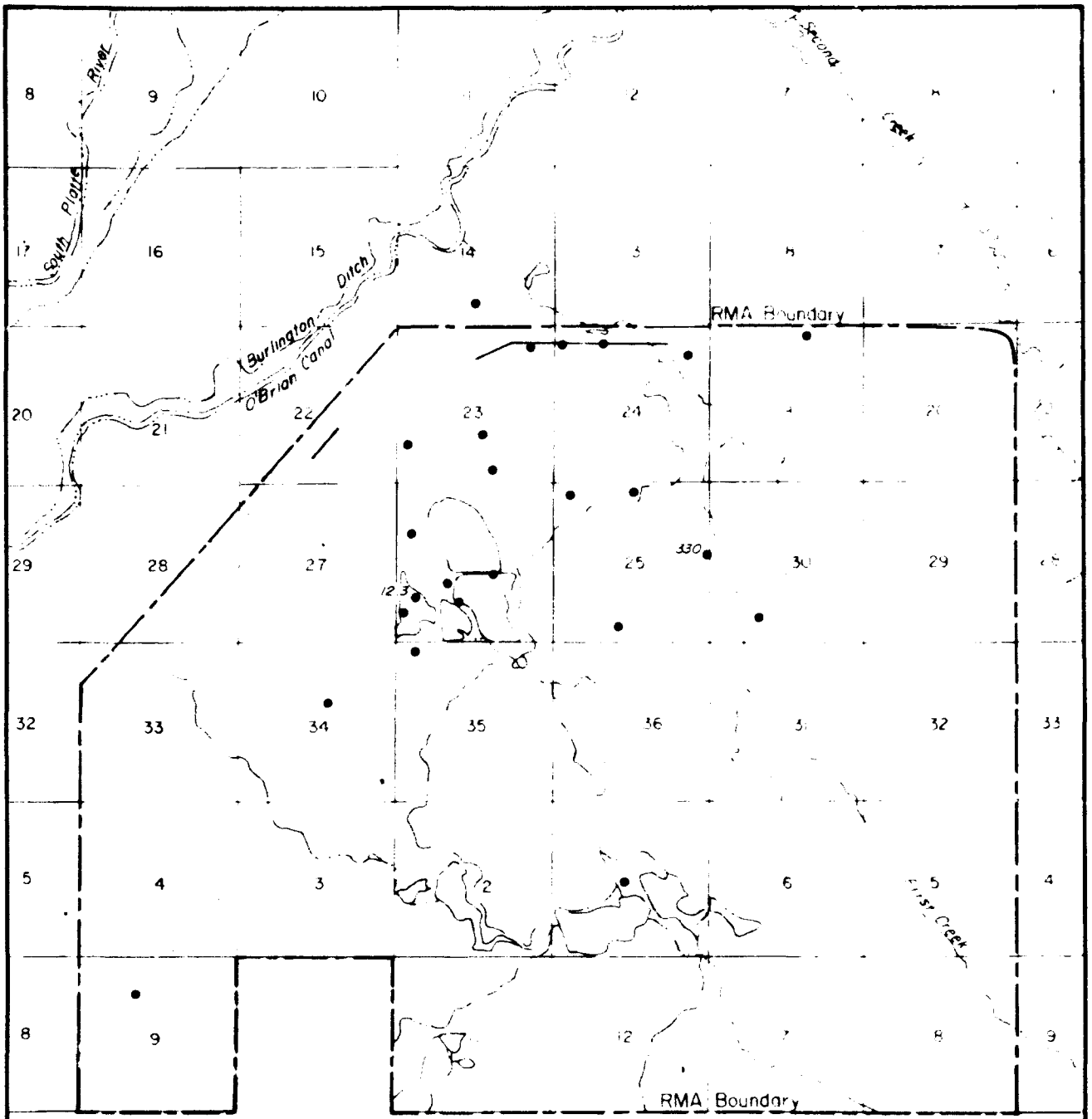
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-82
Dibromochloropropane Detections
Denver Zone 2
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A–83
Dicyclopentadiene Detections
Denver Zones B & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

● Denver Zone 2 Well Location

Analyte Concentration in µg/l

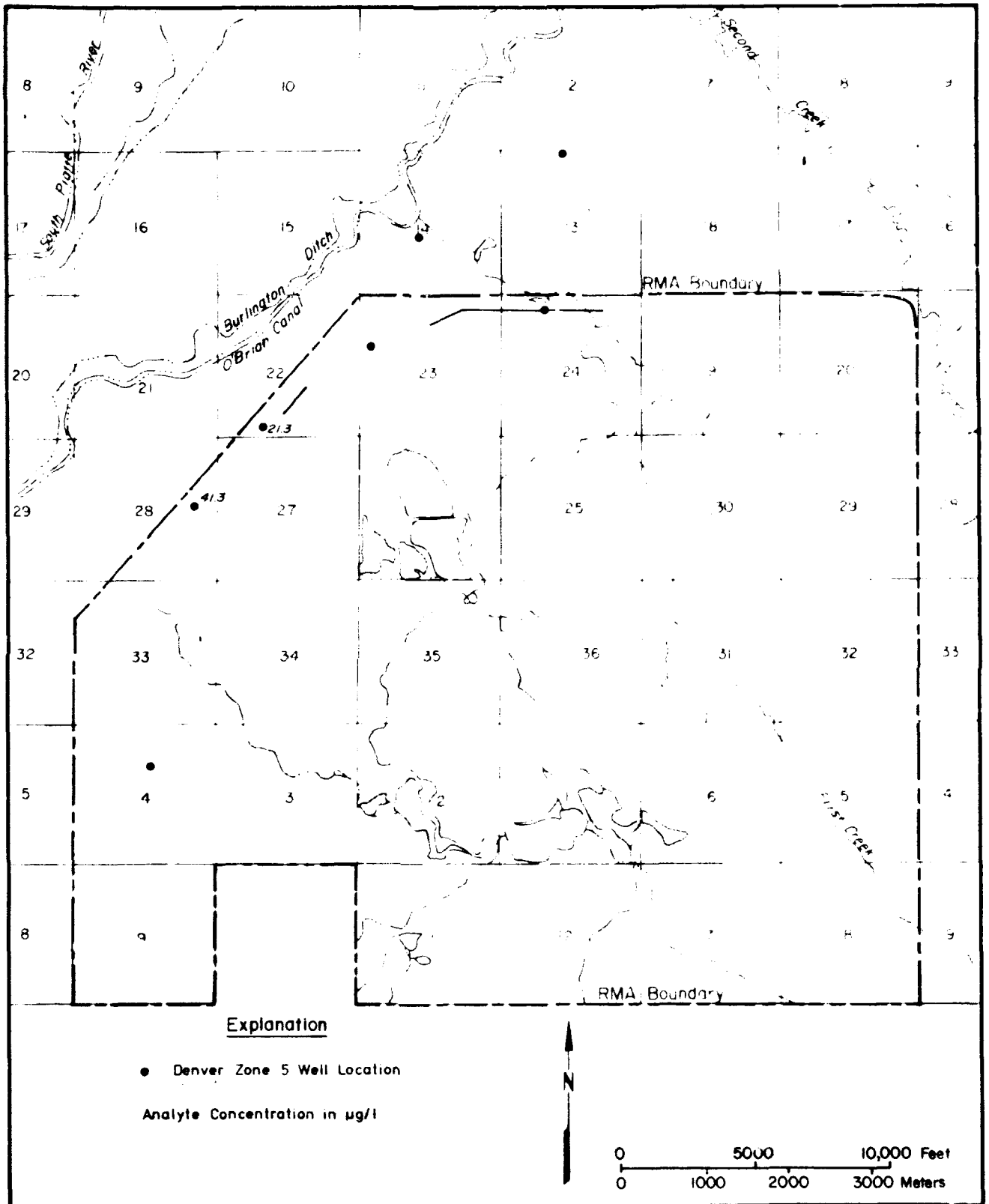
N

0 5000 10,000 Feet

0 1000 2000 3000 Meters

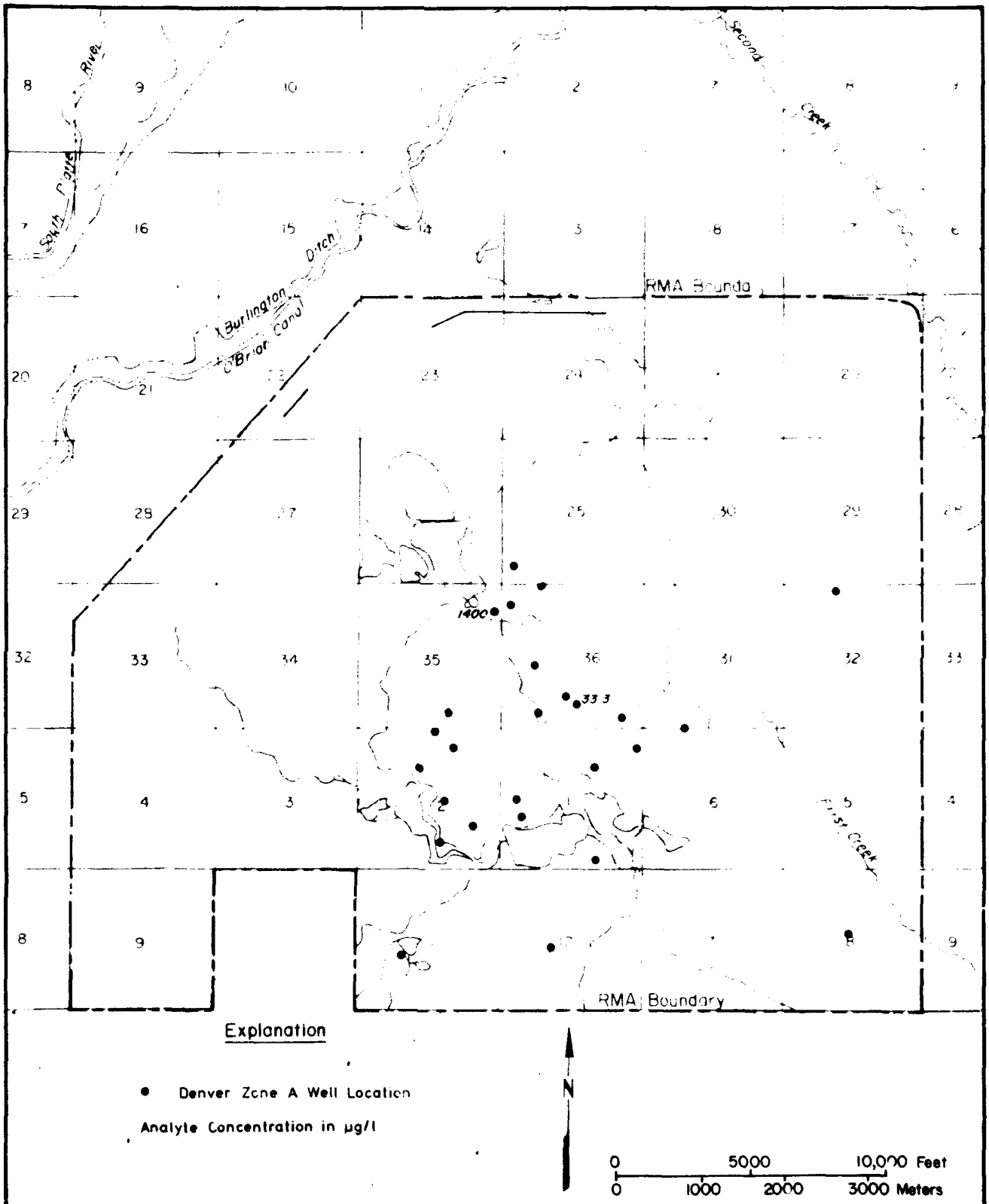
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-84
Dicyclopentadiene Detections
Denver Zone 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



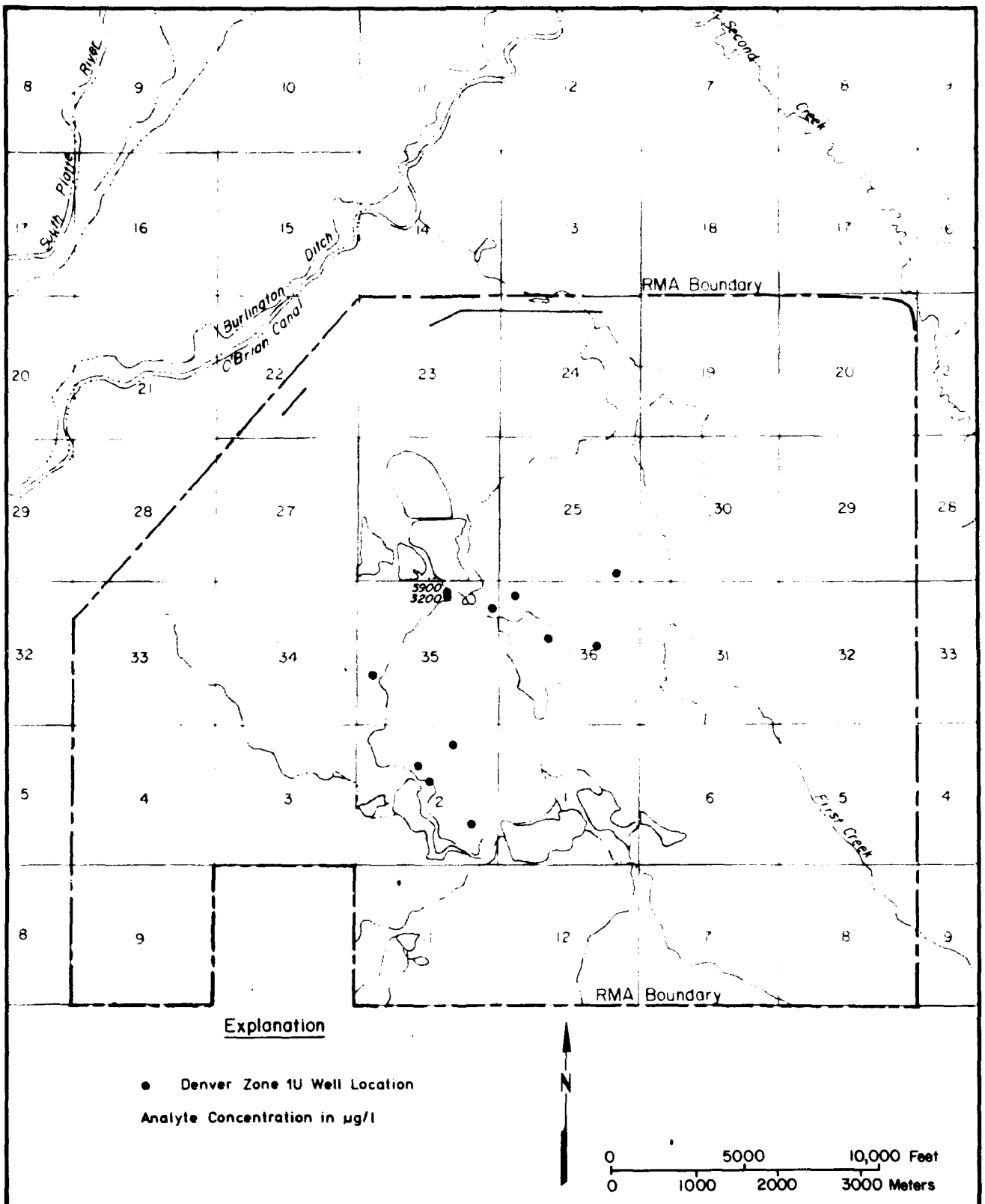
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A–85
Dicyclopentadiene Detections
Denver Zone 5
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



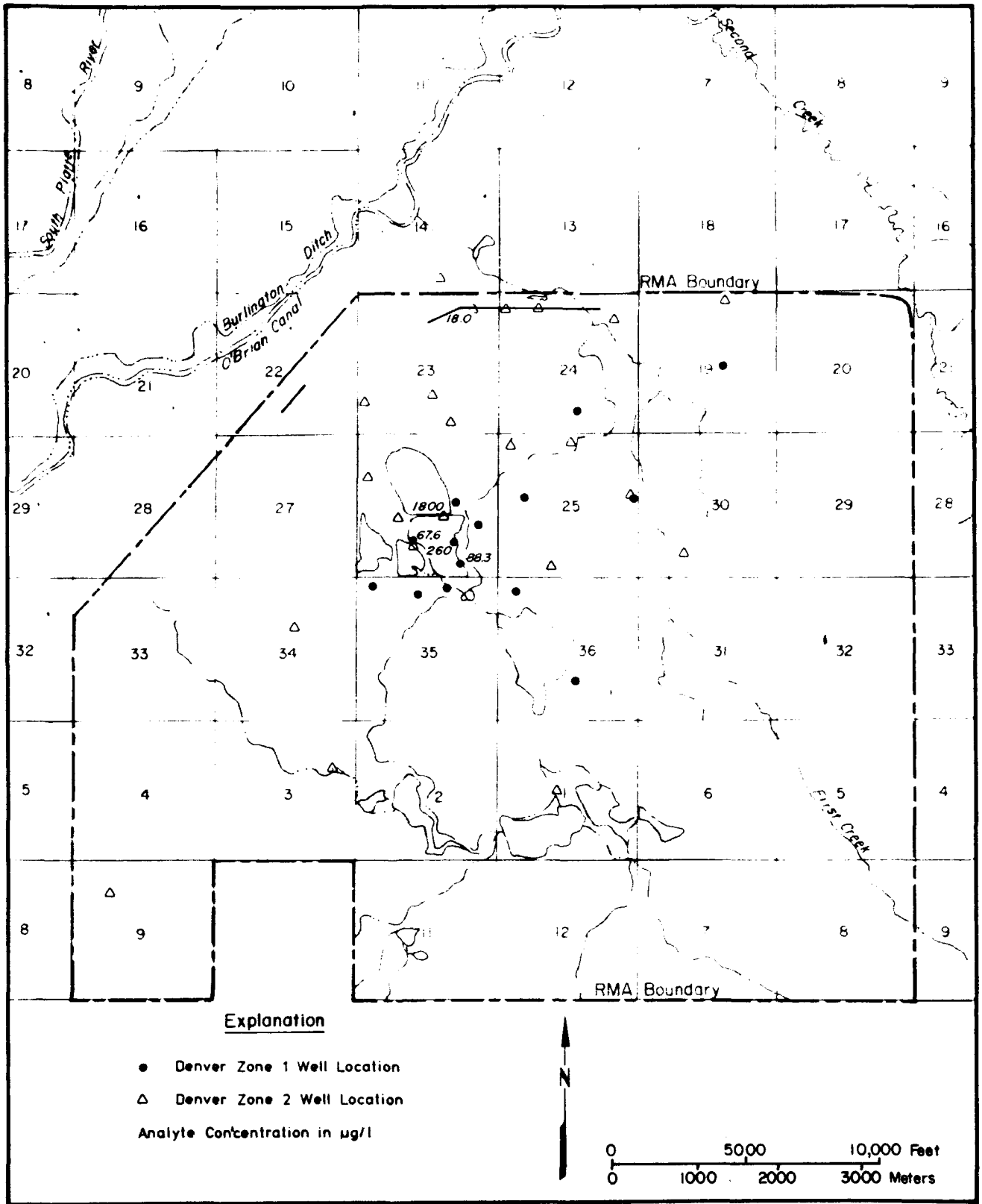
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A–86
Diisopropylmethylphosphonate Detections
Denver Zone A
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



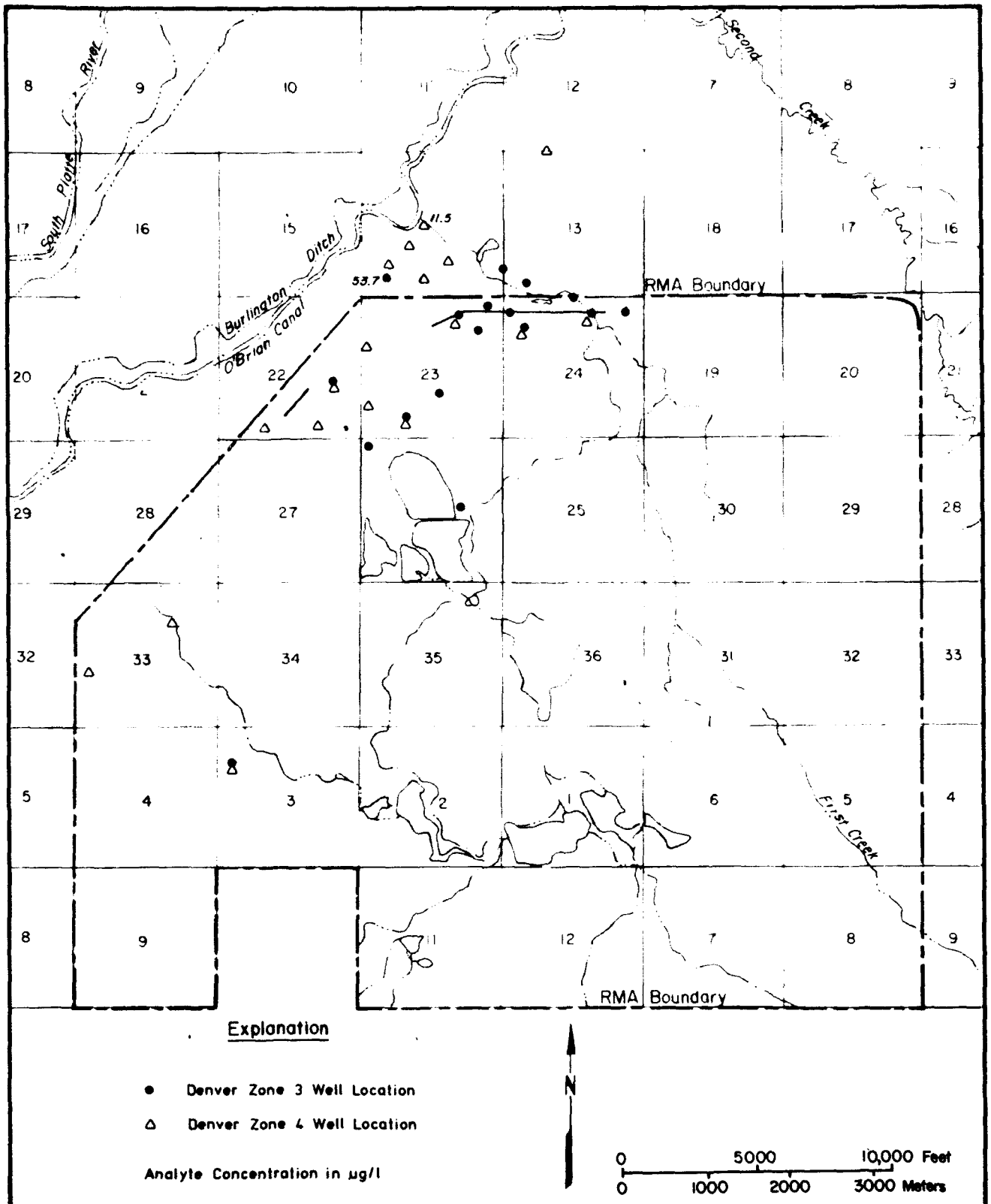
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-87
Diisopropylmethylphosphonate Detections
Denver Zone 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



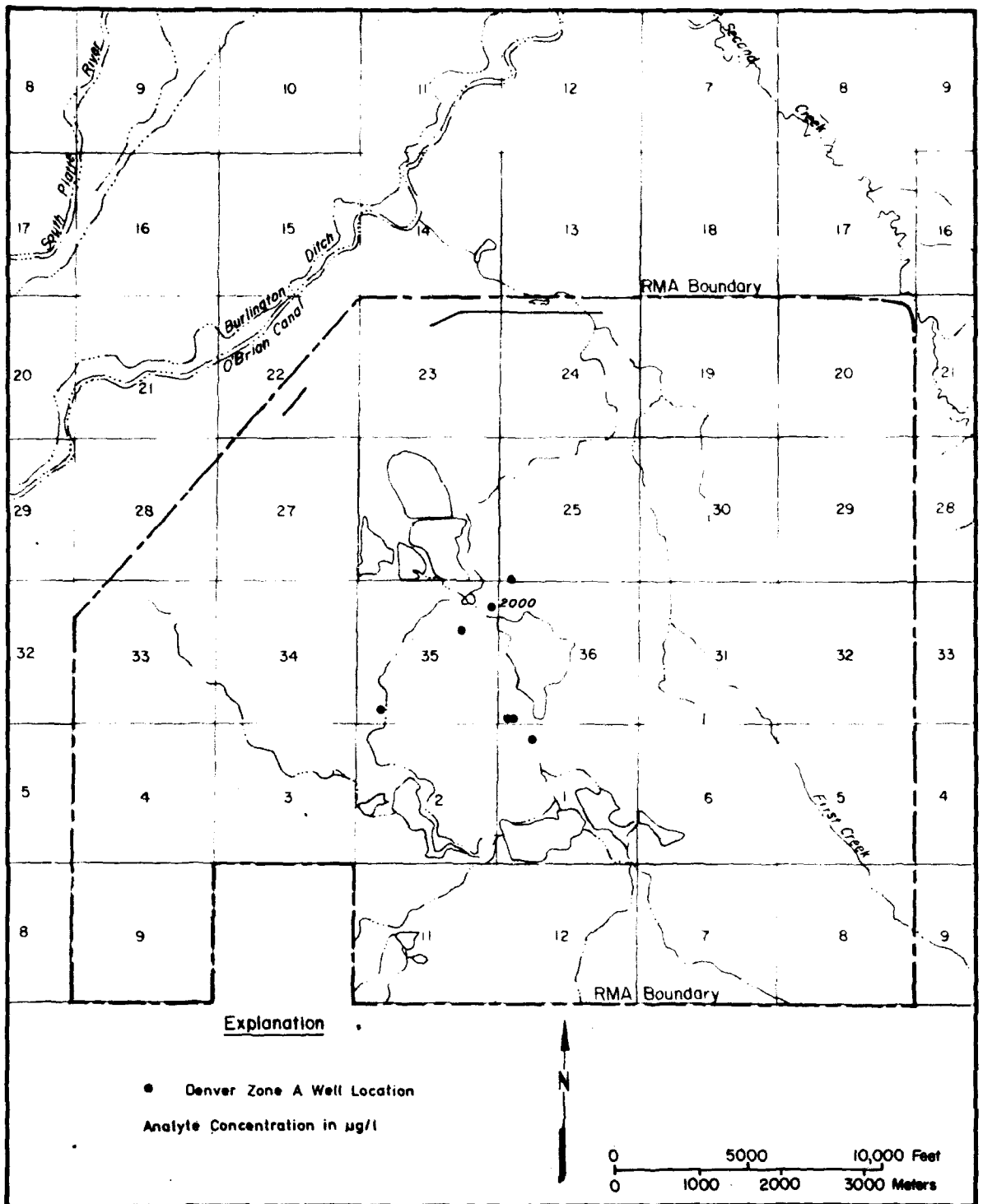
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A—88
Diisopropylmethylphosphonate Detections
Denver Zones 1 & 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



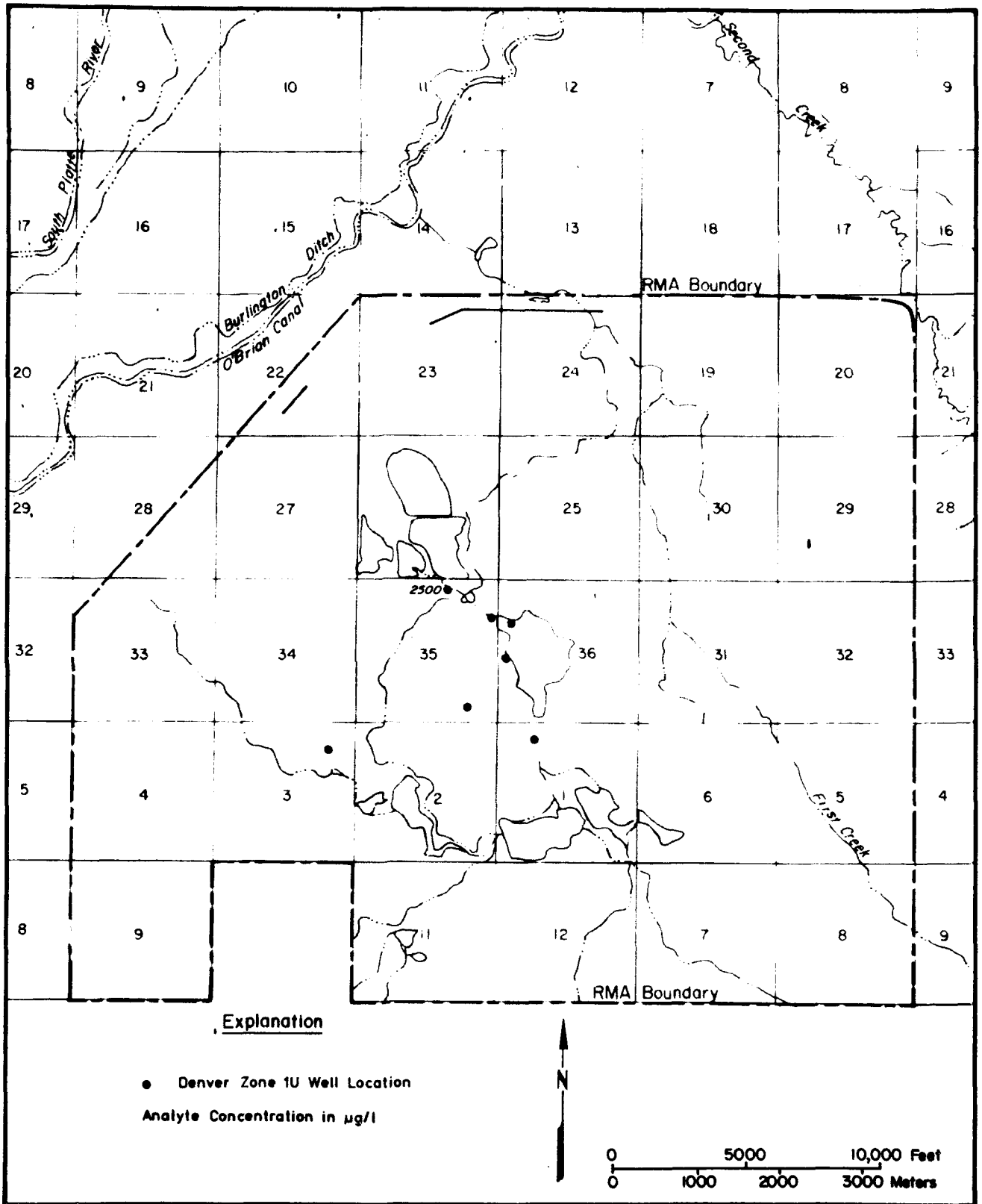
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-89
Diisopropylmethylphosphonate Detections
Denver Zones 3 & 4
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



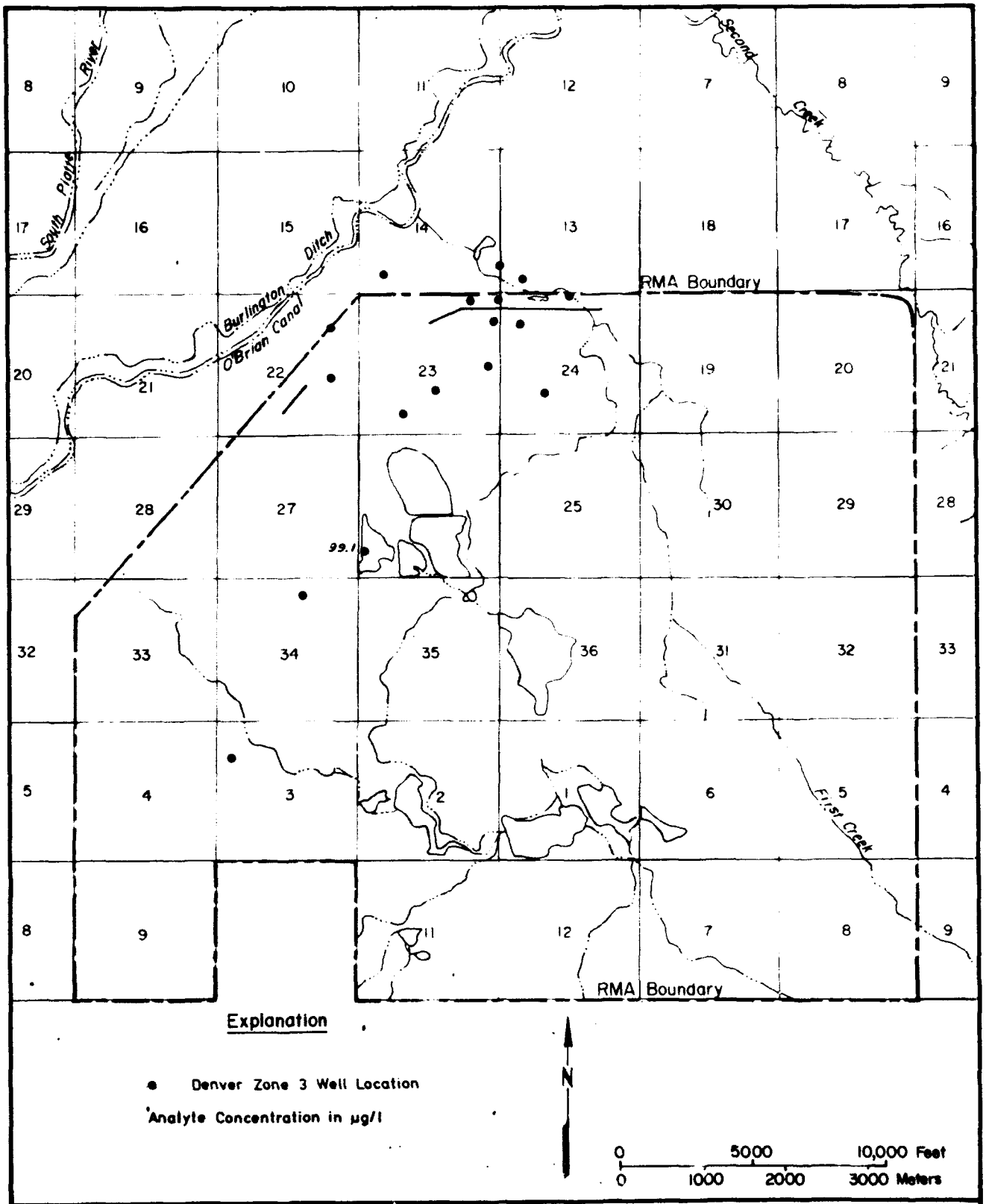
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-90
Diisopropylmethylphosphonate Detections
Denver Zone A
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



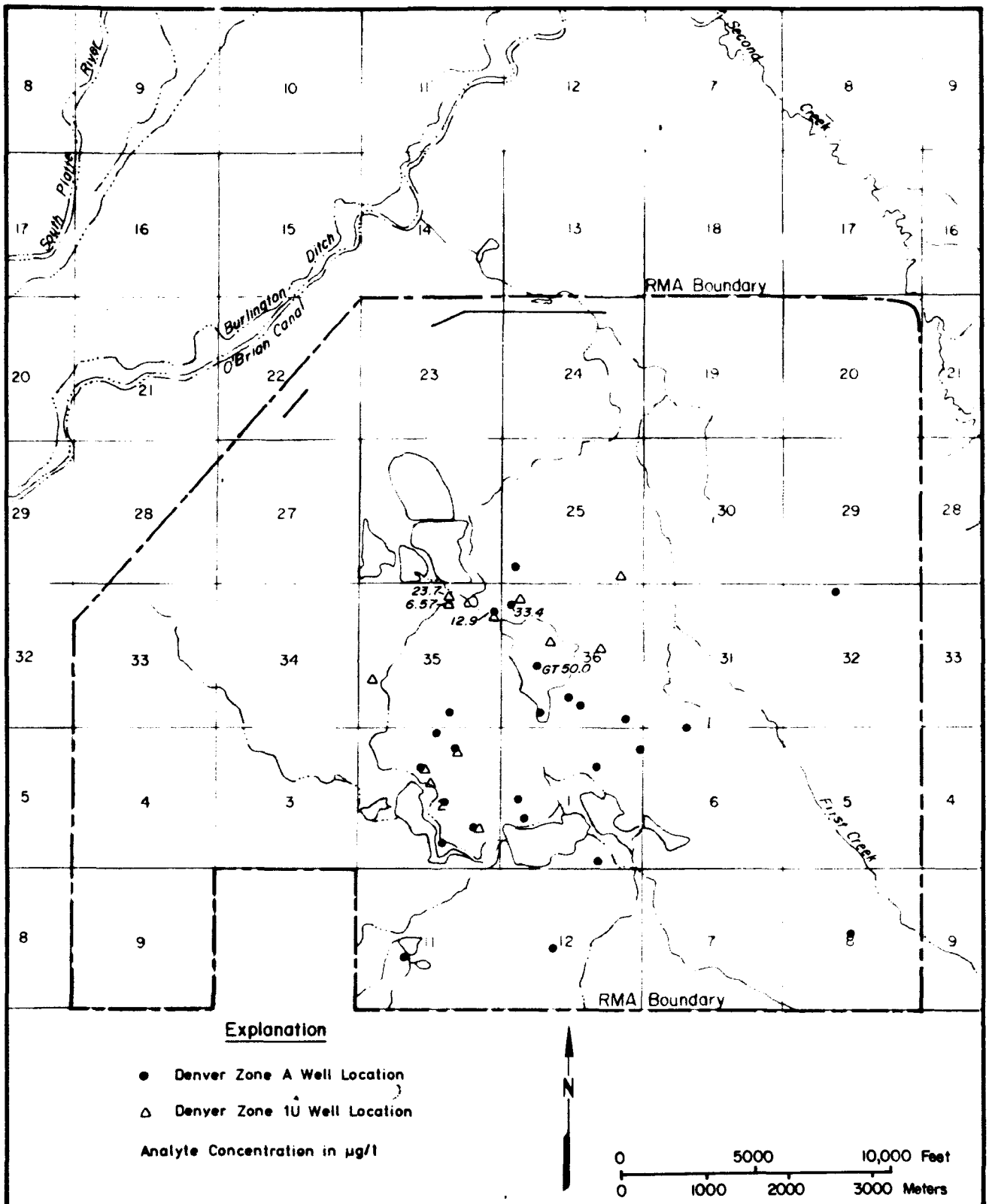
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-91
Diisopropylmethylphosphonate Detections
Denver Zone 1U
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



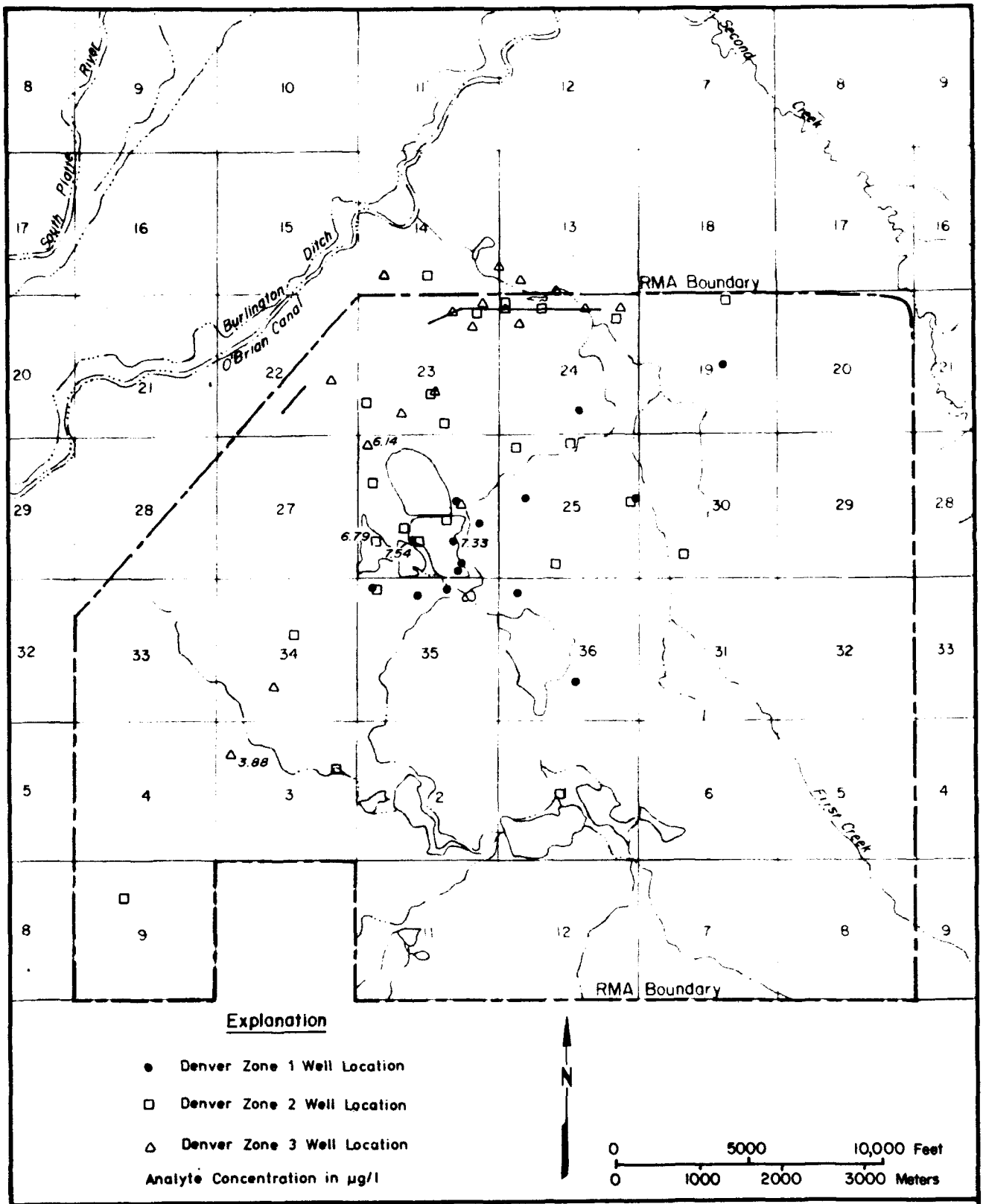
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-92
Diisopropylmethylphosphonate Detections
Denver Zone 3
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



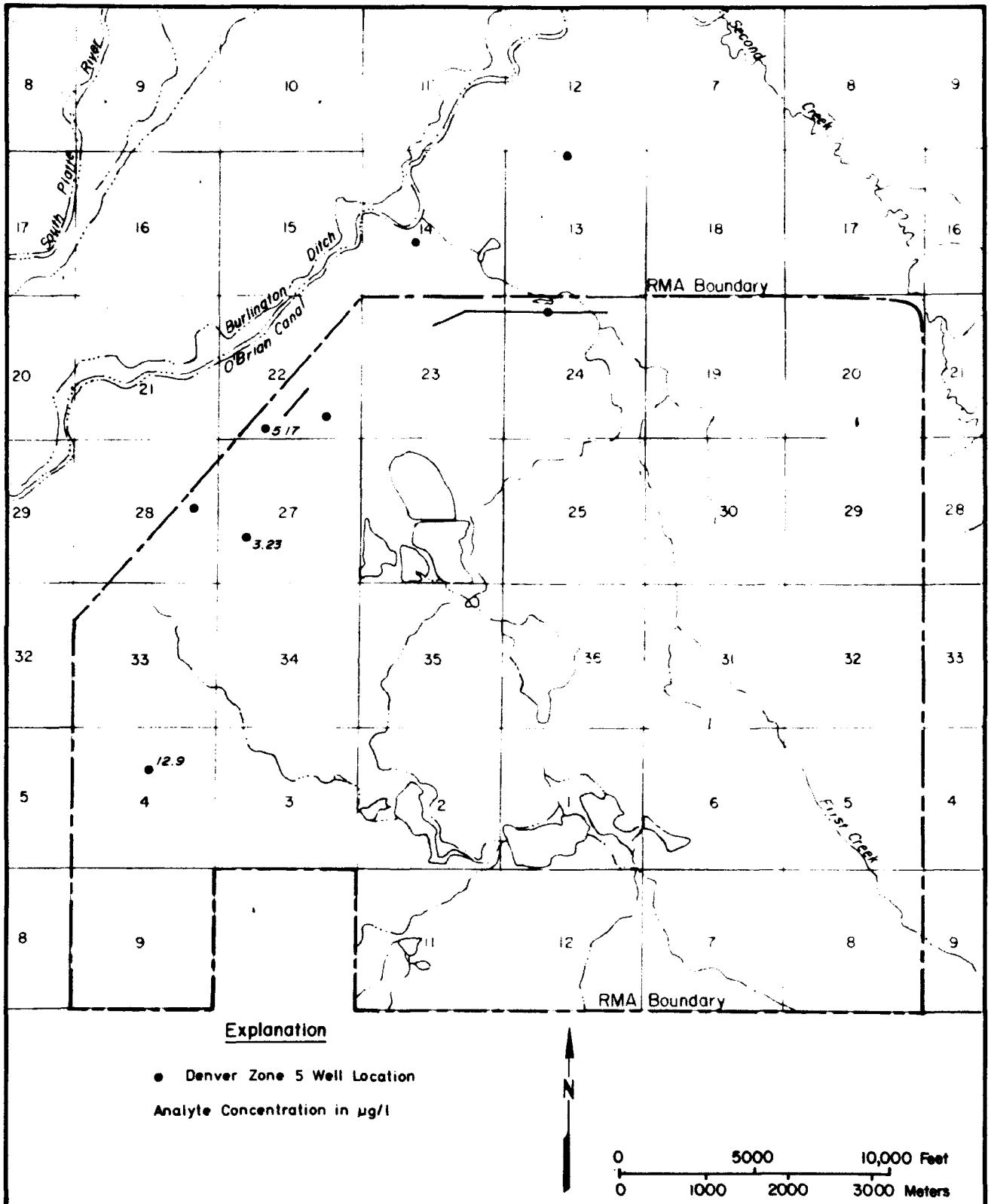
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-93
Arsenic Detections
Denver Zones A & 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



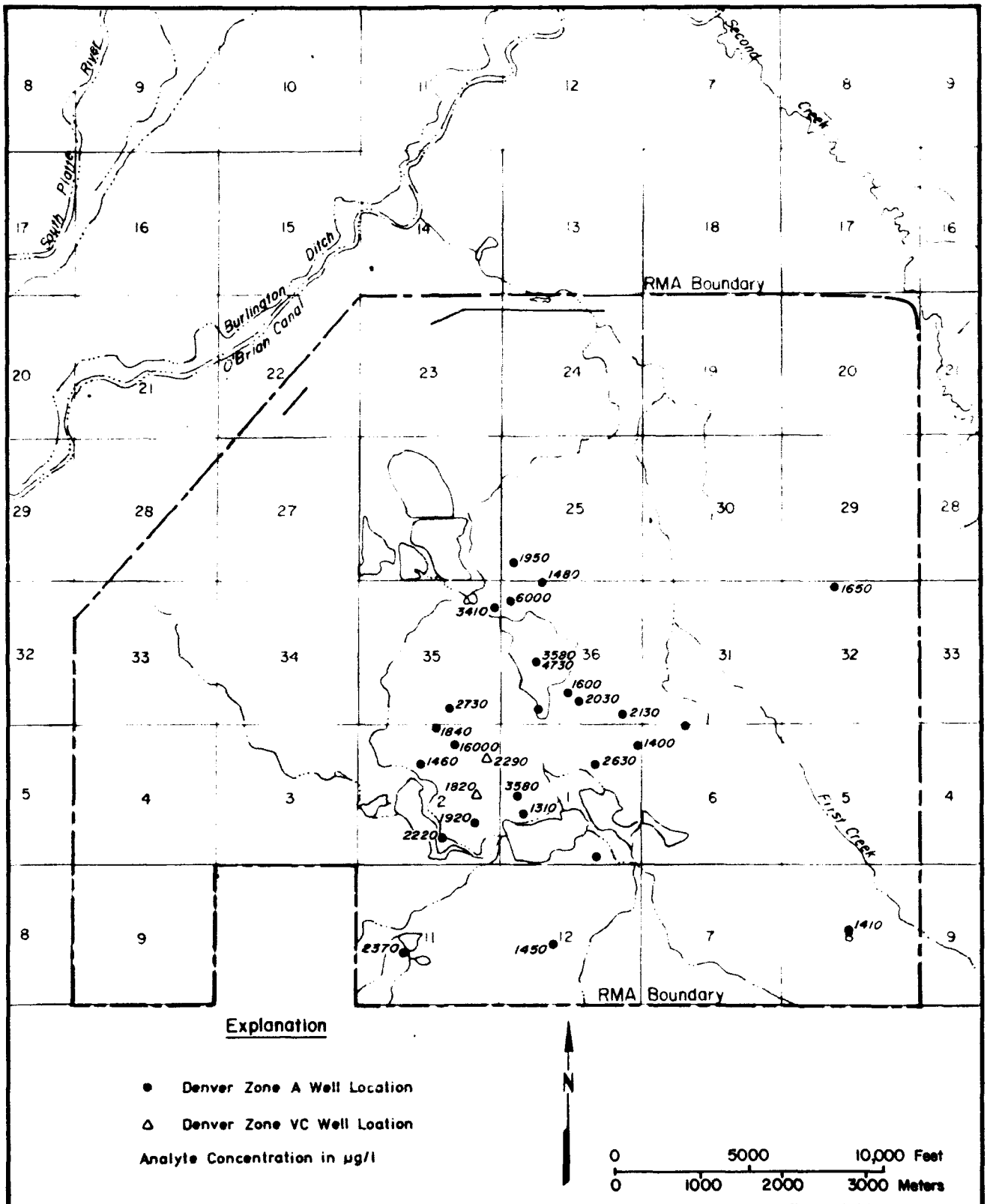
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-94
Arsenic Detections
Denver Zones 1, 2, & 3
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



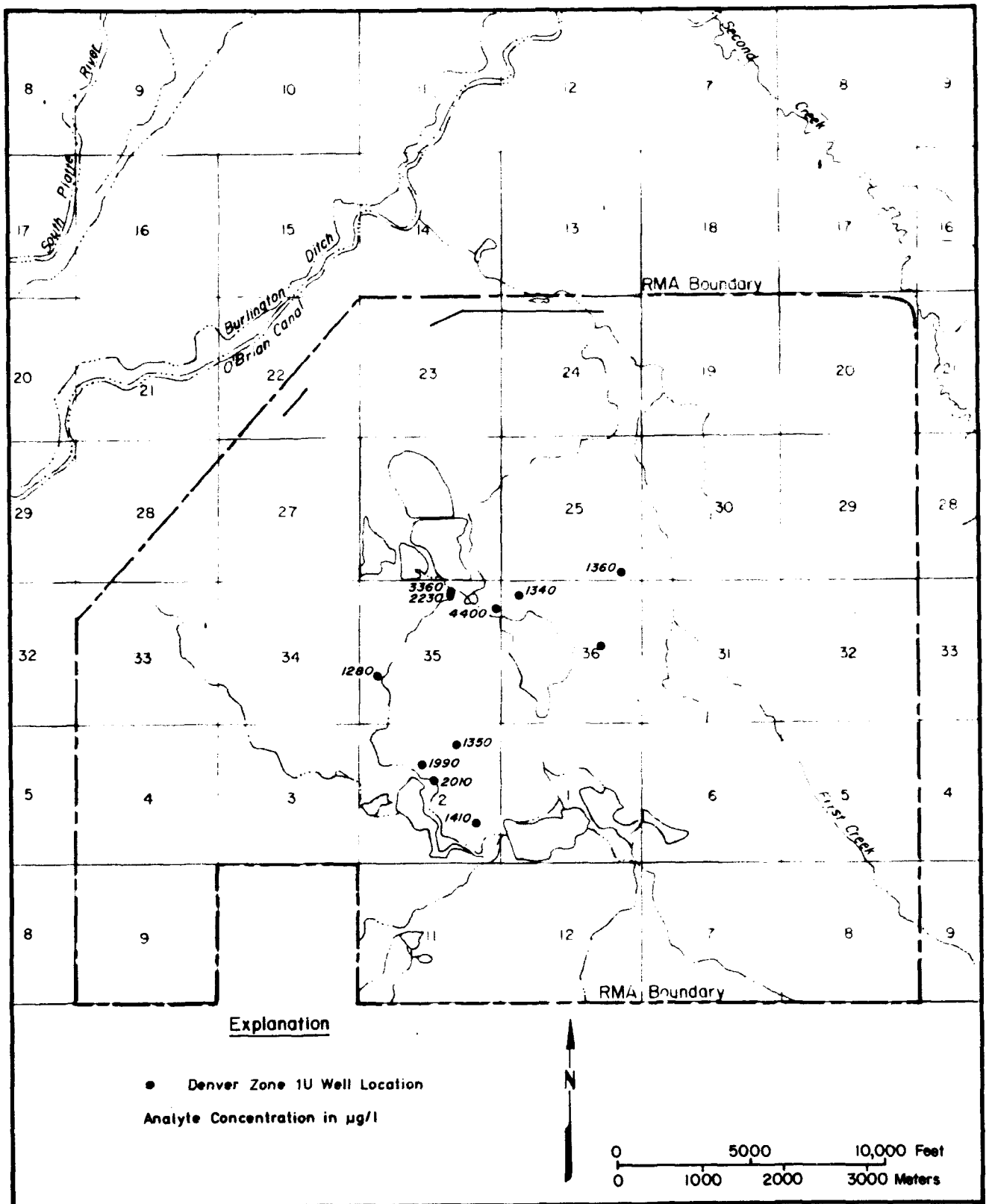
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-95
Arsenic Detections
Denver Zone 5
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



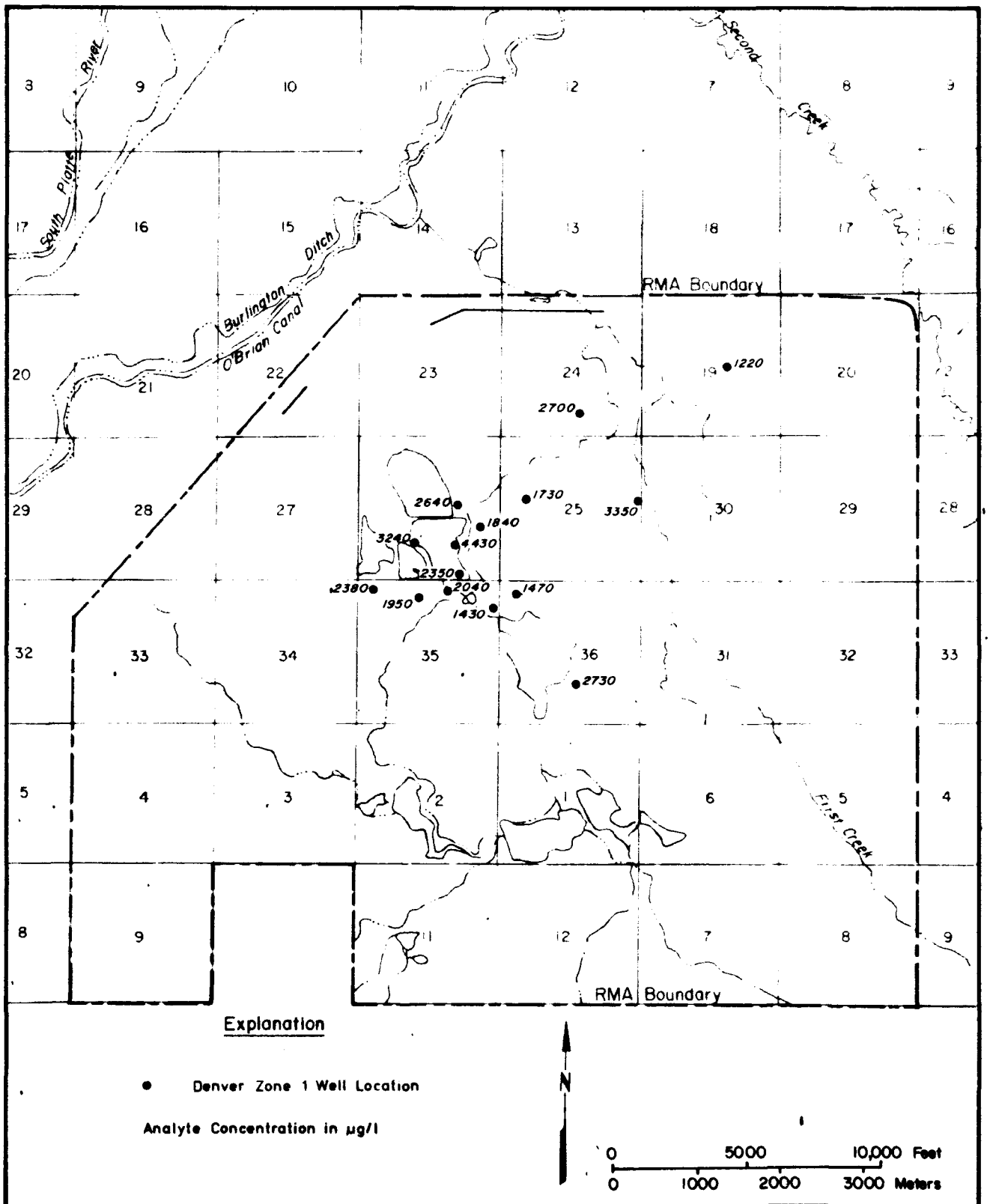
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A–96
Fluoride Detections
Denver Zones A & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



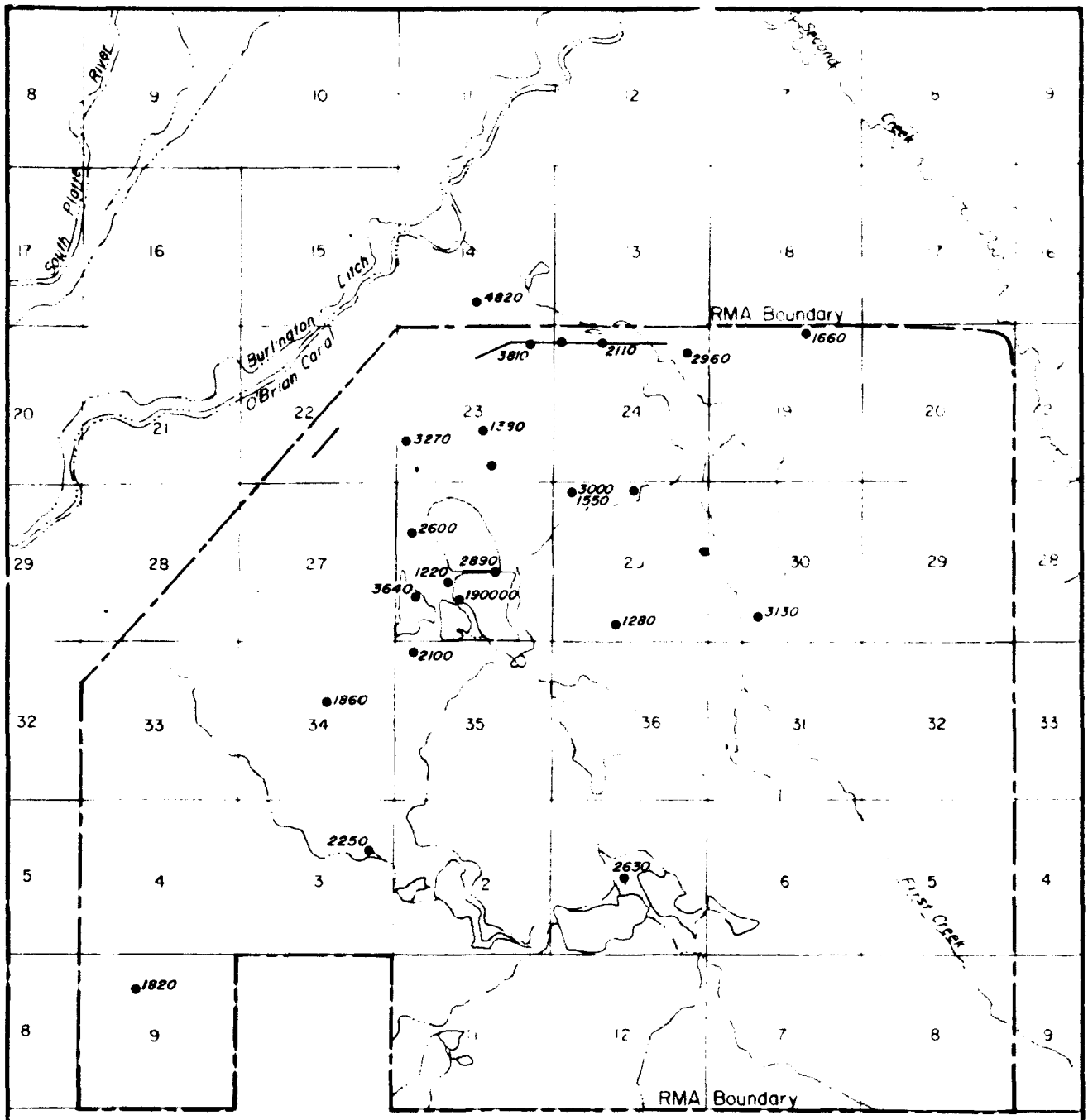
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-97
Fluoride Detections
Denver Zone 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-98
Fluoride Detections
Denver Zone 1
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

● Denver Zone 2 Well Location

Analyte Concentration in µg/l

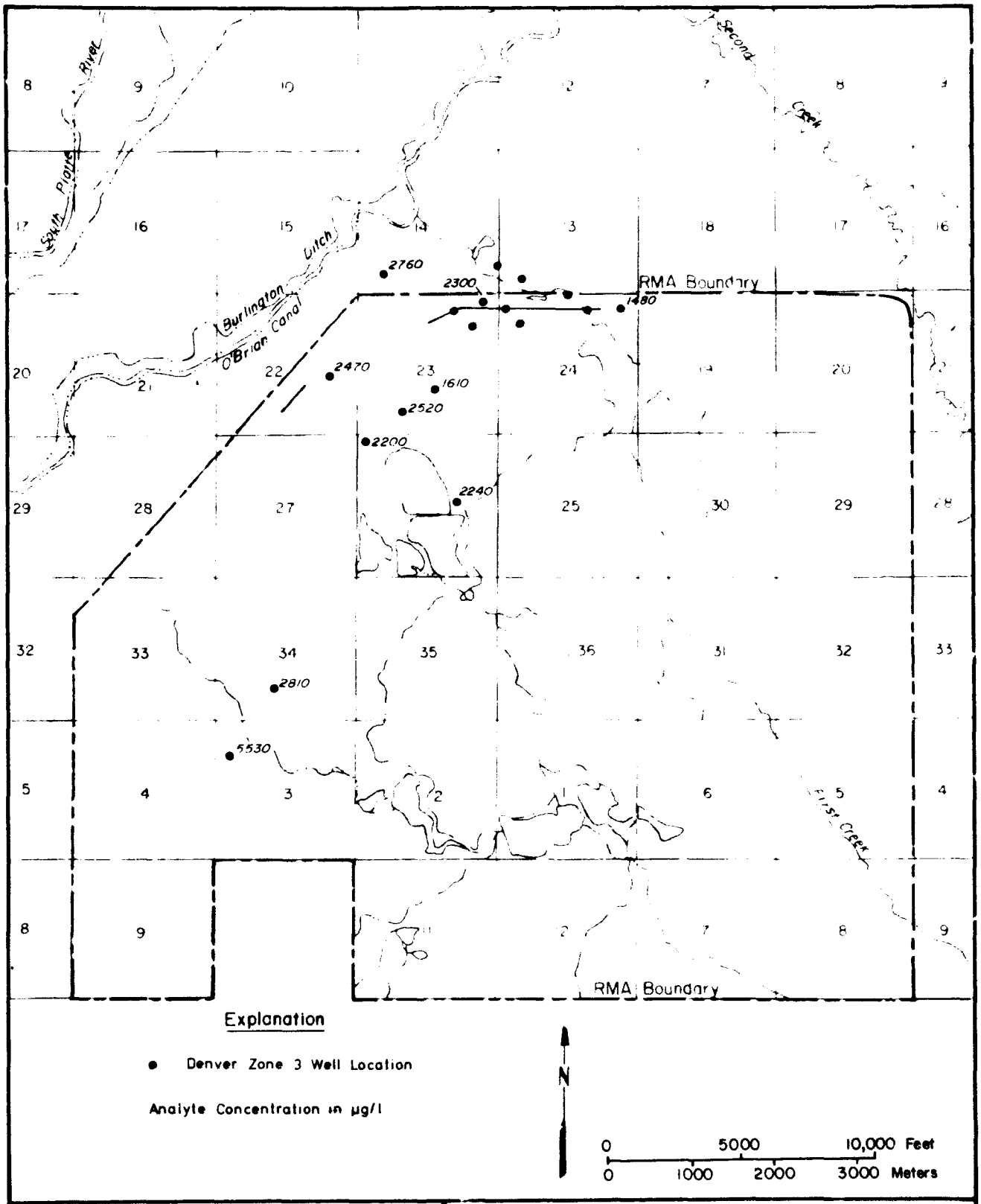
N

0 5000 10,000 Feet

0 1000 2000 3000 Meters

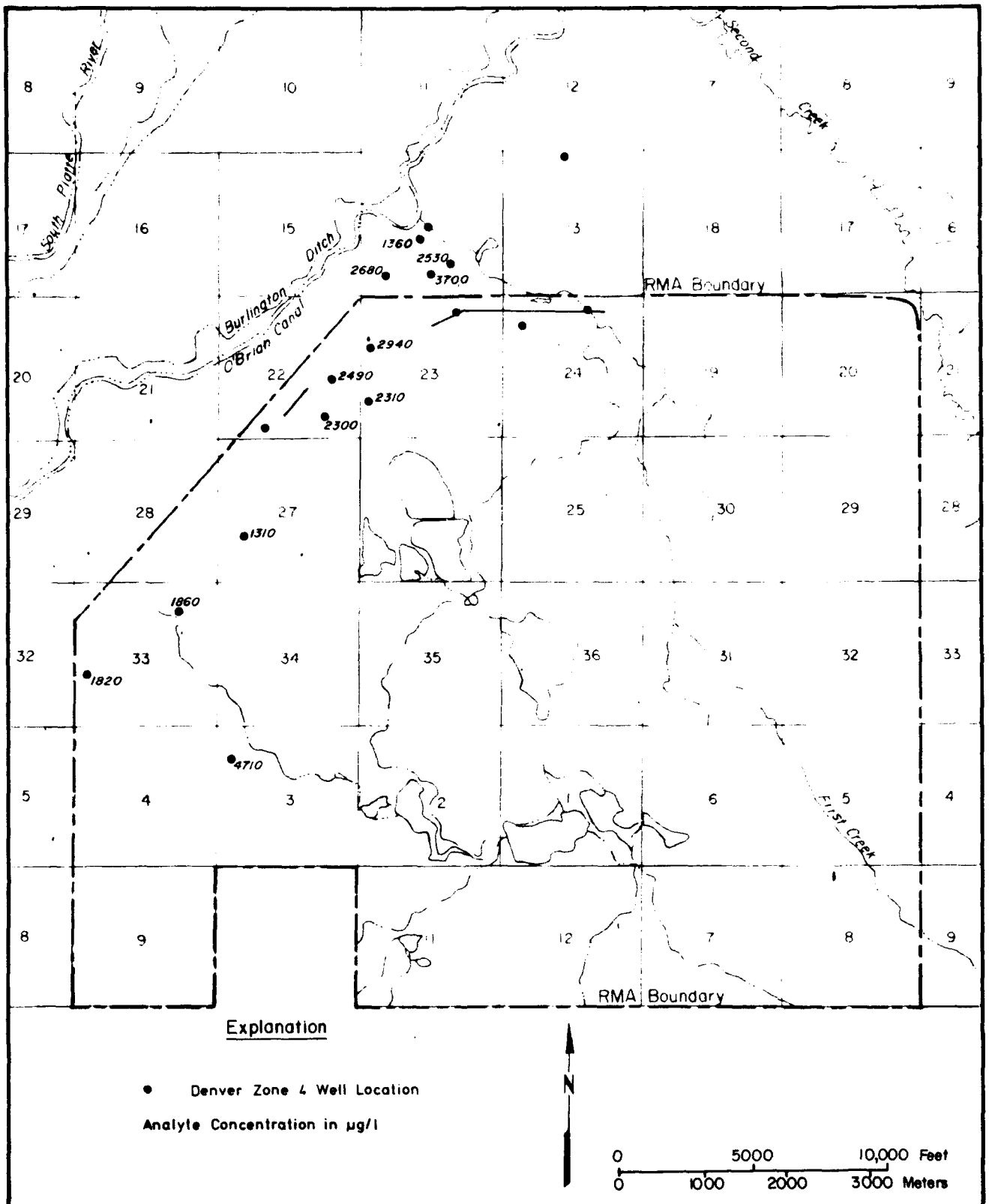
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-99
Fluoride Detections
Denver Zone 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



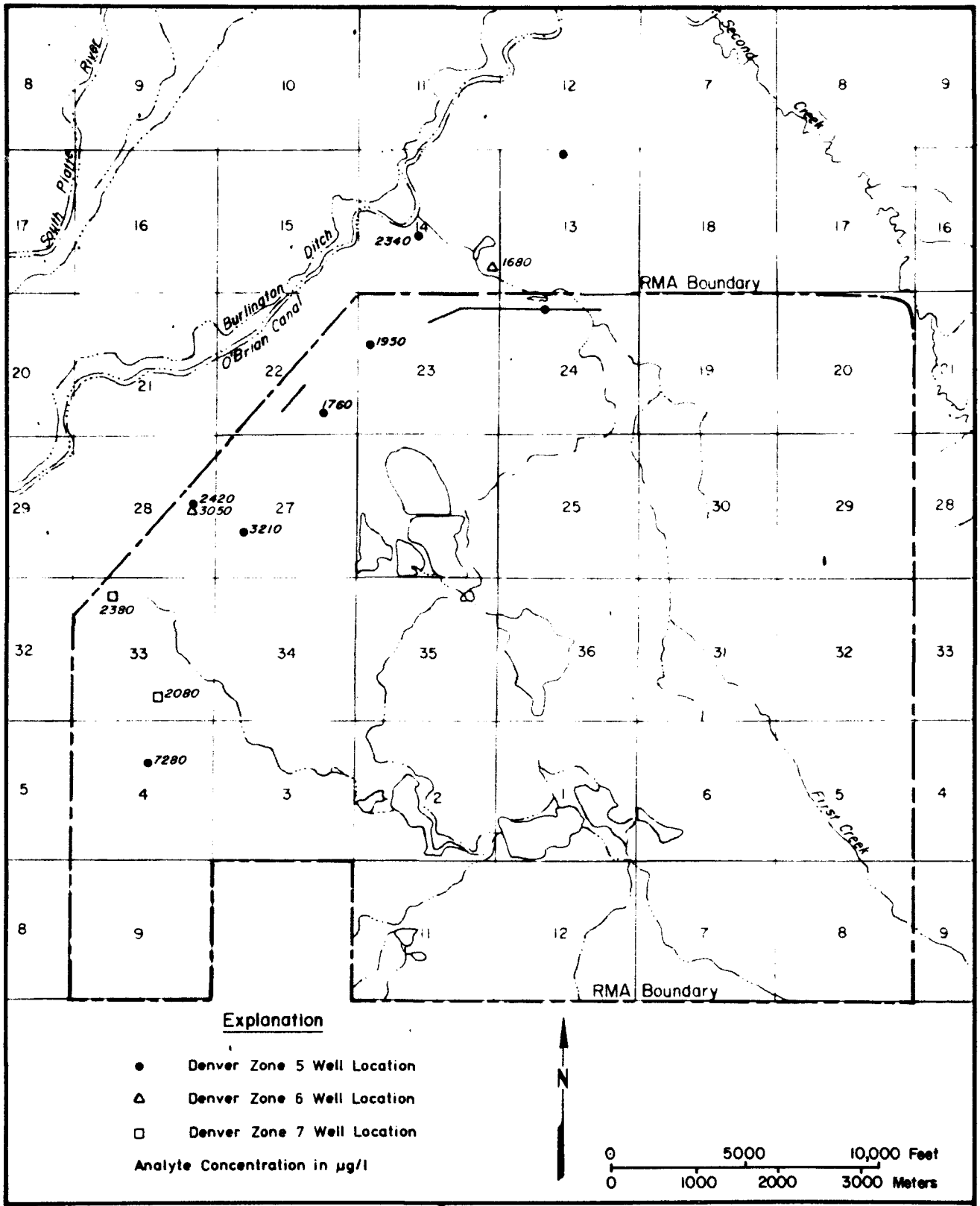
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-100
Fluoride Detections
Denver Zone 3
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



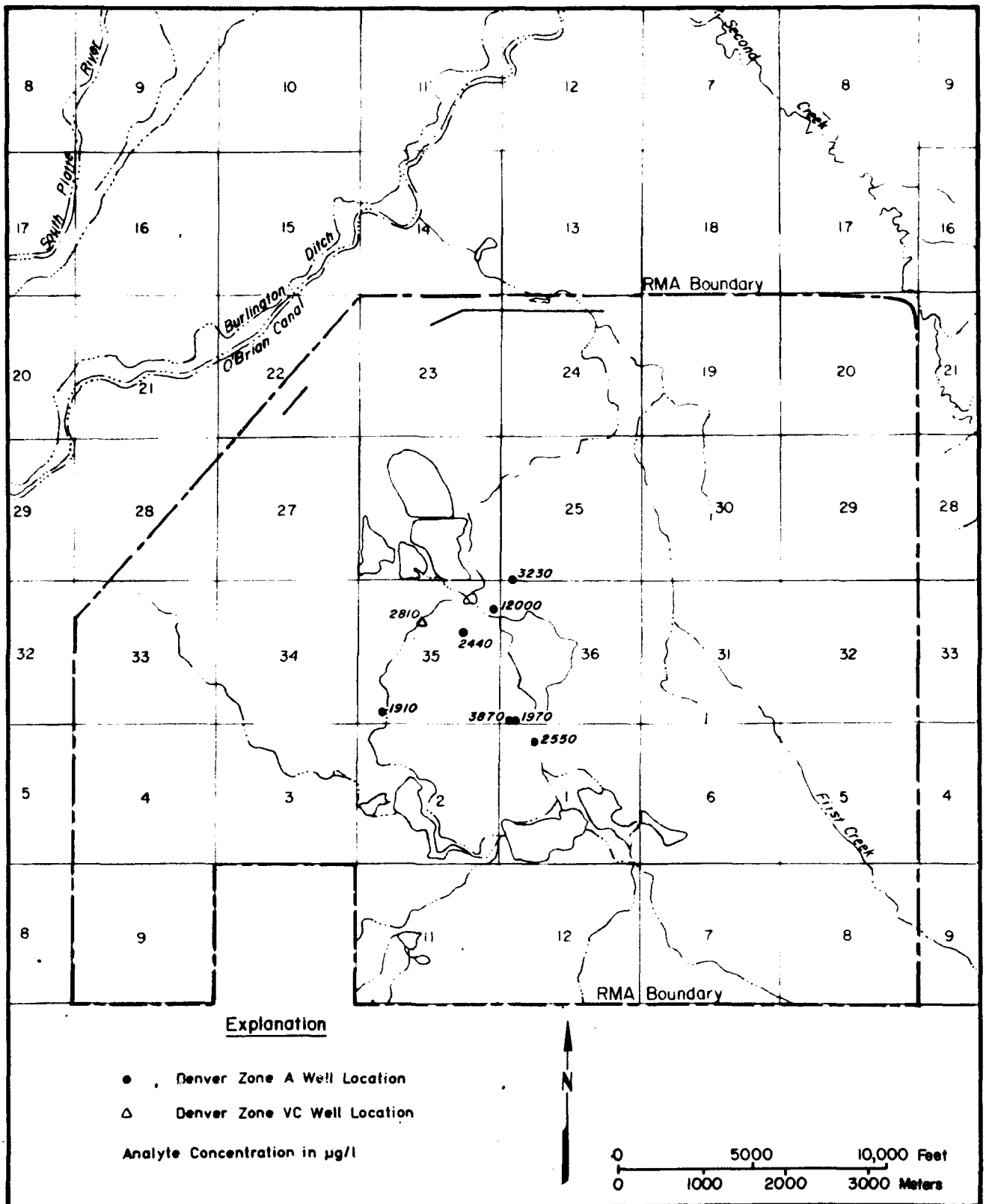
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-101
Fluoride Detections
Denver Zone 4
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



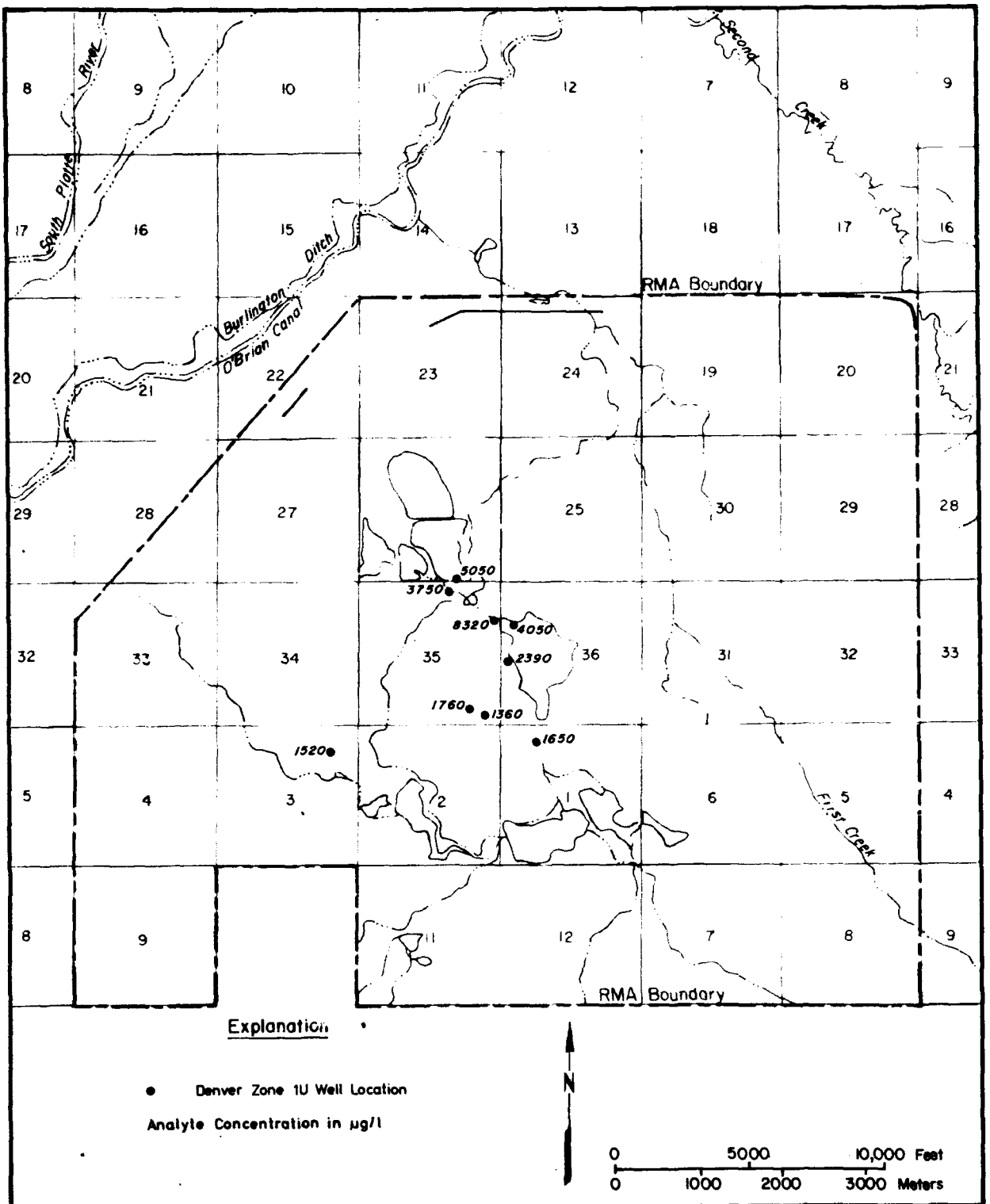
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A—102
Fluoride Detections
Denver Zones 5, 6, & 7
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



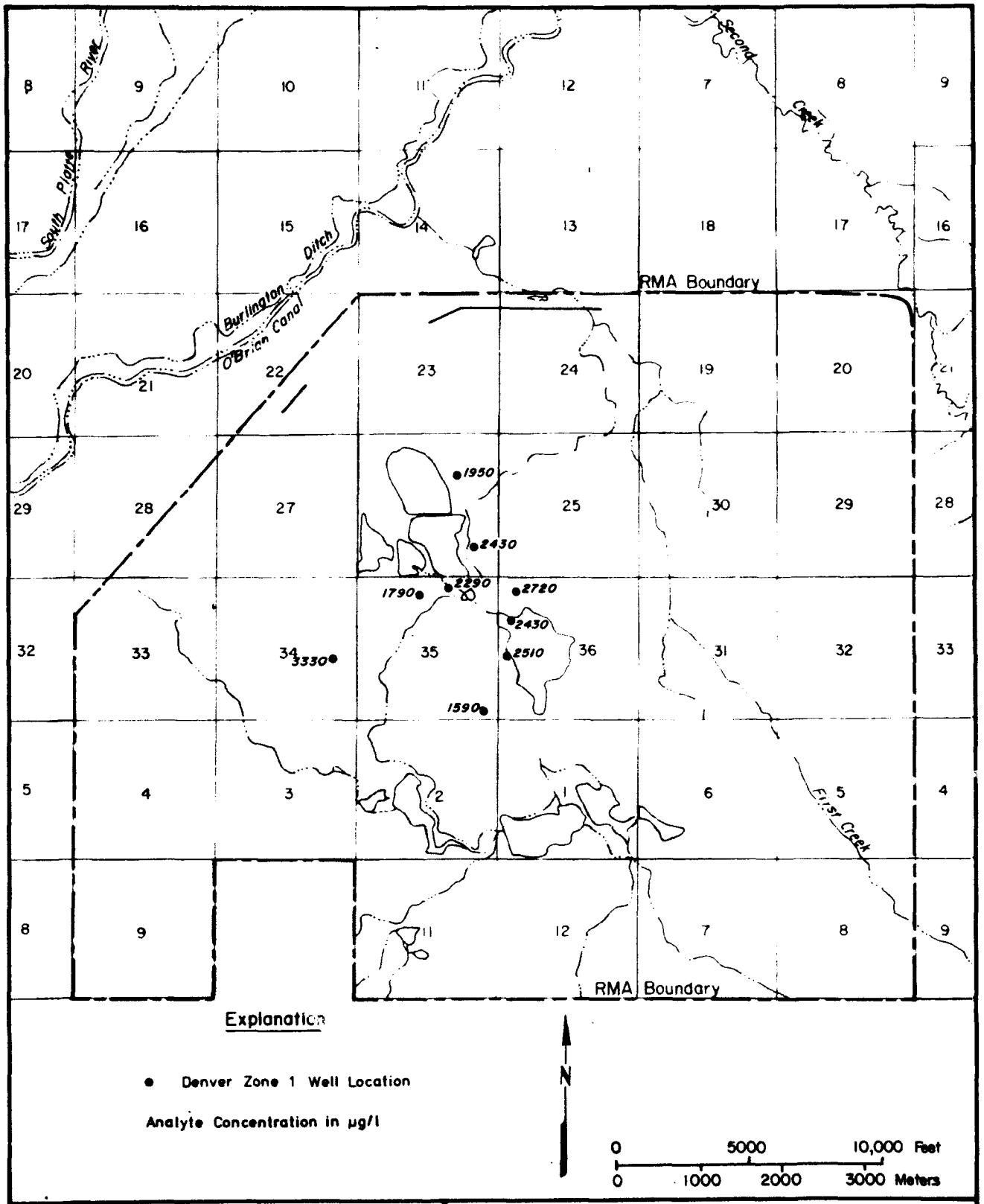
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-103
Fluoride Detections
Denver Zones A & VC
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



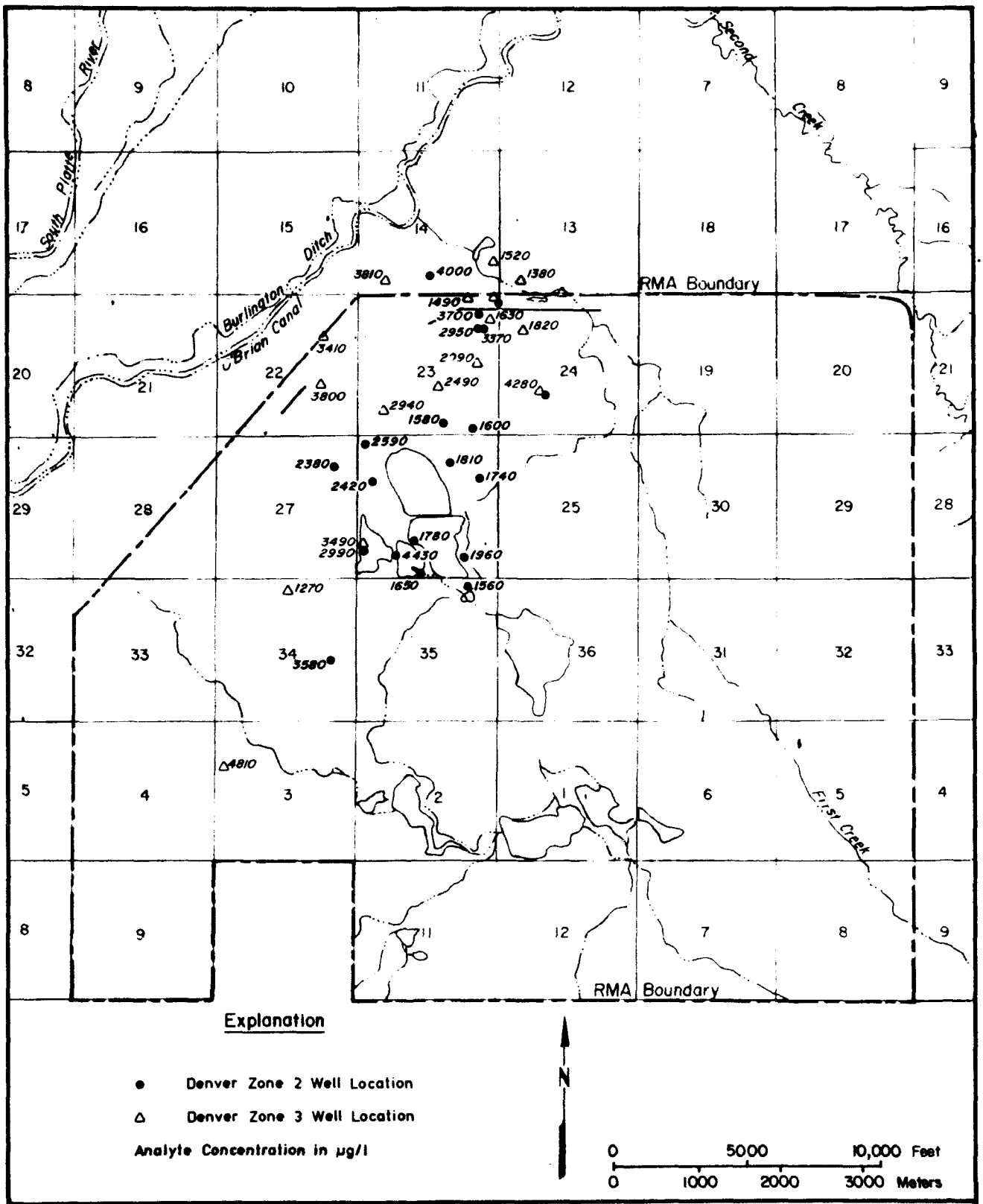
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-104
Fluoride Detections
Denver Zone 1U
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



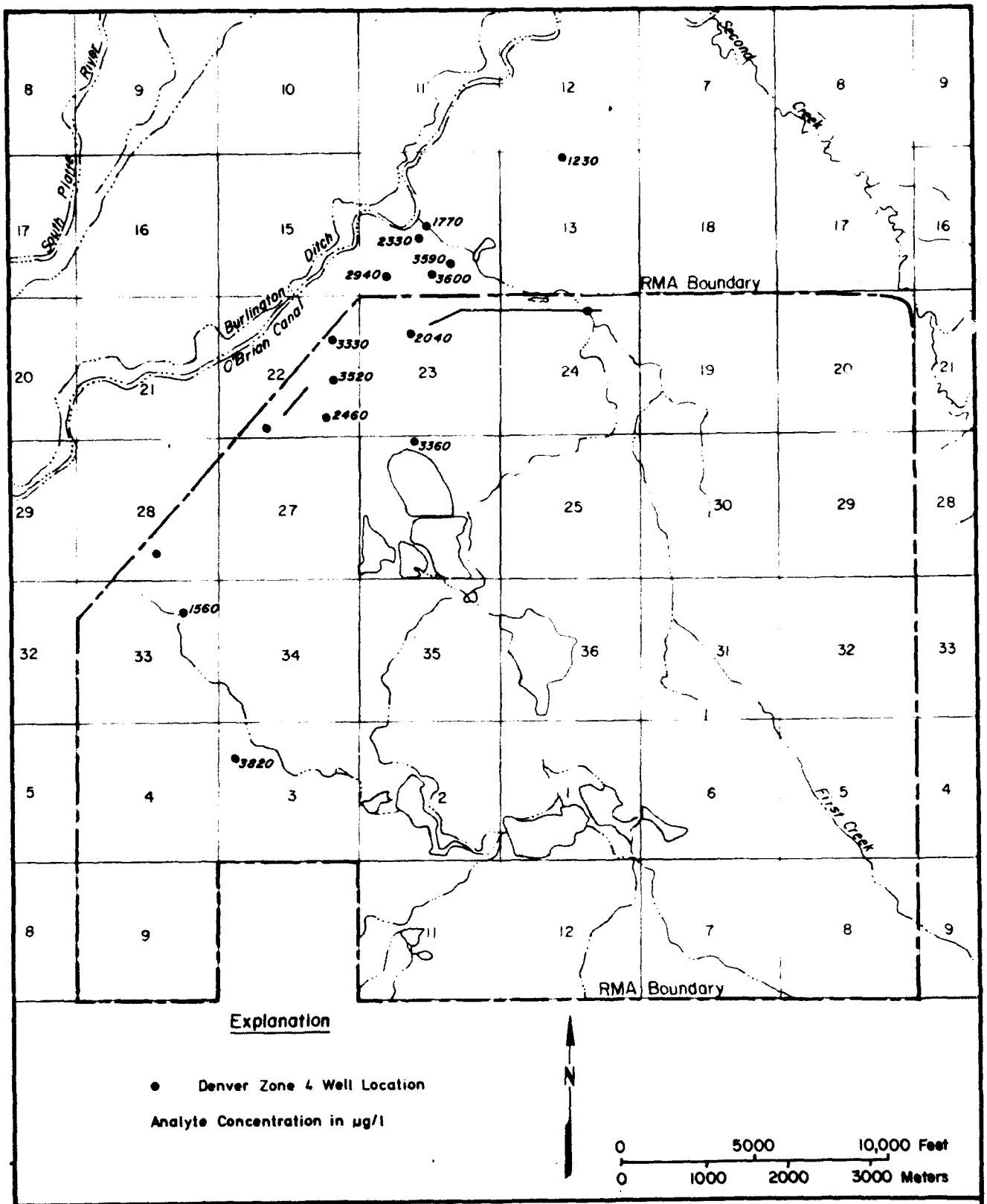
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-105
Fluoride Detections
Denver Zone 1
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



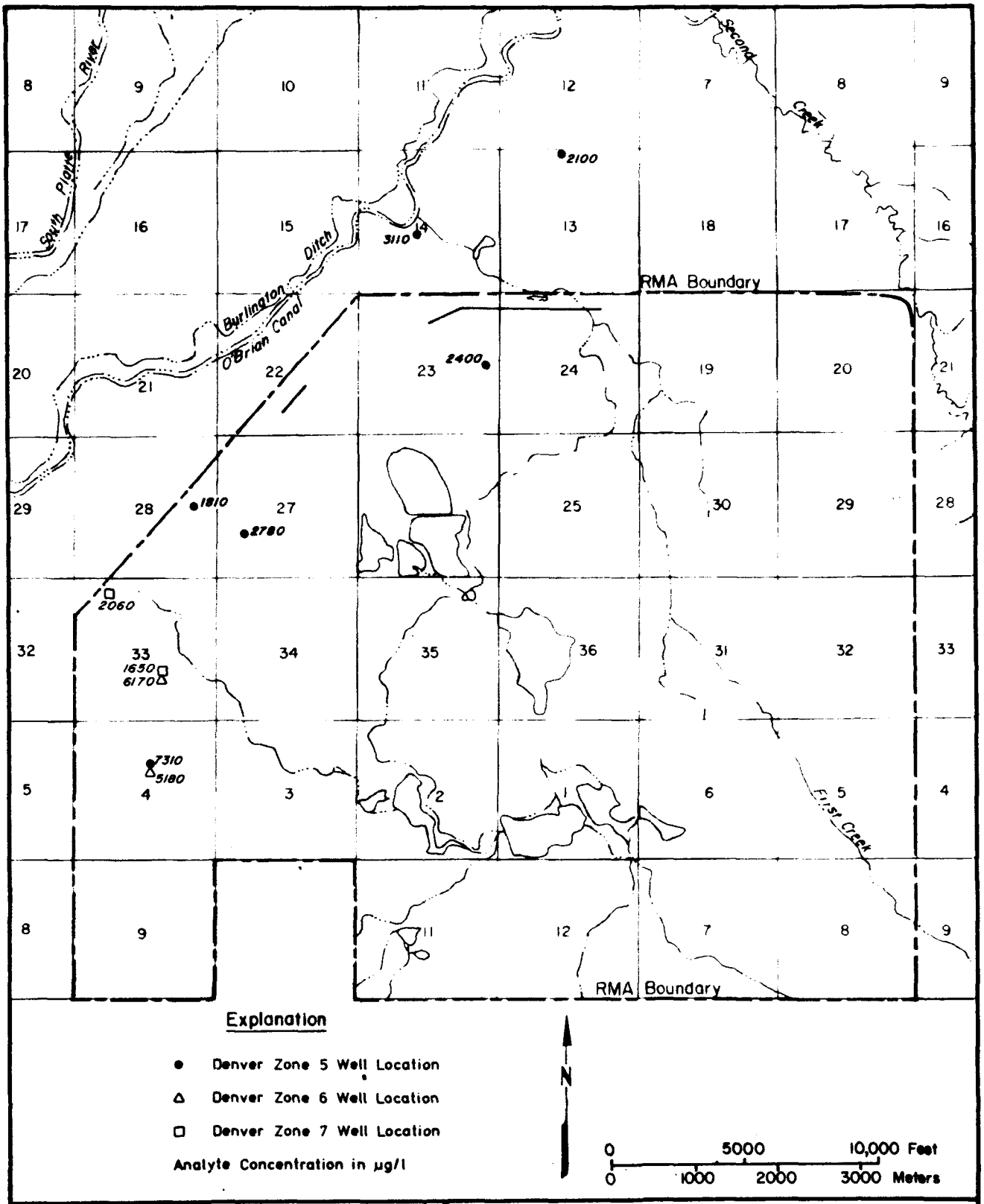
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A–106
Fluoride Detections
Denver Zones 2 & 3
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



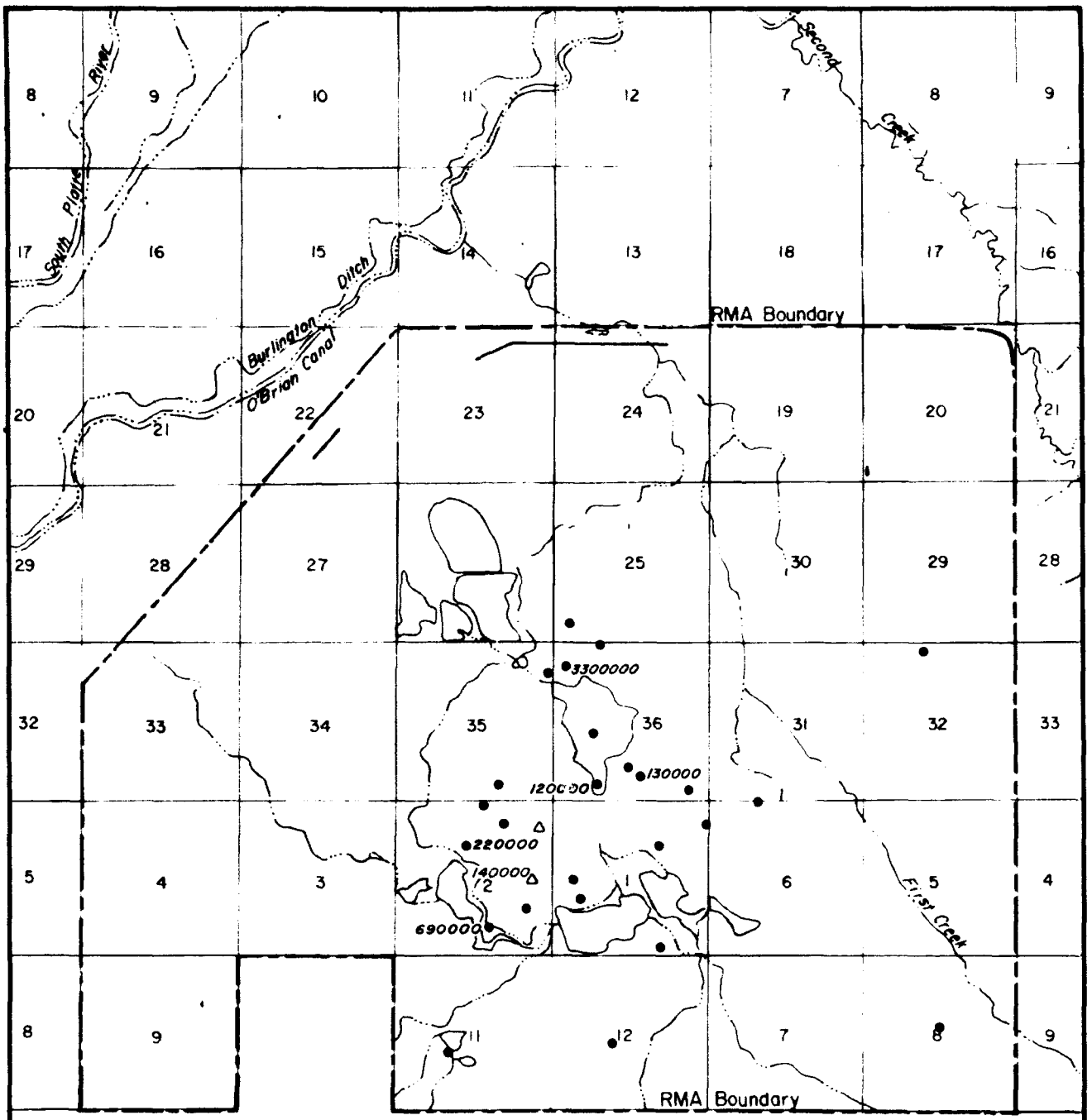
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-107
Fluoride Detections
Denver Zone 4
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A—108
Fluoride Detections
Denver Zones 5, 6, & 7
Spring 1988
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

● Denver Zone A Well Location

△ Denver Zone VC Well Location

Analyte Concentration in µg/l

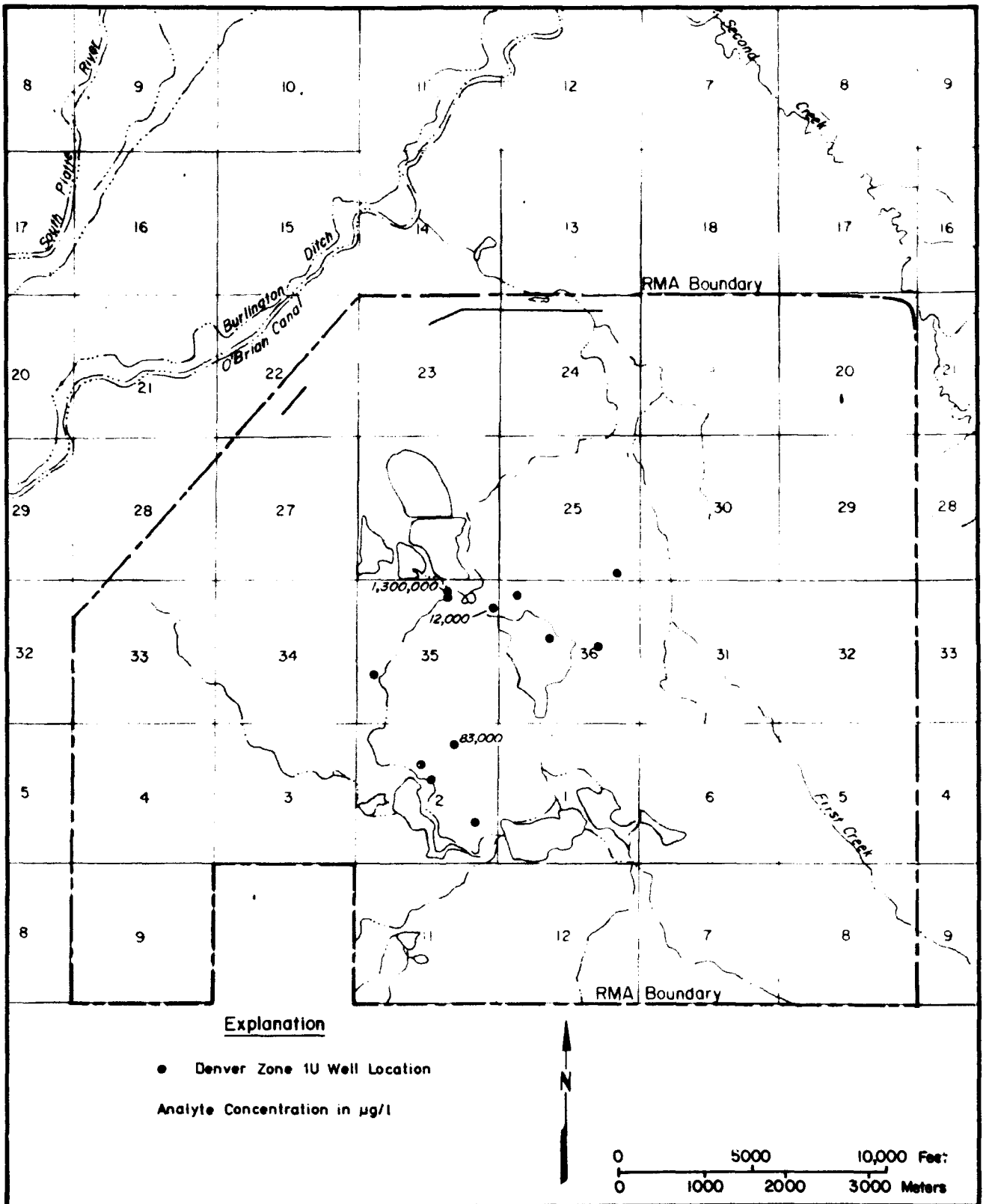
N

0 5000 10,000 Feet

0 1000 2000 3000 Meters

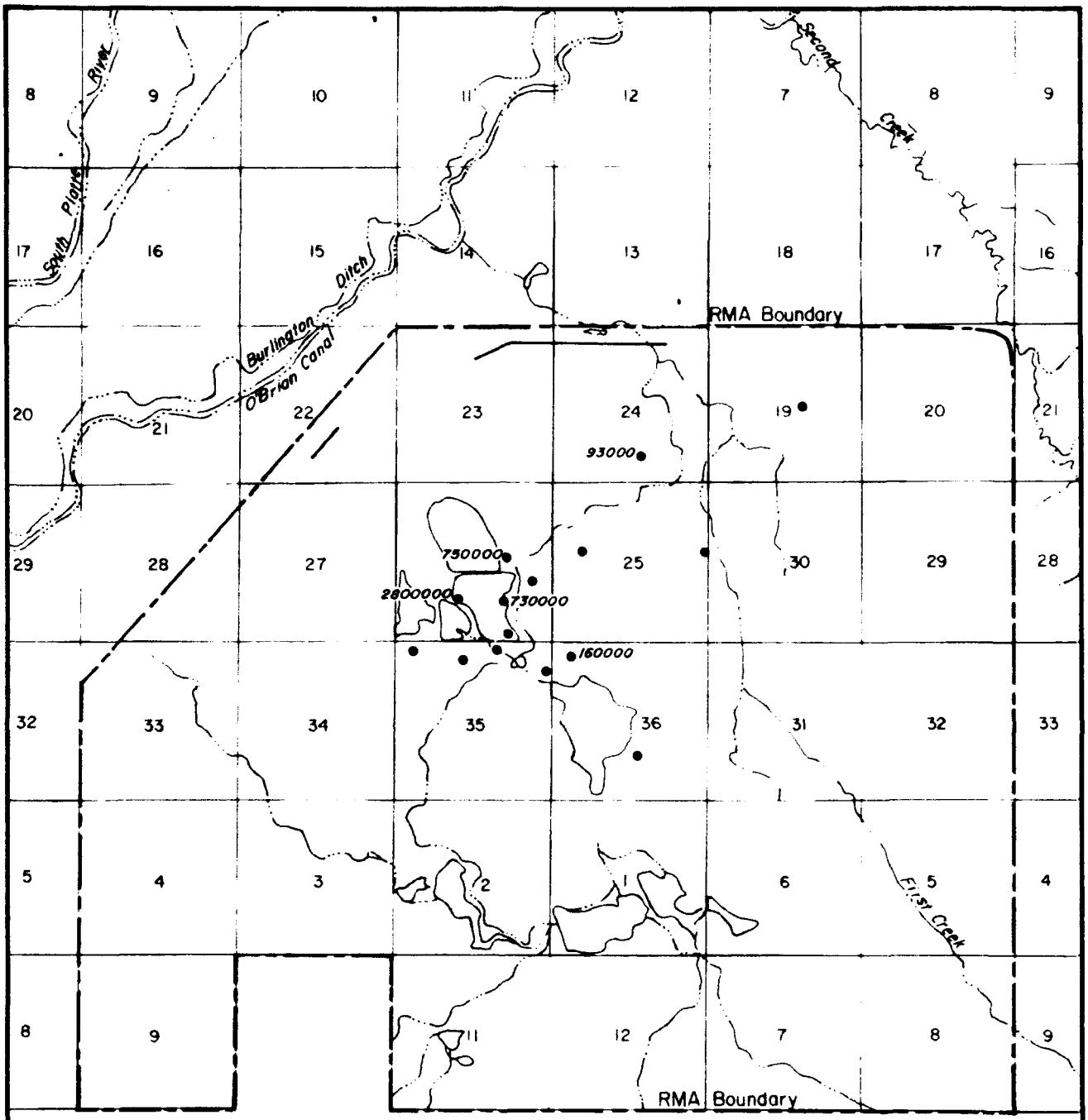
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-109
Chloride Detections
Denver Zones A & VC
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A—110
Chloride Detections
Denver Zone 1U
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

● Denver Zone 1 Well Location

Analyte Concentration in µg/l

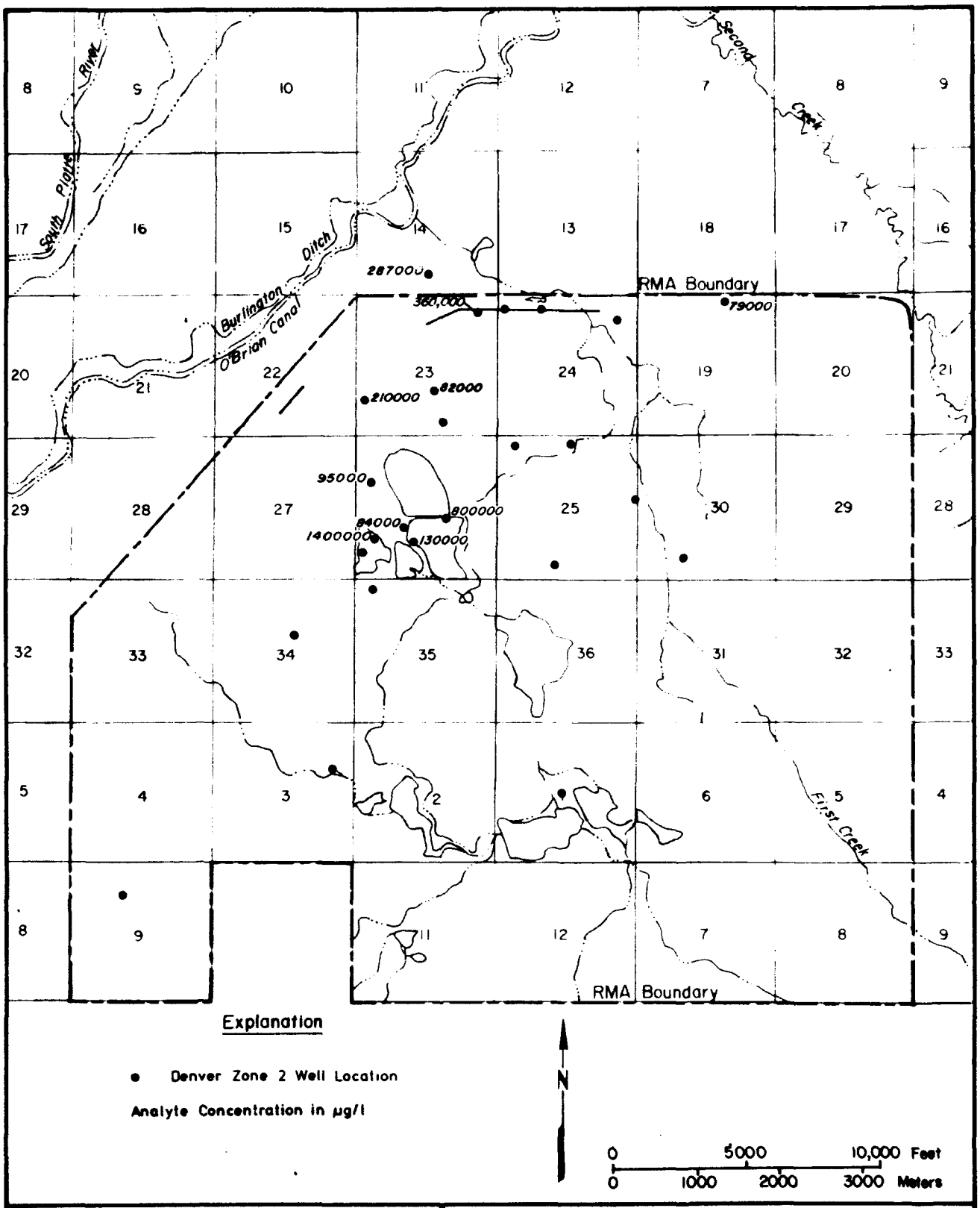
N

0 5000 10,000 Feet

0 1000 2000 3000 Meters

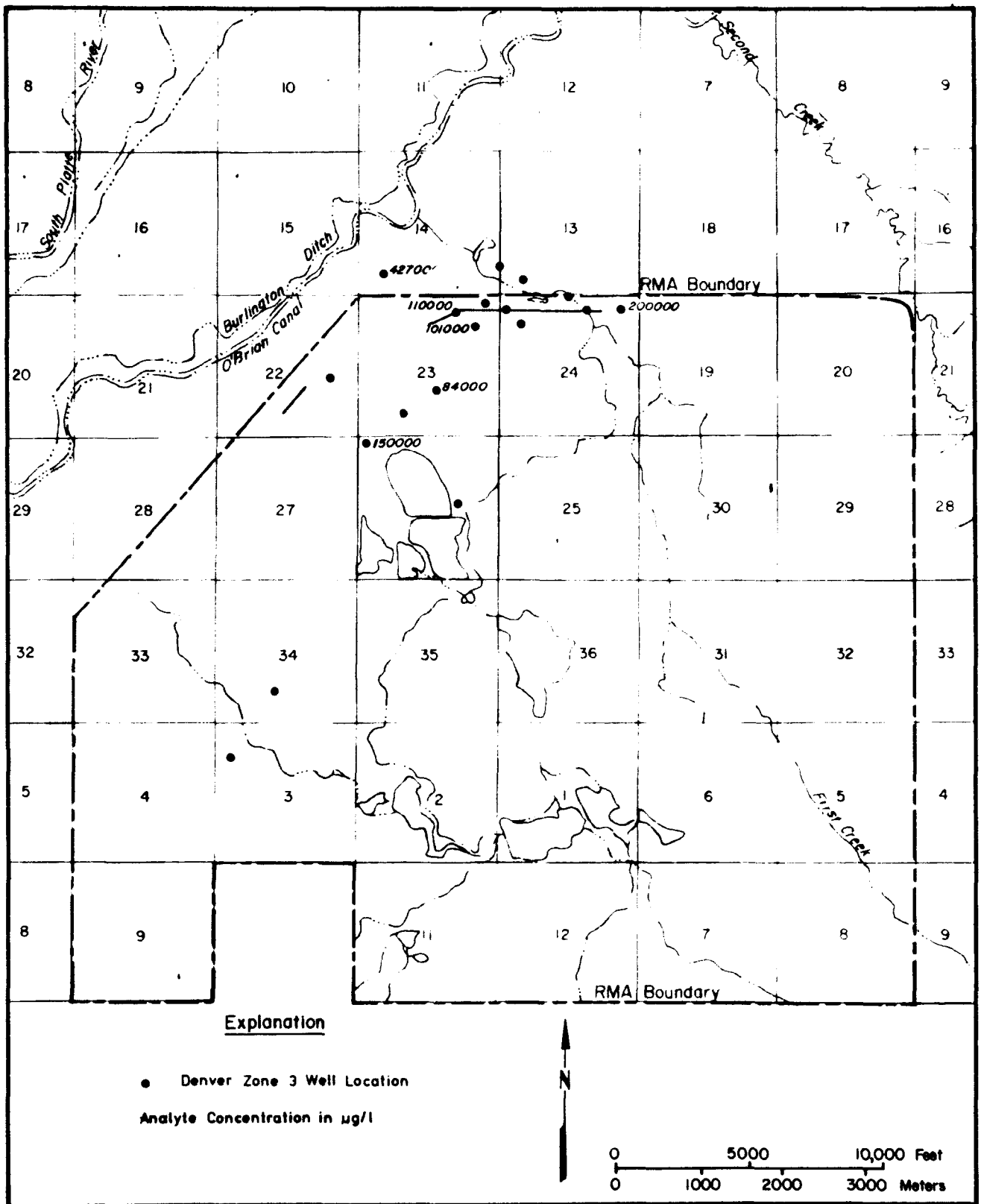
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-111
Chloride Detections
Denver Zone 1
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



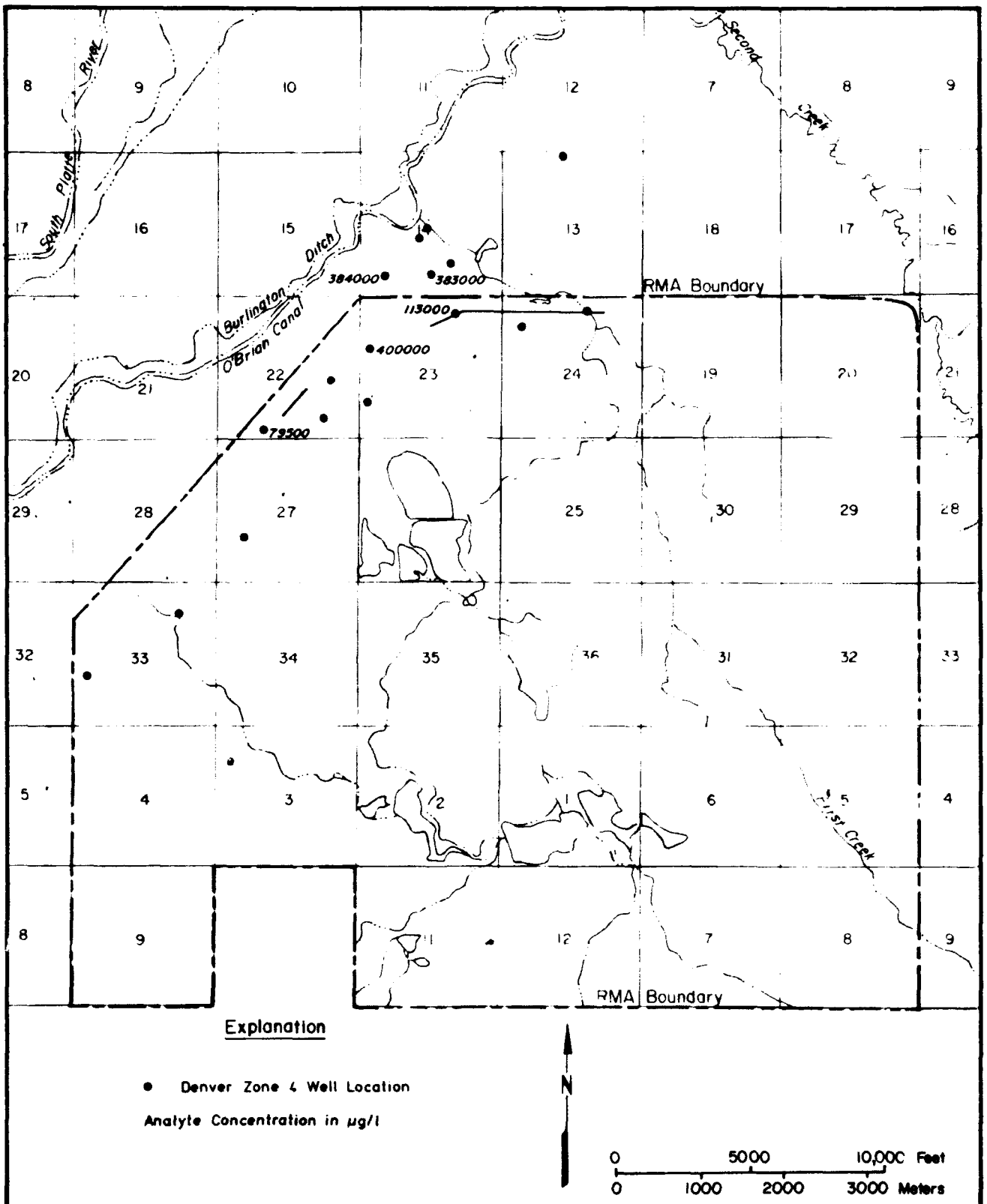
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A—112
Chloride Detections
Denver Zone 2
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



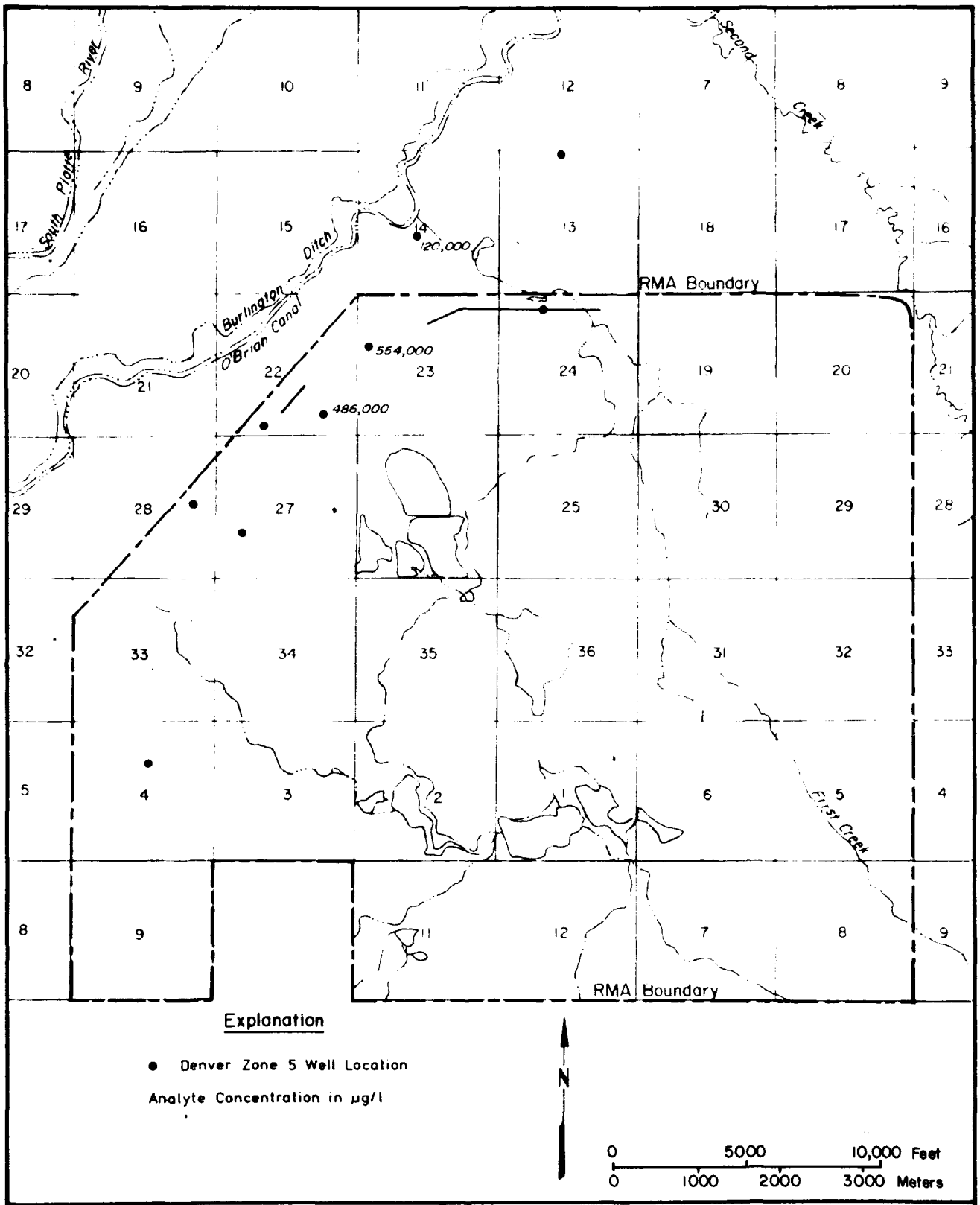
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A—113
Chloride Detections
Denver Zone 3
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



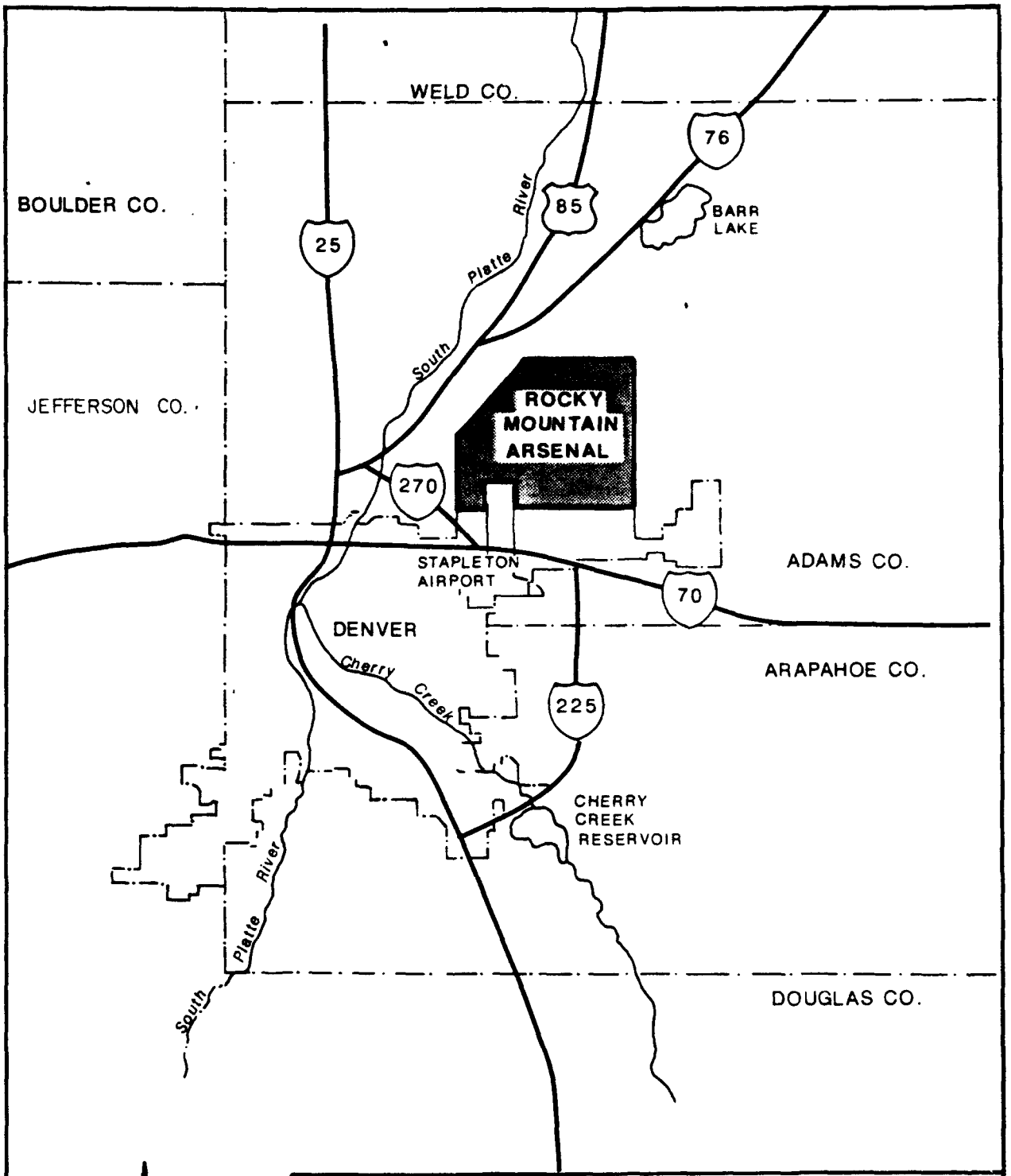
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-114
Chloride Detections
Denver Zone 4
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE A-115
Chloride Detections
Denver Zone 5
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:

U.S. Army Program Manager for Rocky Mountain Arsenal
Commerce City, Colorado

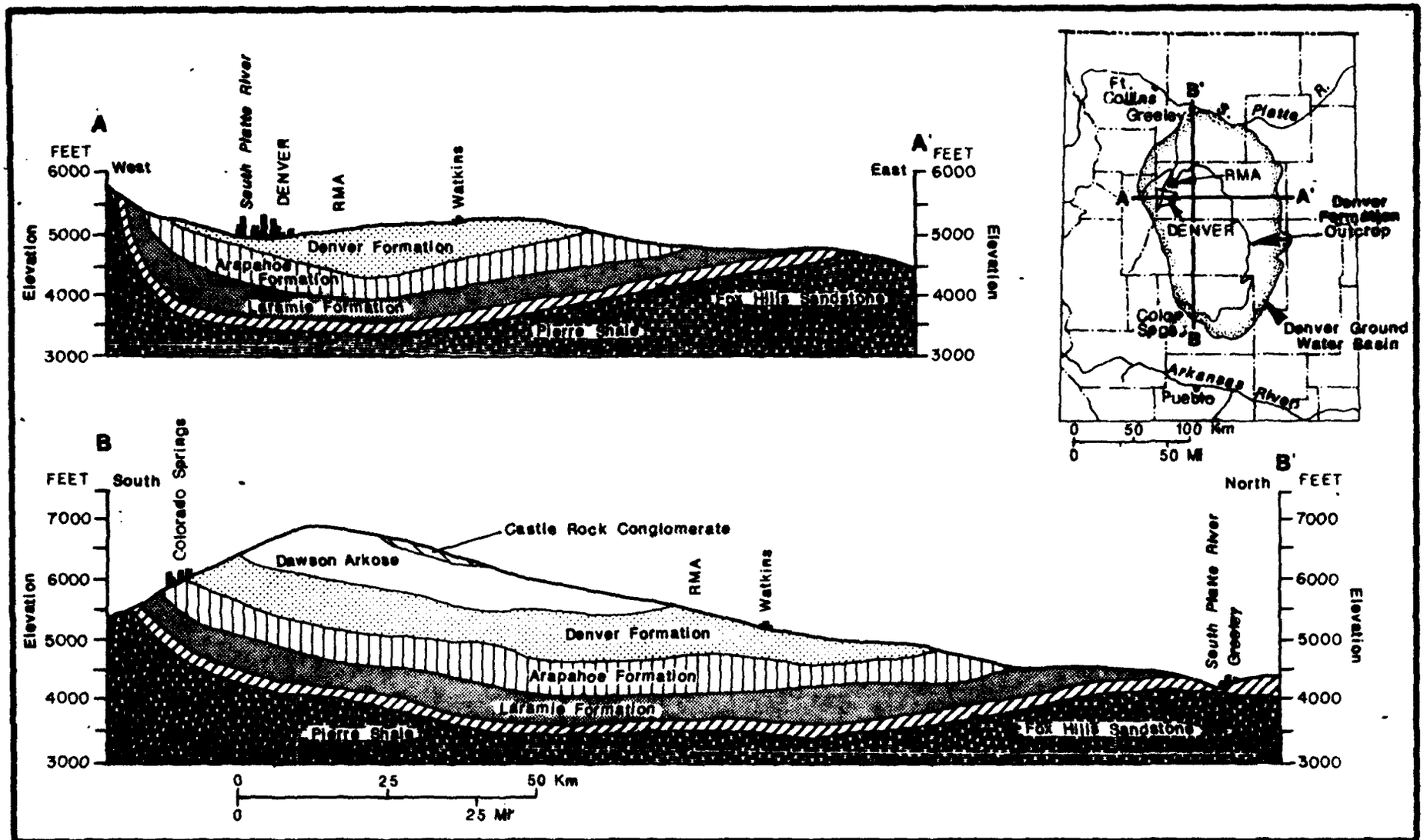
Prepared by:

R.L. Stollar & Associates, Inc.

Figure 1.1-1

Rocky Mountain Arsenal Location Map

CMP FY 88



Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

Aberdeen Proving Ground, Maryland

FIGURE 2.1–1
Upper Stratigraphic Sections of the Denver Basin

Source: Robson, 1981

ERA	PERIOD	EPOCH	AGE	FORMATION
Cenozoic	Quaternary	Holocene		Post Piney Creek
				Piney Creek
				Eolian
		Pleistocene	Wisconsin	Loess
				Broadway
				Louviers
			Illinoian	Slocum
			Kansan	Verdos

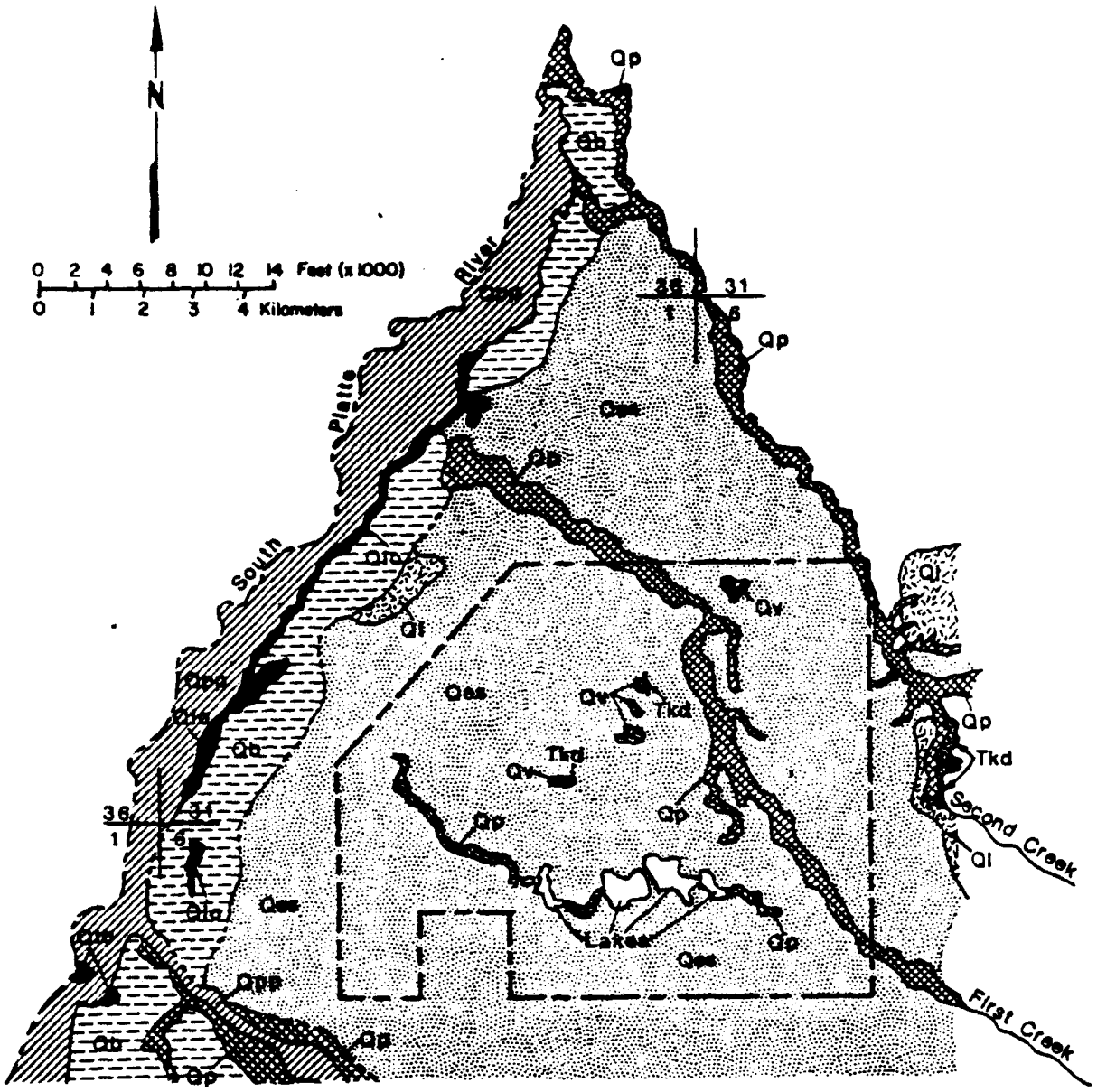
Not to Scale

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

Aberdeen Proving Ground, Maryland

FIGURE 2.1–2
Quaternary Columnar Section

Source: Modified from MKE (1988)



Explanation

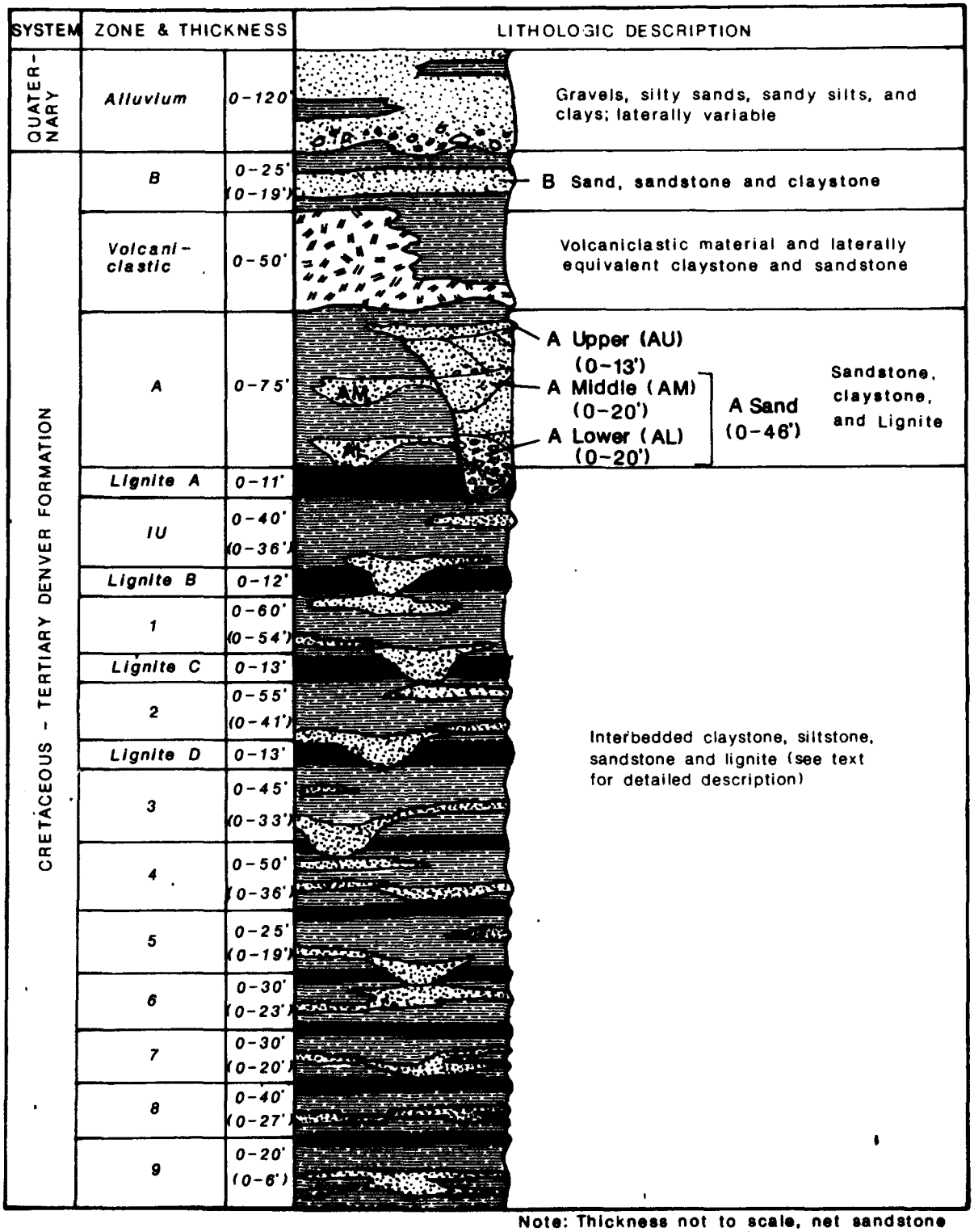
	Qpp	Post Piney Creek Alluvium (Quaternary)
	Qp	Piney Creek Alluvium (Quaternary)
	Qes	Eolian Sand (Quaternary)
	Ql	Loess (Quaternary)
	Qb	Broadway Alluvium (Quaternary)
	Qlo	Louviers Alluvium (Quaternary)
	Qv	Verdos Alluvium (Quaternary)
	Tkd	Denver Formation (Upper Cretaceous & Tertiary)

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

Aberdeen Proving Ground, Maryland

FIGURE 2.1–3
Geologic Map of Rocky Mountain Arsenal Area

Source: Lindvall (1980)



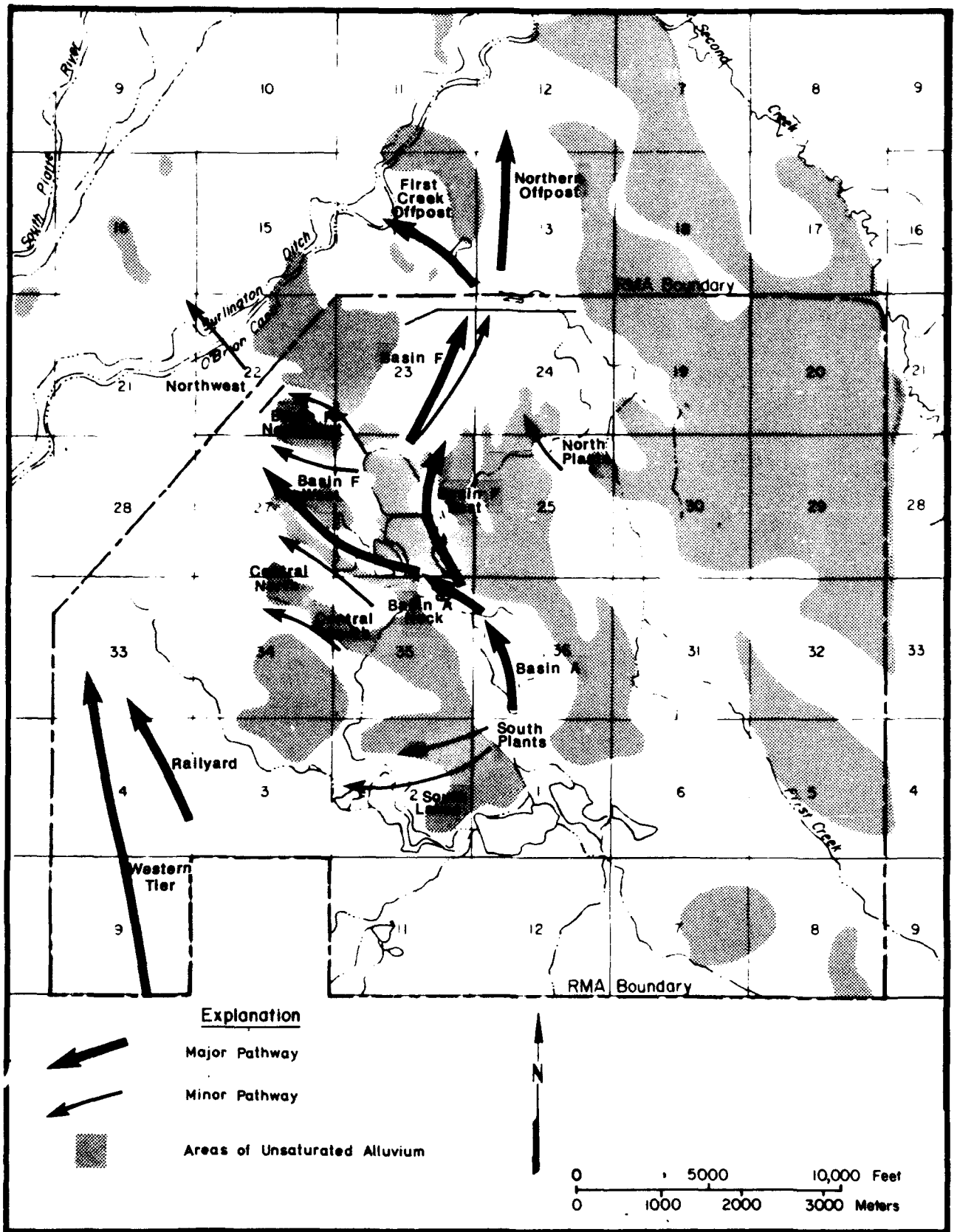
Note: Thickness not to scale, net sandstone thickness shown in parentheses.

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

Aberdeen Proving Ground, Maryland

FIGURE 2.1-4
RMA Denver Formation
Stratigraphic Column

Source: ESE, 1988



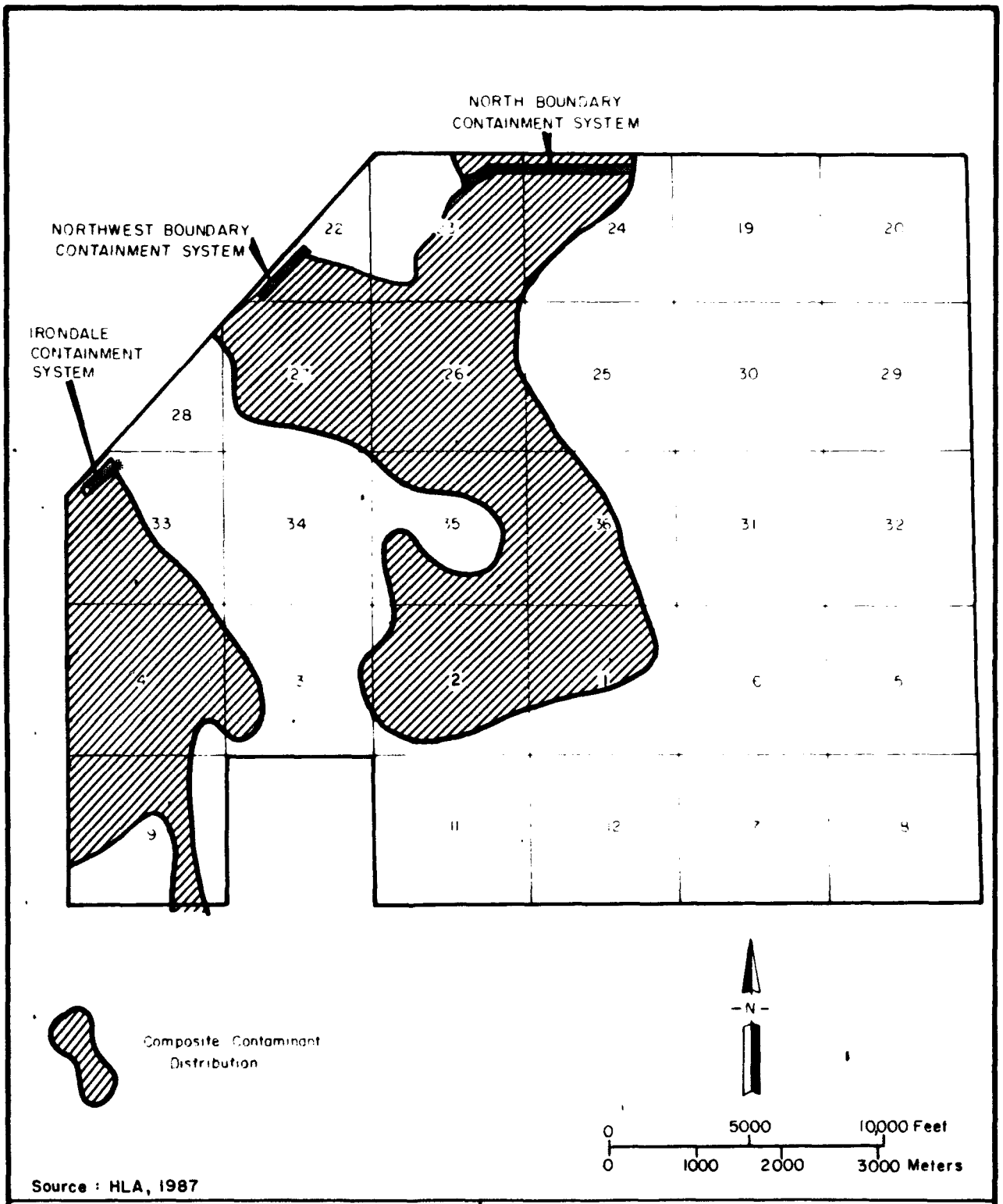
Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

Aberdeen Proving Ground, Maryland

FIGURE 2.2-1

RMA Contaminant Migration Pathways

Prepared by: R.L. Stollar & Associates, Inc.



Source : HLA, 1987

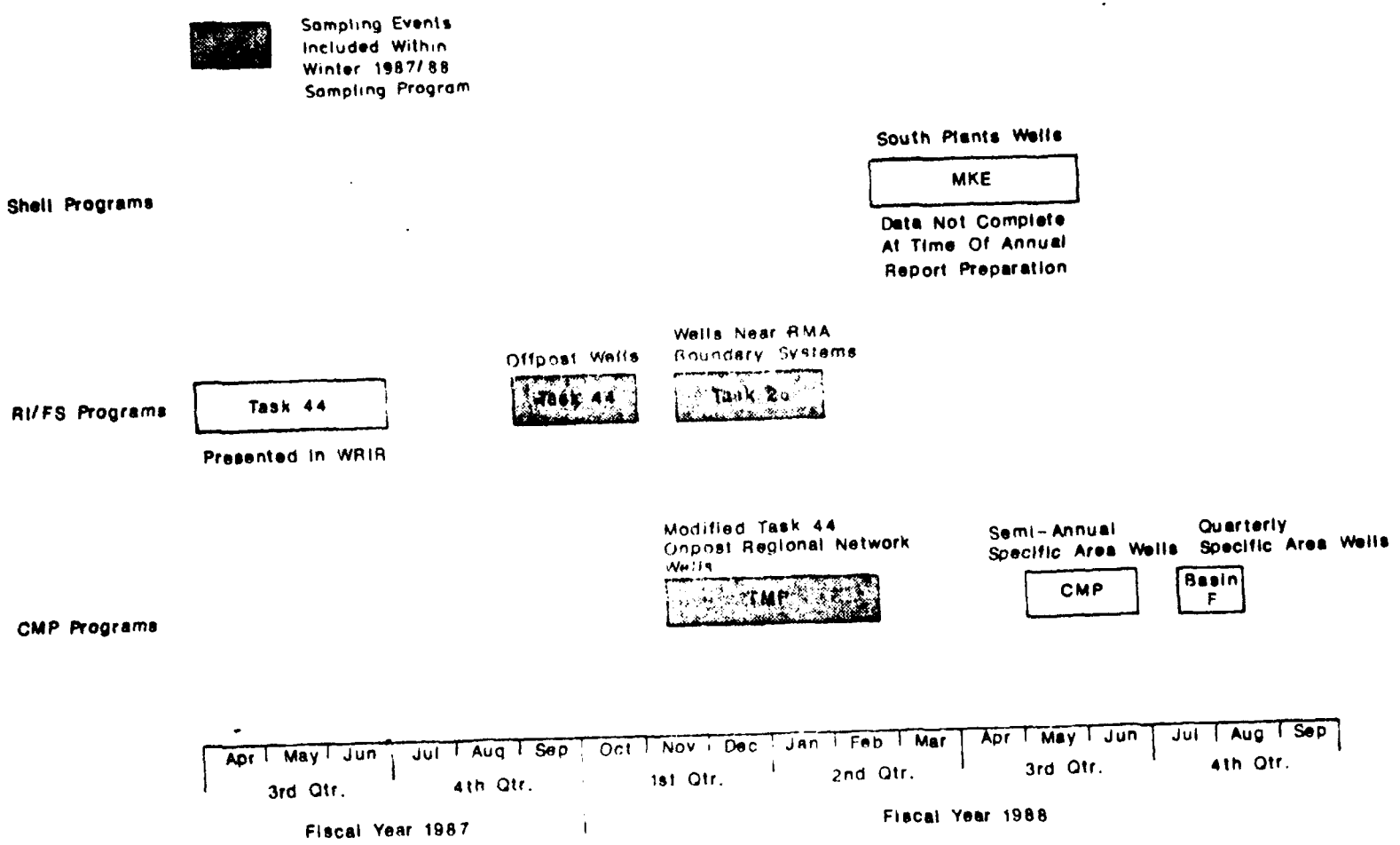
Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE 1.3-1

Generalized Contaminant Distribution Patterns in the Unconfined Ground-Water Flow System

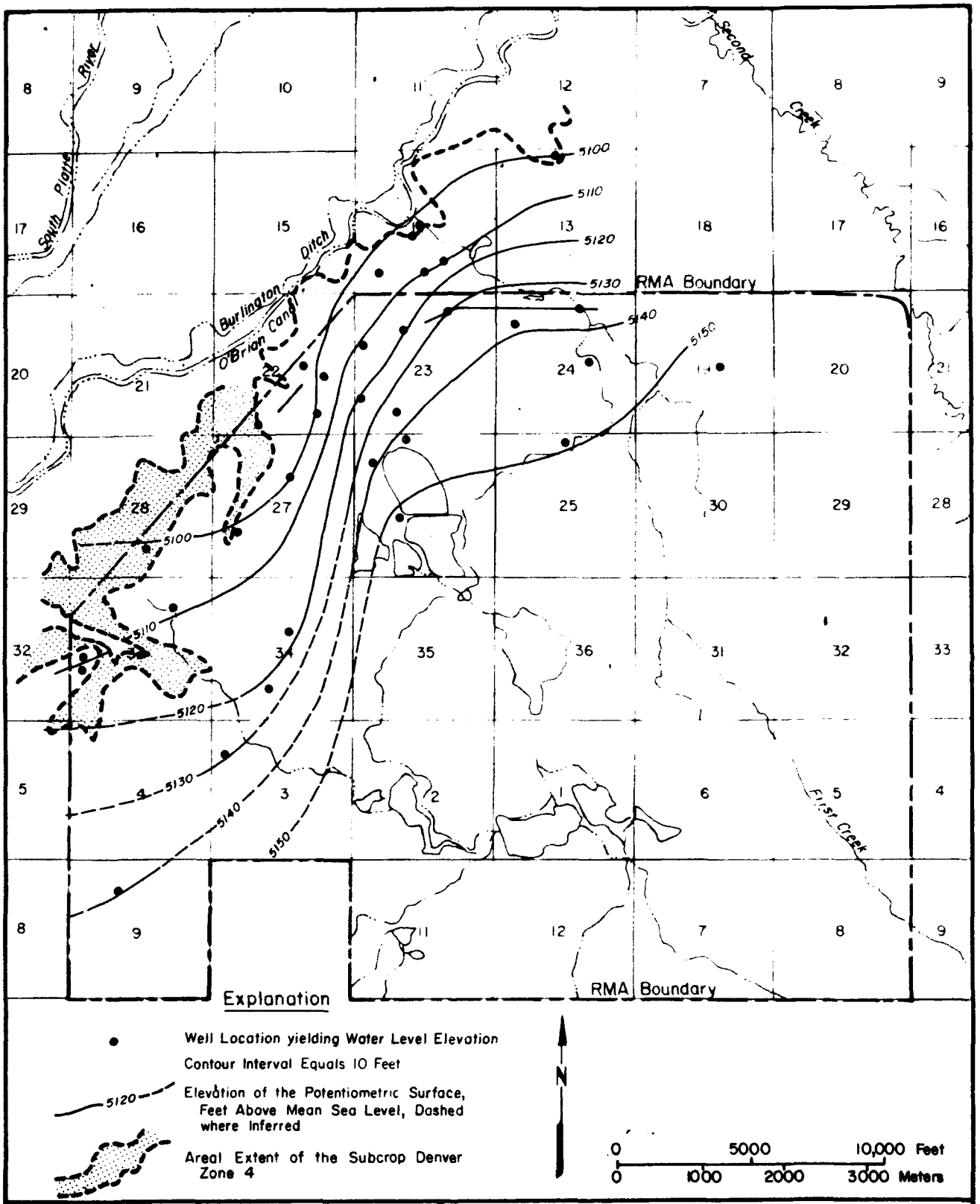
CMP Ground-Water Monitoring Annual Report
Prepared by: R.L. Stollar & Associates Inc.
Harding Lawson Associates



Prepared for:
U.S. Army Program Manager
For Rocky Mountain Arsenal

Figure 3.2-2

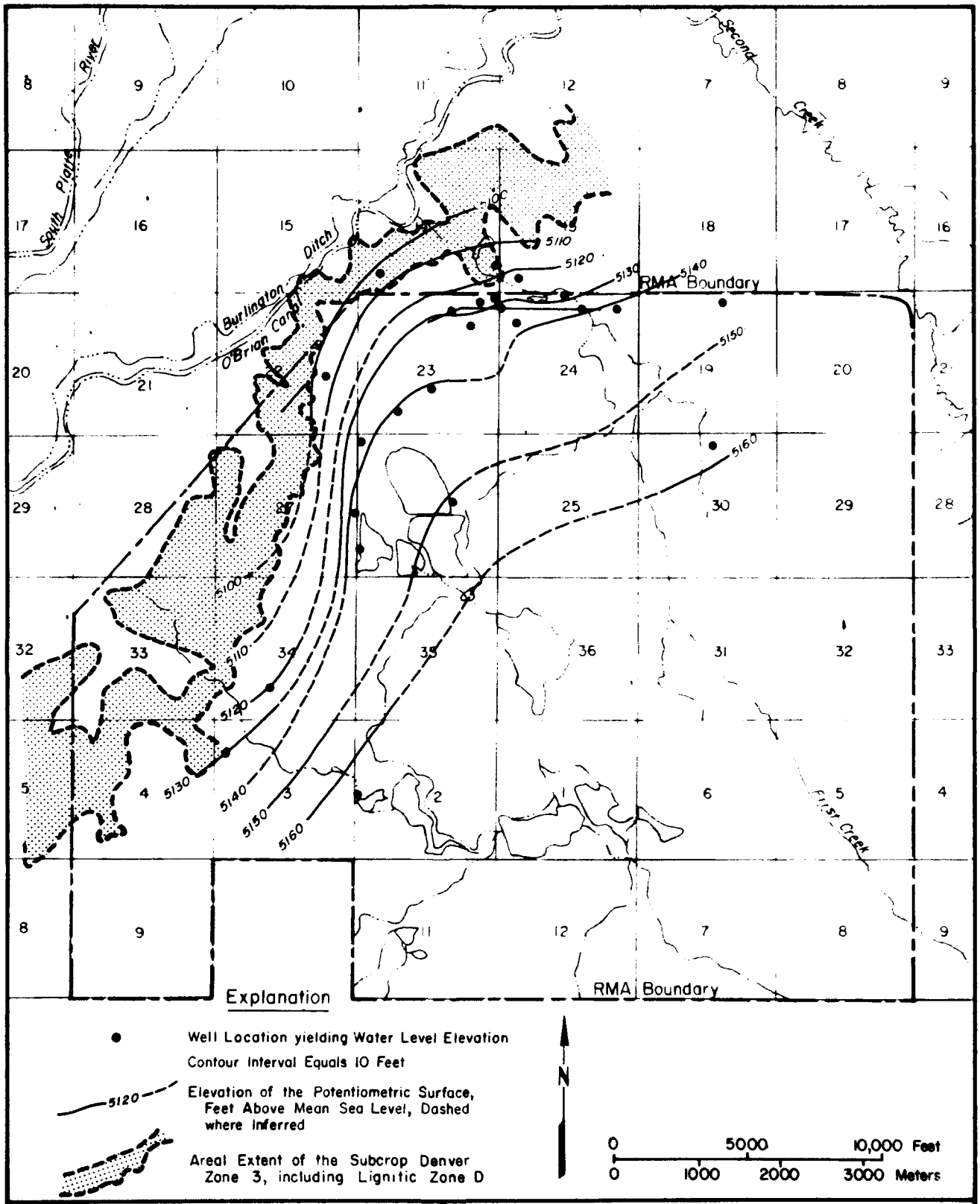
TEMPORAL RELATIONSHIPS BETWEEN VARIOUS SAMPLING EVENTS AT RMA



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE 4.2-1
Potentiometric Surface of Denver Fm
Zone 4, Winter 1987/88

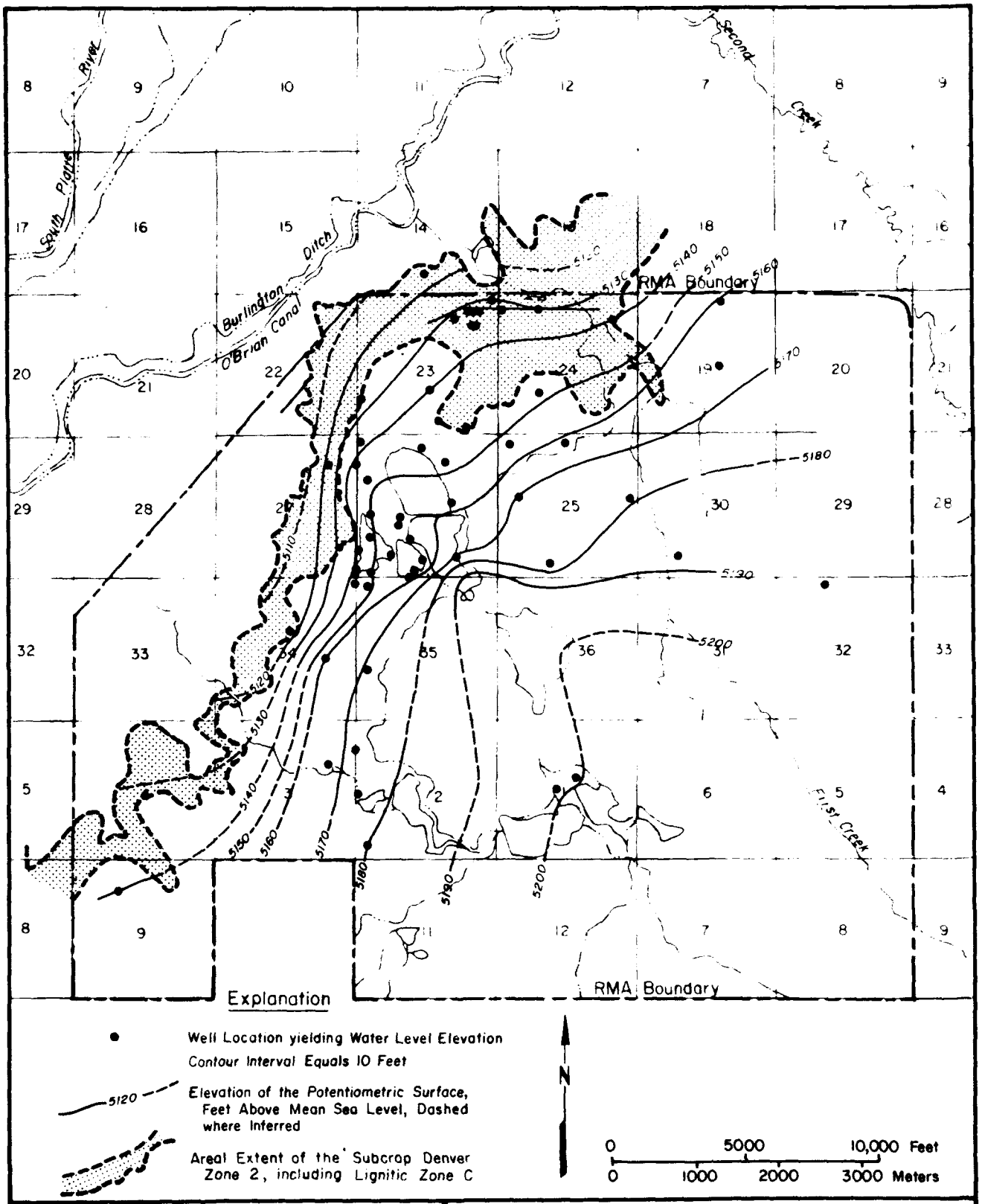
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE 4.2-2
Potentiometric Surface of Denver Fm
Zone 3, Winter 1987/88

Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



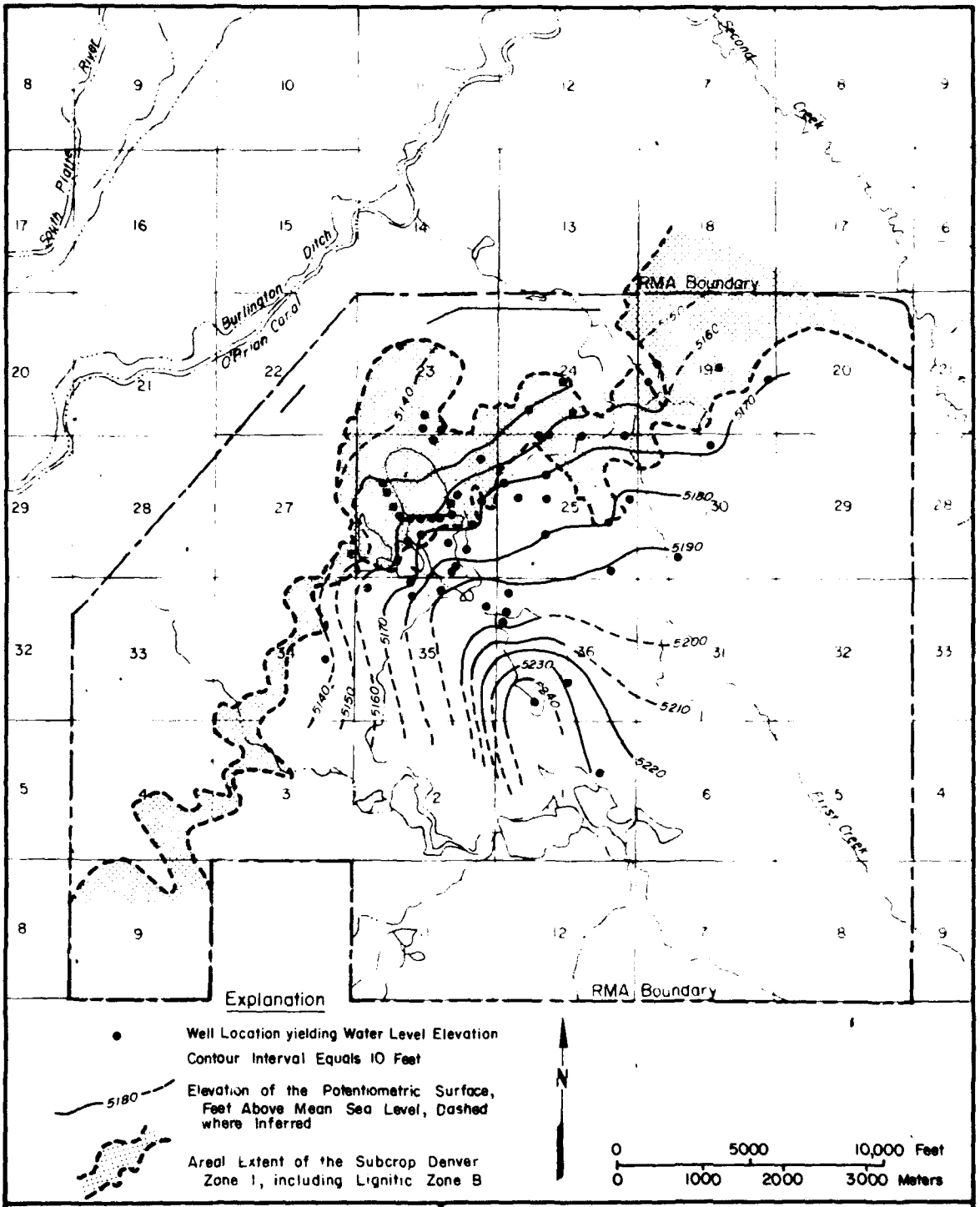
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE 4.2-3
Potentiometric Surface of Denver Fm
Zone 2, Winter 1987/88

Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates

Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

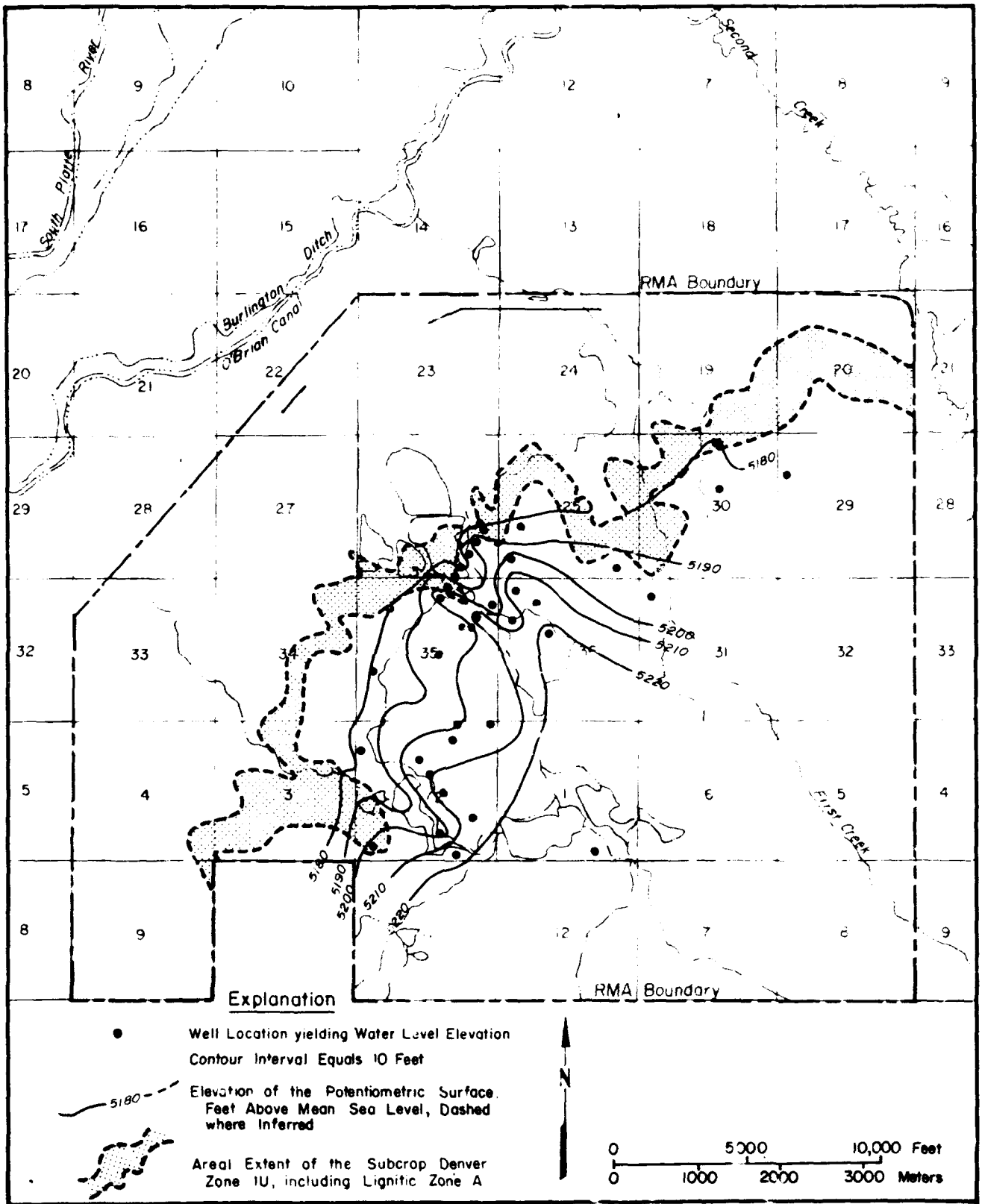
Chloride Detections
Denver Zone 3
Winter 1987/88
Prepared by: R.L. Stollar & Associates, Inc
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE 4.2-4
Potentiometric Surface of Denver Fm
Zone 1, Winter 1987/88

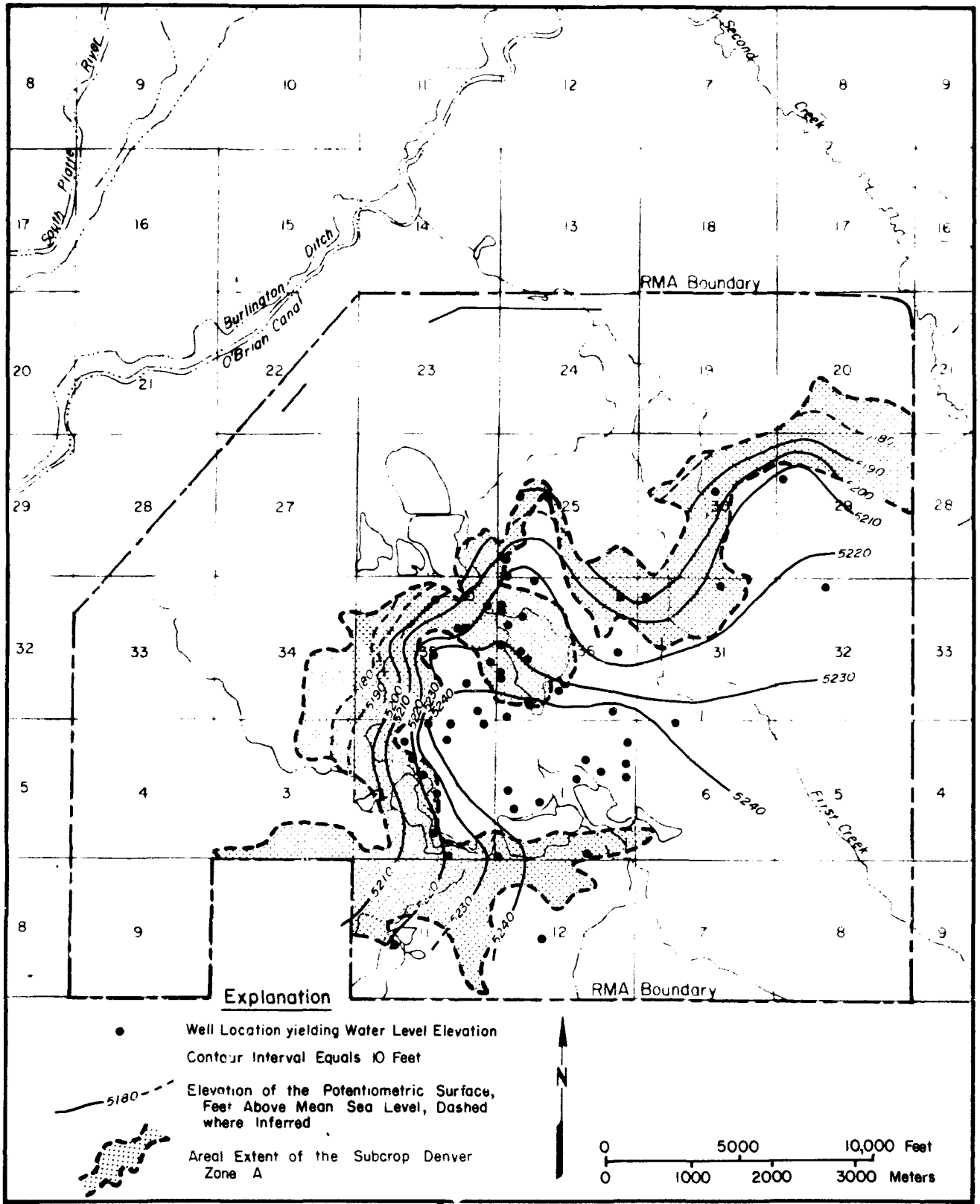
Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE 4.2-5
Potentiometric Surface of Denver Fm
Zone 1U, Winter 1987/88

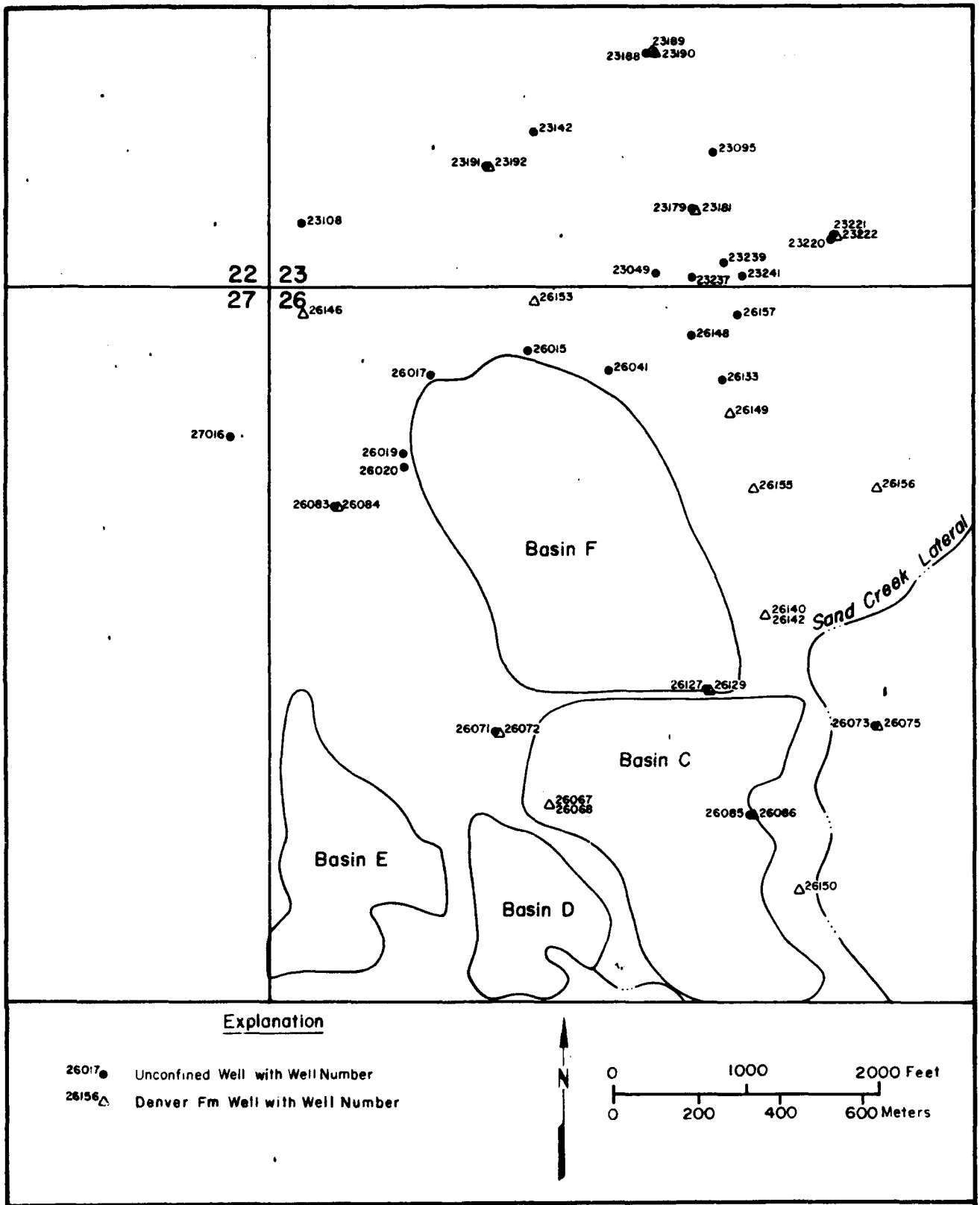
Prepared by: R L. Stollar & Associates, Inc.
Harding Lawson Associates



Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE 4.2-6
Potentiometric Surface of Denver Fm
Zone A, Winter 1987/88

Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates



Explanation

26017● Unconfined Well with Well Number

26156△ Denver Fm Well with Well Number

N

0 1000 2000 Feet

0 200 400 600 Meters

Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

FIGURE 4.3-5

Summer 1988 Well Sampling Network

Prepared by: R.L. Stollar & Associates, Inc.
Harding Lawson Associates

APPENDICES B AND C

APPENDIX B: HYDROLOGIC DATA COLLECTED DURING FY88

(on diskette - enclosed)

APPENDIX C: ANALYTICAL DATA COLLECTED DURING FY88

(on diskette - enclosed)

Appendixes B and C are archived in ASCII format, as ARHCIVE.ARC, on a 1.2 Mbyte diskette. The files are accessed through PKXARC by typing PKXARC and following the instructions.

Appendix B consists of the following files:

> COMALLGW.DAT and COMDENGW.DAT, which contain the FY88 ground-water data for the unconfined and Denver wells respectively. The ground-water data is formatted as follows: well, east, north, well elevation, winter 1987/88 ground-water elevation, spring 1988 ground-water elevation, summer 1988 ground-water elevation, aquifer and sand unit. The elevations are in feet, and east and north are in UTM coordinates.

Appendix C consists of the following files:

> W87_88.DAT, CMPSP.DAT, CMPSU.DAT, and W87ANLYT.DAT. The first three files contain the chemical data for winter 1987/88, spring 1988 and summer 1988 respectively. The fourth file contains chemical data for atrazine, parathion, malathion, and supona for winter 1987/88. The chemistry data is formatted as follows: well, analyte, boolean, concentration (μg/l), aquifer and sand unit.