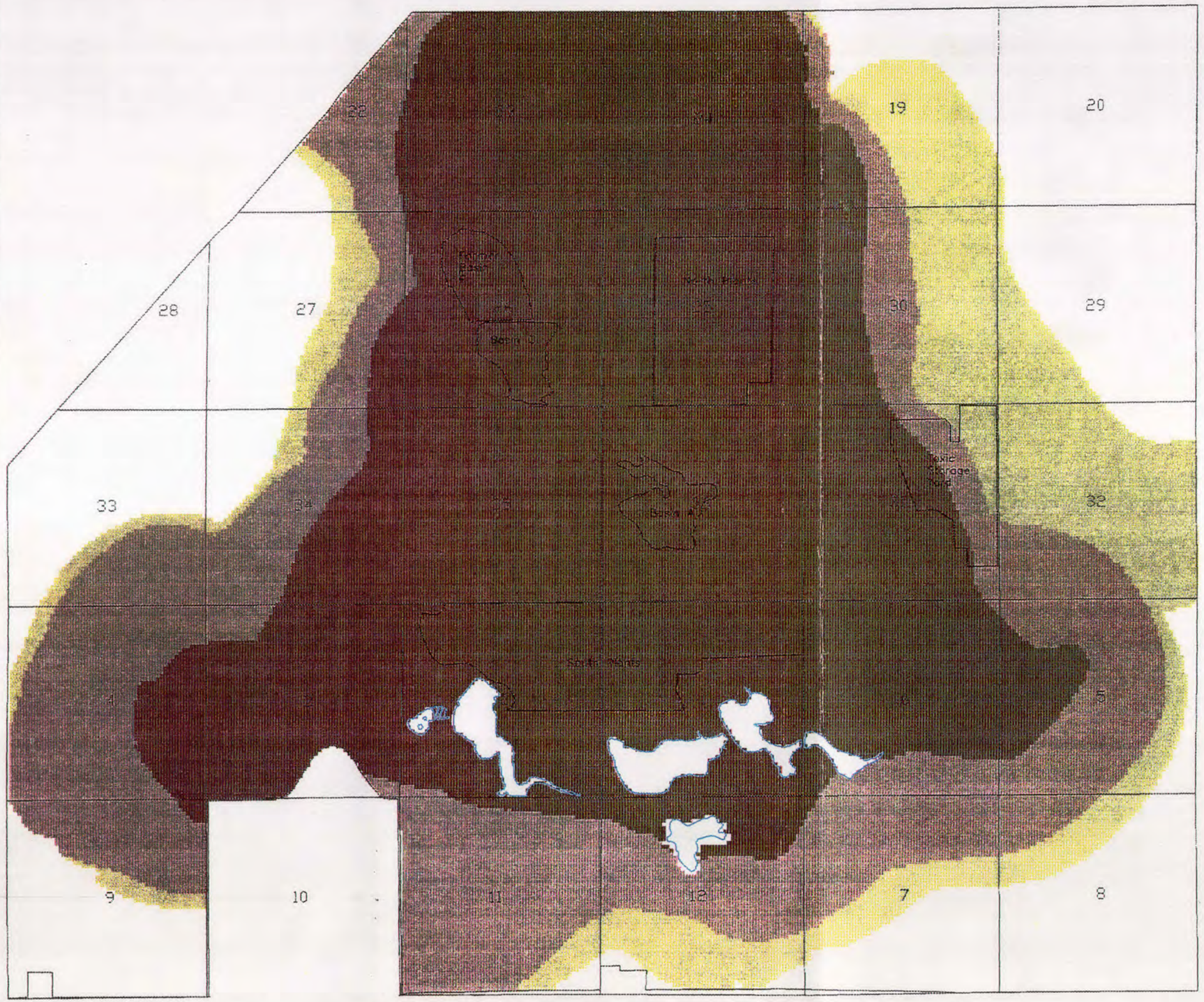


Legend

- EPA Approach
- Shell and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HI > 1 in the areas indicated

Lake

31 Section Number

Section Line

-N-

0 2000 4000

Scale in Feet

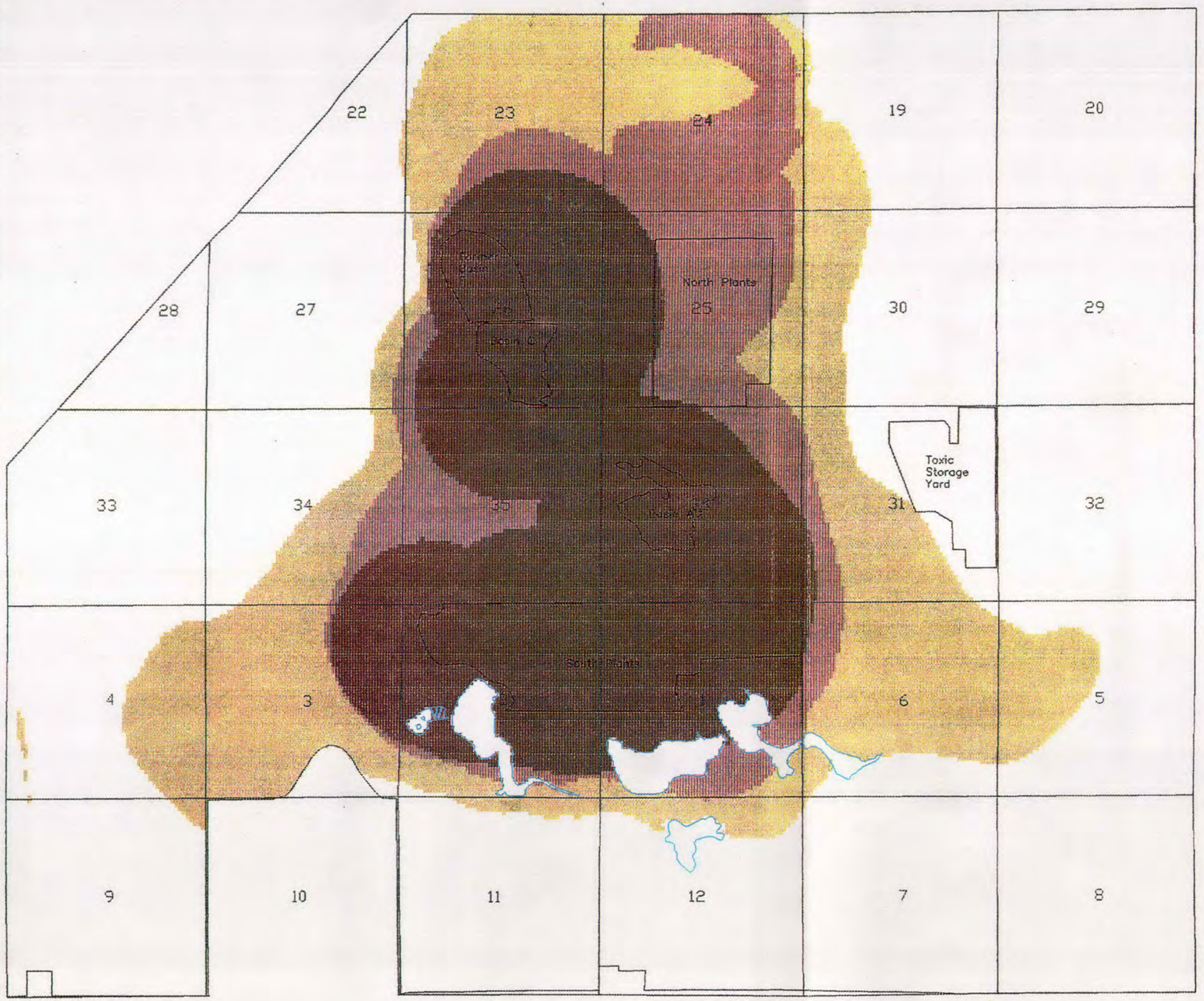
Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3-93

Great Horned Owl Map (HI>1) for Aldrin/Dieldrin, DDT/DDE, and Endrin Combined Based on the Army, Shell, and EPA Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Shell and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HI > 10 in the areas indicated

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:

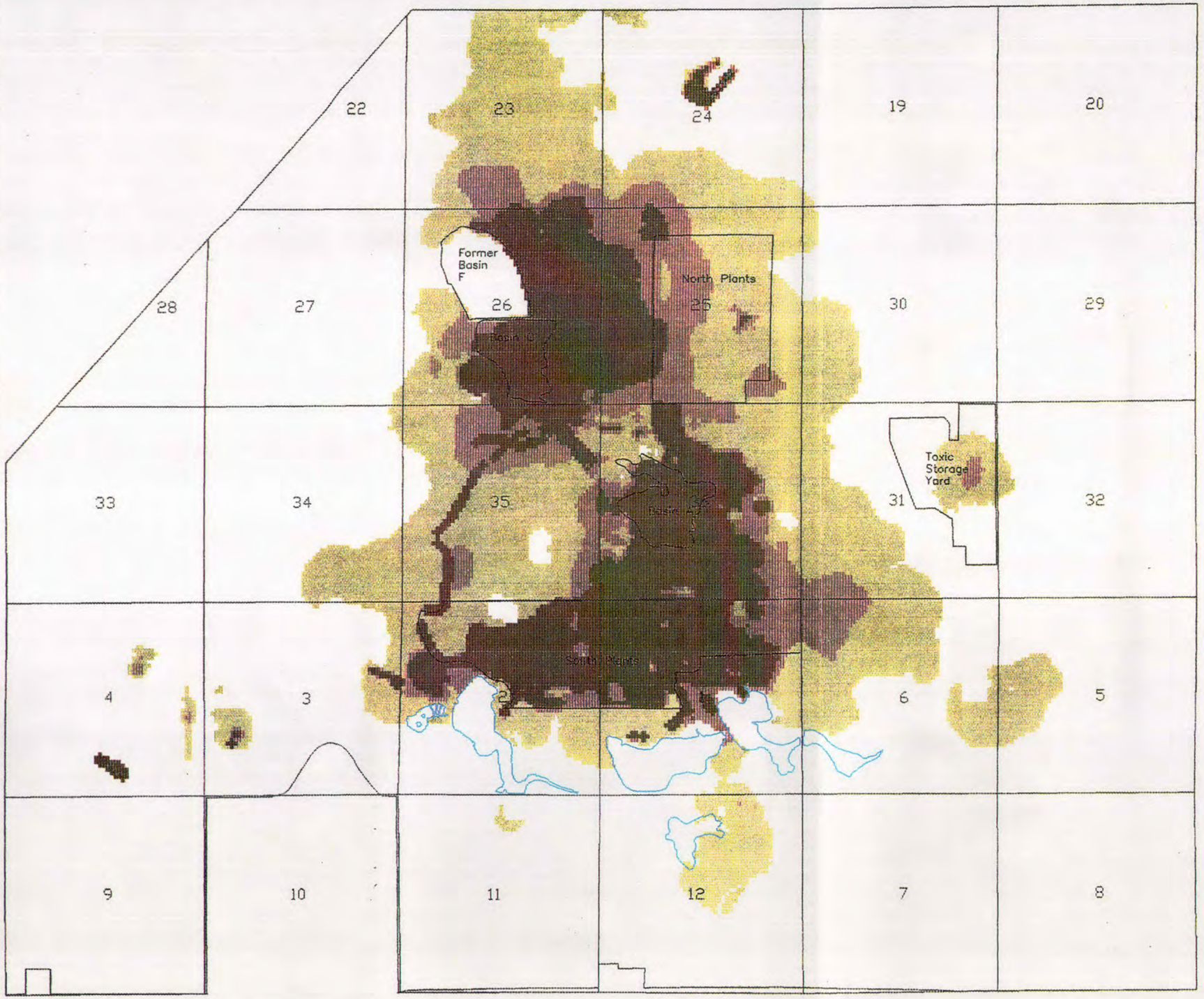
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3–94

Great Horned Owl Map (HI>10) for Aldrin/Dieldrin DDT/DDE, and Endrin Combined Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Shell and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HI > 1 in the areas indicated

- Lake
- 31 Section Number
- Section Line

-N-

0 2000 4000

Scale in Feet

Prepared for:

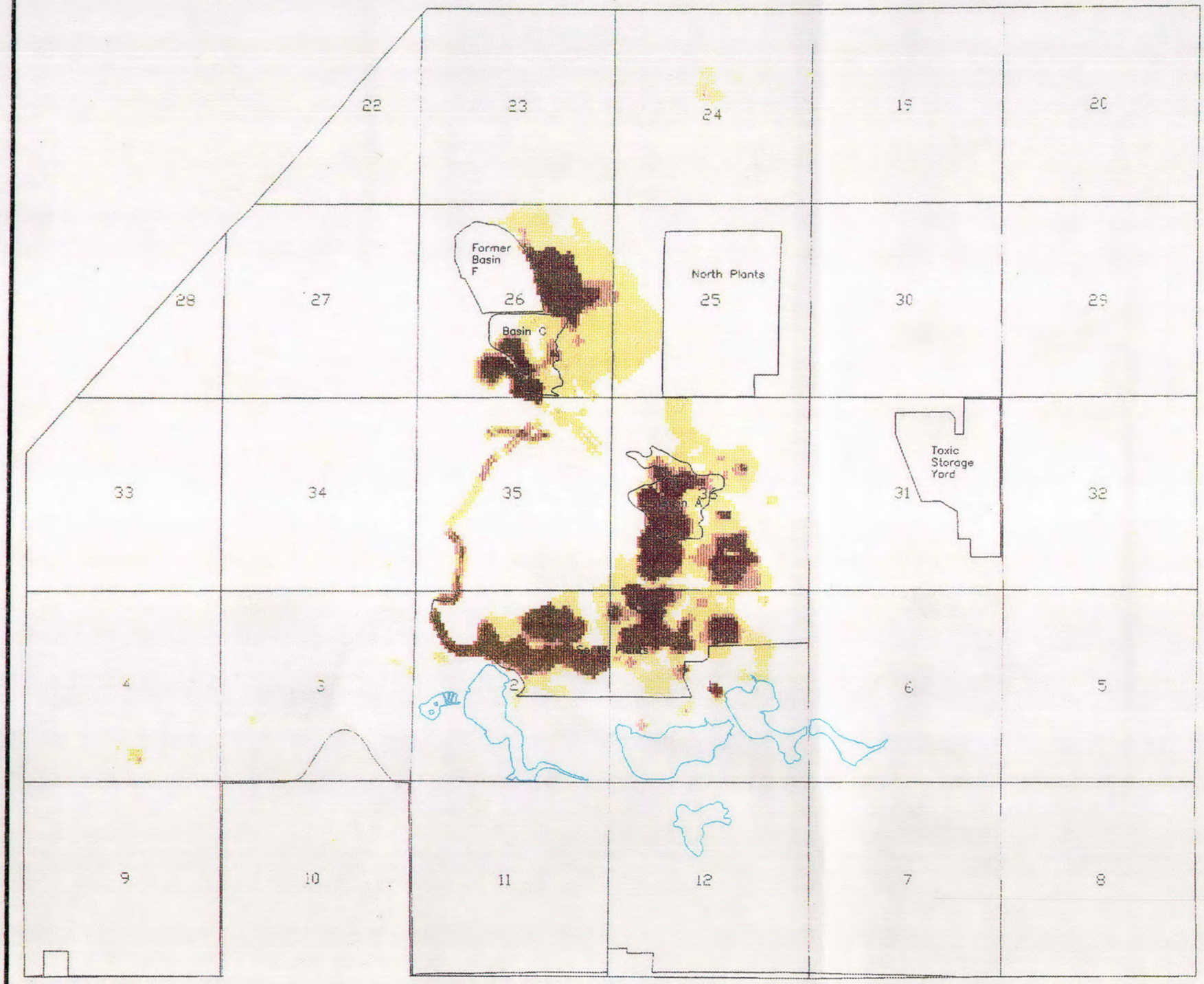
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3-95

Small Mammal Map (HI>1) for Aldrin/Dieldrin, DDT/DDE, and Endrin Combined Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Shell and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HI > 10 in the areas indicated

- Lake
- 31 Section Number
- Section Line

N

0 2000 4000

Scale in Feet

Prepared for:

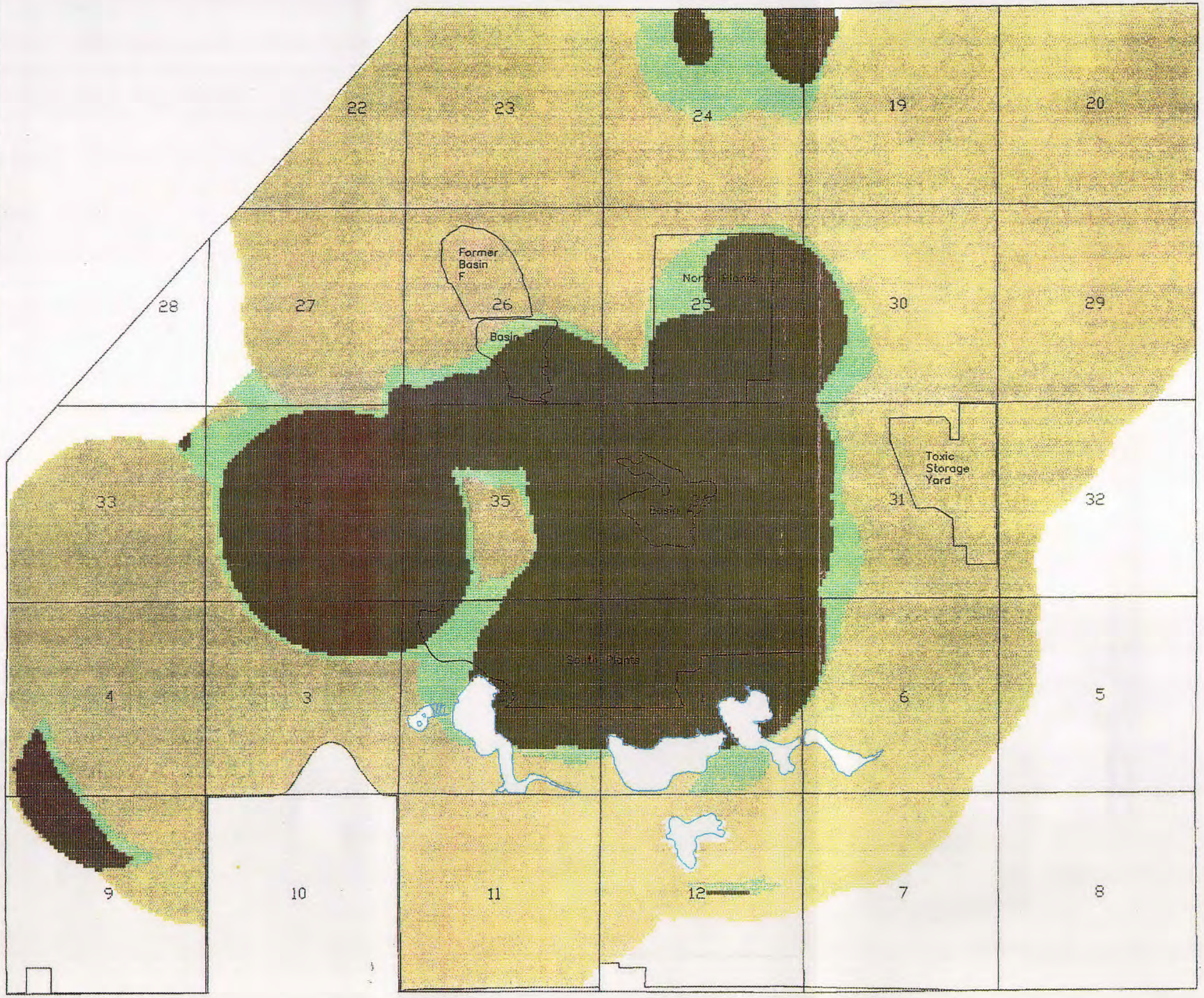
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3-96

Small Mammal Map (HI>10) for Aldrin/Dieldrin, DDT/DDE, and Endrin Combined Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Army and EPA Approaches
- Army and Shell and EPA Appproaches

Colors show which approaches result in HI > 1 in the areas indicated

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:

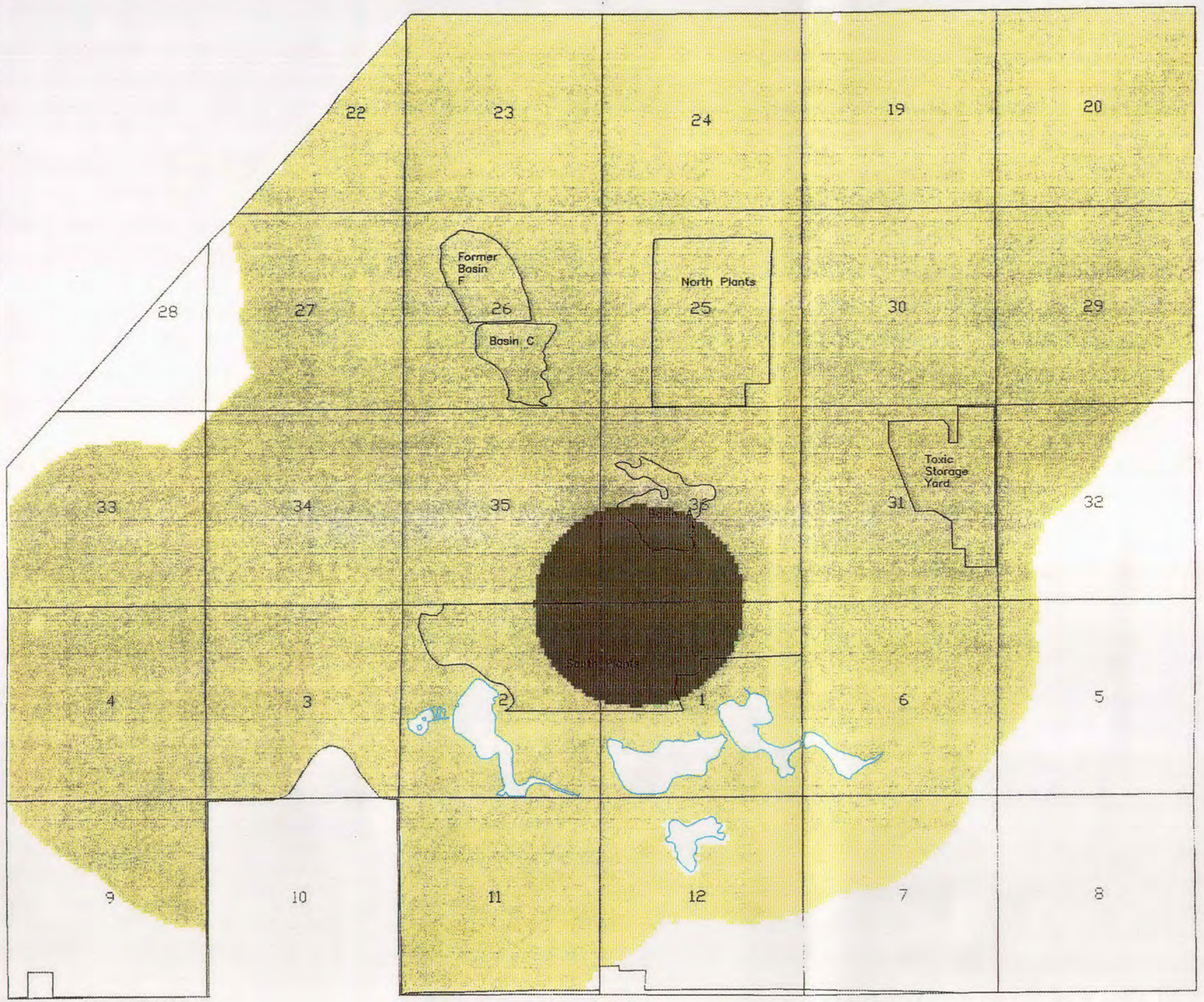
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3-97

Great Horned Owl Map (HI>1) for Mercury, Copper, Cadmium, and Arsenic Combined Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Army and EPA Approaches
- Army and Shell and EPA Appproaches

Colors show which approaches result in HI > 10 in the areas indicated

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:

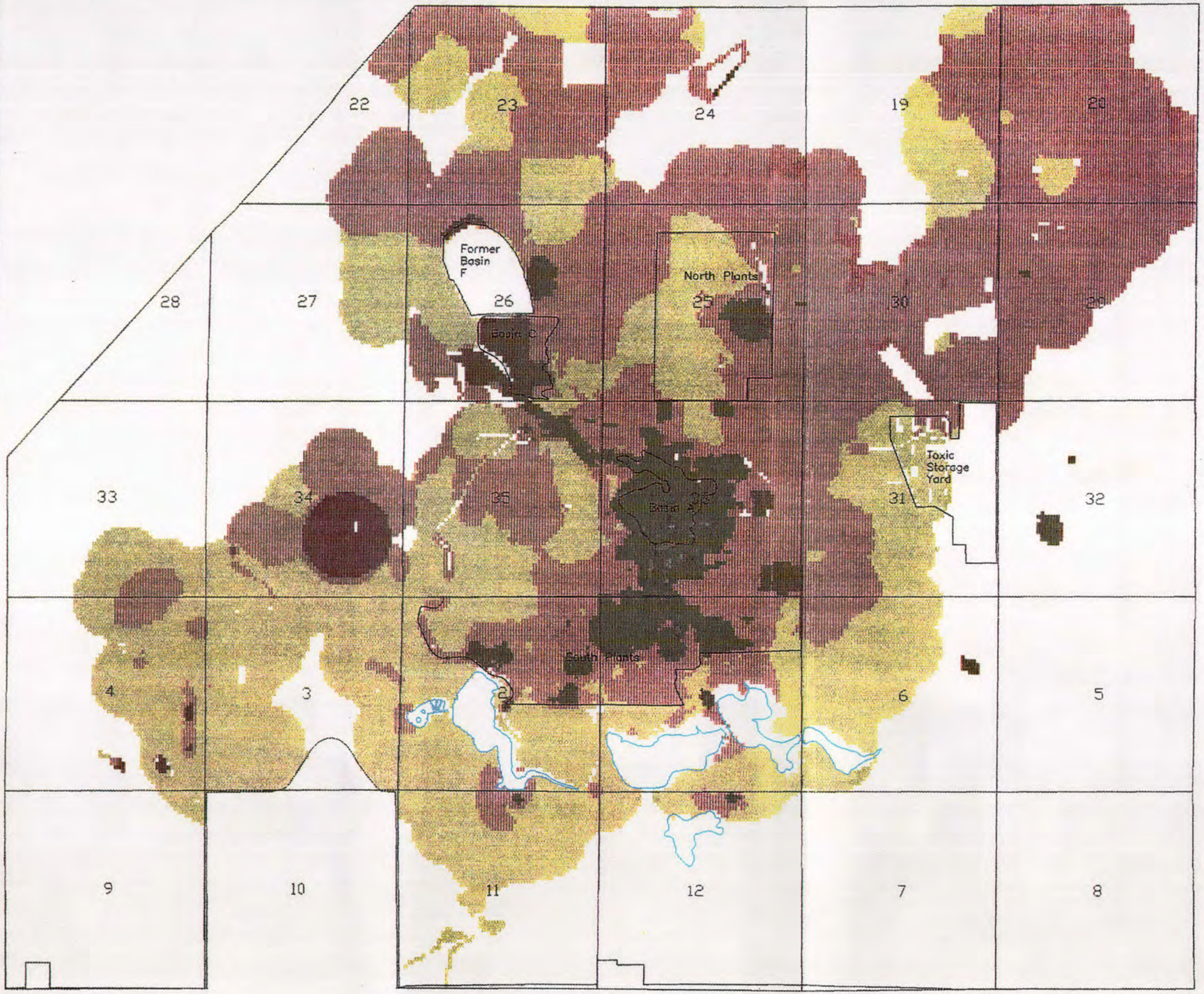
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3–98

Great Horned Owl Map (HI>10) for Mercury, Copper, Cadmium, and Arsenic Combined Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Shell and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HI > 1 in the areas indicated

- Lake
- 31 Section Number
- Section Line

N

0 2000 4000

Scale in Feet

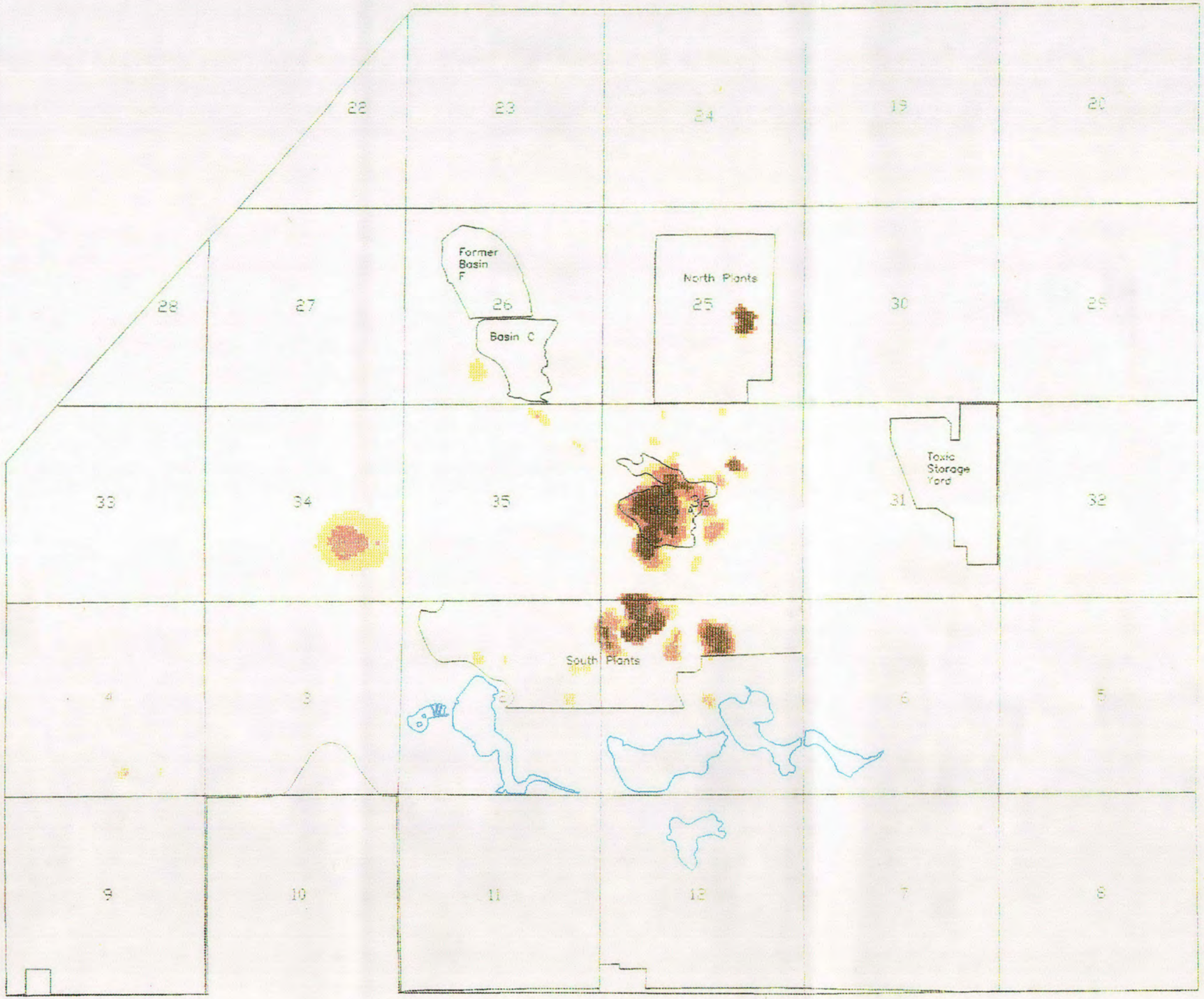
Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3–99

Small Mammal Map (HI>1) for Mercury, Copper, Cadmium, and Arsenic Combined Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Shell and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HI > 10 in the areas indicated

- Lake
- 31 Section Number
- Section Line

N

0 2000 4000

Scale in Feet

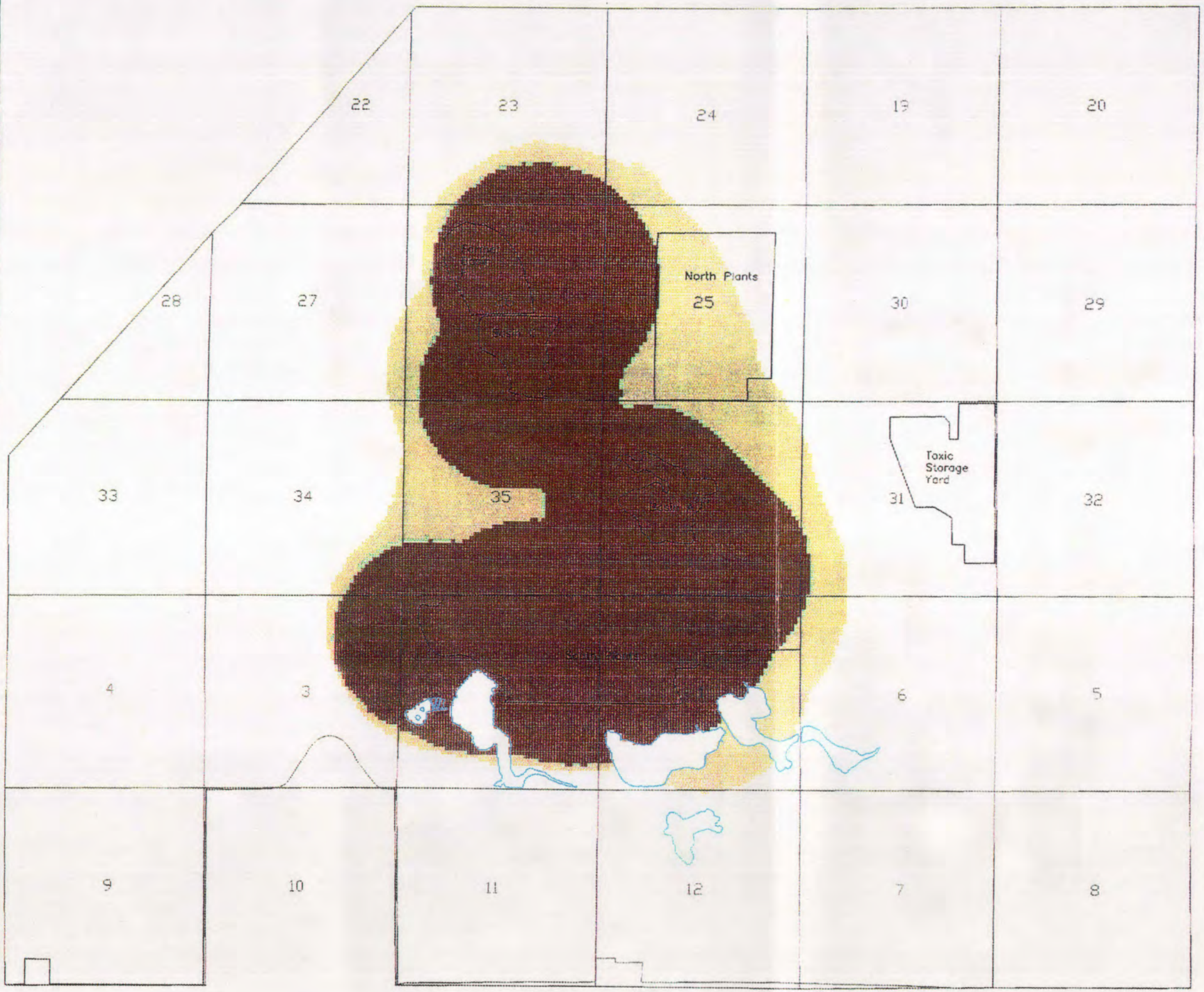
Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3–100

Small Mammal Map (HI>10) for Mercury, Copper, Cadmium, and Arsenic Combined Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Army and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HQ > 10 in the areas indicated

Lake

31 Section Number

Section Line

N

0 2000 4000

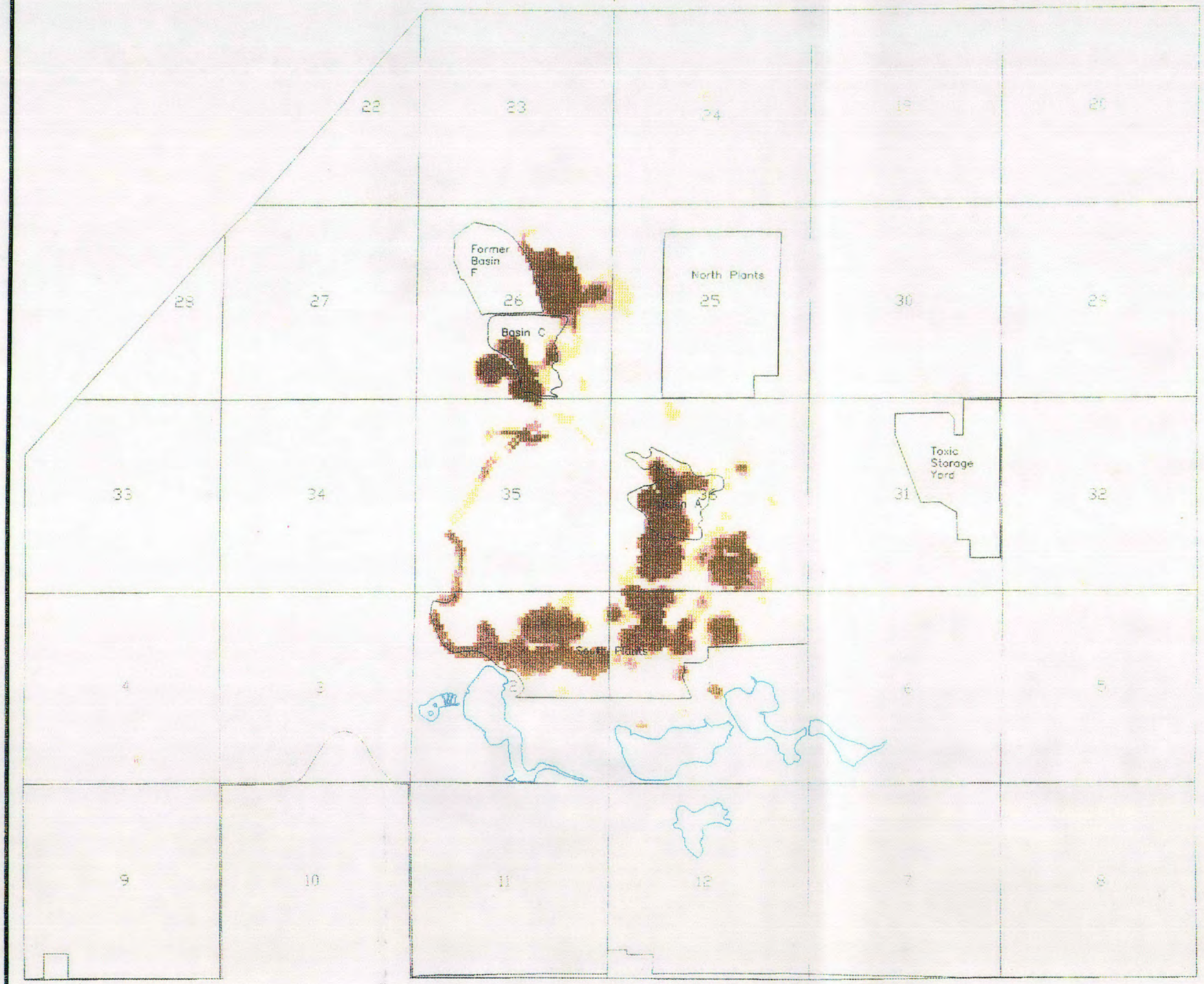
Scale in Feet

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

February 1994

Figure C.3–101

Aldrin/Dieldrin Hazard Quotient Map (HQ>10) for the Great Horned Owl Trophic Box Based on the Army, EPA, and Shell Approaches
Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Shell and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HQ > 10 in the areas indicated

- Lake
- 31 Section Number
- Section Line

N

0 2000 4000

Scale in Feet

Prepared for:

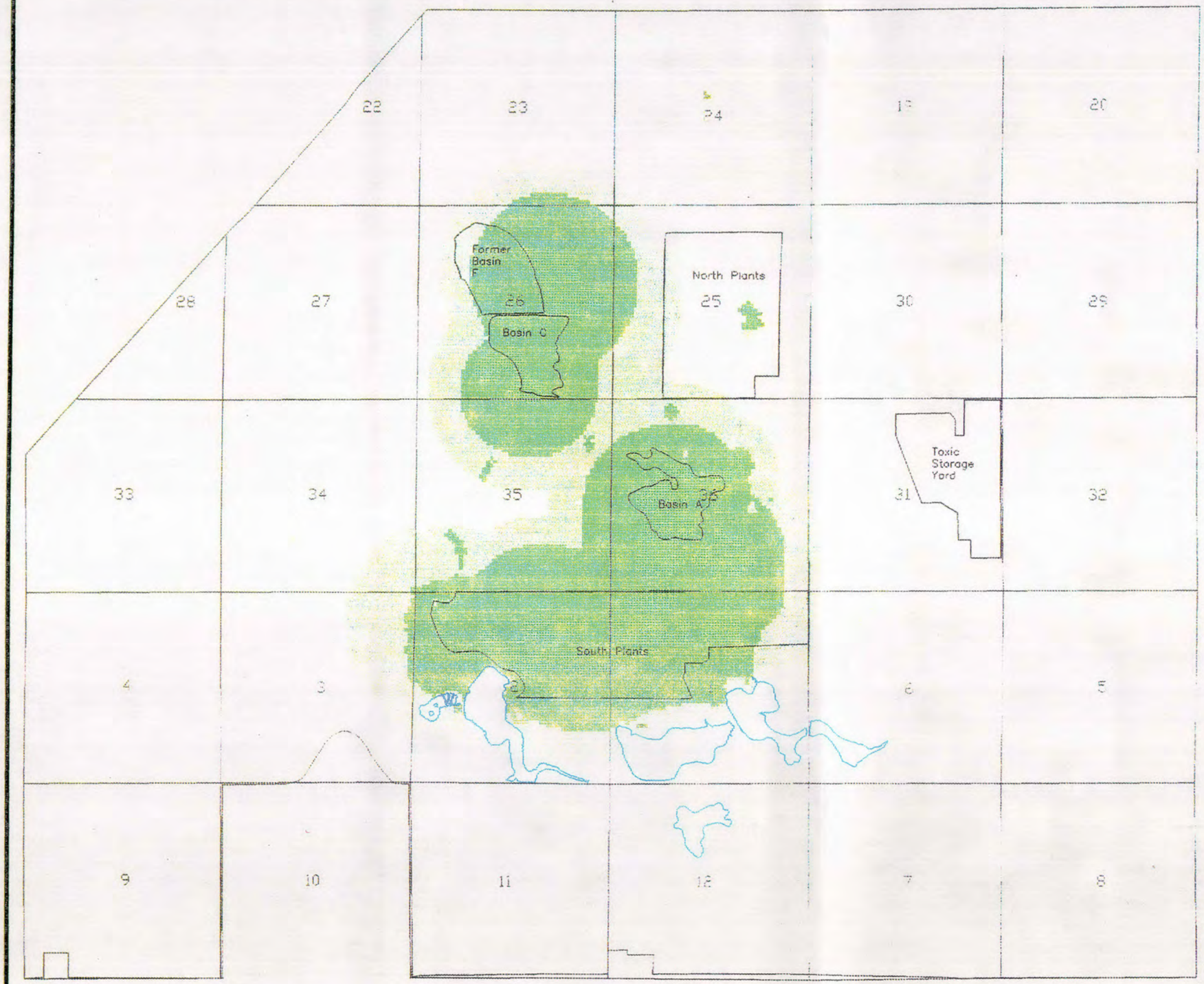
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3–102

Aldrin/Dieldrin Hazard Quotient Map (HQ>10) for the Medium Mammal Trophic Box Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

1 trophic box with HI > 1

2-4 trophic boxes with HI > 1

5-7 trophic boxes with HI > 1

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:

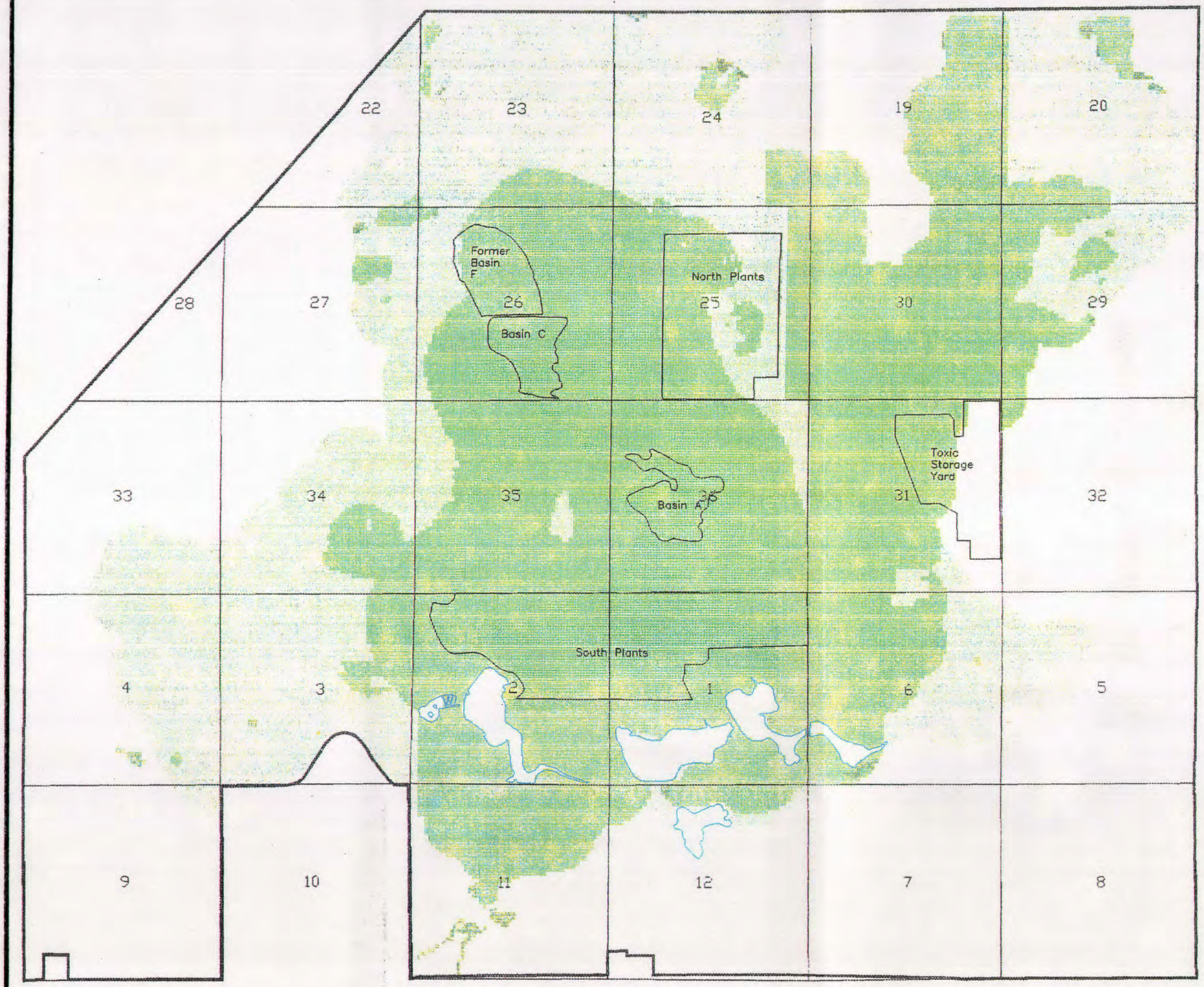
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3-103

Number of Trophic Boxes with Soil Hazard Indices Greater than 10 for All COCs Combined Based on the Army Approach

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

1 trophic box with HI > 10

2-4 trophic boxes with HI > 10

5-7 trophic boxes with HI > 10

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:

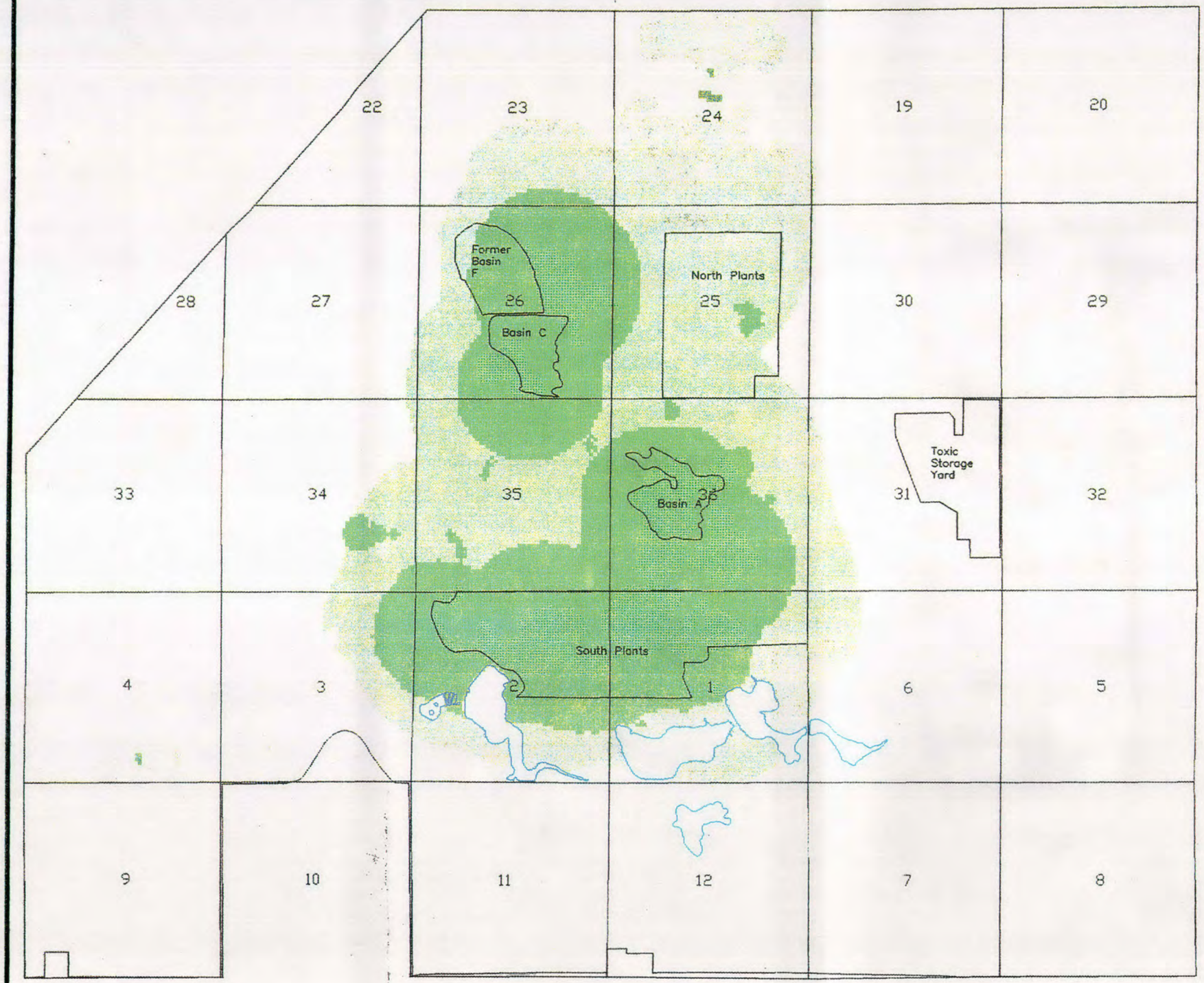
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3-104

Number of Trophic Boxes with Soil Hazard Indices Greater than 10 for All COCs Combined Based on the EPA Approach

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- 1 trophic box with HI > 10
- 2-4 trophic boxes with HI > 10
- 5-7 trophic boxes with HI > 10
- Lake
- 31 Section Number
- Section Line

N

0 2000 4000

Scale in Feet

Prepared for:

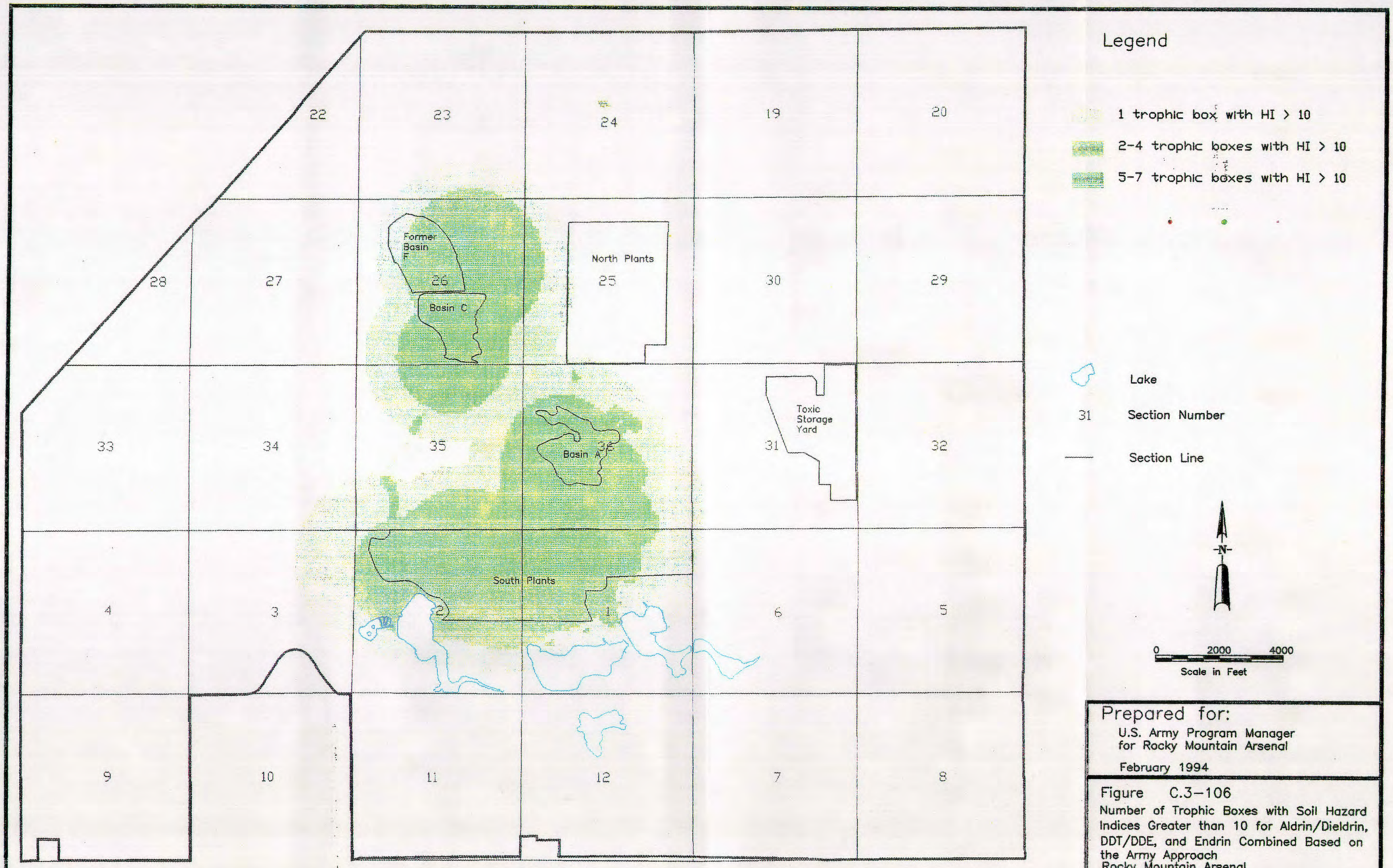
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3-105

Number of Trophic Boxes with Soil Hazard Indices Greater than 10 for All COCs Combined Based on the Shell Approach

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



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

February 1994

Figure C.3–106
Number of Trophic Boxes with Soil Hazard Indices Greater than 10 for Aldrin/Dieldrin, DDT/DDE, and Endrin Combined Based on the Army Approach
Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp

Legend

- 1 trophic box with HI > 10
- 2-4 trophic boxes with HI > 10
- 5-7 trophic boxes with HI > 10
- Lake
- 31 Section Number
- Section Line

N

0 2000 4000

Scale in Feet

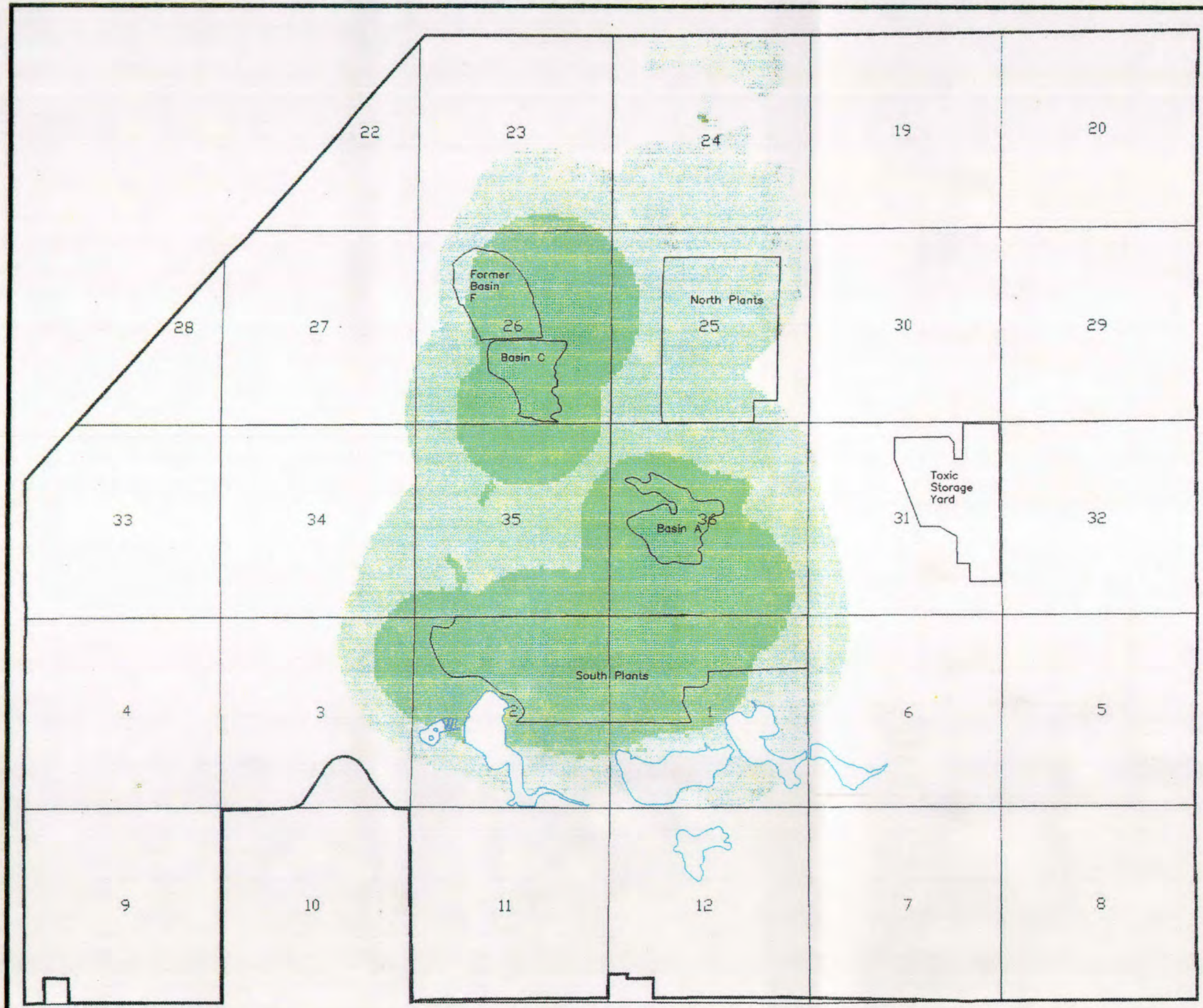
Prepared for:

U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3–107

Number of Trophic Boxes with Soil Hazard Indices Greater than 10 for Aldrin/Dieldrin, DDT/DDE, and Endrin Combined Based on the EPA Approach
Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- 1 trophic box with HI > 10
- 2-4 trophic boxes with HI > 10
- 5-7 trophic boxes with HI > 10
- Lake
- 31 Section Number
- Section Line

N

0 2000 4000

Scale in Feet

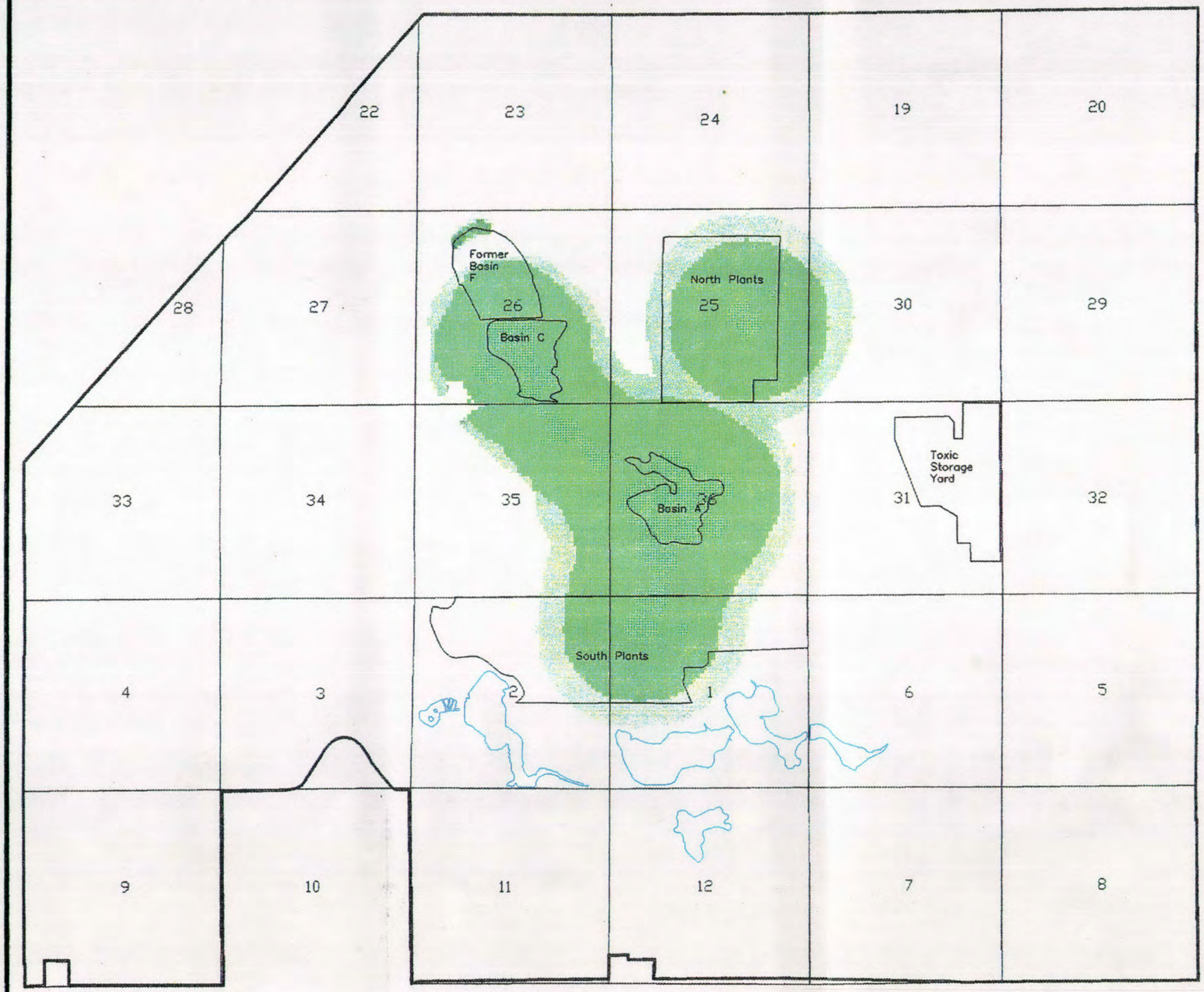
Prepared for:

U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3-108

Number of Trophic Boxes with Soil Hazard Indices Greater than 10 for Aldrin/Dieldrin, DDT/DDE, and Endrin Combined Based on the Shell Approach
Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- 1 trophic box with HI > 10
- 2-4 trophic boxes with HI > 10
- 5-7 trophic boxes with HI > 10
- Lake
- 31 Section Number
- Section Line

N

0 2000 4000

Scale in Feet

Prepared for:

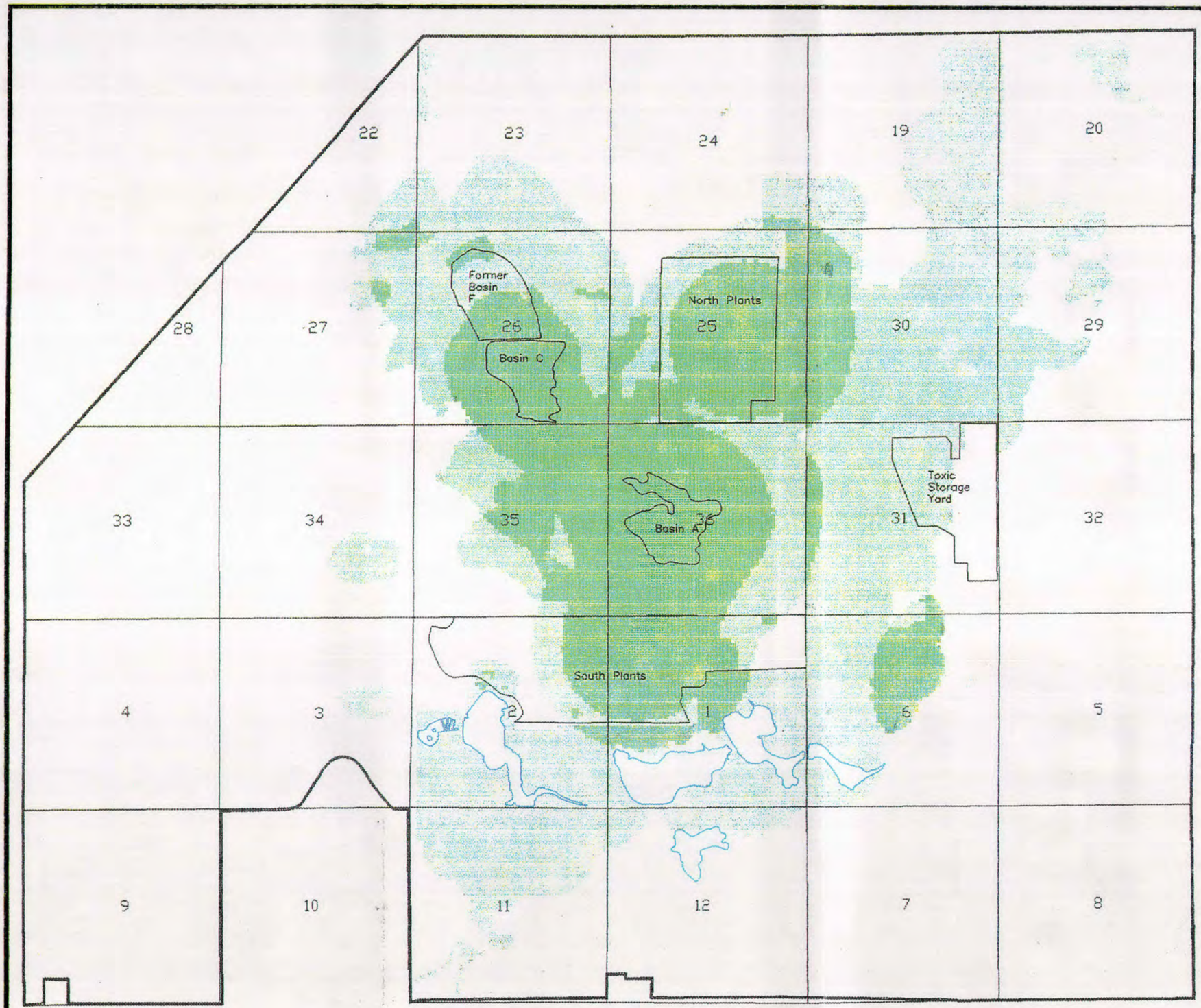
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3-109

Number of Trophic Boxes with Soil Hazard Indices Greater than 10 for Arsenic, Mercury, Cadmium, and Copper Concentrations Above Indicator Levels Based on the Army Approach

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- 1 trophic box with HI > 10
- 2-4 trophic boxes with HI > 10
- 5-7 trophic boxes with HI > 10
- Lake
- 31 Section Number
- Section Line

N

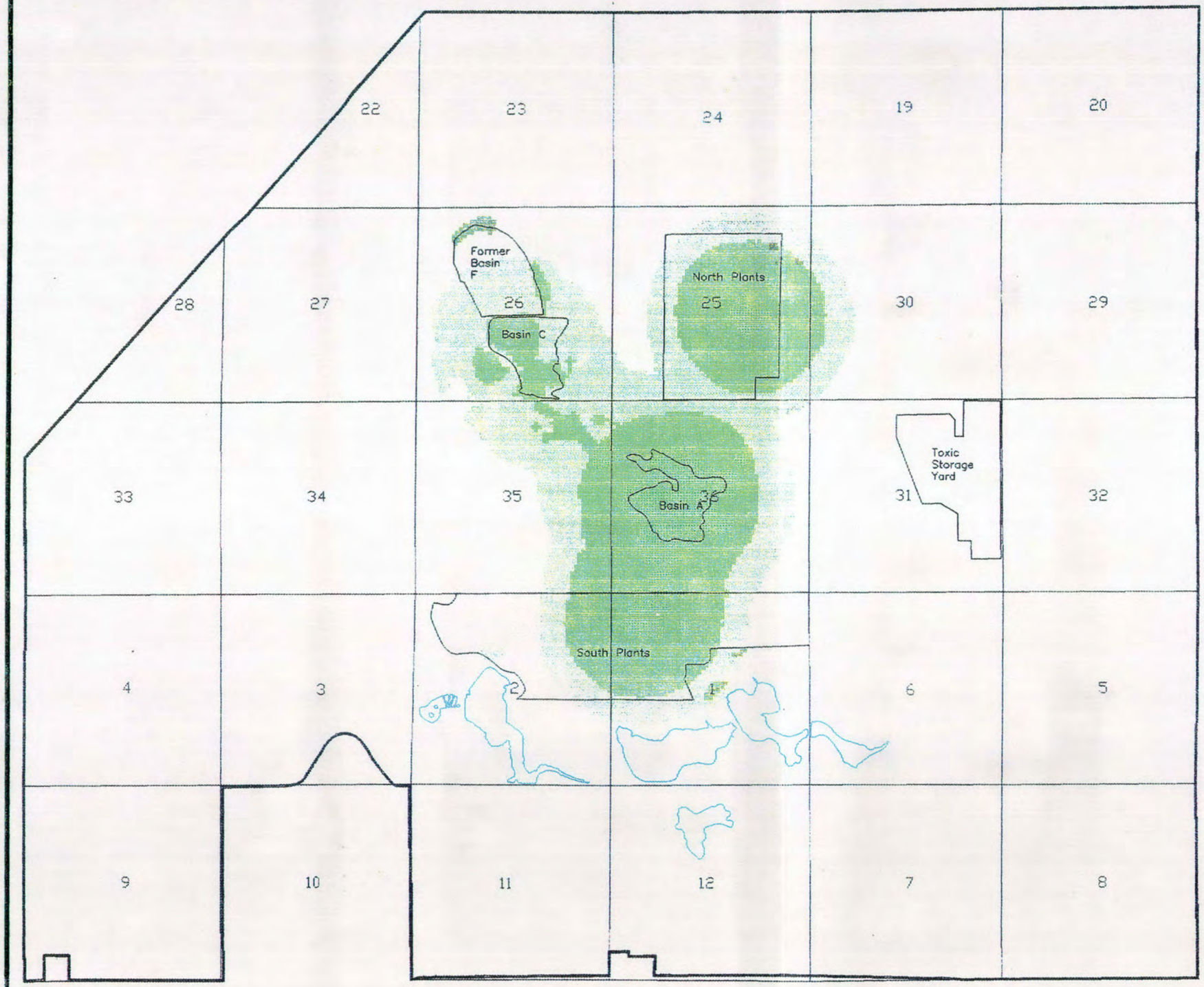
0 2000 4000

Scale in Feet

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

February 1994

Figure C.3-110
Number of Trophic Boxes with Soil Hazard Indices Greater than 10 for Arsenic, Mercury, Cadmium, and Copper Concentrations Above Indicator Levels Based on the EPA Approach
Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- 1 trophic box with HI > 10
- 2-4 trophic boxes with HI > 10
- 5-7 trophic boxes with HI > 10
- Lake
- 31 Section Number
- Section Line

N

0 2000 4000

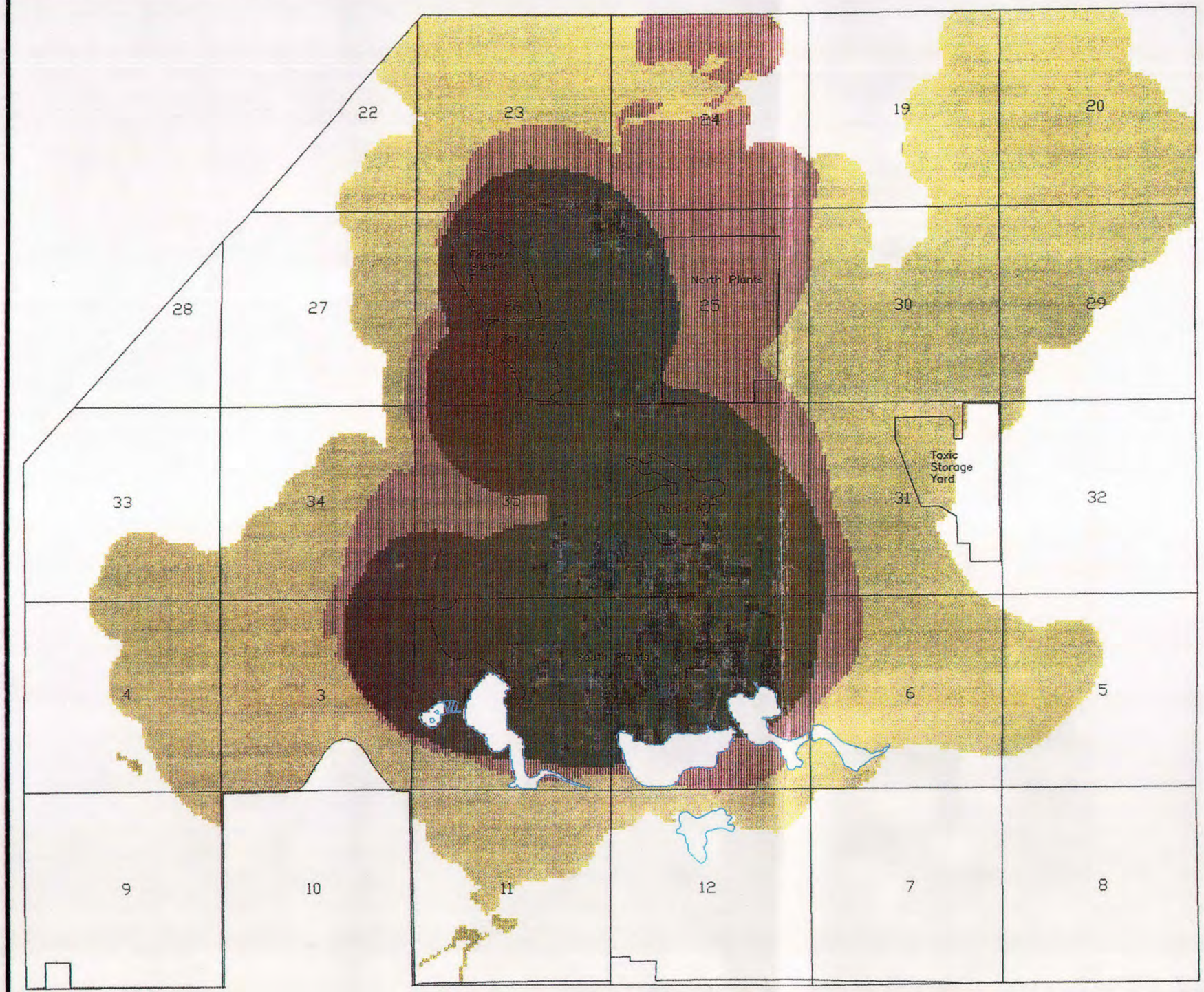
Scale in Feet

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

February 1994

Figure C.3-111

Number of Trophic Boxes with Soil Hazard Indices Greater than 10 for Arsenic, Mercury, Cadmium, and Copper Concentrations Above Indicator Levels Based on the Shell Approach
Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Shell and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HI > 10 in the areas indicated

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:

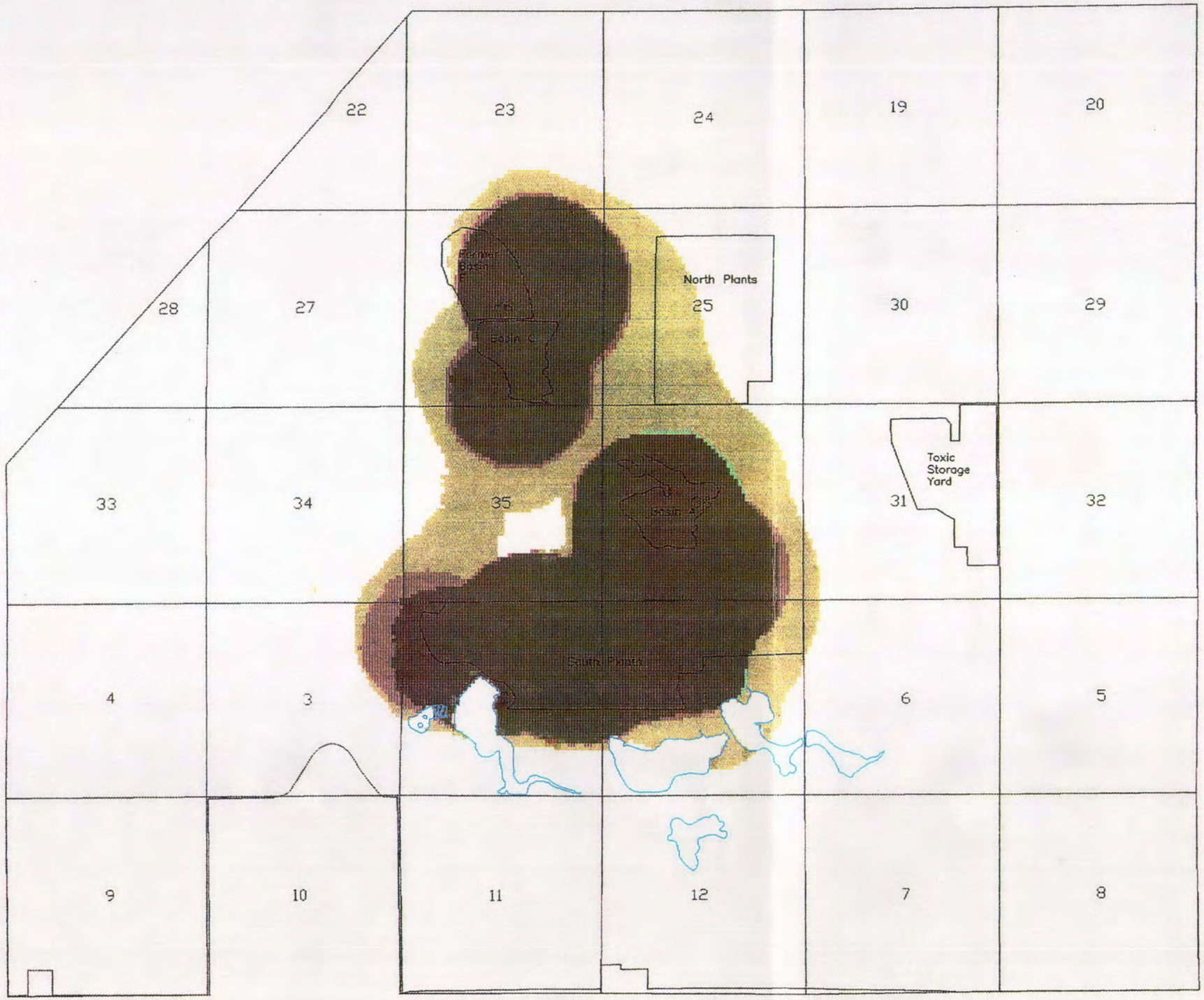
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3–112

Hazard Index Map (HI>10) for the Great Horned Owl Trophic Box Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Army and EPA Approaches
- Shell and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HI > 10 in the areas indicated

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

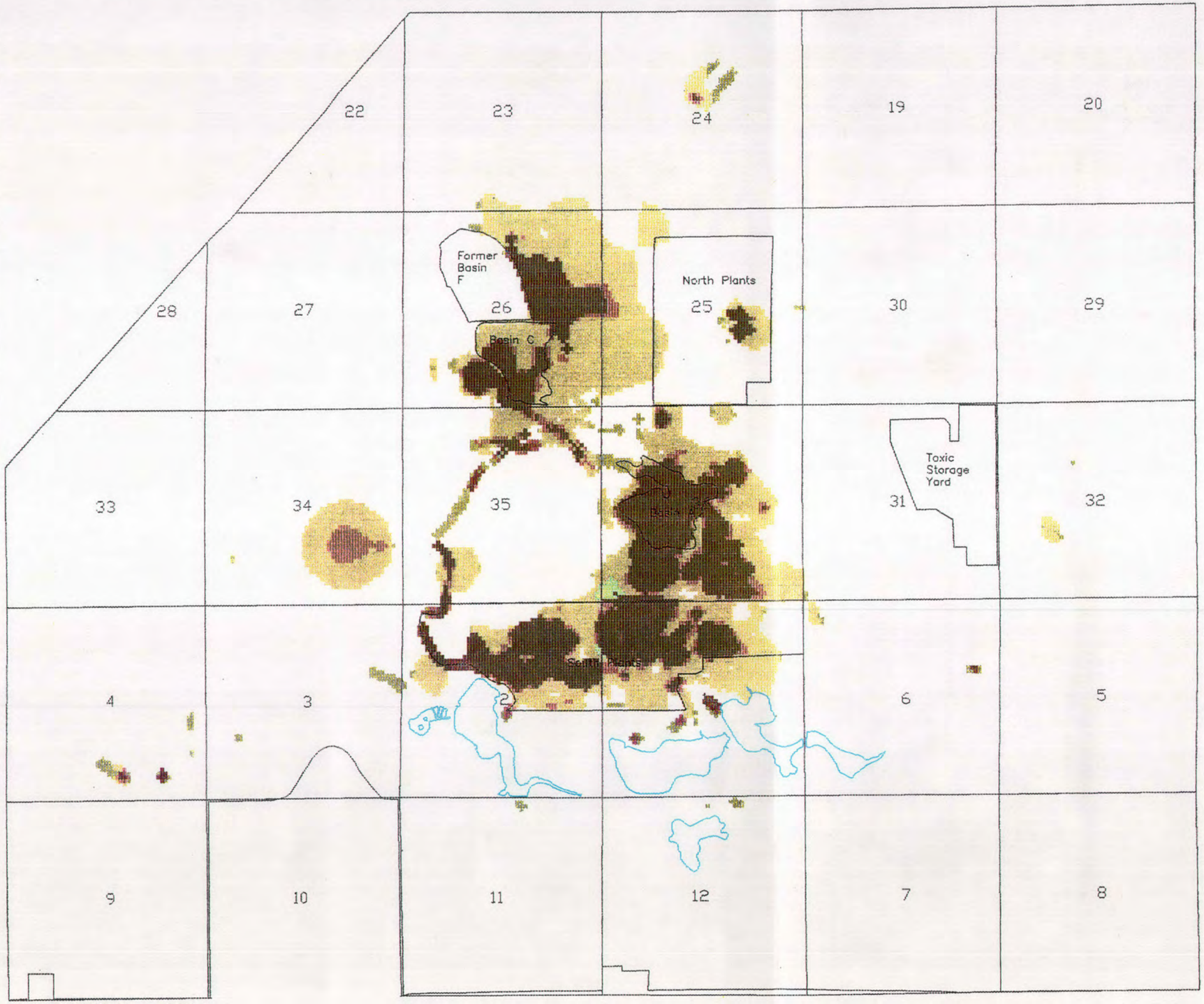
Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3–113

Hazard Index Map (HI>10) for the American Kestrel Trophic Box Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Army and EPA Approaches
- Shell and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HI > 10 in the areas indicated

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

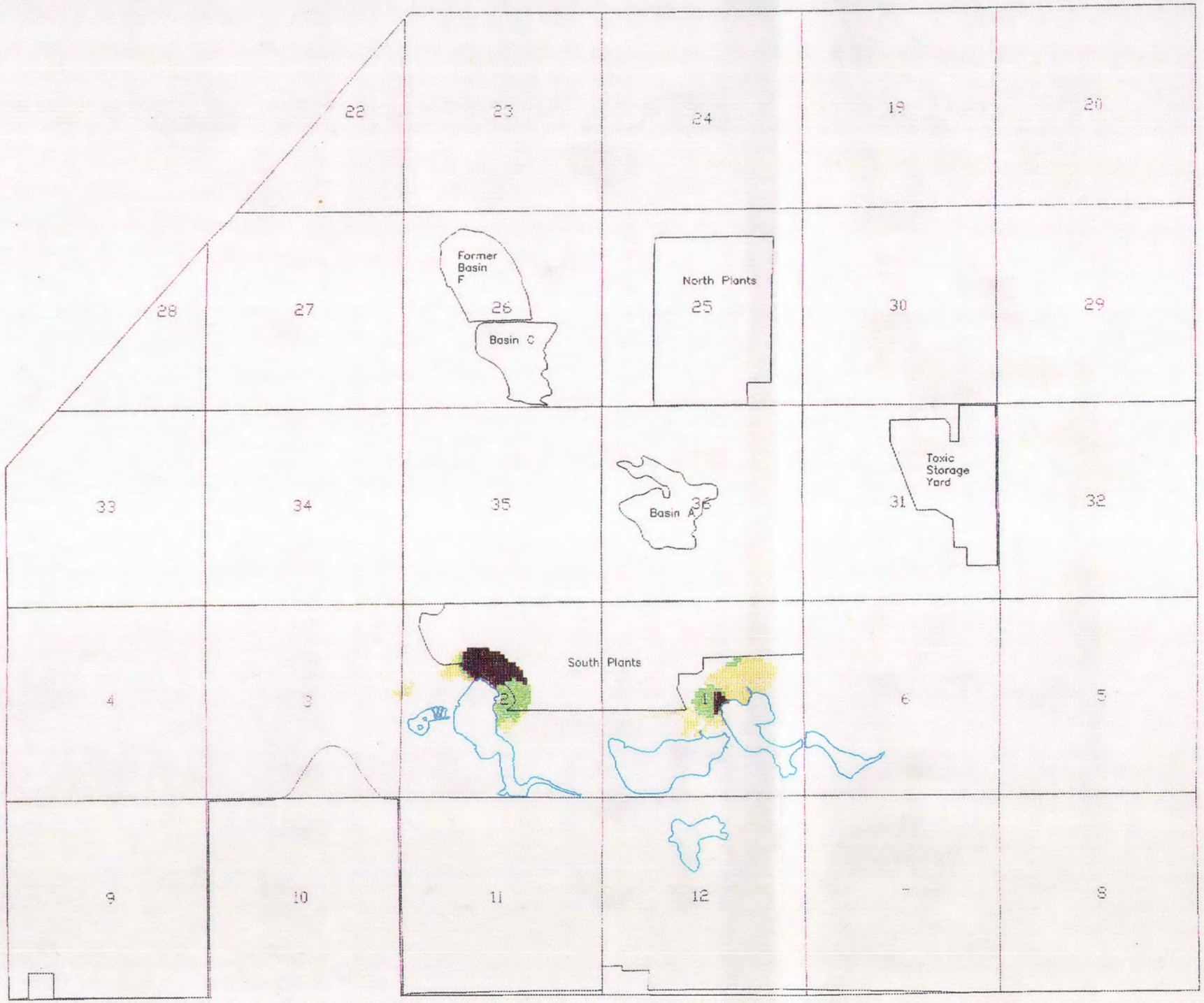
Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3–114

Hazard Index Map (HI>10) for the Medium Mammal Trophic Box Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

- EPA Approach
- Army and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HI > 10 in the areas indicated

Lake

31 Section Number

Section Line

-N-

0 2000 4000

Scale in Feet

Prepared for:

U.S. Army Program Manager
for Rocky Mountain Arsenal

February 1994

Figure C.3–115

Hazard Index Map (HI>10) for the Shorebird Trophic Box Based on the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp

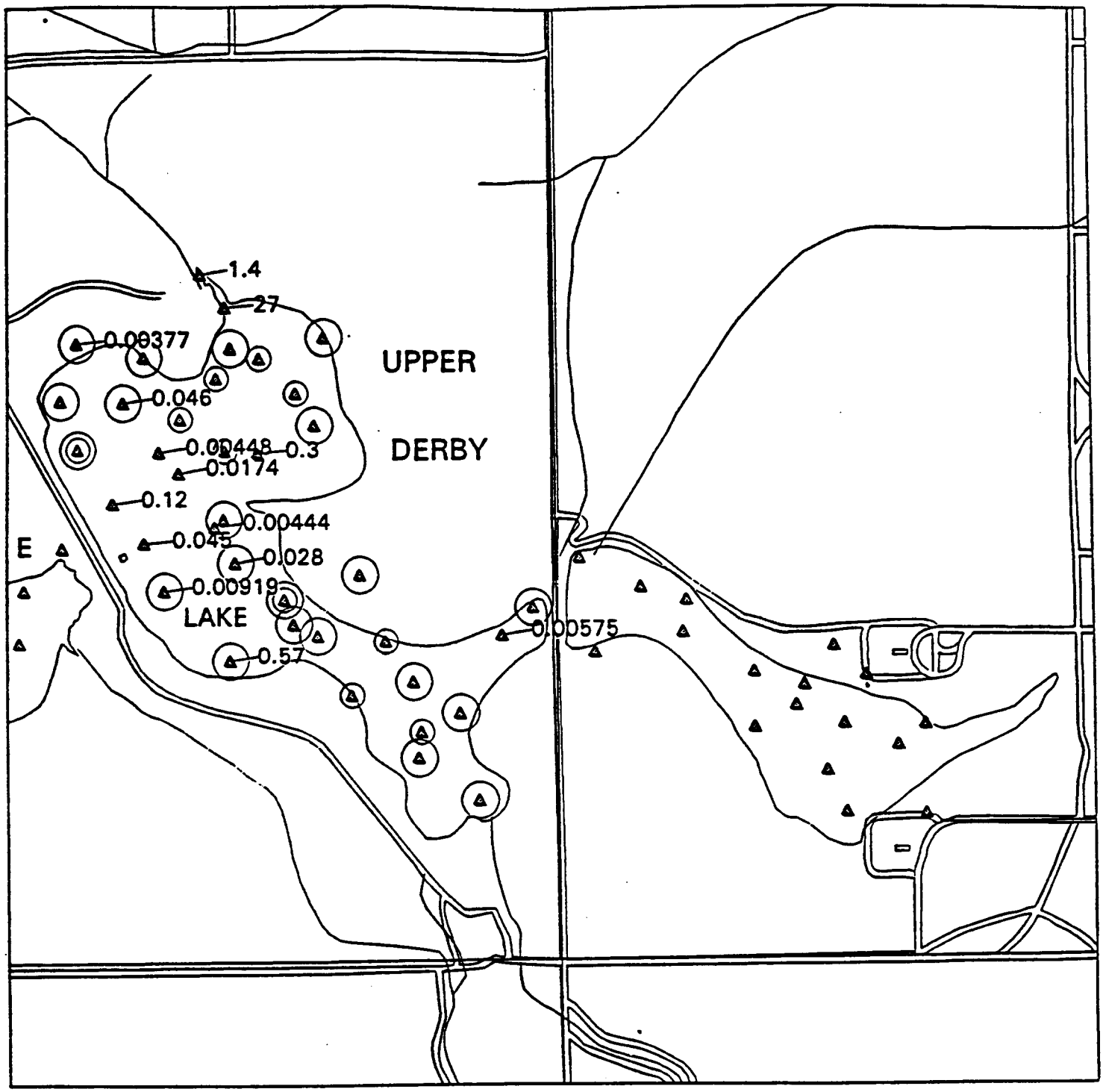


Figure C.3-116

Observed Aldrin Sediment Concentrations (ppm) in Upper Derby Lake (0-1ft. depth profile)

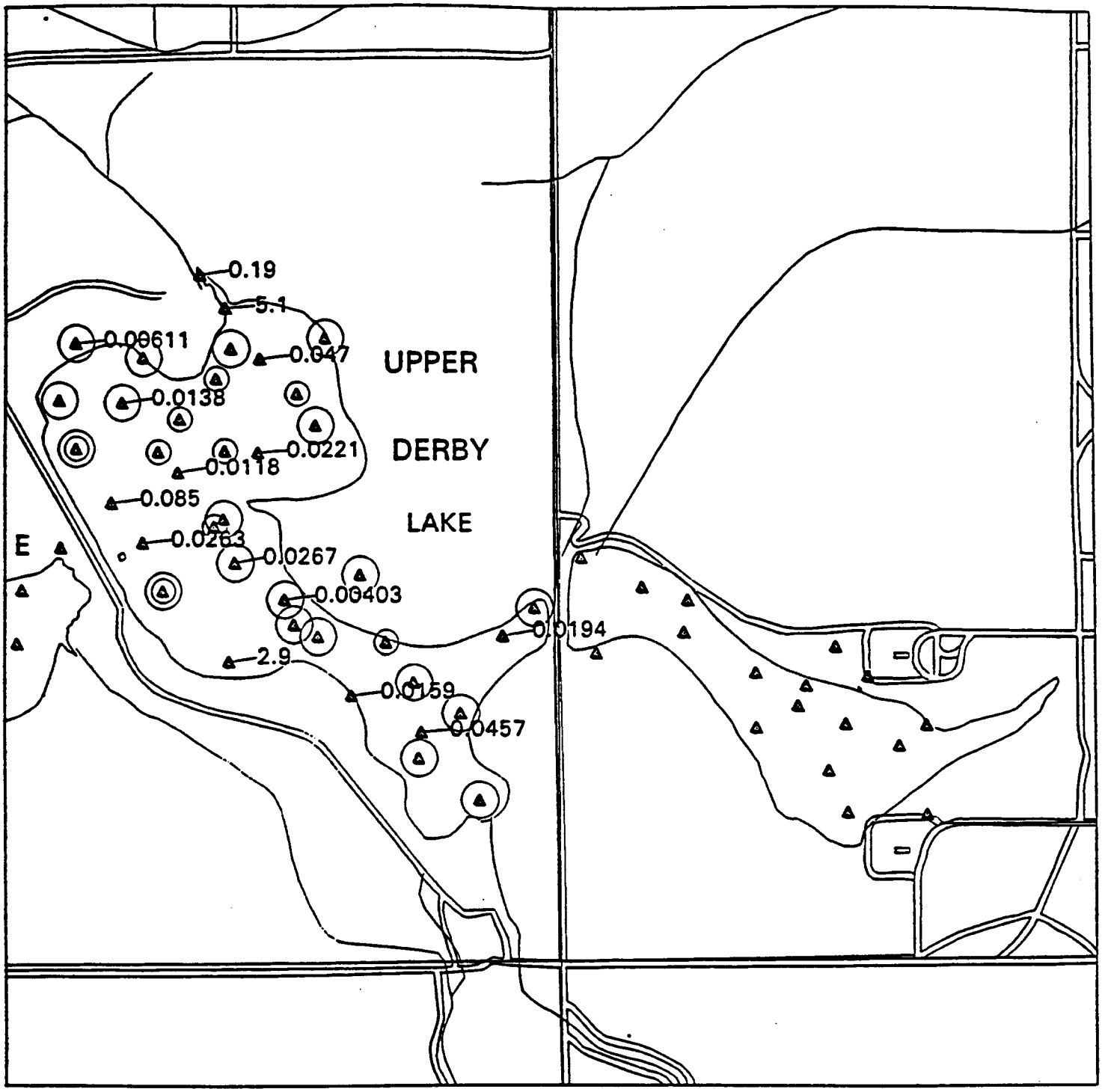
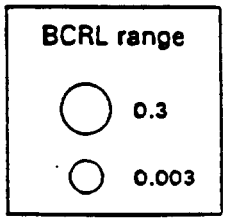


Figure C.3-117

Observed Dieldrin Sediment Concentrations (ppm)
in Upper Derby Lake (0-1ft. depth profile)



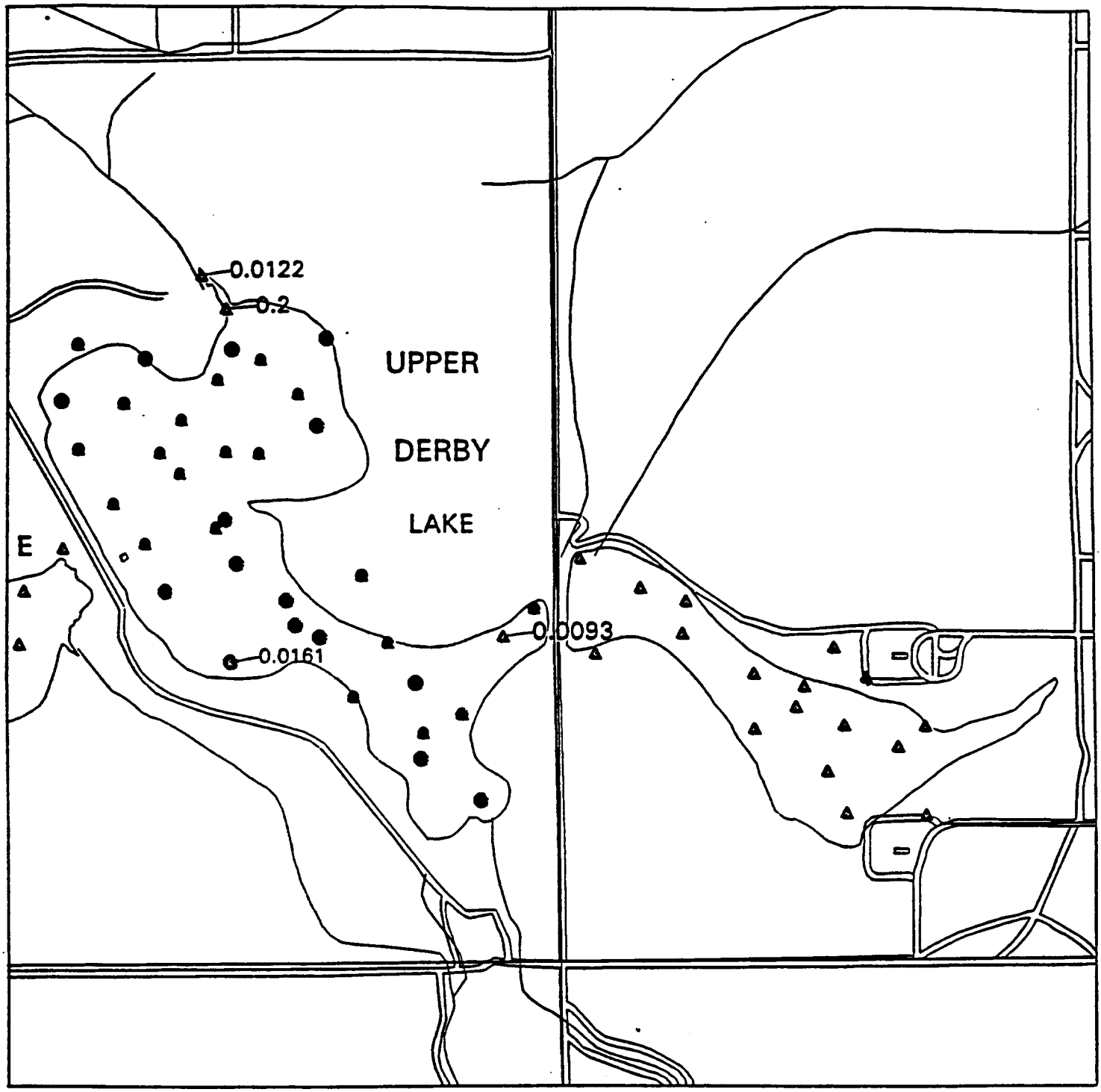


Figure C.3-118

Observed Endrin Sediment Concentrations (ppm)

in Upper Derby Lake (0-1ft. depth profile)

APPENDIX C
(SECTION C.4)

ECOLOGICAL RISK CHARACTERIZATION FIELD SAMPLING PROGRAM

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure

LIST OF ACRONYMS AND ABBREVIATIONS

BSAs	Biota Study Areas
CMP	Comprehensive Monitoring Program
COCs	contaminant of concern
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
ERC	Ecological Risk Characterization
ft	foot/feet
g	grams
mg/kg	milligrams per kilogram
ml	milliliters
µg/l	micrograms per liter
ppe	personal protective equipment
RI	Remedial Investigation
RMA	Rocky Mountain Arsenal
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency

C.4 ECOLOGICAL RISK CHARACTERIZATION FIELD SAMPLING PROGRAM

Ecological risk characterization (ERC) field sampling efforts were implemented to supplement existing site-specific data from the Biota Remedial Investigation (RI) (ESE 1989) and Biota Comprehensive Monitoring Program (CMP) (RLSA 1992). Sampling occurred for biota, sediment, soil, and water. ERC sampling was designed to provide analytical data for collocated soil, earthworm, deer mouse, and plant samples; analytical data collected at the same time on biota, sediment, and water; data on food habits of selected species on Rocky Mountain Arsenal (RMA); and additional data on small bird tissue samples. The methods and results of the analytical sampling effort are presented in Section C.4.1, and the methods and results of the food-item studies of raptors, water birds, vesper sparrows, and fish at RMA are summarized in Section C.4.2.

C.4.1 ECOLOGICAL RISK CHARACTERIZATION ANALYTICAL SAMPLING PROGRAM

C.4.1.1 Introduction

The ERC sampling program was implemented to augment certain existing RMA databases. Additional biota, water, sediment, and soil samples collected in 1989 and 1990 were analyzed for the seven of the biota contaminants of concern (COCs) (aldrin, dieldrin, dichlorodiphenyldichloroethene [DDE], dichlorodiphenyltrichloroethane [DDT], endrin, arsenic, and mercury). There were two types of supplemental data required (Table C.4-1). The first type of data consisted of COC concentrations for simultaneously collected sediment, water, invertebrate, and fish samples from the aquatic ecosystem; soil samples collected from the precise collection locations of some Biota CMP samples; and small bird, amphibian, and reptile samples from the terrestrial ecosystem. The fish collected were to be of a specific size/age class. The second type of data consisted of selected biota-specific parameters. Specific field procedures used to collect these data are described below. The simultaneous collection of surface water, sediment, and biota samples from the same locations minimized time and location as sources of variability between contaminant concentrations at different levels in aquatic food chains. The ERC sampling program design assumed the concurrent collection of data under the Biota CMP. Further details on the Biota CMP sampling program are in the Final Biota Annual Reports

(RLSA 1990a, b, 1992), and results from the analysis of biota samples are presented in Table C.4-2.

Since recordkeeping protocol, sample preparation, personal protective equipment (PPE), equipment decontamination procedures, schedule, and support services were detailed in an unpublished ERC task plan, the sampling methodology is summarized below. Personnel decontamination procedures are described in the Health and Safety Plan (EBASCO 1988). Sample-handling procedures followed those outlined in the Rocky Mountain Arsenal Chemical Quality Assurance Plan, Version 1.0, July 1989 (PMRMA 1989). Sample analysis was conducted in accordance with certified U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) methods (PMRMA 1989). The results of this field program were combined with data from the Biota RI and Biota CMP to provide the database used to characterize ecological risk.

C.4.1.2 Analytical Study Methods and Results

C.4.1.2.1 Biota

In the ERC biota sampling program, amphibian, reptile, and vesper sparrow samples were needed to provide chemical contaminant data for their respective trophic boxes in the American kestrel food web. Amphibians and reptiles, collected fortuitously under the Biota CMP, were analyzed for contaminants under the ERC program. These included three bullsnake, two composite spadefoot toad, two composite tadpole, and four tiger salamander samples. Vesper sparrows were collected in summer 1990 in the biota study areas (BSAs) near active kestrel boxes (Figure C.4-1). Vesper sparrows were collected with a shotgun or .22 rifle (.22 shotshells). Bullsnakes, spadefoot toads, and amphibians were collected by hand during conduct of Biota CMP field sampling. Insofar as possible, these specimens were collected close to the collection locations of other species in the model. Locations of BSAs and staked sites are shown in Figure C.4-2.

Aquatic biota samples were collected from Lake Ladora and Lower Derby Lake in September 1989. Five sampling stations were established in each lake (Figures C.4-3 and C.4-4). Organisms collected included American pondweed, sago pondweed, plankton, aquatic invertebrates, bluegill, largemouth bass, and northern pike.

Fish specimens were collected from gill nets. Ten northern pike were collected as ERC program samples. From each of these specimens, all but the upper gastrointestinal tract was used as a dressed carcass sample to be chemically analyzed for the target analytes. In addition, ten composite largemouth bass and ten composite bluegill samples were collected from Lake Ladora and Lower Derby Lake under the ERC program and treated similarly. Aquatic plants were harvested with a garden rake at or as close to gill net locations as possible. One additional sample of American pondweed and two additional samples of sago pondweed were collected from each sampling station. Plankton were collected using tow nets pulled behind a small motor boat in the vicinity of fish gill net locations. Water-column invertebrates were collected with dip nets wherever they could be found all along the perimeter of each lake from the shoreline to a depth of 3 feet (ft). Subsamples of the invertebrate samples were to be saved for taxonomic identification, but the number of invertebrate samples was too small to permit this option and all samples had to be composited to achieve sample weight. Taxonomic identification was performed on the single composite sample (taken between the lakes) to the extent possible without detriment to the sample. The sample was later shipped for chemical analysis.

Benthic invertebrates were collected from sieved samples of Ekman dredge hauls. Sediment from the Ekman dredge was composited in a stainless steel pan and washed through sieves with hand-pumped lake water at each sampling station to isolate benthic invertebrates. Invertebrates were to be aggregated at a station and composited among stations until a minimum of 13 grams (g) was collected. However, benthic invertebrates in the lakes were quite sparse in September 1989. The equivalent of 15 full dredge hauls were sieved at each sampling station on each lake, but the minimum sample weight of 13 g required for chemical analysis was never attained.

C.4.1.2.2 Sediments

Sediment samples were collected from Lake Ladora and Lower Derby Lake in September 1989. Five sampling stations were established in each lake in association with biota sampling stations (Figures C.4-3 and C.4-4). Sediments collected with an Ekman dredge from the four corners of a sampling station were composited for each sample. The four corners of a sampling station were located on two lines perpendicular to the ends of the gill net line, each corner being located

10 to 15 ft from the net. A separate sample was collected near the center of the gill net for analysis of volatile organic compounds. Results from the analysis of sediment samples are presented in Tables C.4-3 and C.4-4.

C.4.1.2.3 Soil

Sampling locations for soil were geographically correlated with those of biota whenever possible. Samples were taken (0- to 12-inch depth interval) from 20 staked sites chosen from those locations that exhibited the highest levels of biota contamination during the Biota CMP. This procedure allowed for the comparison of data from these soil samples to data from Biota CMP for samples of earthworms, deer mice, or vegetation from the same locations. The samples were composited from four subsamples surrounding and immediately adjacent to selected earthworm locations (pits), deer mouse trap locations, or vegetation clipping areas sampled during the 1988 or 1989 Biota CMP. Hand augers and clean polybutryate tubes were used to obtain the soil samples. Slide hammers facilitated sample collection. Cores were then sent to a laboratory for chemical analysis. Results of the analysis of soil samples are presented in Table C.4-5.

C.4.1.2.4 Water

Unfiltered water samples were collected from Lake Ladora and Lower Derby Lake in September 1989. Five sampling stations were established in each lake in association with biota and sediment sample collection locations. Water samples were collected 6 inches above the bottom of each lake and, if the water column was more than 3 ft deep, also from the mid-point of the water column. Water subsamples collected from the ends of the gill net and from each side of the net were composited to comprise one sample. A Van Dorn sampler was used to collect samples. Water samples were then sent to a laboratory for chemical analysis. Results of the analysis of surface water samples are presented in Table C.4-6.

C.4.2 ROCKY MOUNTAIN ARSENAL FOOD-ITEM STUDIES

C.4.2.1 Introduction

Food-item studies were used where possible to make the ERC food webs specific to RMA. Birds were selected for food-item studies because they have a proventriculus and gizzard where food items are often still recognizable. Further, raptors—which are at the top of food webs and are, therefore, important indicators of food-web health—regurgitate pellets near frequently used perches or nests that can be easily analyzed for food items. Fish were also selected for food studies because of their higher position in aquatic food webs.

Specific biota collected at RMA for the food-item studies included mallards, American coots, vesper sparrows, bluegill, largemouth bass, and northern pike. Food items eaten at RMA by American kestrels and great horned owls were identified from their pellets and from kestrel nest-box remains. Scientific names are provided in Attachment C.5-1.

Food-item studies include preparing the samples, segregating the contents, identifying the food items, recording the data, and evaluating the data (Korschgen 1980). Data on the amounts and kinds of food consumed can be combined with data on contaminant levels found in food items from the same location to determine and quantify the potential pathways of contamination. The methods and results of these studies are provided below by trophic group or species.

C.4.2.2 Food-Item Study Methods and Results

C.4.2.2.1 Water Birds

Methods

Six mallards and five American coots were collected at RMA in August 1990. Mallard samples were collected from Upper Derby Lake (BSA 10). Coot samples were collected from Lake Mary (BSA 6), Lake Ladora (BSA 7), and Upper Derby Lake (BSA 10). The esophagus and proventriculus were removed and the contents analyzed for food items. Gizzard contents were excluded to reduce bias caused by the rapid digestion of soft foods (Swanson and Bartonek 1970). Tissue samples from these specimens were also submitted for chemical analyses. Food-item samples were preserved in ethyl alcohol, placed in a dissecting tray, and then separated

under a dissecting microscope. Vegetation within the sample was identified. Seeds were identified according to Martin and Barkley (1961), Musil (1963), and the U.S. Forest Service (1974), and compared to reference materials such as plants and invertebrates collected at RMA. Insects and invertebrates were identified to taxonomic order according to Merritt and Cummins (1978) and Needham and Needham (1962).

The total number of identifiable individuals was obtained by counting the maximum number of a single body part (divided by the number of such parts per individual) in the entire sample or in a 10 percent subsample. The total volume of contents was measured by volume displacement in either a 25-milliliter (ml) or a 100-ml graduated cylinder depending on the volume of contents. Measurements were taken to the nearest 0.25 ml when possible. For coots, percent volume of individual items (or inseparable material) was estimated by first determining the percent volume of each item in a 10 percent subsample and then multiplying that percent by the total volume of contents. The 10 percent subsample was determined by using a graduated petri dish. Individual food items (wet) were placed in a known volume of water and the cylinder tapped to remove air bubbles. The percent volume of food items was estimated by dividing the actual or calculated volume of each food item by the total volume of the crop contents (minus the volume of sand present in the sample). Mean volume was calculated as the mean of volumetric percentages (aggregate percentage) as described by Swanson et al. (1974). This method minimizes the effect of a few samples dominating a small sample size (i.e., one or two birds gorging themselves on an infrequently consumed food item).

Results

The results of the mallard food-item study, based on the analysis of esophageal contents of mallards at RMA in August 1990, are presented in Table C.4.7. The mallard esophageal contents were primarily pondweed (*Potamogeten spp.*). Sago pondweed (*Potamogeten pectinatus*) occurred in four of the six samples, while small pondweed (*Potamogeten pusillus)* occurred in three of the six samples. An unidentified species of *Potamogeten* occurred in one of the six samples. *P. pusillus* comprised approximately 73, 86, and 94 percent of the total number of organisms

observed in the three samples that contained *P. pusillus*. Insects were observed in three of the six samples, but accounted for a small percentage of the total esophageal contents.

The results of the American coot food-item study, based on the analysis of crop contents at RMA in August 1990, are presented in Table C.4-8. The American coot crops contained primarily vegetation and sand. Coon tail (*Ceratophyllum spp.*) occurred in all five samples and accounted for a mean of 95 percent of the volume of food items. Other vegetation identified from coots accounted for less than 1 percent of the volume of food items and included advanced algae (*Chara spp.)* and filamentous algae. Insects were found in only one sample and accounted for less than 1 percent of the volume of food items. Invertebrates were found in all samples and included tiny clam-like crustaceans (*Ostracoda*) and snails (*Physa spp*). All invertebrates accounted for approximately 4 percent of the volume of food items.

Based on the esophageal contents of six mallard ducks collected in spring, *Potamogeten* is the most important food item used by mallards at RMA in spring. Aquatic vegetation, specifically *Ceratophyllum,* is the most important food item for American coots at RMA in spring. The information provided in these results is applicable only to food items of mallards or coots at the time and location of collection. Because these results were obtained from a small sample size, they are only useful for determining important food items at the time of capture.

C.4.2.2.2 Vesper Sparrow

Methods

Five vesper sparrows were collected at RMA in June and July 1990. As shown in Figure C.4-1, the samples were collected from the Basin A area (Section 36) Basin F area (Section 26), Sand Creek Lateral area (Section 35), and the Lower Lakes area (Section 11). The esophagus and crop were removed from vesper sparrows for analysis of food items. Gizzard contents were excluded to reduce bias caused by the rapid digestion of soft foods (Swanson and Bartonek 1970). These specimens were also used for chemical analysis of tissues. The esophagus and crops were then preserved in ethyl alcohol, placed in a dissecting tray, and then separated under a dissecting

microscope. Seeds were identified according to Martin and Barkley (1961), Musil (1963), and the U.S. Forest Service (1974), and compared to reference materials such as seeds and insects collected at RMA. Insects and invertebrate were identified to order and family when possible. Total number of identifiable materials (i.e., seeds and insects) was obtained by counting all individual items. The minimum number of individual invertebrates present was determined by counting various mouth parts. Mean volume was calculated as the mean of volumetric percentages (aggregate percentage) as described by Swanson et al. (1974).

Results

The results of the vesper sparrow food-item study, based on the analysis of crop contents at RMA in June and July 1990, are presented in Table C.4-9. Grasshoppers (*Acrididae*) were the most common (four of the five samples) invertebrates in the crops of vesper sparrows; more than 10 individuals occurred in two samples. One sample (B1344C) was dominated by more than 41 individual aphids (*Aphididae*). Another sample (B1411C) consisted solely of grass seeds *(Stipa spp.)*.

The information provided in these results is applicable only to food items of vesper sparrows at the time and location of collection. Because these results were obtained from a small sample size, they are only useful for determining important food items at the time of capture.

C.4.2.2.3 Great Horned Owl

Methods

The food-item study conducted for the great horned owl was centered on pellet analysis, which has been proven as a reliable method in determining the diets of owls (Marti 1987). Pellet analysis involves combining food items into prey groups for which percent occurrence is calculated. Percent occurrence reveals general diet composition and is recommended for food-item studies (Korschgen 1980). Great horned owl pellets were collected from five active nests at RMA in spring 1990 for a study of food items (Figure C.4-5). Nest sites 1 through 5 had been used to provide egg samples for chemical analysis. At the time of pellet collection, nest site 2

had been abandoned, so an alternate nest site, nest site 6, was selected for the food-item study. The tag numbers in the figure (e.g., B1214) represent egg samples collected for analysis.

A total of 68 pellets were collected from the areas below owl nests. Only whole pellets were collected to ensure the food items found were indeed consumed during the spring season. When collected, pellets were placed in plastic bags and labeled. In the laboratory, individual pellets were submersed in water until disintegrated, then separated into invertebrate parts (if any), bones, hair, and feathers. Representative hair samples were made into slides. After prey items were sorted, identifiable parts were compared with the bird and mammal collections at the Denver Natural History Museum and identified to the lowest possible taxonomic level, usually species, for mammals and birds. After identification was complete, a specific bone, usually a left or right jaw bone, was used to determine minimum numbers of individuals. Hair samples were identified as described in Moore et al. (1974) and used to confirm other methods of identification. They were not used to quantify results.

From these results, food items were combined into prey groups for which percent occurrence was calculated. Percent occurrence was calculated by dividing the number of pellets into the number of occurrences of each prey group. The number of occurrences for a prey group was determined by the number of pellets that contained a specific prey group regardless of the number of individuals present. In addition, the total number of individuals by prey group were listed for each nest site. Results for individual nests were also totaled for RMA.

Results

Food items from all nest sites were combined into 17 prey groups: 2 lagomorphs, 11 small rodents, 3 birds, and 1 house cat (Table C.4-10). Overall, deer mice *(Peromyscus spp.)* occurred in pellets most frequently and were most prevalent at nest sites 1, 3, and 4 (Table C.4-10). Kangaroo rats (*Dipodomys ordi*) and all lagomorphs (Leporidae) were most prevalent at nest sites 5 and 6, respectively. Rabbits/hares (Leporidae) and cottontails *(Sylvilagus spp.)* combined represented 43 percent of all prey groups, with cottontails making up more than two-thirds of that group. Kangaroo rats represented 34 percent of all prey groups and were present at every nest

site except nest site 3. Prairie voles (*Microtus ochrogaster*) represented 14 percent of all prey groups. All vole groups combined (i.e., prairie voles, meadow voles [*Microtus pennsylvanicus*] and unknown voles [*Microtus spp.*]) comprised 29 percent. Voles were represented at every nest site. Plains pocket gophers (*Geomys bursarius*) represented 14 percent of all prey groups and were present at nest sites 1, 5 and 6. Also present were harvest mice (*Reithrodontomys spp.*), grasshopper mice (*Onychomys leucogaster*), hispid pocket mice (*Perognathus hispidus*), and unknown small pocket mice (*Perognathus spp.*). Unknown small rodents (Cricetidae) made up 30 percent of all prey groups. The identifiable items in this group were all toothless jaws. The remains of a house cat (*Felis catus*) were found in a pellet at nest site four. Birds were represented by three prey groups: pigeons (*Columba livia*), meadowlark (*Sturnella neglecta*), and medium-sized song birds (unknown Passeriformes). Bird species made up 7 percent of all prey groups.

Percent occurrence gave an overview of diet composition. The primary prey groups for great horned owls at RMA during the period of study were cottontails and hares. Small mammals were also important, with deer mice being the most important species. Although fewer cottontail and hare individuals were caught, they are more important than small mammals because of their larger body size. Birds were the least important group. Infrequent food items, such as a domestic cat, may be overemphasized due to the small sample size of this study.

C.4.2.2.4 American Kestrel

Methods

The summer food items of American kestrels at RMA in 1990 were determined using two methods. One involved sorting nest box contents and identifying prey remains to the lowest identifiable taxonomic level. The other method involved taking representative hair samples from each nest box and identifying the samples to genus or species when possible.

Five active nest boxes at RMA were selected for the food-item study (Table C.4-11 and Figure C.4-6). The entire contents of the box were taken after fledging had occurred as representative

of food items from the time of egg laying to fledging (i.e., one season of reproductive activity) since the nest boxes are cleaned annually. Nest material was sorted into five groups: mammal bones, mammal hair, insect parts, feathers, and miscellaneous materials such as nesting material. Mammal bones were further subdivided into identifiable and unidentifiable parts. The identifiable bones, usually jaw bones, were compared to the Denver Natural History Museum mammal collection, and a minimum count was made using similar parts (e.g., all left jaw bones). Mammal hair samples were mounted on microscope slides and compared to Moore et al. (1974). This method was simply used to indicate the presence or absence of mammal species; no quantitative analysis was attempted. Insect parts were also further subdivided and representative parts were mounted and labeled for future confirmation at the Denver Natural History Museum. All similar identifiable parts were grouped for each nest box and tallied for a minimum number of individuals.

Subsequent to the planning for the first two methods, a third method was added to augment the analysis in which stomach contents of juvenile kestrels collected from three of the five nest boxes were analyzed for chemical analysis of tissues for food items. The stomachs were removed and preserved in 70 percent ethyl alcohol. Individual food items were separated, washed with distilled water, and then identified to the lowest taxonomic level.

Results

The taxonomic level of each prey category (Table C.4-12) was determined by the lowest level identifiable within the group. The taxonomic level for insects was order, but Orthoptera was additionally divided into families due to the large number of individuals identified in this order. Mammals were grouped by genus and birds by family. The total number of individuals was listed (Table C.4-12) and the percent frequencies of occurrence were calculated. Of all the prey categories, grasshoppers (Acrididae) and beetles (Coleoptera) were consumed at all nests. Crickets (Gryllidae), dragonflies (Odonata), and voles (*Microtus spp.*) were consumed at 80 percent of the nests. Bees (Hymenoptera) were found in two (40 percent) of the nest boxes. It was not certain whether the bees were food items or individuals that flew into the nest box and were killed by the kestrels. Cicadas (Homoptera), moths (Lepidoptera), thirteen-lined ground

squirrels *(Spermophilus tridecemlineatus)*, and all avian groups were found in only one (20 percent) of the nest boxes, which indicates that kestrels exploit site-specific prey variations.

The hair analysis revealed only the presence or absence of mammals consumed. Voles were consumed at all nests (Table C.4-12). Deer mice (*Peromyscus spp.*) were consumed at 80 percent of the nests, while hispid pocket mice *(Perognathus hispidus)* and thirteen-lined ground squirrels were consumed at only one (20 percent) of the five nests.

The stomach contents verified results of the two methods discussed above and revealed another prey group not yet discovered (Table C.4-13). Crickets were found in two of the three nest boxes where juveniles were taken. Dragonflies, grasshoppers, a vole, and a deer mouse were found in only one location. In addition, one lizard (Iguanidae) was found in the stomach contents of the juvenile from box 138. Kestrels may totally digest reptiles; therefore, no reptile remains were found with the two study methods.

Kestrels, along with all other falcons, digest a large portion of the bone material they consume (Marti 1987), making food-item identification more difficult. Accordingly, a combination of methods was used to reveal all food resources (e.g., identification of nest materials, hair, and stomach contents). If an investigation of nest materials only had been used in this study, more than half of the mammal species would not have been discovered. Moreover, reptiles were only discovered after investigating the contents of stomachs. Because individuals must be sacrificed, however, this method is not preferred. Sometimes reptile scales can be found in nest materials and keyed to the genus level (Peterson 1991).

C.4.2.2.5 Fish

Methods

At RMA, 40 bluegill, 26 largemouth bass, and 10 northern pike were collected in September 1989. All fish were from either Lake Ladora (BSA 7) or Lower Derby Lake (BSA 8). The stomachs were removed from the fish for content analysis. Stomachs were preserved in ethyl

alcohol, placed in a dissection tray, and then separated under a dissection microscope and contents identified.

Results

Although aquatic invertebrates composed nearly 100 percent of bluegill diet, traces of plant material and one adult Dipteran were also observed. *Chironomus* species (larval flies) and *Daphnia* species occurred in 45 and 35 percent of the samples, respectively (Table C.4-14). Other waterfleas *(Bosmina longirostris)* and *Hydroptila* species (caddisflies) occurred in 25 percent of the samples.

Macroinvertebrates and small fish comprised most of the largemouth bass diet. Water boatmen beetles *(Hesperocorixa sp.)* occurred in 27 percent of the samples and occurred most often in the fall diet (Table C.4-15). Small fish occurred infrequently, but were important in terms of total biomass.

Nine out of ten of the stomachs analyzed for northern pike were either empty or only had a trace amounts of food present (Table C.4-16), so no useful information on the diet of northern pike was acquired. These results are not surprising since predatory fish, such as the northern pike, feed infrequently (i.e., not for several days).

Water fleas of several species and larval flies appear to be the most important food items used by bluegill in fall at RMA. Although 60 percent of the largemouth bass analyzed had empty or nearly empty stomachs, macroinvertebrates and small fish appear to be important dietary groups for this species. The information provided in these results is applicable only to food items of the three species at the time and location of study. Because these results were obtained from a small sample size, they are only useful for determining important food items at the time of capture.

C.4.3 REFERENCES

EBASCO. 1988. December. Health and Safety Plan for the Remedial Investigation/Feasibility Study Program at the Rocky Mountain Arsenal.

RTIC 89173R02
ESE. 1989. Biota Remedial Investigation Report. Final Report. Version 3.2

Korschgen, L.J. 1980. Procedures for Food-Habits Analysis. In: S.D. Schemnitz, ed. Wildlife Management Techniques Manual. 4th ed. The Wildlife Society, Inc. Washington, D.C. pp. 113-127.

Marti, C.D. 1987. Raptor Food Habits Studies. In: Giron Pendleton B.A., B.A. Millsap, K.W. Cline, and D.M. Bird, ed. Raptor Management Techniques Manual. National Wildlife Federation. Washington, D.C. pp. 67-80.

Martin, A.C. and W.D. Barkley. 1961. Seed Identification Manual. University of California Press, Berkeley. p. 221.

Merritt, R.W. and K.W. Cummins. 1978. Aquatic Insects of North America. Kendall/Hunt Publishing Co. Dubuque, IA. p. 441.

Moore, T.D., L.E. Spence and C.E. Dugnolle. 1974. Identification of the Dorsal Guard Hairs of Some Mammals of Wyoming. Wyoming Game and Fish Department. Bulletin No. 14.

Musil, A.F. 1963. Identification of Crop and Weed Seeds. USDA Agriculture Handbook. No. 219. p. 171.

Needham, J.D. and P.R. Needham. 1962. A Guide to the Study of Fresh-Water Biology. Holden-Day, Inc. San Francisco, CA. p. 108.

Peterson, B., Colorado State University Researcher. 1991. Personal Communication.

RTIC 89244R01
PMRMA (Program Manager for Rocky Mountain Arsenal). 1989, July. Rocky Mountain Arsenal Chemical Quality Assurance Plan, Version 1.0.

RTIC 921343R01
RLSA. (R.L. Stollar & Associates, Inc.) 1990a. Comprehensive Monitoring Program. Final Surface Water Data Assessement Report for 1989. Version 2.0. June.

RTIC 90231R01
RLSA. 1990b. Comprehensive Monitoring Program. Annual Ground Water Report for 1989.

RLSA. 1992. Comprehensive Monitoring Program. Final Biota Annual Report for 1990 and Summary for 1988 to 1990.

Swanson, G.A. and J.C. Bartonek. 1970. Bias Associated with Food Analysis in Gizzards of Blue-winged Teal. J. Wildlife Management. 34:739-746.

Swanson, G.A., G.L. Krapu, J.C. Bartonek, J.R. Serie and D.H. Johnson. 1974. Advantages in Mathematically Weighing Waterfowl Food Habits Data. J. Wildlife Management. 38:302-307.

U.S. Forest Service. 1974. Seeds of Woody Plants in the United States. USDA Agriculture Handbook. No. 450. p.883.

Table C.4-1 Summary of the Ecological Risk Characterization Field Program

Species Considered for Sampling	ERC Sampling Program Planned	Actual
Aquatic Sites		
Sediment	20	20
Surface Water	20	14
Biota		
Northern Pike	10	10
Largemouth Bass	10*	10*
Bluegill	10*	10*
Mallard		
Plankton		
Invertebrates		
Benthic	10	0
Water–Column	10	1
Aquatic plants	10	6
American Pondweed	2	2
Sago Pondweed	4	4
Terrestrial Sites		
Soil borings	10**	0
Surface Samples	40***	40
Biota		
Prairie Dog		
Terrestrial Plants		
Sunflower		
Kochia		
Cheatgrass		
Lactuca		
Mammals		
Deer Mice		
Thirteen-lined Ground Squirrel		
Reptiles		
Bullsnake	4	3
Amphibians		
Spadefoot Toad	2	2**
Tadpole	2	2
Tiger Salamander	2	4
Earthworms		
Birds		
Vesper Sparrow	5	5
Horned Lark		
Insects		
Grasshoppers		
Ground Beetle		
American Kestrels		
Eggs		
Juvenile		

* Composite Sample
** 1 from each of 10 staked sites
*** 2 composited from 4 locations in the top foot at each of 20 staked sites

Table C.4-2 Ecological Risk Characterization Biota Analytical Results, 1989–90

Tag	Site	Biota Study Area	Species	Group	Tissue	Aldrin		Dieldrin		Endrin		DDE		DDT		Arsenic		Mercury
B0860	5	07	Northern Pike	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1830		0.1180	L	0.4380	L	0.6600
B0862	2	07	Northern Pike	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.7030
B0867	1	07	Northern Pike	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.2540
B0869	1	07	Northern Pike	Large Fish	02	0.1030	L	0.1910		0.0740	L	0.1130		0.1180	L	0.4380	L	0.4020
B0870	1	07	Northern Pike	Large Fish	02	0.1030	L	0.2120		0.0740	L	0.1600		0.1180	L	0.4380	L	0.3490
B0908	2	08	Northern Pike	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1320		0.1180	L	0.4380	L	0.3470
B0907	2	08	Northern Pike	Large Fish	02	0.1030	L	0.0937		0.0740	L	0.2400		0.1180	L	0.4380	L	0.2960
B0906	5	08	Northern Pike	Large Fish	02	0.1030	L	0.1570		0.0740	L	0.3330		0.1180	L	0.4380	L	0.2840
B0905	5	08	Northern Pike	Large Fish	02	0.1030	L	0.1350		0.0740	L	0.2640		0.1180	L	0.4380	L	0.2110
B0904	3	08	Northern Pike	Large Fish	02	0.1030	L	0.1740		0.0740	L	0.2630		0.1180	L	0.4380	L	0.3640
B0877	1	07	Bluegill	Small Fish	02	0.1030	L	0.1280		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0512
B0880	2	07	Bluegill	Small Fish	02	NA		NA		NA		NA		NA		0.4380	L	0.0758
B0882	3	07	Bluegill	Small Fish	02	0.1030	L	0.1200		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.1060
B0886	4	07	Bluegill	Small Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0653
B0892	5	07	Bluegill	Small Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.1480
B0945	2	08	Bluegill	Small Fish	02	0.1030	L	0.1180		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0609
B0944	4	08	Bluegill	Small Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0979
B0960	3	08	Bluegill	Small Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0976
B0953	5	08	Bluegill	Small Fish	02	0.1030	L	0.0974		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0622
B0992	1	08	Bluegill	Small Fish	02	0.1030	L	0.0944		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.1740
B0899	1	07	Largemouth Bass	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0564
B0883	4	07	Largemouth Bass	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.2950
B0879	2	07	Largemouth Bass	Large Fish	02	0.1030	L	0.1170		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0933
B0881	3	07	Largemouth Bass	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0970
B0878	1	07	Largemouth Bass	Large Fish	02	0.1030	L	0.1280		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.1300
B0943	4	08	Largemouth Bass	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0818
B0946	4	08	Largemouth Bass	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0930
B0947	1	08	Largemouth Bass	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.1380
B0959	3	08	Largemouth Bass	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.1280
B0954	5	08	Largemouth Bass	Large Fish	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.1170

Table C.4-2 Ecological Risk Characterization Biota Analytical Results, 1989–90

Tag	Site	Biota Study Area	Species	Group	Tissue	Aldrin		Dieldrin		Endrin		DDE		DDT		Arsenic		Mercury	
B1460	1	04	Gopher Snake	Herptile	01	0.1030	L	0.4120		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0463	L
B1449	24	Sec. 24	Gopher Snake	Herptile	01	0.1030	L	1.2000		0.0740	L	0.2030		0.1180	L	0.4380	L	0.0463	L
B1358	36	01	Vesper Sparrow	Small Bird	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0463	L
B1357	4	01	Vesper Sparrow	Small Bird	02	0.1030	L	0.7750		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0463	L
B1327	26	02	Vesper Sparrow	Small Bird	02	0.1030	L	1.9000		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0463	L
B1344	2	03	Vesper Sparrow	Small Bird	02	0.1030	L	0.2350		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0463	L
B1411	11	05	Vesper Sparrow	Small Bird	02	0.1030	L	0.0840	L	0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0463	L
B0903	2	07	American Pondweed	Aquatic Plant	08	0.0660	L	0.0590	L	0.0470	L	0.0420	L	0.0750	L	0.3660		0.0574	L
B0980	1	08	American Pondweed	Aquatic Plant	08	0.0660	L	0.0590	L	0.0470	L	0.0420	L	0.0750	L	0.8970		0.0574	L
B0902	2	07	Sago Pondweed	Aquatic Plant	08	0.0660	L	0.0590	L	0.0470	L	0.0420	L	0.0750	L	0.4170		0.0574	L
B0901	3	07	Sago Pondweed	Aquatic Plant	08	0.0660	L	0.0590	L	0.0470	L	0.0420	L	0.0750	L	0.5120		0.0574	L
B0981	8	08	Sago Pondweed	Aquatic Plant	08	0.0660	L	0.0590	L	0.0470	L	0.0420	L	0.0750	L	0.9910		0.0574	L
B0979	1	08	Sago Pondweed	Aquatic Plant	08	0.0660	L	0.0590	L	0.0470	L	0.0420	L	0.0750	L	1.4300		0.0574	L
B1458	2	05	Spadefoot Toad	Herptile	07	0.1030	L	0.4800		0.0740	L	0.1000	L	0.1180	L	NA		NA	
B1459	3A	05	Spadefoot Toad	Herptile	07	0.1030	L	0.8100		0.0740	L	0.1000	L	0.1180	L	0.4380	L	0.0625	
BO797	26	02	Tiger Salamander	Herptile	01	0.2080		2.5000		0.5400		0.1000	L	0.1180	L	NA		0.0747	
BO798	26	02	Tiger Salamander	Herptile	01	0.4130		4.0000		1.0000		0.1000	L	0.1240		0.4380	L	0.0758	
B1008	2	07	Aquatic Invertebrate	Aq. Invertebrate	01	NA		NA		NA		NA		NA		0.4380	L	0.0463	L

Notes:

All concentrations in milligrams per kilogram
Tissue: 01 = whole body, 02 = dressed carcass, 07 = composite, 08 = above-substrate plant
Biota Study Area: 1-5,11 = terrestrial biota study area; 07 = Lake Ladora and 08 = Lower Derby lake
"L" following a concentration indicates a nondetection; i.e., below certified reporting limit
NA = Not Analyzed; DDE = dichlorodiphenyldichloroethene; DDT = dichlorodiphenyltrichloroethane

Table C.4-3 Ecological Risk Characterization Sediment Analytical Results from Lake Ladora, 1989

Biota Study Area	Site Identification	Test Name	Sample Date	Mean Depth (feet)	Below Certified Reporting Limit	Concentration (mg/kg)
07	BS07S00589	Aldrin	89263	0.25	X	0.00190
07	BS07S00189	Aldrin	89264	0.25		0.01310
07	BS07S00289	Aldrin	89264	0.25		0.00718
07	BS07S00489	Aldrin	89263	0.25	X	0.00190
07	BS07S00389	Aldrin	89261	0.25	X	0.00190
07	BS07S00289	Arsenic	89264	0.25	X	2.50000
07	BS07S00189	Arsenic	89264	0.25	X	2.50000
07	BS07S00589	Arsenic	89263	0.25	X	2.50000
07	BS07S00489	Arsenic	89263	0.25	X	2.50000
07	BS07S00389	Arsenic	89261	0.25	X	2.50000
07	BS07S00589	Dieldrin	89263	0.25	X	0.00330
07	BS07S00289	Dieldrin	89264	0.25		0.00518
07	BS07S00389	Dieldrin	89261	0.25	X	0.00330
07	BS07S00489	Dieldrin	89263	0.25	X	0.00330
07	BS07S00189	Dieldrin	89264	0.25		0.00409
07	BS07S00289	Endrin	89264	0.25	X	0.00471
07	BS07S00589	Endrin	89263	0.25	X	0.00580
07	BS07S00389	Endrin	89261	0.25	X	0.00580
07	BS07S00189	Endrin	89264	0.25	X	0.00471
07	BS07S00489	Endrin	89263	0.25	X	0.00580
07	BS07S00489	Mercury	89263	0.25	X	0.05000
07	BS07S00589	Mercury	89263	0.25	X	0.05000
07	BS07S00389	Mercury	89261	0.25	X	0.05000
07	BS07S00289	Mercury	89264	0.25	X	0.05000
07	BS07S00189	Mercury	89264	0.25	X	0.05000
07	BS07S00389	DDE	89261	0.25	X	0.00240
07	BS07S00489	DDE	89263	0.25	X	0.00240
07	BS07S00589	DDE	89263	0.25	X	0.00240
07	BS07S00289	DDE	89264	0.25	X	0.00466
07	BS07S00189	DDE	89264	0.25	X	0.00466
07	BS07S00389	DDT	89261	0.25	X	0.00200
07	BS07S00189	DDT	89264	0.25	X	0.00277
07	BS07S00589	DDT	89263	0.25	X	0.00200
07	BS07S00289	DDT	89264	0.25	X	0.00277
07	BS07S00489	DDT	89263	0.25	X	0.00200

mg/kg Milligrams per kilogram
DDE Dichlorodiphenyldichloroethene
DDT Dichlorodiphenyltrichloroethane
Biota Study Area: 07 = Lake Ladora

Table C.4-4 Ecological Risk Characterization Sediment Analytical Results from Lower Derby Lake, 1989

Biota Study Area	Site Identification	Test Name	Sample Date	Mean Depth (feet)	Below Certified Reporting Limit	Concentration (mg/kg)
08	BS08S00489	Aldrin	89265	0.25		0.02400
08	BS08S00389	Aldrin	89269	0.25		3.40000
08	BS08S00189	Aldrin	89269	0.25		0.01090
08	BS08S00589	Aldrin	89268	0.25		0.03350
08	BS08S00289	Aldrin	89268	0.25		0.00648
08	BS08S00589	Arsenic	89268	0.25		2.50000
08	BS08S00489	Arsenic	89265	0.25	X	2.50000
08	BS08S00189	Arsenic	89269	0.25	X	2.50000
08	BS08S00389	Arsenic	89269	0.25	X	2.50000
08	BS08S00289	Arsenic	89268	0.25	X	2.50000
08	BS08S00389	Dieldrin	89269	0.25		0.07300
08	BS08S00289	Dieldrin	89268	0.25	X	0.00181
08	BS08S00489	Dieldrin	89265	0.25		0.00551
08	BS08S00189	Dieldrin	89269	0.25		0.00579
08	BS08S00589	Dieldrin	89268	0.25		0.00611
08	BS08S00289	Endrin	89268	0.25	X	0.00471
08	BS08S00189	Endrin	89269	0.25	X	0.00471
08	BS08S00589	Endrin	89268	0.25		0.00921
08	BS08S00389	Endrin	89269	0.25		0.01150
08	BS08S00489	Mercury	89265	0.25		1.09000
08	BS08S00189	Mercury	89269	0.25		0.08570
08	BS08S00589	Mercury	89268	0.25	X	0.05000
08	BS08S00389	Mercury	89269	0.25	X	0.05000
08	BS08S00289	Mercury	89269	0.25		0.16100
08	BS08S00589	DDE	89268	0.25		0.00629
08	BS08S00489	DDE	89265	0.25		0.00825
08	BS08S00189	DDE	89269	0.25	X	0.00466
08	BS08S00389	DDE	89269	0.25	X	0.00466
08	BS08S00289	DDE	89268	0.25	X	0.00466
08	BS08S00489	DDT	89265	0.25	X	0.00277
08	BS08S00389	DDT	89269	0.25		0.00795
08	BS08S00589	DDT	89268	0.25	X	0.00277
08	BS08S00289	DDT	89268	0.25	X	0.00277
08	BS08S00189	DDT	89269	0.25	X	0.00277

mg/kg Milligrams per kilogram
DDE Dichlorodiphenyldichloroethene
DDT Dichlorodiphenyltrichloroethane
Biota Study Area:08=Lower Derby lake

Table C.4-5 Ecological Risk Characterization Soil Analytical Results, 1990*

Biota Study Area	Site Identification**	Test Name	Sample Date	Below Certified Reporting Level	Concentration (mg/kg)
4	BS04S002VD	Aldrin	90131		0.34000
4	BS04S003E	Aldrin	90131		0.05680
2	BS02S001ED	Aldrin	90129		0.01220
4	BS04S003V	Aldrin	90131		0.06200
2	BS02S001VD	Aldrin	90129		0.01420
4	BS04S001V	Aldrin	90134		0.12000
2	BS02S02AV	Aldrin	90129		0.01940
4	BS04S001P	Aldrin	90134		0.89000
2	BS02S004V	Aldrin	90129		1.80000
5	BS05S03AE	Aldrin	90129		0.00869
2	BS02S03AP	Aldrin	90130		0.01790
5	BS05S002E	Aldrin	90131		0.01770
3	BS03S002V	Aldrin	90130		0.17000
5	BS05S004E	Aldrin	90131		0.00547
3	BS03S03AV	Aldrin	90130		0.00263
5	BS05S006E	Aldrin	90131		0.04530
3	BS03S001PD	Aldrin	90131		0.14000
5	BS05S002V	Aldrin	90131		0.43000
3	BS03S001VD	Aldrin	90131		0.08750
5	BS05S006V	Aldrin	90131		0.01800
12	BS12S001VD	Aldrin	90134		0.00478
5	BS05S004V	Aldrin	90131		0.00462
12	BS12S001E	Aldrin	90134		0.01410
5	BS05S03AP	Aldrin	90129		0.03350
12	BS12S002E	Aldrin	90134		0.00734
2	BS02S001V	Aldrin	90129		0.01520
1	BS01S02AE	Aldrin	90130	X	0.00211
2	BS02S02AE	Aldrin	90129		0.05340
1	BS01S001P	Aldrin	90130		0.02820
2	BS02S004E	Aldrin	90129		0.02810
1	BS01S005P	Aldrin	90130	X	0.00211
2	BS02S03AV	Aldrin	90130		0.02670
1	BS01S003P	Aldrin	90130		1.10000
3	BSO3S002E	Aldrin	90130		0.18000
4	BS04S002ED	Aldrin	90131		0.07240
3	BS03S03AP	Aldrin	90130		0.00361
2	BS02S001E	Aldrin	90129		0.00783
3	BS03S001P	Aldrin	90131		0.22000
1	BS01S005V	Aldrin	90130	X	0.00211

Biota Study Area	Site Identification**	Test Name	Sample Date	Below Certified Reporting Level	Concentration (mg/kg)
4	BS04S002E	Aldrin	90131		0.24000
4	BS04S002V	Aldrin	90131		0.55000
1	BS01S001V	Aldrin	90130		0.00577
1	BS01S003V	Aldrin	90130		0.09320
3	BS03S001V	Aldrin	90131		0.16000
12	BS12S001ED	Aldrin	90134		0.01360
12	BS12S002V	Aldrin	90134		0.01790
12	BS12S001V	Aldrin	90134		0.01960
1	BS01S02AV	Aldrin	90130	X	0.00211
3	BS03S001VD	Arsenic	90131	X	2.50000
2	BS02S02AV	Arsenic	90129	X	2.50000
3	BS03S001V	Arsenic	90131	X	2.50000
2	BS02S02AE	Arsenic	90129	X	2.50000
3	BS03S001P	Arsenic	90131	X	2.50000
2	BS02S001VD	Arsenic	90129		15.10000
3	BS03S03AP	Arsenic	90130	X	2.50000
2	BS02S001V	Arsenic	90129		16.80000
3	BS03S002E	Arsenic	90130	X	2.50000
2	BS02S001ED	Arsenic	90129		3.37000
2	BS02S03AV	Arsenic	90130	X	2.50000
2	BS02S001E	Arsenic	90129		2.89000
2	BS02S004E	Arsenic	90129		3.70000
12	BS12S001E	Arsenic	90134		6.49000
3	BS03S03AV	Arsenic	90130	X	2.50000
2	BS02S03AP	Arsenic	90130	X	2.50000
2	BS02S004V	Arsenic	90129		37.00000
3	BS03S001PD	Arsenic	90131	X	2.50000
3	BS03S002V	Arsenic	90130	X	2.50000
12	BS12S001V	Arsenic	90134		13.30000
12	BS12S002E	Arsenic	90134		6.71000
12	BS12S001ED	Arsenic	90134		10.60000
12	BS12S001VD	Arsenic	90134		11.00000
12	BS12S002V	Arsenic	90134		13.40000
1	BS01S003P	Arsenic	90130		2.94000
5	BS05S006E	Arsenic	90131	X	2.50000
5	BS05S006V	Arsenic	90131	X	2.50000
1	BS01S005P	Arsenic	90130		16.10000
4	BS04S002ED	Arsenic	90131	X	2.50000
1	BS01S001P	Arsenic	90130	X	2.50000

Biota Study Area	Site Identification**	Test Name	Sample Date	Below Certified Reporting Level	Concentration (mg/kg)
4	BS04S003V	Arsenic	90131	X	2.50000
1	BS01S02AE	Arsenic	90130	X	2.50000
4	BS04S001P	Arsenic	90134		2.91000
4	BS04S002E	Arsenic	90131	X	2.50000
4	BS04S002VD	Arsenic	90131		4.51000
4	BS04S003E	Arsenic	90131		2.65000
5	BS05S004V	Arsenic	90131	X	2.50000
1	BS01S003V	Arsenic	90130		3.52000
5	BS05S03AP	Arsenic	90129	X	2.50000
5	BS05S002V	Arsenic	90131	X	2.50000
5	BS05S004E	Arsenic	90131	X	2.50000
5	BS05S03AE	Arsenic	90129	X	2.50000
5	BS05S002E	Arsenic	90131	X	2.50000
1	BS01S005V	Arsenic	90130		28.30000
1	BS01S001V	Arsenic	90130	X	2.50000
1	BS01S02AV	Arsenic	90130	X	2.50000
4	BS04S002V	Arsenic	90131	X	2.50000
4	BS04S001V	Arsenic	90134	X	2.50000
2	BS02S001E	DDE	90129	X	0.00657
2	BS02S004E	DDE	90129		0.00643
2	BS02S004V	DDE	90129		0.55000
2	BS02S001V	DDE	90129	X	0.00466
2	BS02S02AE	DDE	90129	X	0.00466
2	BS02S02AV	DDE	90129	X	0.00466
2	BS02S001ED	DDE	90129	X	0.00466
2	BS02S001VD	DDE	90129	X	0.00466
2	BS02S03AV	DDE	90130		0.00748
2	BS02S03AP	DDE	90130	X	0.00466
3	BSO3S002E	DDE	90130		0.22000
3	BS03S002V	DDE	90130		0.03190
3	BS03S03AP	DDE	90130	X	0.00466
3	BS03S03AV	DDE	90130		0.32000
1	BS01S001P	DDE	90130		0.00671
1	BS01S001V	DDE	90130	X	0.00466
3	BS03S001PD	DDE	90131		0.42000
1	BS01S02AE	DDE	90130	X	0.00466
3	BS03S001VD	DDE	90131	X	0.00466
1	BS01S02AV	DDE	90130	X	0.00466
12	BS12S001ED	DDE	90134		0.03310

Biota Study Area	Site Identification**	Test Name	Sample Date	Below Certified Reporting Level	Concentration (mg/kg)
4	BS04S002E	DDE	90131	X	0.00466
12	BS12S001VD	DDE	90134	X	0.00466
4	BS04S002ED	DDE	90131	X	0.00466
5	BS05S006E	DDE	90131		0.77000
4	BS04S002V	DDE	90131	X	0.00466
5	BS05S006V	DDE	90131		0.18000
4	BS04S002VD	DDE	90131	X	0.00466
1	BS01S003P	DDE	90130		0.01770
4	BS04S003E	DDE	90131	X	0.00466
1	BS01S005P	DDE	90130		0.85000
4	BS04S003V	DDE	90131	X	0.00466
3	BS03S001P	DDE	90131		0.39000
4	BS04S001V	DDE	90134	X	0.00466
12	BS12S001E	DDE	90134	X	0.00466
4	BS04S001P	DDE	90134		2.10000
12	BS12S002E	DDE	90134	X	0.00466
5	BS05S004E	DDE	90131	X	0.00466
5	BS05S03AE	DDE	90129	X	0.00466
1	BS01S003V	DDE	90130		0.03490
3	BS03S001V	DDE	90131	X	0.00466
12	BS12S001V	DDE	90134		0.04880
12	BS12S002V	DDE	90134	X	0.00466
1	BS01S005V	DDE	90130	X	0.00466
5	BS05S03AP	DDE	90129	X	0.00466
5	BS05S002E	DDE	90131	X	0.00466
5	BS05S002V	DDE	90131	X	0.00466
5	BS05S004V	DDE	90131	X	0.00466
5	BS05S006V	DDT	90131		0.05360
2	BS02S001ED	DDT	90129		0.00584
2	BS02S001E	DDT	90129	X	0.00277
2	BS02S001VD	DDT	90129	X	0.00277
2	BS02S02AE	DDT	90129		0.02470
2	BS02S001V	DDT	90129	X	0.00277
2	BS02S004E	DDT	90129		0.01250
2	BS02S004V	DDT	90129		0.49000
2	BS02S02AV	DDT	90129		0.01410
2	BS02S03AP	DDT	90130	X	0.00277
3	BSO3S002E	DDT	90130	X	0.10000
2	BS02S03AV	DDT	90130		0.01170

Biota Study Area	Site Identification**	Test Name	Sample Date	Below Certified Reporting Level	Concentration (mg/kg)
3	BS03S03AP	DDT	90130		0.00319
3	BS03S03AV	DDT	90130		0.23000
3	BS03S002V	DDT	90130		0.05270
3	BS03S001PD	DDT	90131		0.13000
3	BS03S001V	DDT	90131		0.06350
3	BS03S001P	DDT	90131		0.12000
12	BS12S002V	DDT	90134		0.02360
12	BS12S002E	DDT	90134		0.00690
3	BS03S001VD	DDT	90131		0.03230
12	BS12S001V	DDT	90134		0.02500
12	BS12S001ED	DDT	90134		0.08150
12	BS12S001VD	DDT	90134		0.00595
1	BS01S003P	DDT	90130		1.00000
1	BS01S003V	DDT	90130		0.28000
12	BS12S001E	DDT	90134		0.07150
1	BS01S005V	DDT	90130		0.02450
1	BS01S001P	DDT	90130		0.04720
1	BS01S005P	DDT	90130	X	0.00277
1	BS01S02AE	DDT	90130		0.00703
1	BS01S02AV	DDT	90130		0.00337
1	BS01S001V	DDT	90130		0.00612
4	BS04S002ED	DDT	90131		0.04500
4	BS04S002V	DDT	90131		0.26000
4	BS04S002E	DDT	90131		0.11000
4	BS04S003E	DDT	90131		0.03200
4	BS04S003V	DDT	90131		0.05090
4	BS04S002VD	DDT	90131		0.15000
4	BS04S001P	DDT	90134		1.10000
5	BS05S03AE	DDT	90129		0.00309
4	BS04S001V	DDT	90134		0.05800
5	BS05S002V	DDT	90131		0.74000
5	BS05S002E	DDT	90131		0.01500
5	BS05S03AP	DDT	90129		0.03290
5	BS05S006E	DDT	90131		0.22000
5	BS05S004V	DDT	90131		0.01540
5	BS05S004E	DDT	90131		0.00693
2	BS02S02AE	Dieldrin	90129		0.51000
2	BS02S001VD	Dieldrin	90129		0.53000
2	BS02S001V	Dieldrin	90129		0.68000

Biota Study Area	Site Identification**	Test Name	Sample Date	Below Certified Reporting Level	Concentration (mg/kg)
3	BSO3S002E	Dieldrin	90130		4.70000
2	BS02S004E	Dieldrin	90129		0.56000
2	BS02S03AV	Dieldrin	90130		0.34000
3	BS03S001V	Dieldrin	90131	X	0.00181
3	BS03S03AP	Dieldrin	90130		0.05760
3	BS03S001P	Dieldrin	90131		2.50000
12	BS12S002V	Dieldrin	90134		0.10000
12	BS12S001ED	Dieldrin	90134		0.08800
12	BS12S001VD	Dieldrin	90134		0.05130
2	BS02S02AV	Dieldrin	90129		0.58000
12	BS12S001E	Dieldrin	90134		0.09100
12	BS12S002E	Dieldrin	90134		0.07100
12	BS12S001V	Dieldrin	90134		0.09600
2	BS02S004V	Dieldrin	90129		6.10000
2	BS02S03AP	Dieldrin	90130		0.25000
1	BS01S003P	Dieldrin	90130		11.00000
3	BS03S002V	Dieldrin	90130		4.80000
3	BS03S03AV	Dieldrin	90130		0.06100
1	BS01S005V	Dieldrin	90130		0.13000
1	BS01S003V	Dieldrin	90130	X	0.00181
1	BS01S005P	Dieldrin	90130		3.20000
1	BS01S02AE	Dieldrin	90130		0.03740
1	BS01S001P	Dieldrin	90130		0.50000
1	BS01S001V	Dieldrin	90130		0.04330
4	BS04S002ED	Dieldrin	90131	X	0.00181
1	BS01S02AV	Dieldrin	90130		0.05150
4	BS04S002E	Dieldrin	90131		3.90000
4	BS04S003E	Dieldrin	90131		0.44000
4	BS04S002V	Dieldrin	90131		5.50000
4	BS04S002VD	Dieldrin	90131		3.90000
4	BS04S001P	Dieldrin	90134		2.70000
4	BS04S003V	Dieldrin	90131		0.78000
4	BS04S001V	Dieldrin	90134		0.63000
5	BS05S004V	Dieldrin	90131		0.23000
5	BS05S03AP	Dieldrin	90129		2.50000
5	BS05S002V	Dieldrin	90131		6.80000
5	BS05S002E	Dieldrin	90131		0.52000
5	BS05S006V	Dieldrin	90131		0.51000
5	BS05S03AE	Dieldrin	90129		0.47000

Biota Study Area	Site Identification**	Test Name	Sample Date	Below Certified Reporting Level	Concentration (mg/kg)
2	BS02S001ED	Dieldrin	90129		0.20000
5	BS05S004E	Dieldrin	90131		0.10000
2	BS02S001E	Dieldrin	90129		0.06060
3	BS03S001PD	Dieldrin	90131		3.20000
3	BS03S001VD	Dieldrin	90131	X	0.00181
5	BS05S006E	Dieldrin	90131		2.20000
1	BS01S003P	Endrin	90130		0.70000
5	BS05S006V	Endrin	90131		0.01320
2	BS02S03AP	Endrin	90130		0.01160
5	BS05S004V	Endrin	90131		0.00557
2	BS02S02AV	Endrin	90129		0.01830
5	BS05S002V	Endrin	90131		0.22000
2	BS02S001ED	Endrin	90129		0.00875
5	BS05S03AP	Endrin	90129		0.54000
3	BS03S001VD	Endrin	90131		0.01210
4	BS04S001P	Endrin	90134		0.28000
3	BS03S001PD	Endrin	90131	X	0.00471
4	BS04S003V	Endrin	90131		0.02790
3	BS03S002V	Endrin	90130		0.00838
4	BS04S002VD	Endrin	90131		0.04470
2	BS02S004V	Endrin	90129		0.06540
4	BS04S002ED	Endrin	90131		0.02730
2	BS02S001VD	Endrin	90129		0.02070
1	BS01S02AV	Endrin	90130		0.00586
3	BS03S001V	Endrin	90131		0.01070
1	BS01S001V	Endrin	90130	X	0.00471
3	BS03S001P	Endrin	90131		0.00861
1	BS01S005V	Endrin	90130		0.34000
3	BS03S03AP	Endrin	90130	X	0.00471
1	BS01S003V	Endrin	90130		0.94000
3	BSO3S002E	Endrin	90130		0.02240
5	BS05S004E	Endrin	90131	X	0.00471
2	BS02S03AV	Endrin	90130		0.01600
5	BS05S03AE	Endrin	90129		0.01020
2	BS02S004E	Endrin	90129		0.02350
4	BS04S003E	Endrin	90131		0.05240
2	BS02S02AE	Endrin	90129		0.05860
4	BS04S002E	Endrin	90131		0.06830
2	BS02S001V	Endrin	90129		0.09130

Biota Study Area	Site Identification**	Test Name	Sample Date	Below Certified Reporting Level	Concentration (mg/kg)
1	BS01S001P	Endrin	90130		0.03530
2	BS02S001E	Endrin	90129	X	0.00471
5	BS05S006E	Endrin	90131		0.02090
12	BS12S002V	Endrin	90134		0.01390
4	BS04S001V	Endrin	90134		0.02810
1	BS01S02AE	Endrin	90130	X	0.00471
1	BS01S005P	Endrin	90130		4.60000
5	BS05S002E	Endrin	90131		0.02050
4	BS04S002V	Endrin	90131		0.10000
12	BS12S002E	Endrin	90134		0.00733
12	BS12S001VD	Endrin	90134	X	0.00471
12	BS12S001V	Endrin	90134		0.01430
12	BS12S001ED	Endrin	90134		0.02790
12	BS12S001E	Endrin	90134		0.02350
3	BS03S03AV	Endrin	90130	X	0.00471
1	BS01S003V	Mercury	90130		0.38000
2	BS02S02AE	Mercury	90129	X	0.05000
5	BS05S006E	Mercury	90131	X	0.05000
12	BS12S002V	Mercury	90134		0.25200
5	BS05S004E	Mercury	90131	X	0.05000
12	BS12S002E	Mercury	90134		0.15600
5	BS05S002E	Mercury	90131	X	0.05000
12	BS12S001VD	Mercury	90134	X	0.05000
5	BS05S03AE	Mercury	90129	X	0.05000
12	BS12S001V	Mercury	90134		0.05290
4	BS04S001P	Mercury	90134		0.15200
12	BS12S001ED	Mercury	90134		0.18100
4	BS04S003V	Mercury	90131	X	0.05000
12	BS12S001E	Mercury	90134		0.16200
4	BS04S002VD	Mercury	90131		0.41400
2	BS02S03AV	Mercury	90130	X	0.05000
4	BS04S002ED	Mercury	90131	X	0.05000
2	BS02S001E	Mercury	90129	X	0.05000
1	BS01S003P	Mercury	90130		0.39000

Biota Study Area	Site Identification**	Test Name	Sample Date	Below Certified Reporting Level	Concentration (mg/kg)
2	BS02S004E	Mercury	90129		0.14500
1	BS01S005P	Mercury	90130		0.14700
2	BS02S001V	Mercury	90129		0.08980
1	BS01S001V	Mercury	90130	X	0.05000
2	BS02S03AP	Mercury	90130	X	0.05000
5	BS05S006V	Mercury	90131	X	0.05000
2	BS02S004V	Mercury	90129		0.64200
5	BS05S002V	Mercury	90131		1.70000
2	BS02S02AV	Mercury	90129	X	0.05000
1	BS01S001P	Mercury	90130	X	0.05000
2	BS02S001VD	Mercury	90129		0.05610
4	BS04S003E	Mercury	90131	X	0.05000
2	BS02S001ED	Mercury	90129	X	0.05000
4	BS04S002E	Mercury	90131	X	0.05000
3	BS03S001VD	Mercury	90131	X	0.05000
1	BS01S02AV	Mercury	90130	X	0.05000
3	BS03S001V	Mercury	90131	X	0.05000
5	BS05S004V	Mercury	90131	X	0.05000
3	BS03S001PD	Mercury	90131	X	0.05000
4	BS04S001V	Mercury	90134	X	0.05000
1	BS01S02AE	Mercury	90130	X	0.05000
1	BS01S005V	Mercury	90130	X	0.05000
5	BS05S03AP	Mercury	90129		0.17900
4	BS04S002V	Mercury	90131		0.46300
3	BS03S001P	Mercury	90131	X	0.05000
3	BS03S03AV	Mercury	90130	X	0.05000
3	BS03S03AP	Mercury	90130	X	0.05000
3	BS03S002V	Mercury	90130	X	0.05000
3	BS03S002E	Mercury	90130	X	0.05000

mg/kg Milligrams per kilogram
DDE Dichlorodiphenyldichloroethene
DDT Dichlorodiphenyltrichloroethane
* Mean depth of all samples = 0.5 ft
** Soil samples were collocated with earthworms (E), deer mice (P), or vegetables (V) samples; samples with a "D" are duplicates.

Table C.4-6 Ecological Risk Characterization Surface Water Analytical Results, 1989

Biota Study Area	Site	Test Name	Mean Sample Depth (ft)	Concentration (µg/l)	
7	BS07S00189	Aldrin	4.8	0.050	L
7	BS07S00189	Aldrin	2.0	0.050	L
7	BS07S00289	Aldrin	4.3	0.050	L
7	BS07S00389	Aldrin	10.0	0.050	L
7	BS07S00389	Aldrin	4.5	0.050	L
7	BS07S00489	Aldrin	3.8	0.050	L
7	BS07S00489	Aldrin	7.5	0.050	L
7	BS07S00589	Aldrin	5.5	0.050	L
8	BS08S00289	Aldrin	6.0	0.050	L
8	BS08S00189	Aldrin	2.5	0.050	L
8	BS08S00289	Aldrin	2.0	0.050	L
8	BS08S00389	Aldrin	3.5	0.050	L
8	BS08S00489	Aldrin	3.0	0.050	L
8	BS08S00589	Aldrin	2.5	0.050	L
7	BS07S00189	Arsenic	4.8	2.350	L
7	BS07S00189	Arsenic	2.3	2.440	
7	BS07S00289	Arsenic	4.3	2.740	
7	BS07S00389	Arsenic	10.0	2.440	
7	BS07S00389	Arsenic	4.5	2.350	L
7	BS07S00489	Arsenic	3.8	2.740	
7	BS07S00489	Arsenic	7.5	2.350	L
7	BS07S00589	Arsenic	5.5	2.350	L
8	BS08S00189	Arsenic	2.5	2.740	
8	BS08S00289	Arsenic	6.0	2.440	
8	BS08S00289	Arsenic	2.0	2.350	L
8	BS08S00389	Arsenic	3.5	2.740	
8	BS08S00489	Arsenic	3.0	2.600	
8	BS08S00589	Arsenic	2.5	2.440	
7	BS07S00189	Dieldrin	4.8	0.050	L
7	BS07S00189	Dieldrin	2.0	0.050	L
7	BS07S00289	Dieldrin	4.3	0.050	L
7	BS07S00389	Dieldrin	10.0	0.050	L
7	BS07S00389	Dieldrin	4.5	0.050	L
7	BS07S00489	Dieldrin	3.8	0.050	L
7	BS07S00489	Dieldrin	7.5	0.050	L

Biota Study Area	Site	Test Name	Mean Sample Depth (ft)	Concentration (µg/l)	
7	BS07S00589	Dieldrin	5.5	0.050	L
8	BS08S00289	Dieldrin	6.0	0.050	L
8	BS08S00189	Dieldrin	2.5	0.050	L
8	BS08S00289	Dieldrin	2.0	0.050	L
8	BS08S00389	Dieldrin	3.5	0.050	L
8	BS08S00489	Dieldrin	3.0	0.050	L
8	BS08S00589	Dieldrin	2.5	0.050	L
7	BS07S00189	Endrin	4.8	0.050	L
7	BS07S00189	Endrin	2.0	0.050	L
7	BS07S00289	Endrin	4.3	0.050	L
7	BS07S00389	Endrin	10.0	0.050	L
7	BS07S00389	Endrin	4.5	0.050	L
7	BS07S00489	Endrin	3.8	0.050	L
7	BS07S00489	Endrin	7.5	0.050	L
7	BS07S00589	Endrin	5.5	0.050	L
8	BS08S00289	Endrin	6.0	0.050	L
8	BS08S00189	Endrin	2.5	0.050	L
8	BS08S00289	Endrin	2.0	0.050	L
8	BS08S00389	Endrin	3.5	0.050	L
8	BS08S00489	Endrin	3.0	0.050	L
8	BS08S00589	Endrin	2.5	0.050	L
7	BS07S00189	Mercury	4.8	0.100	L
7	BS07S00189	Mercury	2.3	0.100	L
7	BS07S00289	Mercury	4.3	0.100	L
7	BS07S00389	Mercury	10.0	0.100	L
7	BS07S00389	Mercury	4.5	0.179	
7	BS07S00489	Mercury	3.8	0.100	L
7	BS07S00489	Mercury	7.5	0.100	L
7	BS07S00589	Mercury	5.5	0.100	L
8	BS08S00189	Mercury	2.5	0.100	L
8	BS08S00289	Mercury	6.0	0.100	L
8	BS08S00289	Mercury	2.0	0.100	L
8	BS08S00389	Mercury	3.5	0.100	L
8	BS08S00489	Mercury	3.0	0.100	L
8	BS08S00589	Mercury	2.5	0.100	L

Table C.4-6 Ecological Risk Characterization Surface Water Analytical Results, 1989

Biota Study Area	Site	Test Name	Mean Sample Depth (ft)	Concentration (µg/l)	
7	BS07S00189	DDE	4.8	0.054	L
7	BS07S00189	DDE	2.0	0.054	L
7	BS07S00289	DDE	4.3	0.054	L
7	BS07S00389	DDE	10.0	0.054	L
7	BS07S00389	DDE	4.5	0.054	L
7	BS07S00489	DDE	3.8	0.054	L
7	BS07S00489	DDE	7.5	0.054	L
7	BS07S00589	DDE	5.5	0.054	L
8	BS08S00289	DDE	2.5	0.054	L
8	BS08S00189	DDE	6.0	0.054	L
8	BS08S00289	DDE	2.0	0.054	L
8	BS08S00389	DDE	3.5	0.054	L
8	BS08S00489	DDE	3.0	0.054	L
8	BS08S00589	DDE	2.5	0.054	L
7	BS07S00189	DDT	4.8	0.049	L
7	BS07S00189	DDT	2.0	0.049	L
7	BS07S00289	DDT	4.3	0.049	L
7	BS07S00389	DDT	10.0	0.049	L
7	BS07S00389	DDT	4.5	0.049	L
7	BS07S00489	DDT	3.8	0.049	L
7	BS07S00489	DDT	7.5	0.049	L
7	BS07S00589	DDT	5.5	0.049	L
8	BS07S00589	DDT	2.5	0.049	L
8	BS08S00289	DDT	6.0	0.049	L
8	BS08S00289	DDT	2.0	0.049	L
8	BS08S00389	DDT	3.5	0.049	L
8	BS08S00489	DDT	3.0	0.049	L
8	BS08S00589	DDT	2.5	0.049	L

Notes: "L" following a concentration indicates a nondetection, i.e., below certified reporting limit
Biota Study Area: 7 = Lake Ladora; 8 = Lower Derby Lake
DDE = dichlorodiphenydichloroethene; DDT = dichlorodiphenyltrichloroethane
mg/l = micrograms per liter
RMA.IEA/RC.7/93 js

Table C.4-7 Mallard Food Items Based on Analysis of Esophageal Contents, Rocky Mountain Arsenal, August 1990[1,2] Page 1 of 1

Sample	Description	Seeds			Vegetation	Insects					Invertebrates	TOTAL
		P. pusillus	P. pectinatus	Solanum spp.	Algae/ Leaf matter	Orthop-tera	Coleop-tera	Hymenop-tera	Hemip-tera	Unknown	Unknown	
B1432C	Total #		10.0		NA		1.0		1.0			
	Volume ml		0.2		0.8		Trace		Trace			1.0
	% Volume		25.0		75.0							100.0
B1433C	Total #	~420	~150							1.0		
	Volume ml	1.8	1.2		3.0					Trace		6.0
	% Volume	30.0	20.0		50.0							100.0
B1434C	Total #			5.0	NA							
	Volume ml			0.1	2.9							3.0
	% Volume			3.3	96.7							100.0
B1435C	Total #	~310	~20		NA	1.0	1.0	2.0			25.0	
	Volume ml	1.8	0.1		3.4			0.1			0.1	5.5
	% Volume	32.7	1.8		61.8			1.8			1.8	99.9
B1441C	Total #		~150		NA							
	Volume ml		1.2		2.0							3.2
	% Volume		37.5		62.5							100.0
B1442C	Total #	~740	~34		Trace							
	Volume ml	4.4	0.1									4.5
	% Volume	97.8	2.2									100.0
Total	Volume ml	8.0	2.9	0.1	12.1	Trace	Trace	0.1	Trace	Trace	0.1	23.2
Mean	Volume ml	1.3	0.5	0.0	2.0			0.02			0.02	3.9
	% Volume	26.8	14.4	0.6	57.7			0.3			0.3	100.0

1 Volume measured by water displacement
2 Mean volume is calculated by the aggregate percent method (Swanson et al. 1974)
P. Potamogeten
NA Not Applicable
Trace Less than 0.05 millileters (ml)

Table C.4-8 American Coot Food Items Based on Analysis of Esophageal Contents, Rocky Mountain Arsenal, August 1990[1,2] Page 1 of 1

Sample	Description	Plants			Insects	Invertebrates		
		Ceratophyllum	Chara spp.	Fil. Algae	Plecoptera	Ostracoda	Physa spp.	Total
B1437C	Total #	NA	NA	NA			25	
	Volume ml	8.2	Trace			1.2	0.25	9.65
	% Volume	85.0				12.4	2.6	100.00
B1439C	Total #	NA	NA	NA	1	100		
	Volume ml	8.63	Trace		0.06	0.06		8.75
	% Volume	98.6			0.7	0.7		100.00
B1436C	Total #	NA	NA	NA			2	
	Volume ml	11.6					0.1	11.70
	% Volume	99.1					0.9	100.00
B1421C	Total #	NA	NA	NA		820	16	
	Volume ml	13.1				0.1	0.25	13.45
	% Volume	97.4				0.7	1.9	100.00
B1438C	Total #	NA	NA	NA		61		
	Volume ml	5.97	0.125	0.125		0.03		6.25
	% Volume	95.5	2.0	2.0		0.5		100.00
Total	Total #	NA	NA	NA	1.00	981.00	43.00	1025.00
	Volume ml	47.50	0.13	0.13	0.06	1.39	0.60	49.81
Mean	Total #	NA	NA	NA	0.20	196.20	8.60	
	Volume ml	9.50	0.03	0.03	0.01	0.28	0.12	9.96
	% Volume	95.1	0.4	0.4	0.1	2.9	1.1	100.00

1 Volume measured by water displacement
2 Mean % volume is calculated by the aggregate percent method (Swanson et al. 1974)
NA Not Applicable
Trace Less than .125 milliliters (ml)

Table C.4-9 Vesper Sparrow Food Items Based on Analysis of Crop Contents, Rocky Mountain Arsenal, June and July 1990[1]

Species	B1357C Total #	B1411C Total #	B1344C Total #	B1358C Total #	B1327C Total #
Orthoptera					
Acrididae	4		1	>10	>11
Coleoptera A	1		1	1	
B				1	
Curculionidae					1
Hymenoptera					
Formicidae	1			1	1
Unknown family					1
Dermaptera					2
Homoptera					
Aphididae			>41		
Araneae (Lycosidae)	1				
Diptera Nemotocera	1				
Graminae (Stipa spp.)		~80			

[1] Total Number of individuals

Table C.4-10 Great Horned Owl Food Items Based on Analysis of Pellets, Rocky Mountain Arsenal, Spring 1990

Species	Nest 1 n = 13			Nest 3 n = 5			Nest 4 n = 20			Nest 5 n = 10		
	# occur.	% occur.	Total #	# occur.	% occur.	Total #	# occur.	% occur.	Total #	# occur.	% occur.	Total #
Leporidae (all)	3	23.08	3	2	40.00	2	3	15.00	3	3	30.00	3
unknown Leporidae	1	7.69	1	2	40.00	2	1	5.00	1	0	0.00	0
Sylvilagus spp.	2	15.38	2	0	0.00	0	2	10.00	2	3	30.00	3
Dipodomys ordi	2	15.38	2	0	0.00	0	5	5.00	5	4	40.00	4
Perognathus hispidus	0	0.00	0	0	0.00	0	2	10.00	2	1	10.00	1
Perognathus small spp.	0	0.00	0	1	20.00	2	1	5.00	1	1	10.00	1
Reithrodontomys spp.	1	7.69	1	0	0.00	0	1	5.00	2	0	0.00	0
Peromyscus spp.	11	84.62	22	5	100.00	7	20	100.00	61	3	30.00	5
Onychomys leucogaster	1	7.69	1	0	0.00	0	0	0.00	0	0	0.00	0
Microtus ochrogaster	2	15.38	2	2	40.00	2	1	5.00	1	3	30.00	3
Microtus pennsylvanicus	0	0.00	0	3	60.00	3	0	0.00	0	1	10.00	1
Microtus spp.	1	7.69	1	0	0.00	0	0	0.00	0	1	10.00	1
Geomys bursarius	3	23.08	3	0	0.00	0	0	0.00	0	3	30.00	3
unknown Cricetidae	3	23.08	10	0	0.00	0	12	60.00	31	0	0.00	0
Felis catus`	0	0.00	0	0	0.00	0	1	5.00	1	0	0.00	0
Columba livia	1	7.69	1	0	0.00	0	0	0.00	0	0	0.00	0
Sturnella neglecta	1	7.69	1	0	0.00	0	0	0.00	0	1	10.00	1
unknown Passeriformes (mid-sized)	0	0.00	0	0	0.00	0	0	0.00	0	1	10.00	1
Totals			47			16			107			24

Table C.4-10 Summary of Previous Groups for Great Horned Owl Pellet Analysis

Species	Nest 6 n = 20 # occur.	Nest 6 n = 20 % occur.	Nest 6 n = 20 Total #	All Nests n = 68 # occur.	All Nests n = 68 % occur.	All Nests n = 68 Total #
Leporidae (all)	13	65.00	14	24	42.86	25
unknown Leporidae	5	25.00	5	9	16.07	9
Sylvilagus spp.	8	40.00	9	15	26.79	16
Dipodomys ordi	8	40.00	10	19	33.93	21
Perognathus hispidus	0	0.00	0	3	5.36	3
Perognathus small spp.	1	5.00	1	4	7.14	5
Reithrodontomys spp.	1	5.00	1	3	5.36	4
Peromyscus spp.	9	45.00	12	48	85.71	107
Onychomys leucogaster	0	0.00	0	1	1.79	1
Microtus ochrogaster	0	0.00	0	8	14.29	8
Microtus pennsylvanicus	1	5.00	1	5	8.93	5
Microtus spp.	1	5.00	1	3	5.36	3
Geomys bursarius	2	10.00	2	8	14.29	8
unknown Cricetidae	2	10.00	2	17	30.36	43
Felis catus	0	0.00	0	1	1.79	1
Columba livia	0	0.00	0	1	1.79	1
Sturnella neglecta	0	0.00	0	2	3.57	2
unknown Passeriformes (mid-sized)	0	0.00	0	1	1.79	1
Totals			44			238

Table C.4-11 Location of American Kestrel Nest Boxes Used for Analysis of Prey Remains, Rocky Mountain Arsenal, Summer 1990

Box Number	Section	Site Identification
122	SW1/4SE1/4SEC31	BURMB12290
123	NE1/4NE1/4SEC36	BS01B12390
129	NE1/4SE1/4SEC03	BURMB12990
136	NW1/4NW1/4SEC12	BS05B13690
138	NE1/4NE1/4SEC12	BS05B13890

Table C.4-12 American Kestrel Food Items Based on Analysis of Remains in Nest Boxes, Rocky Mountain Arsenal, Summer 1990

Prey Category	Common Names	Box Number					Total	Frequency
Analysis of Prey Body Parts								
Insects		122	123	129	136	138		
Orthoptera	grasshoppers and crickets	21	19	15	31	33	119	100
(Acrididae)	grasshoppers	(13)	(12)	(15)	(25)	(7)	(72)	100
(Gryllidae)	crickets	(8)	(7)	(0)	(6)	(26)	(47)	80
Coleoptera	beetles	6	1	1	4	3	15	100
Odonata	dragonflies	1	0	1	6	5	13	80
Homoptera	cicadas	0	0	0	0	4	4	20
Hymenoptera	bees	1	0	1	0	0	2	40
Lepidoptera	moths	0	1	0	0	0	1	20
Mammals								
Microtus spp.	vole	1	10	1	1	0	13	80
Citellus tridecemlineatus	thirteen-lined ground squirrel	3	0	0	0	0	3	20
Birds								
Columbidae	pigeon	1	0	0	0	0	1	20
Corvidae	magpie	0	0	1	0	0	1	20
Frigillidae	sparrow	0	0	0	0	1	1	20
Analysis of Hair*								
Mammals		122	123	129	136	138		
Microtus spp.	vole	X	X	X	X	X	5	100
Peromyscus spp.	deer mouse	X	X		X	X	4	80
Citellus tridecemlineatus	thirteen-lined ground squirrel		X				1	20
Perognathus hispidus	hispid pocket mouse				X		1	20

* This analysis provides only the presence or absence of mammalian species.

X Presence or absence of prey species

Table C.4-13 American Kestrel Food Items Based on Analysis of Juvenile Stomach Contents, Rocky Mountain Arsenal, 1990

Stomach Contents Prey Catagory	Common Names	Box Number		
		129	136	138
Insects				
Orthoptera	grasshoppers and crickets		X	X
(Acrididae)	grasshoppers		(X)	
(Gryllidae)	crickets		(X)	(X)
Odonata	dragonflies		X	
Mammals				
Microtus spp.	vole		X	
Peromyscus spp.	deer mouse	X		
Reptiles				
Iguanidae	lizard			X

X = Presence at prey species
(X) = a subset of X

Table C.4-14 Bluegill Food Items Based on Analysis of Stomach Contents, Rocky Mountain Arsenal, September 1989

Tag #	Location #	Length mm	Weight gm	Fullness Category	Micro-Invertebrates Bosmina Longirostris	Chydorus Sphaericus	Cyclops Biscupidatus	Daphnia Pulex	Daphnia Rosa	Diaptomas Oregonensis
B0992C	BS08S00189	60	3	6	7	16	9	1	3	5
B0886C	BS07S00489	64	5	3						
B0892A	BS07S00589	65	4	6	3		10	3	1	
B0953C	BS08S00589	67	5	6						
B0953A	BS08S00589	70	6	1						
B0886B	BS07S00489	73	6	4						
B0992B	BS08S00189	74	6	3				6		
B0960D	BS08S00389	74	7	4	9	33	24	19		26
B0945D	BS08S00289	75	7	2				3		
B0945A	BS08S00289	76	7	5				6		
B0953B	BS08S00589	85	11	3						
B0960C	BS08S00389	85	18	6						
B0992D	BS08S00189	89	11	3						
B0944C	BS08S00489	89	12	6	72	37	62	48	9	51
B0945B	BS08S00289	93	12	5	12	17	23	31	9	17
B0945C	BS08S00289	93	12	5	63	29	55	40	11	43
B0944B	BS08S00489	94	13	6						
B0944A	BS08S00489	95	13	4						
B0960A	BS08S00389	97	15	6						
B0960B	BS08S00389	100	17	5	77	160	48	103	14	68
B0992A	BS08S00189	100	18	6	3	1		3		
B0944D	BS08S00489	100	19	6						
B0953D	BS08S00589	100	19	1						
B0882B	BS07S00289	122	34	3						
B0892B	BS07S00589	127	31	3				6	1	
B0882C	BS07S00289	127	37	1						
B0886D	BS07S00489	130	40	6	8	7	17	9	30	6
B0892D	BS07S00589	133	41	3						
B0886A	BS07S00489	134	43	6						
B0882A	BS07S00289	135	43	2						
B0882D	BS07S00289	135	43	3						
B0892C	BS07S00589	139	48	5	7	11	3	4	1	11

Tag #	Location #	Length mm	Weight gm	Fullness Category	Micro-Invertebrates Bosmina Longirostris	Chydorus Sphaericus	Cyclops Biscupidatus	Daphnia Pulex	Daphnia Rosa	Diaptomas Oregonensis
B0877A	BS07S00189	NR	NR	1						
B0877B	BS07S00189	NR	NR	6						
B0877C	BS07S00189	NR	NR	6						
B0877D	BS07S00189	NR	NR	6						
B0880A	BS07S00289	NR	NR	3						
B0880B	BS07S00289	NR	NR	3						
B0880C	BS07S00289	NR	NR	4						
B0880D	BS07S00289	NR	NR	3						

1) 1 Empty
2 Trace
3 Full
4 1/2 Full
5 3/4 Full
6 Full
NR Not Recorded
mm milligrams
gm gram
P Present
sp 1 species
spp 2 or more species

Table C.4-14 Bluegill Food Items Based on Analysis of Stomach Contents, Rocky Mountain Arsenal, September 1989

Tag #	Location #	Length mm	Weight gm	Fullness Category	Macro-Invertebrates Hesperocorixa SPP	Chironomus SPP	Diptera (Terrestrial)	Hydroptila SP	Lestes SP	Macro-Odonata
B0992C	BS08S00189	60	3	6		2		17		
B0886C	BS07S00489	64	5	3						
B0892A	BS07S00589	65	4	6	2	12				
B0953C	BS08S00589	67	5	6	1	30				
B0953A	BS08S00589	70	6	1						
B0886B	BS07S00489	73	6	4	1					
B0992B	BS08S00189	74	6	3		4		2		
B0960D	BS08S00389	74	7	4						
B0945D	BS08S00289	75	7	2						
B0945A	BS08S00289	76	7	5	3					
B0953B	BS08S00589	85	11	3		7				
B0960C	BS08S00389	85	18	6		27				
B0992D	BS08S00189	89	11	3		9		3		
B0944C	BS08S00489	89	12	6						
B0945B	BS08S00289	93	12	5	1					
B0945C	BS08S00289	93	12	5						
B0944B	BS08S00489	94	13	6		7		5		
B0944A	BS08S00489	95	13	4				6		
B0960A	BS08S00389	97	15	6		29				
B0960B	BS08S00389	100	17	5						
B0992A	BS08S00189	100	18	6	2	23				
B0944D	BS08S00489	100	19	6	6	11				
B0953D	BS08S00589	100	19	1						
B0882B	BS07S00289	122	34	3						1
B0892B	BS07S00589	127	31	3		4		2		
B0882C	BS07S00289	127	37	1						
B0886D	BS07S00489	130	40	6					5	
B0892D	BS07S00589	133	41	3		9		3		
B0886A	BS07S00489	134	43	6						2
B0882A	BS07S00289	135	43	2		1				
B0882D	BS07S00289	135	43	3		3				
B0892C	BS07S00589	139	48	5		2		17		

Tag #	Location #	Length mm	Weight gm	Fullness Category	Macro-Invertebrates Hesperocorixa SPP	Chironomus SPP	Diptera (Terrestrial)	Hydroptila SP	Lestes SP	Macro- Odonata
B0877A	BS07S00189	NR	NR	1						
B0877B	BS07S00189	NR	NR	6	6	10		2		
B0877C	BS07S00189	NR	NR	6	2				1	
B0877D	BS07S00189	NR	NR	6		6				
B0880A	BS07S00289	NR	NR	3			1			
B0880B	BS07S00289	NR	NR	3						
B0880C	BS07S00289	NR	NR	4				5		
B0880D	BS07S00289	NR	NR	3						

1) 1 Empty
2 Trace
3 Full
4 1/2 Full
5 3/4 Full
6 Full
NR Not Recorded
mm milligrams.
gm gram
P Present
sp 1 species
spp 2 or more species

Tag #	Location #	Length mm	Weight gm	Fullness Category	Macro-Invertebrates Orthocladius SP	Physa SP	Polypedilum SP	Unidentified	Macro-Organic Material
B0992C	BS08S00189	60	3	6					
B0886C	BS07S00489	64	5	3				2	
B0892A	BS07S00589	65	4	6	10		1		
B0953C	BS08S00589	67	5	6	1				
B0953A	BS08S00589	70	6	1					
B0886B	BS07S00489	73	6	4		3			
B0992B	BS08S00189	74	6	3					
B0960D	BS08S00389	74	7	4					
B0945D	BS08S00289	75	7	2					
B0945A	BS08S00289	76	7	5					
B0953B	BS08S00589	85	11	3				2	
B0960C	BS08S00389	85	18	6					
B0992D	BS08S00189	89	11	3	1				
B0944C	BS08S00489	89	12	6					
B0945B	BS08S00289	93	12	5					
B0945C	BS08S00289	93	12	5					P
B0944B	BS08S00489	94	13	6					P
B0944A	BS08S00489	95	13	4					
B0960A	BS08S00389	97	15	6	3		3		P
B0960B	BS08S00389	100	17	5					
B0992A	BS08S00189	100	18	6	2		5		
B0944D	BS08S00489	100	19	6	1		1		
B0953D	BS08S00589	100	19	1					
B0882B	BS07S00289	122	34	3					
B0892B	BS07S00589	127	31	3					
B0882C	BS07S00289	127	37	1					
B0886D	BS07S00489	130	40	6		1			
B0892D	BS07S00589	133	41	3			1		
B0886A	BS07S00489	134	43	6					
B0882A	BS07S00289	135	43	2	1			1	
B0882D	BS07S00289	135	43	3	1	2		3	
B0892C	BS07S00589	139	48	5					

Tag #	Location #	Length mm	Weight gm	Fullness Category	Macro-Invertebrates Orthocladius SP	Physa SP	Polypedilum SP	Unidentified	Macro-Organic Material
B0877A	BS07S00189	NR	NR	1					
B0877B	BS07S00189	NR	NR	6					
B0877C	BS07S00189	NR	NR	6					P
B0877D	BS07S00189	NR	NR	6					P
B0880A	BS07S00289	NR	NR	3					
B0880B	BS07S00289	NR	NR	3		1	1		
B0880C	BS07S00289	NR	NR	4					
B0880D	BS07S00289	NR	NR	3	2	2	2	1	

1) 1 Empty
2 Trace
3 Full
4 1/2 Full
5 3/4 Full
6 Full
NR Not Recorded
mm milligrams
gm gram
P Present
sp 1 species
spp 2 or more species

Table C.4-15. Largemouth Bass Food Items Based on Analysis of Stomach Contents, Rocky Mountain Arsenal, September 1989

Tag #	Location #	Length mm	Weight gm	Fullness Category (1)	Macro-Invertebrates Hesperocorixa SP	Chironomus SPP	Lestes SP	Odonata	Unidentified
B0946B	BS08S00489	165	51	3	7				
B0946C	BS08S00489	169	52	1					
B0959B	BS08S00289	174	58	6			3	1	
B0947C	BS08S00189	179	63	4	15				
B0954D	BS08S00589	180	63	4					
B0947D	BS08S00189	182	69	2	1				
B0947B	BS08S00189	187	71	3	15				
BO943C	BS08S00489	190	80	2			3		
B0954A	BS08S00589	195	84	2			1		
B0947A	BS08S00189	195	86	4	11				
B0943B	BS08S00489	195	88	1					
B0954C	BS08S00589	200	91	2			1	1	
B0946A	BS08S00489	204	87	1					
BO954B	BS08S00589	204	114	6	5				
BO943A	BS08S00489	207	91	2	3				
B0959A	BS08S00289	211	107	1					
BO881B	BS07S00189	222	160	2					
BO881A	BS07S00189	251	230	4					
B0899B	BS07S00189	269	264	1					
B0899A	BS07S00189	295	328	4		11			
B0883B	BS07S00489	312	448	2					1
BO883A	BS07S00489	360	277	6					
B0878A	BS07S00189	NR	NR	1					
B0878B	BS07S00189	NR	NR	1					
B0879A	BS07S00289	NR	NR	2		3			
B0879B	BS07S00289	NR	NR	4				7	

(1) 1 Empty
2 Trace
3 1/4 Full
4 1/2 Full
5 3/4 Full
6 Full

sp 1 species
spp 2 or more species
mm millimeter
gm gram
P Present

Table C.4-15. Largemouth Bass Food Items Based on Analysis of Stomach Contents, Rocky Mountain Arsenal, September 1989

Tag #	Location #	Length mm	Weight gm	Fullness Category (1)	Organic Material	Bluegill	Lumbricus SP	Largemouth Bass	Fish Unidentified
B0946B	BS08S00489	165	51	3					
B0946C	BS08S00489	169	52	1					
B0959B	BS08S00289	174	58	6					1
B0947C	BS08S00189	179	63	4					
B0954D	BS08S00589	180	63	4				1	
B0947D	BS08S00189	182	69	2					
B0947B	BS08S00189	187	71	3					
BO943C	BS08S00489	190	80	2					
B0954A	BS08S00589	195	84	2	P				
B0947A	BS08S00189	195	86	4					
B0943B	BS08S00489	195	88	1					
B0954C	BS08S00589	200	91	2					
B0946A	BS08S00489	204	87	1					
BO954B	BS08S00589	204	114	6					2
BO943A	BS08S00489	207	91	2					
B0959A	BS08S00289	211	107	1					
BO881B	BS07S00189	222	160	2	P				
BO881A	BS07S00189	251	230	4					
B0899B	BS07S00189	269	264	1					
B0899A	BS07S00189	295	328	4	P				
B0883B	BS07S00489	312	448	2					
BO883A	BS07S00489	360	277	6		1			
B0878A	BS07S00189	NR	NR	1	P				
B0878B	BS07S00189	NR	NR	1					
B0879A	BS07S00289	NR	NR	2	P				
B0879B	BS07S00289	NR	NR	4					

(1) 1 Empty
2 Trace
3 1/4 Full
4 1/2 Full
5 3/4 Full
6 Full

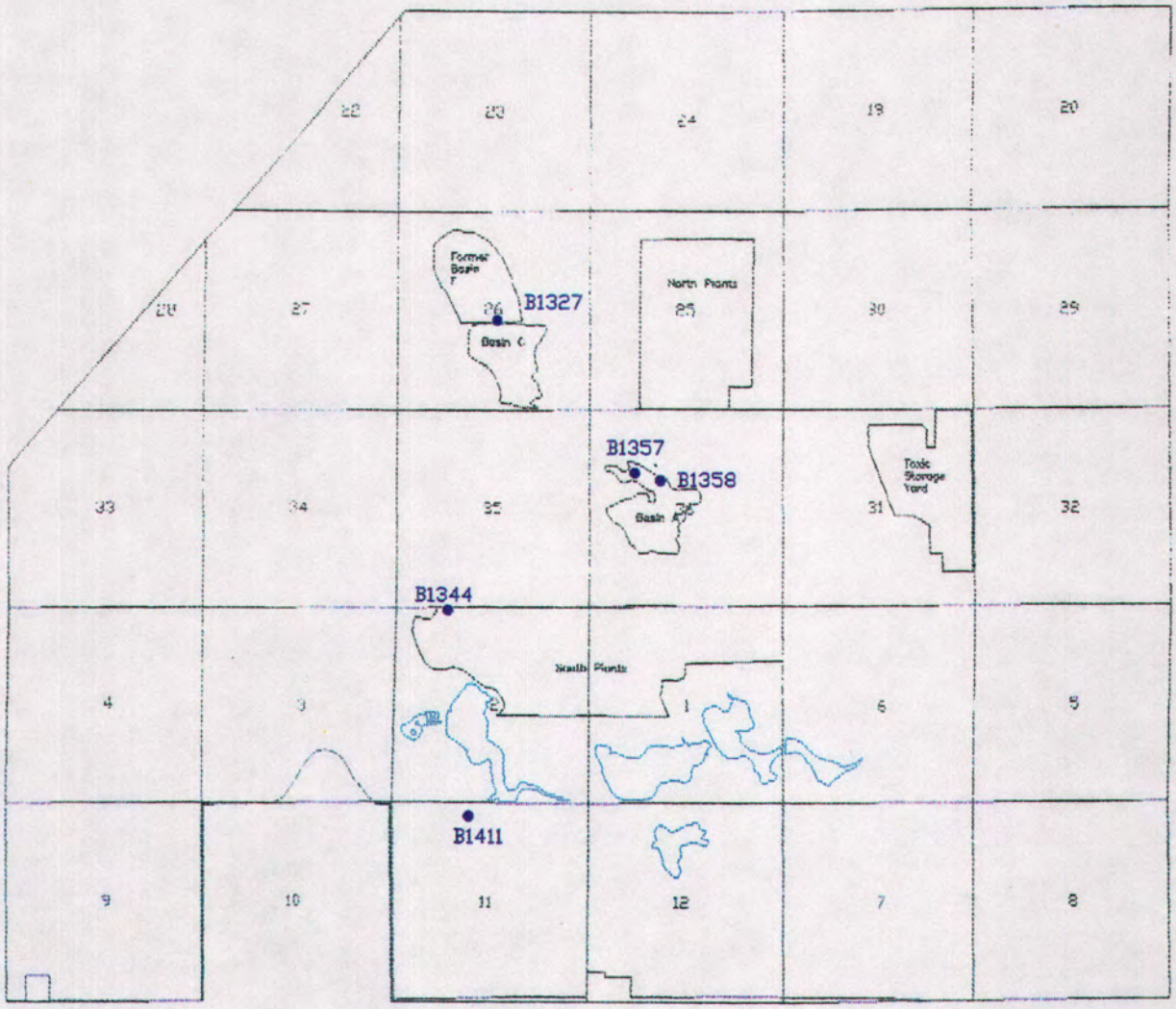
sp 1 species
spp 2 or more species
mm millimeter
gm gram
P Present

Table C.4-16 Northern Pike Food Items Based on Analysis of Stomach Contents, Rocky Mountain Arsenal, September 1989

Tag #	Location #	Fullness Category (1)	Bluegill	Lumbricus SP	Organic Matter (2)
B0860	BS07S00589	1			P
B0862	BS07S00289	2			P
B0867	BS07S00189	2			P
B0869	BS07S00189	1			
B0870	BS07S00189	2		1	
B0904	BS08S00389	1			
B0905	BS08S00589	4	1		
B0906	BS08S00589	1			
B0907	BS08S00289	2			P
B0908	BS08S00289	2			P

(1) 1 Empty
2 Trace
3 1/4 Full
4 1/2 Full
5 3/4 Full
6 Full
sp 1 species
P Present
All fish remains found in stomachs were Bluegill

(2) Present



Legend

Lake

31 Section Number

Section Line

Sample Point
B1411

0 2000 4000
Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal
February 1994

Figure C.4-1

Location of Vesper Sparrows
Collected for Food Item Study and
Tissue Samples, RMA, 1990

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp

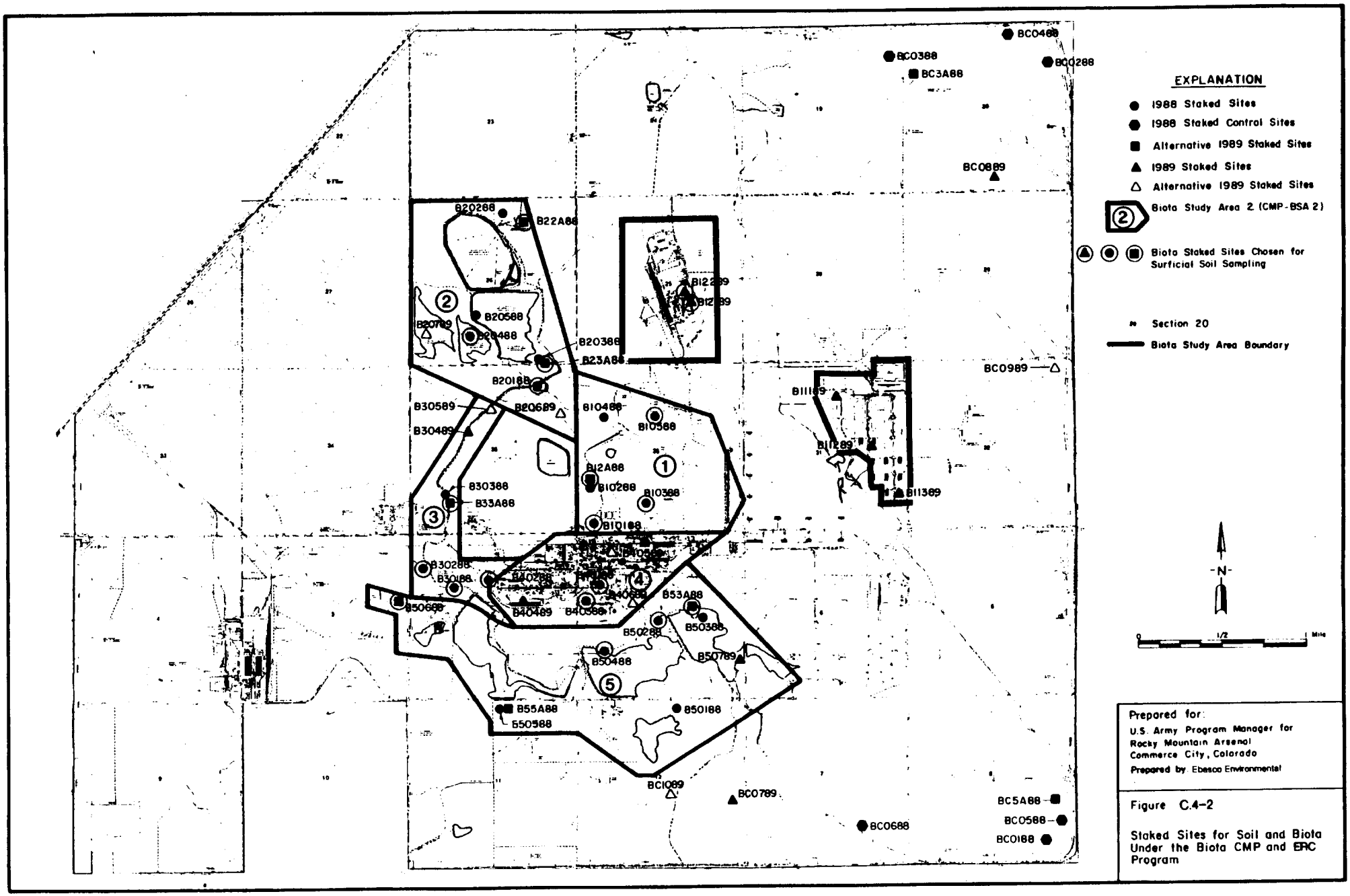
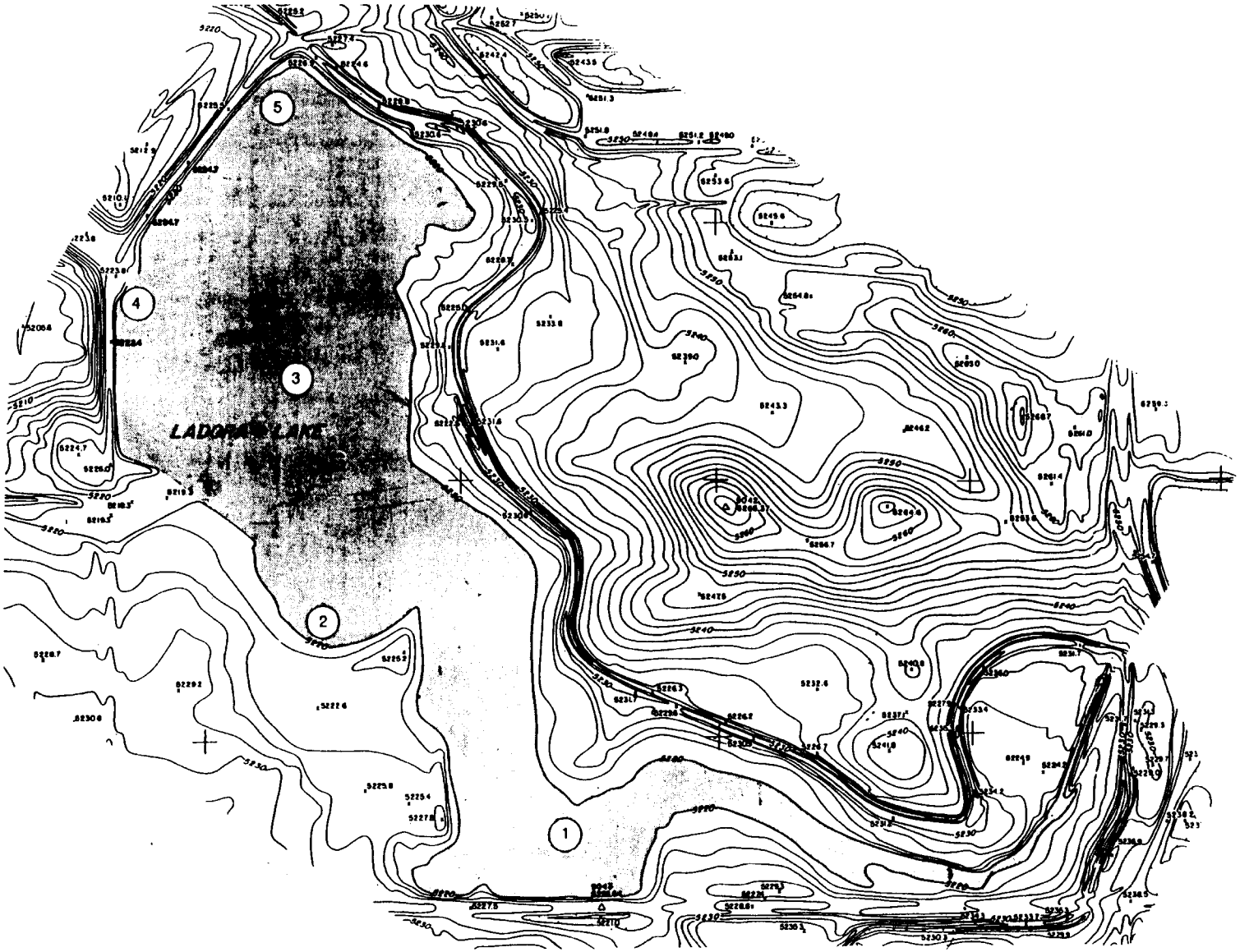


Figure C.4-2

Staked Sites for Soil and Biota Under the Biota CMP and ERC Program



EXPLANATION

(1) Aquatic Sampling Station

2' Contour Interval

N

0 400

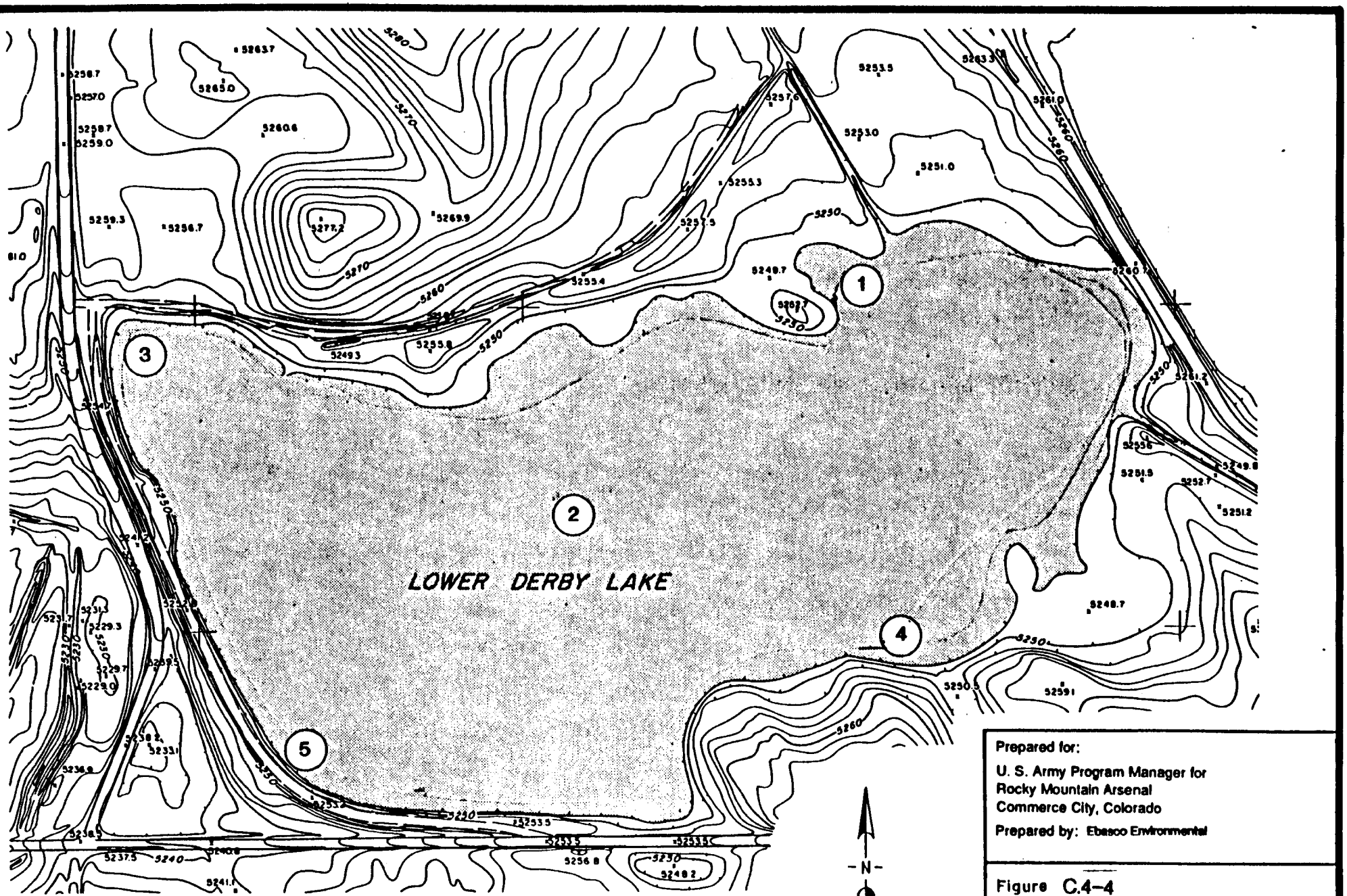
SCALE IN FEET

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

Prepared by: Ebasco Environmental

Figure C.4-3

Aquatic Sampling Stations
in Lake Ladora, BSA 7



Legend

(1) Aquatic Sampling Station

2' Contour Interval

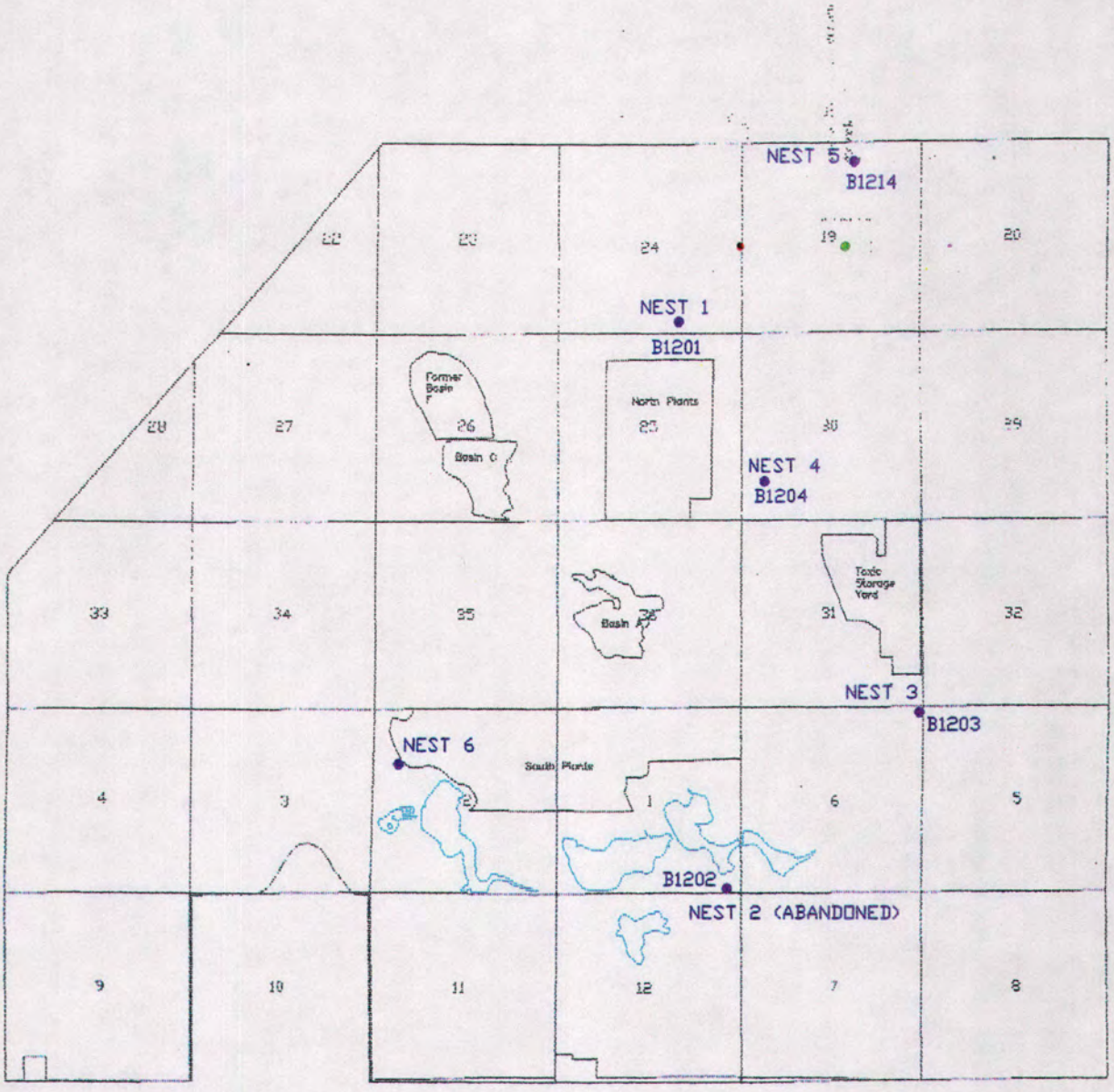
Prepared for:

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

Prepared by: Ebasco Environmental

Figure C.4-4

Aquatic Sampling Stations in Lower Derby Lake, BSA 8



Legend

Lake

31 Section Number

Section Line

NEST 3 / B1203 Sample Point

0 2000 4000

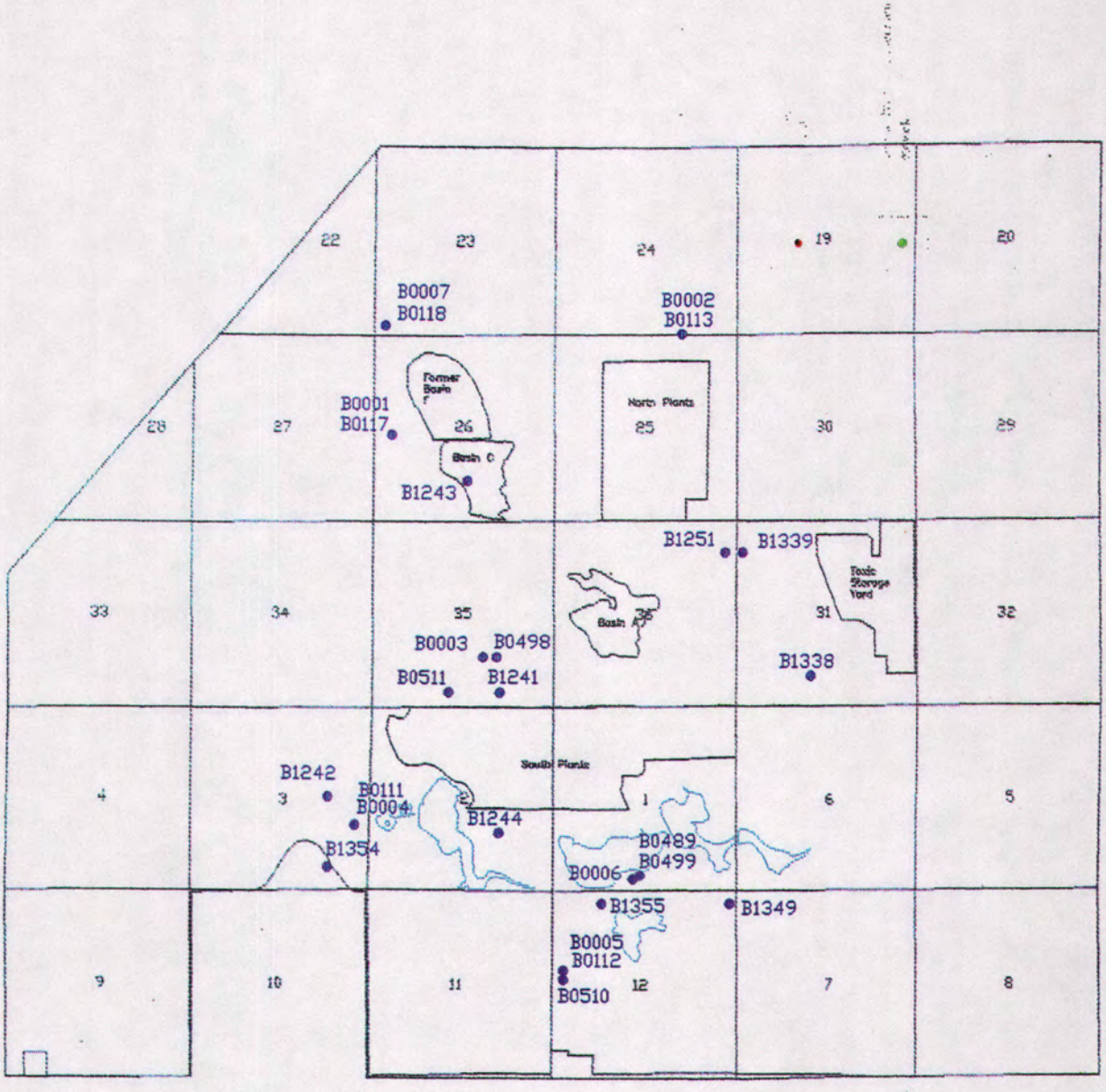
Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal
February 1994

Figure C.4-5

Location of Great Horned Owl Nests Used for Food Item Study and Tissue Samples, RMA, 1990

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp



Legend

Lake

31 Section Number

Section Line

B1349 Sample Point

0 2000 4000

Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal
February 1994

Figure C.4-6

Location of American Kestrel Nest Boxes Used for Food Item Study and Tissue Samples, RMA, 1988 and 1990

Rocky Mountain Arsenal
Prepared by: ENSERCH Environmental Corp