DRAFT

PHASE II DATA SUMMARY INDUSTRIAL AREA ENVIRONMENTAL EVALUATION

ROCKY FLATS PLANT
INDUSTRIAL AREA
OPERABLE UNIT NOS. 8, 9, 10, 12, 13, and 14

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

ENVIRONMENTAL MANAGEMENT PROGRAM

NOVEMBER 1993

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1.0 INTRODUCTION

The Industrial Area (IA) Environmental Evaluation (EE) Phase II Data Summary describes the results of three major activities. These activities are a continuation of Phase I, which included an ecological field survey of plant communities and animal habitats within the IA. The following activities completed during this phase included:

- Existing ecological and abiotic environmental media data were reviewed. The review addressed a listing of species recorded during past surveys, and those observed during the July and October through November 1993 field surveys. Habitat and species distribution and dominance was also noted. Abiotic environmental media data were also reviewed, summarized and evaluated with respect to suitability for inclusion as Contaminants of Concern (COCs).

- Potential COCs were selected. The chemicals were evaluated for toxicity to biota based on a data search and literature review of toxicological data found in TOMES, an Environmental Protection Agency (EPA) toxicological data base. These data are summarized in Table 1 to show, among other things, Lethal Dose to 50 percent of the population (LD50s), No Observed Adverse Effect Level (NOAEL) data or Lowest Observed Adverse Effect Level (LOAEL) data, and other data pertinent to the COCs.

- A generalized foodweb for the IA ecosystem was constructed. The foodweb provides data for the selection of key receptor species and the construction of a sink foodweb to illustrate pathway-receptor models for contaminant transport from source to biotic receptor. The pathway-receptor model will be used in the evaluation of potential ecological risk.

The three activities culminated in identifying data gaps where additional data are needed for the pathway-receptor models and for calculating tissue contaminant residue accumulation. In order to perform a quantitative characterization of risk, validated concentration values for tissues (key species of vegetation and wildlife) and environmental media are required.

2.0 ECOLOGICAL DATA SUMMARY

A vegetation survey conducted in the mid 1970's by Weber et al (1974) reported the presence of over 300 vascular plants representative of tall grass, mid grass and short grass prairie, and of foothill and montane vegetation communities. A vegetation map prepared for the RFP in the late 1970's identified 16 vegetation mapping units grouped into prairie, pasture and valley-side. The groupings were separated based on plant species composition (Clark et al 1980). Because much of the land surrounding the IA has been undisturbed for almost 20 years, recent observations show that plant succession in annual/weed communities in moving to perennial grasslands. Similar observations also have been made within the Protected Area (PA). Current mapping studies identify 17 vegetation mapping units. A comparison between these recent studies and Clark et al (1980) mapping units is presented in DOE (1990).

The major vegetation mapping units found within the IA include the following:

- Reclaimed Grassland - (20%);
- Disturbed (annual/forb) - (4%);
- Deciduous woodland - (1%);
- Mesic Grassland - (1%);
- Xeric Grassland - (1%);
- Short Marsh - (1%);
- Tall Marsh - (1%); and
- Ornamental (tree) Plantings - (1%).

Percentages next to the mapping unit represent the vegetation type occupying space within the IA. The majority of space in the IA is occupied by buildings/structures (70%), pond/impoundment (6%), and disturbed/barren land (10%) (DOE 1992). The percentages add up to 116%, probably because of two different survey periods and refinement of vegetation mapping units.

A variety of grasses, forbs and weedy species occur within these habitat types. Based on a qualitative survey conducted during July and October 1993, dominant species which are potential food sources for wildlife within the IA are:

- Smooth brome (*Bromopsis inermis*);
- Crested wheatgrass (*Agropyron cristatum*);
- Diffuse knapweed (*Centaurea diffusa*);

- Klamath weed (*Hypericum perforatum*);
- Curlycup gumweed (*Grindelia squarrosa*);
- Annual sunflower (*Helianthus annuus*);
- White sweetclover (*Melilotus alba*);
- Yellow sweetclover (*Melilotus officinalis*);
- Russian Olive (*Eleagnus angustifolia*); and
- Willow (*Salix spp.*).

Small mammal surveys conducted during July and October-November 1993 revealed that the IA provides habitat for a small number of species. The largest herbivore is the mule deer that moves in and out of the IA, particularly in the west area. The cottontail rabbit appears to be common throughout the IA, but mainly in the annual grass/weedy forb and xeric grassland habitat types. The deer mouse, prairie vole and harvest mouse were the common small herbivorous mammals. These species were most abundant in the reclaimed grassland habitat near sources of water and tall grass cover. The vole and harvest mouse are considered herbivorous but probably include some insects in their diets, while the deer mouse is omnivorous. A small population of pocket gophers exists in the reclaimed/mesic grassland along the northwest drainage.

Because of migratory patterns in songbirds, the IA supports year round residents, spring nesting species and winter visitors. Common year round residents include the house sparrow, house finch and European starling, while the black-eyed juncos and rosey finches winter in the IA drainages. Common nesting species observed within the IA were the American robin, Say's phoebe, house sparrow, house finch, European starling, barn swallow and cliff swallow.

Many of the above small mammal and bird species form the prey base for raptors, and feline and canine predators.

Feral cats were observed in the East Drainage, North Pond and Seep, Northwest Drainage and West Area study areas. Although drainage structures may provide canine predators access to the IA from the buffer zone, this was not confirmed. Scat found within the IA were not analyzed in detail and could have been from feral cats or smaller canids.

Two owl casts were found within the IA, and probably were from the great-horned owl. This raptor hunts for small mammals and will also take cottontail rabbits and feral cats. No carcasses of either were found within the IA. The American kestrel was commonly observed perched on fence and telephone poles. Within the IA this species will also feed on small mammals, insects and an occasional bird.

Based on the results of the existing data review and ecological field survey, a generalized foodweb was constructed for the IA and is illustrated in Figure 1. This figure indicates that the great-horned owl and American kestral are at the top of the foodweb in the IA. However, because these species have large home ranges, the IA prey base probably contributes to a relatively small proportion of their diet. The feral cat, on the other hand, appears to hunt exclusively in the IA, therefore a large proportion of feral cat food items are from the IA. One exception to this are songbirds that may move in and out of the IA on a seasonal basis.

3.0 ENVIRONMENTAL MEDIA CHEMICAL CONCENTRATION SUMMARY

The IA Remedial Investigation is just beginning, therefore a review of the data was not possible. However, potential COCs were selected by reviewing the following sources: *Reconstruction of Historical Rocky Flats Operations & Identification of Release Points* (ChemRisk, 1992); OU4 Draft Summary Table of Contaminants of Concern in Surficial Soil and Vadose Soil, Phase I IM/IRA-EA; and *State of Colorado's Health Studies on Rocky Flats* (CDH, 1993). A list of potential COCs is provided in Table 1. Existing data that are not part of an ongoing RFI/RI suggest that the nature and extent of contamination within the IA is not well understood and is based on waste stream identification, ground water and surface water monitoring, previous site uses, or knowledge of how materials were stored or disposed. Validated environmental media data are not yet available for review.

4.0 TOXICITY ASSESSMENT

The objective of the toxicity assessment is to evaluate the COCs identified in the data evaluated relative to their potential to cause harm to biota identified as key species. This was accomplished by review and evaluation of the toxicity data gathered from the literature, and the comparison of these data with established criteria indicating potential harm to IA species. The criteria to be used are the lowest tissue concentrations or daily doses in key species which indicate a potential adverse effect, determined through easily accessible literature.

Presently, no tissue analysis data exists for IA plant and animal species. Therefore, the literature review consisted of evaluating the toxicity of potential COCs based on experimental results performed on laboratory animals. This information was compared to contaminant concentration ranges found in OU4 soils or vadose zone (Table 1). The data review suggests that volatile organics occur in concentration ranges far below published LOAEL or NOEL for laboratory mice and rats, and no animal toxicity data are available for radionuclides. However, LOAEL or NOEL for laboratory test animals are below or within the concentration ranges reported for Beryllium, Cadmium, Nickel, Silicon and Strontium at OU4. These data suggest that these metals should be investigated further as COCs, and used in the pathway-receptor model to evaluate potential ecological risk to key species.

NOTICE:

The following two pages are shown as page number 5-1 and were misnumbered when originally printed. No pages are missing from this document.

The Administrative Record Staff

5.0 EXPOSURE ASSESSMENT

Pathway-receptor models were developed from the generalized foodweb into sink foodwebs to evaluate potential exposure of biotic species to contaminants. Sink foodwebs include all food chains leading to a particular species considered important in that foodweb because of its special status (i.e. endangered), importance in the ecosystem, or economic importance to man, either as a game animal or food source. Sink foodwebs were constructed for the great-horned owl, feral cat and American kestrel. These sink foodwebs, or pathway-receptor models, are illustrated in Figures 2 through 5. Two foodwebs were constructed for the great-horned owl to illustrate contribution from the small mammal pathway by itself, and from the small mammal and feral cat pathway combined (Figures 2 and 3).

The great-horned owl and American kestrel were selected for evaluation because both are protected species. However, these two species probably rely on IA biota for only a small percentage of their daily diet. The feral cat, on the other hand, probably derives a great percentage of its food items from small mice and birds resident within the IA boundaries.

The emphasis of this evaluation was qualitative in nature and did not address quantitative issues. The pathway-receptor models appropriate for a quantitative analysis of the IA use the approach proposed by Thomann (1981) which evaluates bioaccumulation, bioconcentration and biomagnification from estimates of exposure by biota to COCs. Since bioconcentration occurs from direct exposure to water in an aquatic environment, it is not relevant in this evaluation. Bioaccumulation (contaminant concentrations from diet and drinking water) is assumed to be derived mainly from the diet, therefore the water term can be eliminated. Biomagnification, on the other hand, is the increase in tissue contaminant concentration as it moves from one trophic level to the next higher trophic level in the food chain. This value is an important part of the model development.

In the quantitative calculation of contaminant residue accumulation in biota, tissue concentration values are required along with values for contaminant concentrations in water, sediment, or soils. In addition, food habits (diet items and amounts consumed) along with some estimate of

assimilation and loss rate, are required to calculate a food term as a model input. The quantitative evaluation of exposure will be calculated when the required data are available during the next phase of the ecological risk assessment.

6.0 REFERENCES

ChemRisk. 1992. *Reconstruction of Historical Rocky Flats Operations & Identification of Release Points*. August 1992. ChemRisk. A Division of McLaren/Hart. 1135 Atlantic Avenue. Alameda, CA 94501.

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Weber, W.A., G. Kunkel and L. Schultz. 1974. *A Botanical Inventory of the Rocky Flats AEC Site*. University of Colorado, Boulder, Colorado. Report prepared for the U.S. Atomic Energy Commission under Contract No. AT(11-1)-2371.

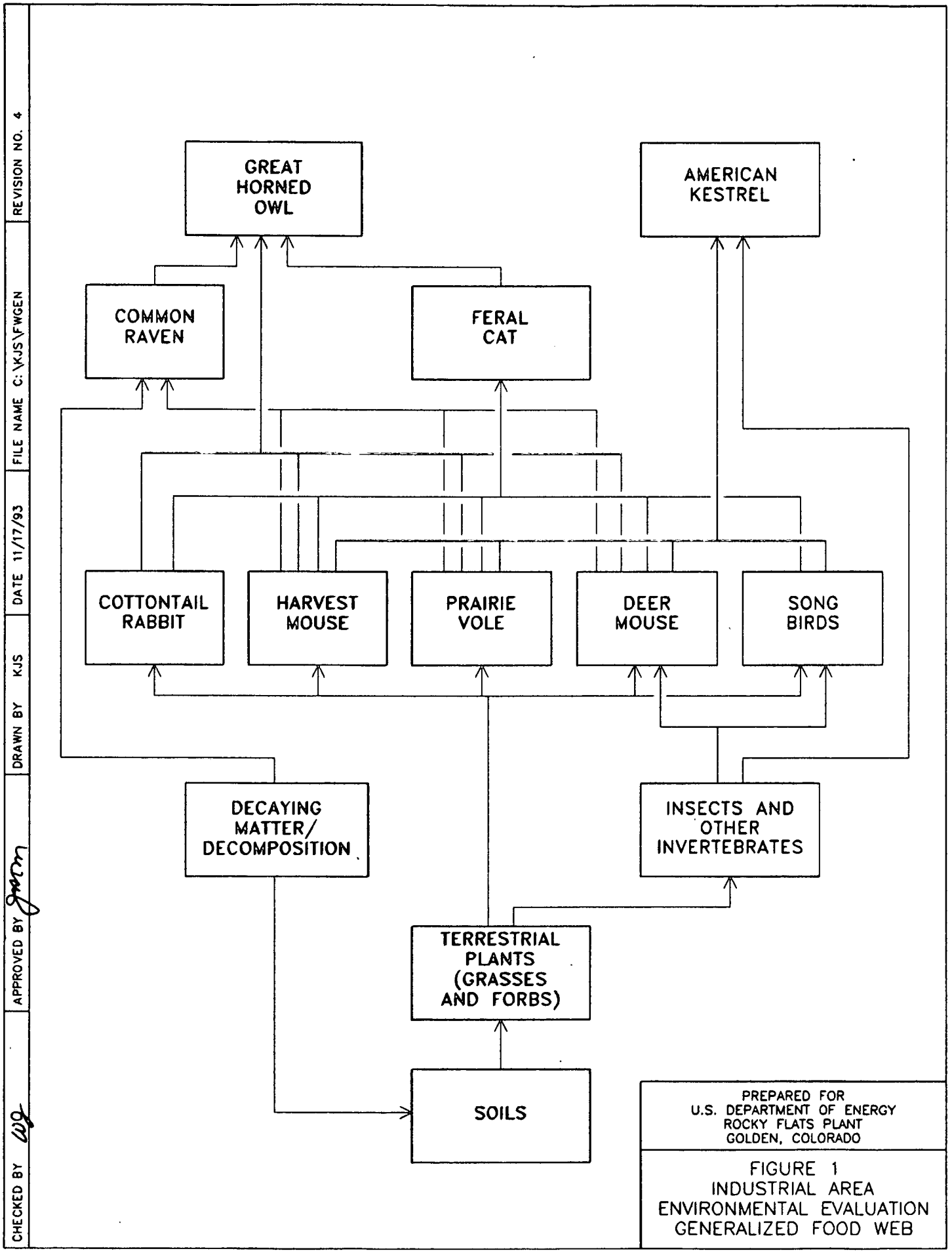
TABLE 1
Rocky Flats Industrial Area Environmental Evaluation
Potential Contaminants of Concern

Contaminant of Concern	Toxicity Information	Concentration Ranges from OU4	Applicable or Relevant and Appropriate Requirements (ARAR)	Carcinogen Classification
INORGANICS				
Beryllium	LD_{50}: Intravenous - rat 496 mg/kg NOAEL: 0.95 mg/kg/day	1.1 - 9.6 mg/kg	0.2 mg/kg[1]	B2; probable human carcinogen
Cadmium	LD_{50}: Ingestion - mouse 790 mcmol Cd/kg NOAEL: 0.005 mg/kg/day	1.1 - 380 mg/kg	40 mg/kg[1]	B1; probable human carcinogen
Chromium	Chronic toxicity studies with rats showed no significant adverse effects	4.2 - 48.4 mg/kg	400 mg/kg[1]	A; human carcinogen
Mercury	Rats were injected with metallic mercury and observed for their lifetimes, sarcomas were seen only in those tissues that had been in direct contact with the metal	0.05 - 18 mg/kg	20 mg/kg[1]	D; not classifiable as to human carcinogenicity
Nickel	LD_{50}: Ingestion - Rat 2.0 g/kg NOAEL: 5 mg/kg/day	10 - 180 mg/kg	2000 mg/kg[1]	EPA has not evaluated for potential human carcinogenicity
Silicon	LD_{50}: Ingestion - Rat 3160 mg/kg	463 - 11300 mg/kg		
Strontium	NOAEL: 375 mg/kg/day	22 - 510 mg/kg	8 pCi/l[2]	EPA has not evaluated for potential human carcinogenicity
RADIONUCLIDES				
Americium-241		0 - 6.1 pCi/g	0.05 pCi/l[3]	
Plutonium-230/240		0 - 25 pCi/g	0.05 pCi/l[3]	
Thorium			500 pCi/l[3]	

TABLE 1
Rocky Flats Industrial Area Environmental Evaluation
Potential Contaminants of Concern

Contaminant of Concern	Toxicity Information	Concentration Ranges from OU4	Applicable or Relevant and Appropriate Requirements (ARAR)	Carcinogen Classification
Tritium		0.11 - 62 pCi/ml	20,000 pCi/l[2]	
Uranium-233/234		0 - 21 pCi/g		
Uranium-235		0 - 0.87 pCi/g		
Uranium-238		0 - 11 pCi/g	5 pCi/l[3]	
VOLATILE ORGANICS				
Carbon Tetrachloride	LD_{50}: Ingestion - Rat 2350 mg/kg NOAEL: 1 mg/kg/day	6 - 29 µg/l	5 mg/kg[1]	B2; probable human carcinogen
Chloroform	LD_{50}: Ingestion - rat 300 mg/kg LOAEL: 12.9 mg/kg/day	6 - 29 µg/l	100 mg/kg[1]	B2; probable human carcinogen
Methylene Chloride	NOAEL: 5 mg/kg/day	0 - 6000 µg/kg	90 mg/kg[1]	B2; probable human carcinogen
Tetrachloroethylene	LD_{50}: Ingestion - rat 2629 mg/kg NOEL: 14 mg/kg/day	6 - 29 µg/kg	10 mg/kg[1]	The evaluation for this chemical is under review by an EPA inter-office agency work group.
1,1,1-Trichloroethane	LD_{50}: Ingestion - human estimation 500 mg/kg	6 - 29 µg/kg	200 µg/l[2]	D; not classifiable as to human carcinogenicity
1,1,2,2-Tetrachlorethane		6 - 29 µg/kg	30 mg/kg[1]	C; possible human carcinogen

LD_{50}: Lethal dose to 50% of the population
NOAEL: No observed adverse effect level
LOAEL: Lowest observed adverse effect level
NOEL: No observed effect level
[1] Values from the Corrective Action for Solid Waste Management Units (SWMUs) at Hazardous Waste Management Facilities, Proposed Rule, Vol. 55, No. 145, Friday, July 27, 1990
[2] Maximum Contaminant Level
[3] Colorado Department of Health Standard


GREAT HORNED OWL
AMERICAN KESTREL
COMMON RAVEN
FERAL CAT
COTTONTAIL RABBIT
HARVEST MOUSE
PRAIRIE VOLE
DEER MOUSE
SONG BIRDS
DECAYING MATTER/ DECOMPOSITION
INSECTS AND OTHER INVERTEBRATES
TERRESTRIAL PLANTS (GRASSES AND FORBS)
SOILS
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ROCKY FLATS PLANT
GOLDEN, COLORADO
FIGURE 1
INDUSTRIAL AREA
ENVIRONMENTAL EVALUATION
GENERALIZED FOOD WEB

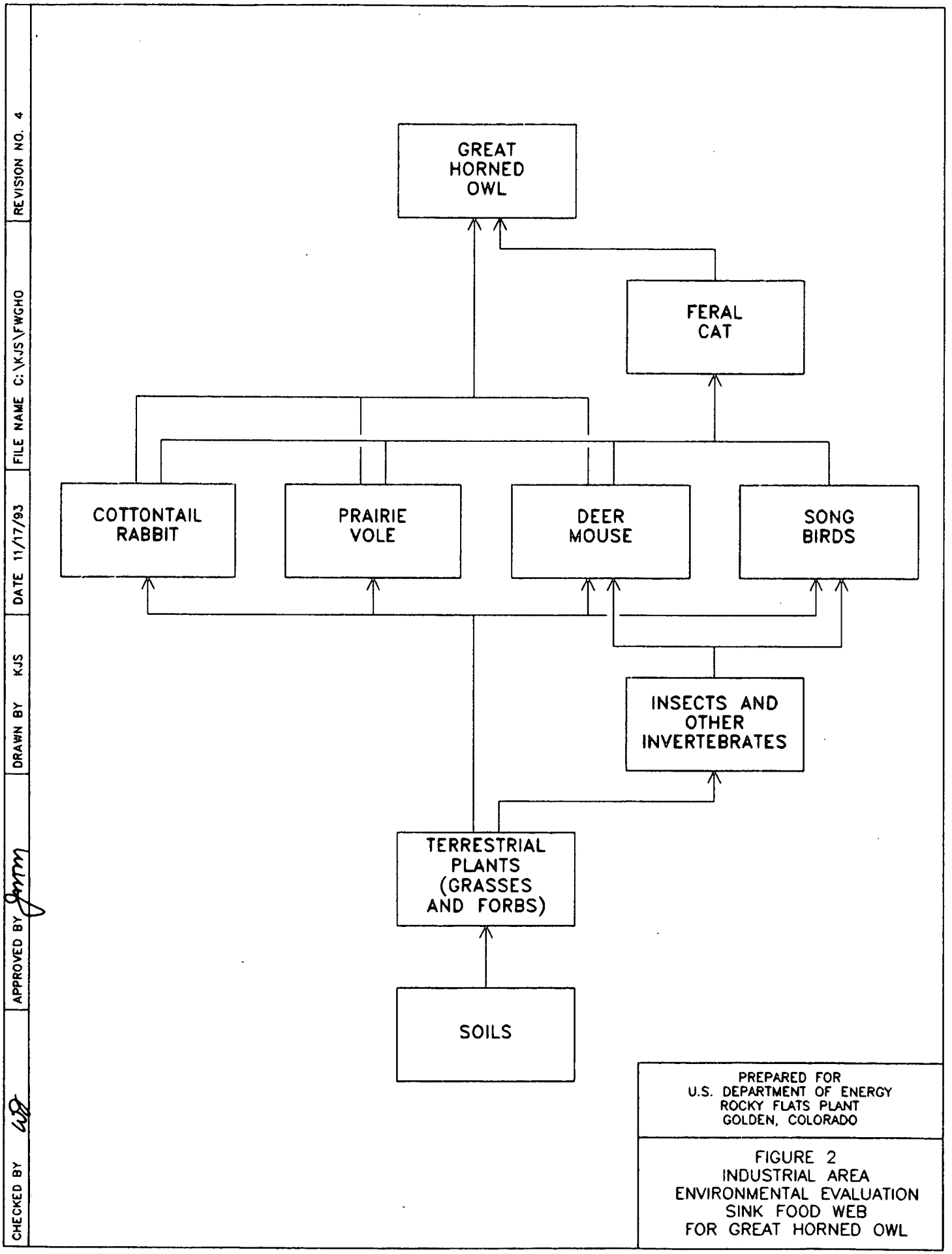
GREAT HORNED OWL
FERAL CAT
COTTONTAIL RABBIT
PRAIRIE VOLE
DEER MOUSE
SONG BIRDS
INSECTS AND OTHER INVERTEBRATES
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FIGURE 2
INDUSTRIAL AREA
ENVIRONMENTAL EVALUATION
SINK FOOD WEB
FOR GREAT HORNED OWL

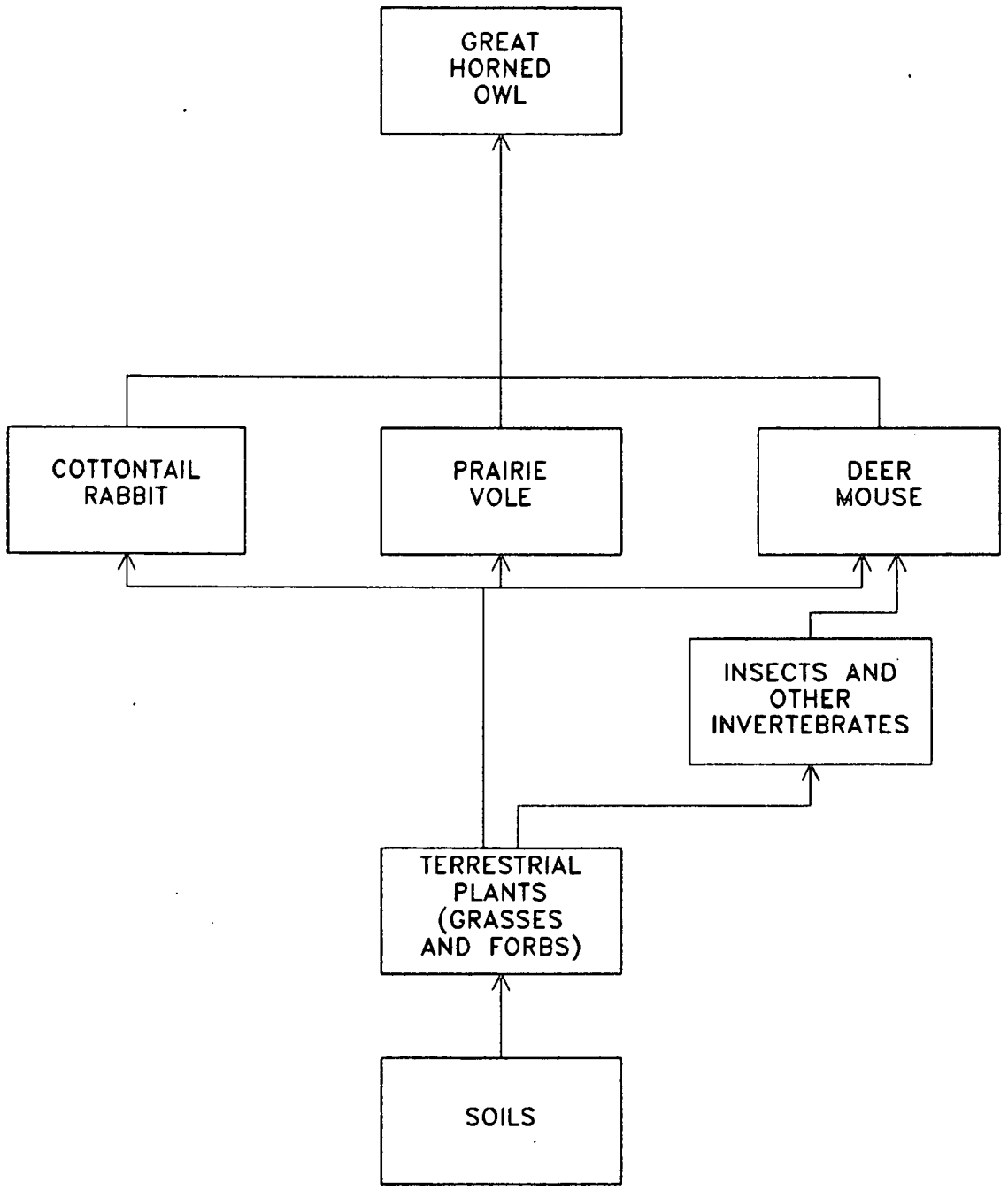

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FIGURE 3
INDUSTRIAL AREA
ENVIRONMENTAL EVALUATION
SINK FOOD WEB
FOR GREAT HORNED OWL
WITHOUT FERAL CAT PATHWAY

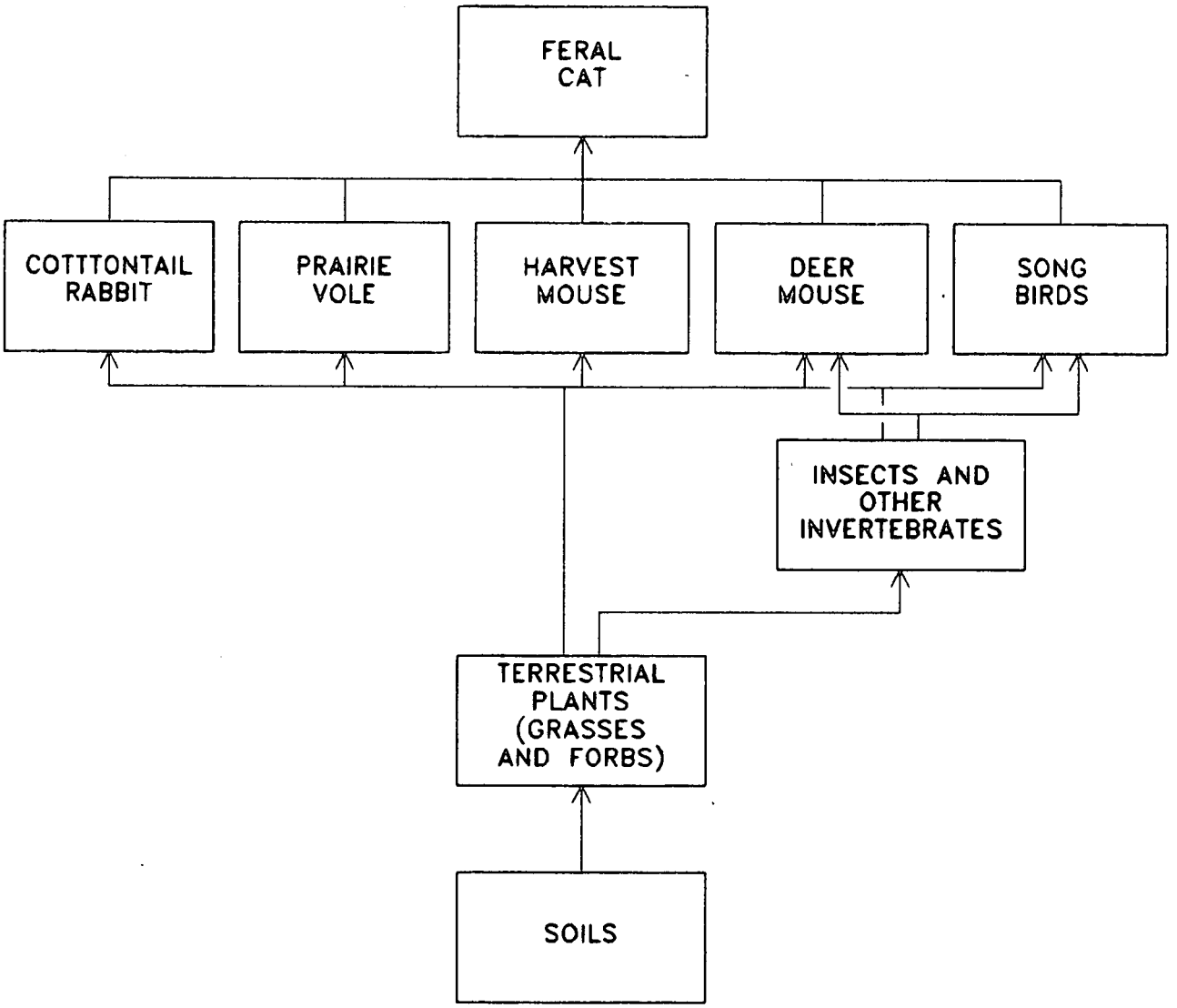

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FIGURE 4
INDUSTRIAL AREA
ENVIRONMENTAL EVALUATION
SINK FOOD WEB
FOR FERAL CAT

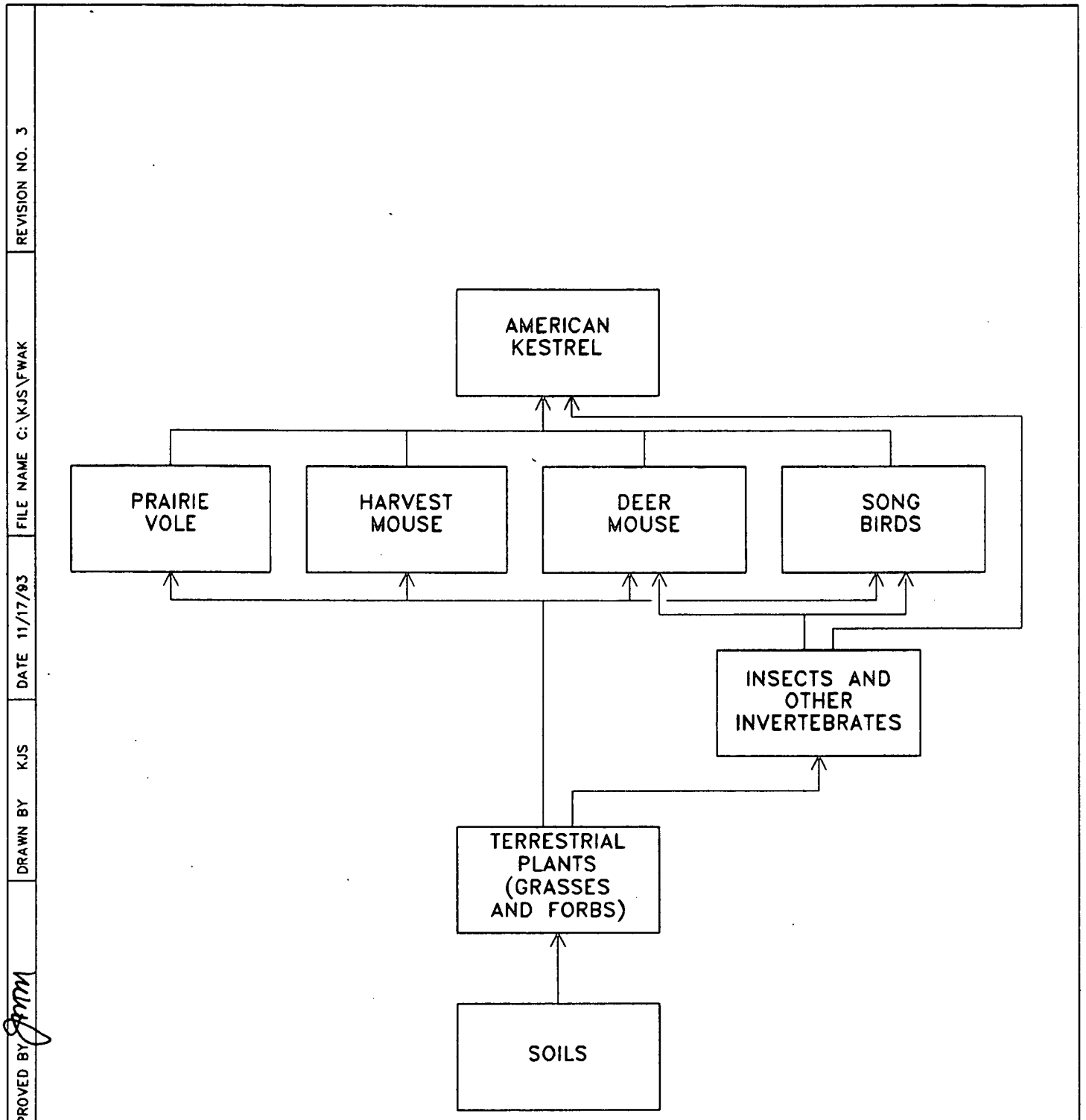

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FIGURE 5
INDUSTRIAL AREA
ENVIRONMENTAL EVALUATION
SINK FOOD WEB
FOR AMERICAN KESTREL