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BIOTA OF THE 300-FF-1 OPERABLE UNIT

W. H. Rickard, Jr.
R. E. Fitzner
C. A. Brandt

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Environmental Management Operations
Pacific Northwest Laboratory
Richland, Washington 99352

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PREFACE

This report summarizes Task 5a-2 of the Phase I Remedial Investigation--Operable Unit Characterization of the 300-FF-1 Operable Unit on the Hanford Site, near Richland, Washington. The ultimate goal of Phase I is to determine the nature and extent of the threat to public health and the environment from releases of hazardous substances from the operable unit. The purpose of Task 5a-2 was to determine what species inhabit the 300-FF-1 Operable Unit and how they use the unit. The focus is on those species listed as endangered or threatened, those that are economically important, or those that constitute significant components of the human food chain.

Westinghouse Hanford Company was responsible for coordinating Phase I efforts. The information presented in this report was collected by Pacific Northwest Laboratory, for Pacific Northwest Division's Environmental Management Operations, at the request of Westinghouse Hanford Company. The Westinghouse Hanford Company technical coordinator for these activities was Larry C. Hulstrom, the Environmental Management Operations program manager was Donald A. Kane, and the Pacific Northwest Laboratory project manager was George V. Last.

SUMMARY

In 1989-1990, the Pacific Northwest Laboratory conducted surveys of plants, birds, and medium- to-large sized mammals at the 300-FF-1 Operable Unit in the 300 Area on the U.S. Department of Energy's Hanford Site. The purpose was to determine what species are present, focusing on those species that are listed by U.S. Fish and Wildlife Service or the State of Washington as threatened or endangered, are of economic importance, or that constitute significant components of the human food chain.

Three transects were established and surveys were conducted generally in the early morning and/or evening hours. Plant, bird, and mammal surveys were conducted as separate tasks.

The plant community over most of the operable unit is primarily cheatgrass, Russian thistle, and grey rabbitbrush. Other communities include grey rabbitbrush/snow buckwheat, bitterbrush/Sandberg's bluegrass, and riparian. Plant species indicated as contaminant migration pathways to humans or threatened or endangered species include mulberry, bitterbrush, cheatgrass, bulrushes, and asparagus. No federal or state listed threatened or endangered plant species were seen.

Twenty-five bird species were seen during the transect surveys: five species of ducks and geese; two species of gulls; two species of dove; two species of swallow; and fourteen other species. The bird species potentially involved in the spread of contaminants to people through dietary intakes are rock dove (common pigeon), mallard, Canada goose, and mourning dove.

Seven medium- to-large-sized mammals used the 300-FF-1 Operable Unit. Four species were herbivores (i.e., black-tailed hare, Nuttall's cottontail, mule deer, and porcupine). Three species were carnivores or omnivores (i.e., the badger, coyote, and raccoon). The mule deer presents the most likely pathway for contaminant exposure to humans. Its mobility and use as a desirable food by humans place it in a position of exposure risk to humans. Badgers and coyotes could pose a problem in the nuisance spread of contaminants through excavation of buried waste and fecal deposition.

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1.0 INTRODUCTION

The U.S. Department of Energy's (DOE) Hanford Site in southeastern Washington State (Figure 1.1) has been placed on the National Priorities List for hazardous waste cleanup. The Site has been divided into "Operable Units," each of which is being characterized to determine possible routes of exposure to humans and methods for cleanup.

Westinghouse Hanford Company (WHC), as the operations contractor for the Site, requested that the Pacific Northwest Laboratory (PNL)^(a) conduct surveys of biota at one of the designated operable units--the 300-FF-1 Operable Unit in the 300 Area of the Hanford Site (see Figure 1.1). The objectives for these surveys were set by the Remedial Investigation/Feasibility Study Work Plan for the 300-FF-1 Operable Unit (DOE 1990a) under Task 5a-2 — Species Survey, viz.

"... to determine what species - which are endangered, threatened, economically important, or constitute significant components of the human food chain - inhabit 300-FF-1. In addition, the use of the operable unit habitat of each such species identified will be characterized to allow for an assessment of potential biological impacts." (DOE 1990a, p. SAP/FSP-29).

The survey was required to be qualitative in nature (DOE 1990a, p. WP-175) rather than quantitative. A listing of endangered and threatened species potentially associated with the 300 Area was provided in the Work Plan (DOE 1990a, p. WP-51).

This report addresses the results of those biological surveys instigated in Fiscal Year 1990 (FY1990) under Task 5a-2. One portion of the survey, the small mammal survey, was not funded in FY1990, but will be performed later. Invertebrates, a potential contaminant transport medium (Fitzner et al. 1979), were not examined. The need for further study of this group will be addressed in a later report. This report describes the bird, medium- to large-sized mammal, and plant species utilizing or occurring on the 300-FF-1 Operable Unit (Figure 1.2). This operable unit does not include the Columbia River or its associated riparian community; these are considered part of the 300-FF-5 Operable Unit (DOE 1990b) and will be surveyed as part of the remedial investigation for that unit. Aspects of biological contamination and uptake within the 300-FF-1 Operable Unit will be addressed in a separate report. Biological uptake studies are described under Task 5a-1 (DOE 1990a, p. SAP/FSP-29).

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FIGURE 1.1. Location of the 300 Area and Hanford Site

FIGURE 1.2. Location of Transects Used in Biota Surveys

2.0 METHODS

Bird and animal results were obtained by walking along transects following standard procedures (PNL 1989, 1990). Three transect lines were established north and adjacent to the 300 Area. These lines are labeled A, B, and C for convenience (see Figure 1.2). Transect A bordered the process trenches, Transect B followed the fence line and Columbia River shoreline, and Transect C was located along the transmission line right-of-way (see Figure 1.2). Transect C was located in relatively undisturbed bitterbrush (*Purshia tridentata*), Sandberg's bluegrass (*Poa sandbergii*) habitat. Other transects showed various degrees of human-induced disturbance.

Plant surveys were conducted by PNL biologists using procedures documented in Laboratory Record Book BNW 53502. Areas within radiation zones were examined visually from outside the controlled area boundaries. Plant community boundaries were marked on a map of the operable unit area. Plant communities were described by the dominant vegetation occurring within the community boundaries. Boundaries were defined by changes in dominant species or the first occurrence of major structural elements, such as species of grasses or shrubs. Species occurrences within community types were noted. Locations of species directly consumed by humans (i.e., asparagus) were noted on scale maps.

Bird surveys were conducted to determine species composition and relative abundance of breeding and migratory birds using the 300-FF-1 operable unit and vicinity for food, cover, or nesting. Surveys were conducted by walking along the three transects in the early morning hours. Transect A surveyed birds associated with the process trenches and adjacent shrub-steppe habitat. Transect B surveyed birds associated with the Columbia River shoreline and adjacent shrub-steppe habitat. Transect C surveyed birds associated with shrub-steppe habitat. Birds were recorded as seen and entered by species as perched and singing, fly-by, perched, or flushed (Schuler et al. 1988). Bird surveys were conducted at two times of the year: fall/winter and spring/early summer. Four surveys were made during each time period. This timing was chosen to provide the temporal coverage necessary to detect the presence of migratory species.

Surveys for medium- and large-sized mammals were conducted by walking transect lines during early morning or evening hours. Morning surveys took place between 0500 and 0800 hours, and evening surveys took place between 1830 and 2100 hours. Recorded data included observations of mammals, their tracks, and scats. Each survey line was walked at least 24 hours before the survey, and all tracks and scats were erased. Thus each survey counted the tracks and scats of animals that had used the area during the previous 24+ hours.

Data on which the following report is based are contained in Laboratory Record Books
BNW 53502, BNW 53574, and BNW 5364.

3.0 RESULTS AND DISCUSSION

3.1 PLANTS

3.1.1 Recent History and Habitats

In the years before the advent of neo-European people to southcentral Washington, the land near the operable unit was occupied by native plants. The shrub component comprised mostly two species: bitterbrush and sagebrush (*Artemisia tridentata*). The understory comprised mostly perennial grasses, especially Sandberg's bluegrass, needle-and-thread grass (*Stipa comata*), and Indian rice grass (*Oryzopsis hymenoides*) (Daubenmire 1970).

The advent of cattle grazing in the mid-1800s stressed the grasses and opened the native vegetation to invasion by Eurasian plants (Chatters 1989). One of the most aggressive of the Eurasian species is cheatgrass (*Bromus tectorum*) (Daubenmire 1970). Following the advent of cultivation agriculture in the late 1800s, other alien herb species were introduced to the area [e.g., Russian thistle (*Salsola kali*), tumble mustard (*Sisymbrium altissimum*), filaree (*Erodium cicutarium*), white sweet clover (*Melilotus alba*), asparagus (*Asparagus officinalis*), St. John's wort (*Hypericum perforatum*), Russian knapweed (*Centaurea repens*), and white top (*Cardaria draba*)].

Alien trees introduced to the region have become established along the shoreline of the Columbia River. These include mulberry (*Morus alba*) and Russian olive (*Eleagnus angustifolia*) (Rickard et al. 1982).

Although livestock grazing and cultivation agriculture near the operable unit ceased in the early 1940s, construction activities have created numerous vegetation disturbances that have required earth moving (e.g., excavation of trenches and ponds and road building). These places are colonized by alien weeds. Native plants are slow to colonize severely disturbed ground partly because of competition from aliens.

One parcel of land near the operable unit was seeded with crested wheatgrass (*Agropyron desertorum*) in the fall of 1989, after top soil was removed for placement elsewhere.

3.1.2 Vegetation Description

Today three general kinds of vegetation habitats exist in and near the operable unit. Shrub-steppe habitat occupies most of the land area. Here the successful plants are those that can grow and reproduce relying only on the annual input of precipitation. Riparian habitat occurs along the shoreline of the Columbia River. Here plants rely on root zone wetting by river water or spring

seeps. A third habitat is the water-filled process trenches that allow for the growth of submerged and emergent aquatic plants [e.g., cat-tail (*Typha latifolia*)].

The principal vegetative communities of the 300-FF-1 Operable Unit are shown in Figure 3.1. The shrub-steppe plant community showing the least amount of human-induced disturbance is the bitterbrush-Sandberg's bluegrass community (Putr/Posa) located in the northwestern corner of the operable unit. Other mapped communities are *Eriogonum niveum*/*Bromus tectorum* (Erni/Brte), *Bromus tectorum*/*Salsola kali* (Brte/Saka), *Chrysothamnus nauseosus*/*Poa sandbergii* (Chna/Posa), *Chrysothamnus nauseosus*/*Bromus tectorum* (Chna/Brte), *Artemisia tridentata*/*Poa sandbergii* (Artt/Posa), *Cardaria draba* (Cadr), *Chrysothamnus nauseosus*/*Oryzopsis hymenoides* (Chna/Orhy), and *Stipa comata*/*Poa sandbergii* (Stco/Posa). Species names and occurrences within each plant community are listed in Table 3.1.

The plant community over most of the waste site areas comprised primarily cheatgrass, Russian thistle, and grey rabbitbrush. The shrub component growing over Burial Ground #4 comprised grey rabbitbrush and snow buckwheat, with cheatgrass as the predominant grass. The bitterbrush/Sandberg's bluegrass (PUTR/POSA) community comprised the northern and western portions of the operable unit. Riparian flora occurred as a narrow strip near the Columbia River and near the water line of the sanitary trenches and process trenches. The remainder of the undeveloped portions of the operable unit were dominated by grey rabbitbrush, Sandberg's bluegrass, and cheatgrass.

Contaminants may be transported from contaminated groundwater into the surface zones by plants. Deep-rooted plants such as trees, Russian thistle, bitterbrush, rabbitbrush, and sagebrush have been implicated in radionuclide and metals uptake from waste sites (DOE 1987; Rickard and Kirby 1987). Russian thistle and cheatgrass have been shown to take up transuranic elements from soils and soil water under experimental conditions (Price 1972, 1973).

Contaminants present in soils and groundwater may be made available to animals, including humans, that directly or indirectly consume plants which have taken up contaminants (Price et al. 1981). Sandberg's bluegrass and cheatgrass within the operable unit are grazed by Canada geese in the fall, winter, and early spring. The area grazed most heavily lies in the STCO/POSA and ERNI/POSA plant communities north and east of the process trenches (Figure 3.1). Bitterbrush is browsed by mule deer.

Yarrow and needle-and-thread grass are heavily used by black-tailed jackrabbits as a food item (Uresk 1978). Yarrow was most abundant in the burned area (Figure 3.1), although it occurs

FIGURE 3.1. Plant Communities of the 300-FF-1 Operable Unit (See text for habitat codes and Table 3.1 for species lists.)

TABLE 3.1. Plants and Plant Communities of the 300-FF-1 Operable Unit

<u>Community^(a)</u>	<u>Species Common Name^(b)</u>	<u>Latin Name</u>
ERNI/BRTE	grey rabbitbrush cheatgrass snow buckwheat	<i>Chrysothamnus nauseosus</i> <i>Bromus tectorum</i> <i>Eriogonum niveum</i>
BRTE/SAKA	cheatgrass Russian thistle grey rabbitbrush tumble mustard Sandberg's bluegrass	<i>Salsola kali</i> <i>Sisymbrium altissimum</i> <i>Poa sandbergii</i>
Burned	cheatgrass diffuse knapweed yarrow Russian thistle Sandberg's bluegrass	<i>Centaurea diffusa</i> <i>Achillea millefolium</i>
CHNA/POSA	cheatgrass Sandberg's bluegrass grey rabbitbrush needle-and-thread grass snow buckwheat	<i>Stipa comata</i>
CHNA/BRTE	cheatgrass grey rabbitbrush tumble mustard Russian thistle	
ARTR/POSA	cheatgrass Sandberg's bluegrass grey rabbitbrush big sagebrush	
CADR	whitetop cheatgrass	<i>Cardaria draba</i>
CHNA/ORHY	Indian ricegrass cheatgrass grey rabbitbrush	<i>Oryzopsis hymenoides</i>
STCO/POSA	needle-and-thread grass Sandberg's bluegrass grey rabbitbrush	
ERNI/POSA	Sandberg's bluegrass snow buckwheat cheatgrass grey rabbitbrush bottlebrush squirreltail	<i>Sitanion hystrix</i>

TABLE 3.1. (contd)

<u>Community</u> ^(a)	<u>Species Common Name</u> ^(b)	<u>Latin Name</u>
PUTR/POSA	bitterbrush Sandberg's bluegrass cheatgrass grey rabbitbrush snow buckwheat needle-and-thread grass	<i>Purshia tridentata</i>
Riparian (River)	Sandberg's bluegrass reed canary grass perennial ryegrass sandbar willow Russian knapweed cheatgrass wiregrass mulberry asparagus	<i>Poa sandbergii</i> <i>Phalaris arundinacea</i> <i>Elymus cinerius</i> <i>Salix exigua</i> <i>Centaurea repens</i> <i>Eleocharis palustris</i> <i>Morus alba</i> <i>Asparagus officinalis</i>
Riparian (Trenches)	smartweed bulrush cattail	<i>Polygonum persicaria</i> <i>Scirpus americanus</i> <i>Typha latifolia</i>
Unimproved Roadways	Russian thistle tumble mustard lance-leaf scurf-pea bur ragweed	 <i>Psoralea lanceolata</i> <i>Ambrosia acanthicarpa</i>

(a) See Figure 3.1 for locations; see text for acronym definitions.

(b) Species listed in order of abundance (cover).

throughout the operable unit. Needle-and-thread grass occurred in nearly all communities except the most disturbed. No studies of contaminant uptake have been conducted on these plant species.

Seeds of riparian vegetation such as bulrushes that have settled to the bottom of shallow areas (Terres 1980) are the primary feed of mallards, the most common duck seen on the waste trenches. They also consume aquatic insects, which in turn feed on organic detritus that falls or is blown into the water. Weeds and grasses are fed on heavily by rock doves (*Columba livia*) and mourning doves (*Zenaida macroura*), especially in areas near water (Terres 1980).

Asparagus occurred sporadically within 40 m of mean water level along the Columbia River. The locations where asparagus plants were discovered are shown in Figure 3.1. Asparagus was not limited to the riparian community, but was found most often in that community.

Plants ranged from very old stands to first-year plants. Mature stands showed evidence of previous harvesting by humans despite the presence of DOE "No Trespassing" signs. Most stands had been grazed, probably by deer.

3.1.3 Threatened and Endangered Plant Taxa

No plant species that are federally listed as threatened or endangered occur within the Hanford Reach (50 CFR 17). Currently, three species that may potentially occur within the operable unit boundaries (DOE 1990a) are protected in Washington State as either threatened or endangered. These are Hoover's desert parsley (*Lomatium tuberosum*), Columbia River milkvetch (*Astragalus columbianus*), and persistentsepel yellowcress (*Rorippa columbiae*). Thompson's sandwort (*Arenaria franklinii* var. *thompsonii*), listed in the Work Plan (DOE 1990a) as a threatened species, currently has no protected status. It was removed from the Washington State list of threatened species because of taxonomic issues related to its legitimacy as a variety (DNR 1987).

Hoover's desert parsley generally occurs on rocky hillsides and was not found in the operable unit area. Columbia River milkvetch is found only along the western side of the Columbia River in southcentral Washington on sandy to silty soil where competition with cheatgrass is minimal (i.e., where anthropogenic disturbances have been minimal). It is known to occur on the Hanford Site in the vicinity of Vernita Bridge (Fickeisen et al. 1980). It was not found in the 300-FF-1 Operable Unit. Persistentsepel yellowcress occurs along the Hanford Reach of the Columbia River, but was not found within the boundaries of the operable unit; however, the riparian zone along the Columbia River was not thoroughly searched. This habitat zone lies outside the 300-FF-1 Operable Unit and within the 300-FF-5 Operable Unit. As noted earlier, this habitat zone will be studied as part of the Remedial Investigation/ Feasibility Study biota investigations for that operable unit (DOE 1990b).

3.2 BIRDS

Twenty five species of birds were recorded during the surveys of the 300-FF-1 Operable Unit (Table 3.2).

3.2.1 Results of Fall/Winter Surveys

Only 14 bird species were recorded from all transects in the fall/winter months of 1989 (Table 3.3). Six species were seen along Transect C. These were the western meadowlark, black-billed magpie, house finch, Canada goose, prairie falcon, and European starling. A flock of

TABLE 3.2. Species of Birds Recorded During Surveys of the 300-FF-1 Operable Unit, 1989-90

<u>Family, Latin Name</u>	<u>Common Name</u>
Ardeidae	
<i>Ardea herodias</i>	great blue heron
Anatidae	
<i>Branta canadensis</i>	Canada goose
<i>Anas platyrhynchos</i>	mallard
<i>Anas americana</i>	American wigeon
<i>Aythya collaris</i>	ring-necked duck
<i>Bucephala albeola</i>	bufflehead
Falconidae	
<i>Falco mexicanus</i>	prairie falcon
Phasianidae	
<i>Callipepla californica</i>	California quail
Charadriidae	
<i>Charadrius vociferus</i>	killdeer
Laridae	
<i>Larus delawarensis</i>	ring-billed gull
<i>Larus californicus</i>	California gull
Columbidae	
<i>Columba livia</i>	rock dove
<i>Zenaida macroura</i>	mourning dove
Tyrannidae	
<i>Tyrannus verticalis</i>	western kingbird
Alaudidae	
<i>Eremophila alpestris</i>	horned lark
Hirundinidae	
<i>Tachycineta thalassina</i>	violet-green swallow
<i>Hirundo pyrrhonota</i>	cliff swallow
Corvidae	
<i>Pica pica</i>	black-billed magpie
Sturnidae	
<i>Sturnus vulgaris</i>	European starling
Emberizidae	
<i>Sturnella neglecta</i>	western meadowlark
<i>Euphagus cyanocephalus</i>	Brewer's blackbird
<i>Chondestes grammacus</i>	lark sparrow
<i>Melospiza melodia</i>	song sparrow
<i>Zonotrichia leucophrys</i>	white-crowned sparrow
Fringillidae	
<i>Carpodacus mexicanus</i>	house finch

Canada geese was seen foraging on the ground east of the transect. Six species were also observed along Transect A. Mallards were seen on the process trenches in three of the four surveys. A maximum count of 25 mallards was recorded in mid-December. Ten species were seen along the Transect B, including mallards, Canada geese, bufflehead, American wigeon, ring-necked duck, and great blue heron. These birds are generally associated with the Columbia River shoreline.

The white-crowned sparrow was the most abundant passerine bird seen along the winter transects, although it did not occur along Transect C. White-crowned sparrows were seen within and close to the piles of Russian thistle along the chain-link fence around the process trenches at Transects A and B. The rock dove (common pigeon) was commonly observed perched on artificial structures inside the fenced exclusion areas along Transect B.

3.2.2 Results of Spring/Early Summer Surveys

Nineteen species of birds other than gulls were recorded during the spring/early summer surveys (Table 3.4). Only seven species were seen along the Transect C. Of these seven, the western meadowlark, horned lark, and lark sparrow typically nest in shrub-steppe habitat. The other birds recorded along Transect C are regarded as visitants.

Twelve species were recorded along Transect A. Horned larks, western meadowlarks, and lark sparrows were seen along this transect in addition to a few mallards, California quail, and mourning doves. The mallards were on the process trenches.

Fourteen species of birds were recorded along Transect B. Even though the vegetation along the Columbia River shoreline is used as a source of forage for broods of Canada geese during spring and summer months, only adult geese were seen in this area. Rock doves perched on artificial structures inside the fenced exclusion areas. Black-billed magpies nested in a mulberry tree along the river shore, and cliff swallows were seen feeding on flying insects.

California gulls and ring-billed gulls nested in large numbers (several thousand) on Columbia River islands downriver from the operable unit. The nearness of nesting islands resulted in many of the gulls crossing the transect lines as flybys. They were not observed to use the operable unit and are not listed in Tables 3.3 and 3.4.

3.2.3 Relationship to Previous Surveys

Surveys of birds were conducted at four 300 Area burial grounds over a decade ago (Fitzner et al. 1979). The species recorded in those surveys included those found in the present survey, with the addition of long-billed curlew (*Numenius americanus*), American kestrel (*Falco*

TABLE 3.3. Fall/Winter Bird Surveys at the 300-FF-1 Operable Unit, 1989

<u>Bird Species</u>	<u>10/30</u>	<u>11/15</u>	<u>12/15</u>	<u>12/22</u>	<u>Freq. %</u>
<u>Transect A</u>					
white-crowned sparrow	2	4	1	1	100
mallard	8	4		25(a)	75
western meadowlark	1				25
black-billed magpie	1				25
house finch	1				25
Canada goose			25(b)		25
<u>Transect B</u>					
white-crowned sparrow	1	3	10	28	100
black-billed magpie	1	2	1		75
great blue heron	3	2		1	75
mallard		2	10	2	75
bufflehead		5	6	1	75
rock dove		7	20		50
house finch			6		25
Canada goose			45(b)		25
American wigeon				2	25
ring-necked duck				3	25
<u>Transect C</u>					
western meadowlark	3		1		50
black-billed magpie	5		1		50
house finch	2				25
Canada goose			30(c)		25
European starling			1		25
Prairie falcon				1	25

(a) Mallards were on a process trench.

(b) Canada geese recorded as flybys.

(c) Canada geese recorded as foraging on ground.

TABLE 3.4. Spring/Early Summer Bird Surveys at the 300-FF-1 Operable Unit, 1990

<u>Bird Species</u>	<u>5/11</u>	<u>5/18</u>	<u>6/5</u>	<u>6/12</u>	<u>Freq. %</u>
<u>Transect A</u>					
western meadowlark	2	5	5	3	100
black-billed magpie		1	1		50
killdeer		1	2		50
mourning dove		1		2	50
Brewer's blackbird	2	2			50
house finch				2	25
mallard			4		25
California quail			4		25
western kingbird		2			25
European starling			1		25
horned lark			3		25
lark sparrow			1		25
<u>Transect B</u>					
rock dove	4	6	2		75
black-billed magpie	2	1	9		75
cliff swallow		10	14	2	75
killdeer	1	1	1		75
house finch		5		9	50
western meadowlark	1	1			50
Brewer's blackbird	1	1			50
European starling		1		2	50
song sparrow			1		25
violet-green swallow			3		25
lark sparrow				2	25
western kingbird				2	25
Canada goose	2				25
flycatcher (unident.)			1		25
<u>Transect C</u>					
western meadowlark	8	4	9	8	100
lark sparrow	3	2	3	1	100
black-billed magpie	5		1		50
house finch	2			9	25
European starling		1			25
western kingbird			2		25
horned lark			3		25

sparverius), burrowing owl (*Athene cunicularia*), Swainson's hawk (*Buteo swainsoni*), logger-head shrike (*Lanius ludovicianus*), and sage sparrow (*Amphispiza belli*). Lark sparrows were seen on the present survey, but not on the previous survey.

At times during the winter months, human activity within and near the operable unit in the early morning hours may have lessened the chances of detecting wary birds, especially waterfowl. Singing birds (e.g., western meadowlarks, lark sparrows, and horned larks) or those that are large and conspicuous (e.g., geese, ducks, magpies, and great blue herons) have a higher likelihood of being detected. Birds that tend to remain silent, are difficult to flush, and tend to seek dense vegetation cover may not be detected at all, or their abundance greatly underestimated. Some birds are active at night, and these would not be expected to be seen during daytime surveys.

3.2.4 Endangered and Threatened Bird Species

Four bird species that have the potential to occur in or near the 300-FF-1 operable unit are listed as endangered by the U.S. Fish and Wildlife Service (50 CFR 17.11) or the State of Washington (WDW 1989). These are

- American white pelican (state) (*Pelecanus erythrorhynchos*)
- Aleutian Canada goose (federal) (*Branta canadensis leucopareia*)
- sandhill crane (state) (*Grus canadensis*)
- peregrine falcon (federal) (*Falco peregrinus*).

The American white pelican was present year-round on the Hanford Reach of the Columbia River, but was not seen during the bird surveys. The sandhill crane flies across the Hanford Site during autumn and spring migration, and the Aleutian Canada goose and peregrine falcon are rare visitants. No Aleutian Canada goose was observed among the Canada geese recorded during the surveys in the operable unit. Peregrine falcons were not seen during the bird surveys. The long-billed curlew, a candidate federal species, has been sighted near the 300 Area (Fitzner et al. 1979). There are no Washington State sensitive bird species (WDW 1989).

Two bird species that have the potential to occur in or near the 300-FF-1 operable unit are listed as threatened by the U.S. Fish and Wildlife Service (50 CFR 17) or the State of Washington (WDW 1989). These are

- ferruginous hawk (state) (*Buteo regalis*)
- bald eagle (federal) (*Haliaeetus leucocephalus*).

The ferruginous hawk nests on the Hanford Site, and the bald eagle is a regular winter visitant (Jaquish and Bryce 1989). However, no ferruginous hawks or bald eagles were seen during the bird surveys in the operable unit.

3.2.5 Potential Contribution to Contaminant Migration

The only game bird seen on the water-filled process trenches in the operable unit was the mallard. Mallards used the process trenches in fall and winter, but they were seen on only one survey in the spring (Table 3.4). Mallards feed primarily on seeds of riparian vegetation and aquatic insects. Uncovered, the process trenches have the potential to support several pairs of nesting mallards. A wire mesh screen that has been used to cover the trenches since the survey was completed is a deterrent to waterfowl use. Only a few mallards nest on the islands or on the shoreline of the Columbia River. Although no tagging studies have been done, probably very few of the mallards killed during the waterfowl hunting season are local birds. Table 3.5 shows harvest numbers for select bird species (WDW 1990a).

Canada geese were observed foraging on cheatgrass and Sandberg's bluegrass in the operable unit in the fall and winter months following the onset of autumn rains. Canada geese nest on the Columbia River island immediately east of the operable unit (Fitzner and Rickard 1983), and juvenile and adult geese forage along the shoreline near the operable unit in the spring and summer months. The island in the Columbia River immediately upstream from the operable unit annually supports 20 to 30 Canada goose nests. Both adults and young that are capable of flight forage on rangeland plants or cultivated fields at some distance from the river. Migrating birds provide the bulk of the geese killed by hunters during the hunting season.

Upland game birds seen were the mourning dove and California quail. Mourning doves nest in shrub-steppe vegetation throughout the Hanford Site. Most mourning doves migrate from the Hanford Site in September. Mourning doves feed on seeds of weeds and grasses. The number of mourning doves from the Hanford Site that are killed offsite is unknown. California quail are closely associated with riparian vegetation on the Hanford Site (Rickard and Poole 1989). Quail are seed eaters. Quail are year-round residents with limited mobility, making most of those birds produced on the Hanford Site unavailable to hunters.

TABLE 3.5. 1989-90 Washington Department of Wildlife Game Harvest Numbers for Select Bird Species^(a)

<u>Species</u>	<u>Benton County</u>	<u>Franklin County</u>
California quail	7,032	4,570
mourning dove	8,190	9,375
duck	23,350	16,567
goose	3,311	2,759

(a) From WDW (1990a).

Rock doves are resident birds. They were more abundant than either mourning doves or California quail. Rock doves are also much more mobile than quail. Rock doves were seen perched inside the fenced exclusion zone and were observed to fly across the Columbia River toward Franklin County, where they potentially could be shot by hunters. Rock doves often nest on urban and industrial buildings where they are sometimes regarded as pests. Rock doves have been identified as biological vectors of radionuclides of Hanford Site origin in the 200 Areas.

There are four major sources of contaminants to upland game birds and water fowl. These are plant parts and insects ingested as food, drinking water, and particles of mineral soil and organic matter ingested with foods or gleaned from feathers by preening (Figure 3.2).

Birds that are year-round residents and also nest on or near the operable unit (e.g., California quail and rock dove) have the highest potential to obtain body burdens of contaminants.

FIGURE 3.2. Potential Exposure Pathways for Upland Game Birds and Waterfowl on the 300-FF-1 Operable Unit

Mallards use small ponds and ditches more intensively than do Canada geese, but Canada geese tend to forage more often on rangeland grasses than do mallards.

3.3 MEDIUM- AND LARGE-SIZED MAMMALS

Five surveys were conducted for medium and large mammals on the 300-FF-1 Operable Unit. The dates (1990) and times (PDT) were

<u>Date</u>	<u>Time</u>
June 5	0540 - 0705
June 12	0535 - 0645
June 15	1930 - 2100
June 27	1830 - 2000
June 29	0530 - 0700

The only mammal seen during these surveys was Nuttall's cottontail (*Sylvilagus nuttallii*). Several were observed along Transect A, primarily in the bitterbrush habitat (Figure 3.1). Russian thistles had accumulated against the exclusion fence, providing escape cover. Tracks and fecal pellets were observed along Transects B and C.

Cottontails are expected to occur wherever burrows or other protective cover, such as debris piles, culverts, or foundation structures, are present. Cottontails are game animals; an estimated 412 cottontails were harvested in Benton County in the 1989-90 season (WDW 1990a). Home ranges of cottontails are small, with diameters of less than 100 m (Chapman et al. 1982), although juveniles may disperse over much longer distances. Offsite harvest of cottontails that were derived from the 300-FF-1 Operable Unit is therefore unlikely.

Cottontails are herbivores, feeding primarily on grasses and shrubs (Chapman et al. 1982; Rickard et al. 1974). Cottontails are prey to raptors, especially Swainson's hawks and northern harriers (*Circus cyaneus*), and coyotes (*Canis latrans*) (Chapman et al. 1982; Fitzner et al. 1979). The large home ranges of these predator species provide a potential pathway for offsite migration of contaminants. Cottontails may thus be of concern if they consume contaminated vegetation and are, in turn, eaten by a protected species. A generalized exposure pathway diagram for mammals using the 300-FF-1 Operable Unit is given in Figure 3.3.

Few tracks of black-tailed hares (*Lepus californicus*) were noted. On June 27, two separate sets of tracks were found along the west fence of the process trenches on Transect A.

FIGURE 3.3. Potential Exposure Pathways for Medium-to-Large Mammals on the 300-FF-1 Operable Unit

Black-tailed hares (jackrabbits) are the most abundant leporid on the Hanford Site. Studies of the food habits of this species on the Arid Lands Ecology Reserve found yarrow to be the most common component of the diet, although needle-and-thread grass and Sandberg's bluegrass were also common (Uresk 1978). Rabbitbrush is also a significant dietary component (Uresk 1978).

Black-tailed hares have relatively large home ranges (~250 m diameter), though actual home-range size is greatly affected by the pattern of food, cover, and water in the area (Dunn et al.

1982). Juvenile black-tailed hares may disperse over many kilometers and are not constrained by fences, except those that are partially buried (Fitzner et al. 1979). Black-tailed hares are considered game species, with an estimated take in Benton County during 1989-90 of 438 animals (WDW 1990a). Black-tailed hares have been implicated in biotic dispersion of radioactive strontium and cesium in the B-C Crib area of the 200-East Area (O'Farrell and Gilbert 1975) and have been found to transport other radionuclides as a result of ingesting contaminated vegetation (Romney et al. 1970). Black-tailed hares are important prey for coyotes and golden eagles (*Aquila chrysaetos*) (Rickard et al. 1974). Consequently, black-tailed hares would constitute a potential pathway for migration of contaminants from the 300-FF-1 Operable Unit should evidence be found of contamination in forage grasses or shrubs.

One set of porcupine (*Erethizon dorsatum*) tracks were observed along Transect B on June 29. No other tracks or signs were observed. One set of raccoon (*Procyon lotor*) tracks were noted on Transect B on June 5. Both species are primarily associated with riparian habitat. Porcupines are herbivores, feeding primarily on twigs, leaves, buds, and bark of trees and shrubs in the riparian area. Porcupines have few natural predators on the Hanford Site (Rickard et al. 1974), although they are occasionally killed by collisions with motorized vehicles. They are not regarded as game animals or furbearers. Raccoons consume both plant and animal foods found in the riparian areas, including birds and small mammals. Raccoons are capable of scaling chain-link fences and could serve as a potential migration pathway for contaminants outside the fenced areas. Maximum home-range diameters for raccoons can be from 1 to 3 km (Kaufmann 1982).

Signs of coyote were present on all three transect lines. Though no animals were sighted, tracks and scats were frequently found. Coyote diggings were also noted at two locations under the chain-link fence surrounding the process trenches.

Coyotes are the most abundant and ubiquitous mammalian predator on the Hanford Site. Coyote diets may be extremely varied, ranging from insects and small mammals to birds and mule deer (*Odocoileus hemionus*) fawns. In lowland areas of the Hanford Site, coyotes prey primarily on Great Basin pocket mice (*Perognathus parvus*), black-tailed hares, and Nuttall's cottontails (Stoel 1976). In riparian areas, coyotes prey heavily on waterfowl (Rickard et al. 1974). Home ranges of coyotes on the Hanford Site can be as large as 89 km² (Springer 1982).

Because of their reliance on small burrowing mammals and waterfowl as dietary staples, coyotes constitute a potential vector for the movement of contaminants out of the 300-FF-1 Operable Unit and even off the Hanford Site. Coyotes are considered to be primarily nuisance animals outside the Hanford Site, although they are classed as furbearers by Washington State. A

total harvest of 108 coyotes was taken in Benton County during 1989-1990 (WDW 1990b). No studies have been undertaken to determine what portion of the offsite take is made up of individuals from the Hanford Site.

One badger (*Taxidea taxus*) digging was noted in the bitterbrush habitat along Transect A on June 5. Badgers feed mostly on small mammals, which they generally catch through excavation of their intended prey's burrow. Badgers are powerful diggers and have been blamed for the nuisance spread of contaminants at Hanford. At the B-C Crib area in the 200-East Area, a badger excavated into a radioactive waste burial site, unearthing radioactive salts. These salts were consumed by hares. Several hundred acres of ground were contaminated when these animals deposited feces and urine over the surrounding landscape (O'Farrell and Gilbert 1975).

No studies of badgers have been undertaken on the Hanford Site. In the sagebrush-steppe of southern Idaho, male badgers had home ranges of 2.4 km² (Lindzey 1982). Badgers are considered to be furbearers, though none were taken in Benton County during 1989-1990 (WDW 1990b). Because of their relative scarcity, badgers may be less important as vectors of contamination than as agents exposing buried wastes. Badgers may excavate several meters below the surface in pursuit of prey or to create a den. Burial of waste at least 3 m below ground surface has been thought to minimize the likelihood of waste exposure (Fitzner et al. 1979). Badger excavations were most frequent along the bank of the Columbia River in the 300-FF-1 Operable Unit. The importance of waste exposure in the operable unit by badgers is probably low.

The largest wild mammal present at the 300-FF-1 Operable Unit is the mule deer. Deer tracks and fecal pellets were observed on Transects B and C, and one set of deer tracks was noted on Transect A. Deer tracks were observed on Transects B and C during every survey.

Mule deer are primarily browsers foraging mainly on bitterbrush and willows, though they also forage on cheatgrass, Sandberg's bluegrass, and a variety of forbs, including tumble mustard and Russian thistle (Rickard et al. 1974). Mule deer require access to drinking water; consequently, their greatest density on the Hanford Site is generally within several kilometers of the Columbia River (Eberhardt et al. 1984).

The Columbia River restricts deer movement, but does not prevent their crossing. Telemetry studies of adult animals found nearly half of the telemetered animals crossed the river or swam to islands during a 2-year period (Eberhardt et al. 1984). Home ranges may cover as much as 93 km² (Eberhardt et al. 1984), and juveniles may disperse more than 113 km from their initial point of capture (Eberhardt et al. 1979). In other studies of deer near the 200-East Area and the

Hanford townsite, at least 25% of the monitored adult animals moved off the Hanford Site at least temporarily, with the farthest movement being 7 km beyond the site boundary (Eberhardt et al. 1982).

Deer foraging in radioactively contaminated areas accumulate radionuclides in their tissues apparently in proportion to the amount of time spent foraging in the area (Eberhardt et al. 1982). Although no studies of deer at the 300 Area have been undertaken, a minimum estimate of offsite harvest of deer from the Hanford Site is 8%, with the 95% confidence interval ranging from 0 to 21% (Eberhardt et al. 1982). Mule deer tagged as fawns on the Hanford Site have been harvested by hunters as far away as Mattawa, Prosser, and Wallula Junction (Hedlund 1975). Deer harvest in the Ringold, Wahluke, and Priest Rapids game units during the 1989 season was 22, 11, and 65, respectively (WDW 1990c).

Mule deer have been observed jumping over the waste area fences in the 300-FF-1 Operable Unit area in the past when fence heights were lower than they are today (Fitzner et al. 1979). Deer feeding on contaminated vegetation in the 300-FF-1 Operable Unit constitute a potentially significant pathway for contaminant transfer to humans.

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