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Threatened and Endangered Wildlife Species of the Hanford Site Related to CERCLA Characterization Activities

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Dick Fitzner, the lead author, was killed in a plane accident on June 3, 1992, while conducting research on sage grouse. Dick's 20 years of experience, knowledge, and love of wildlife were indispensable in preparing this report. He will be sorely missed by the professional community and his many friends.

SUMMARY

Because the U.S. Department of Energy's Hanford Site in south-central Washington State was placed on the National Priorities List to be remediated, the U.S. Department of Energy began waste site characterization activities. These activities take place in the 100, 200, 300, 600, and 1100 Areas of the Hanford Site in a number of operable units. Activities include nonintrusive activities (e.g., surface radiation surveys, ground-penetrating radar surveys, electromagnetic induction/magnetometer surveys, soil and sediment sampling, soil-gas surveys, geologic investigations, and surface water and sediment sampling) and intrusive activities (test pit soil sampling, waste site cleanup, and borehole and well drilling). Other work includes air monitoring, ecological investigations, and cultural resources investigations.

Special-status wildlife species of the Hanford Site include the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), American white pelican (*Pelecanus erythrorhynchos*), sandhill crane (*Grus canadensis*), pygmy rabbit (*Sylvilagus idahoensis*), ferruginous hawk (*Buteo regalis*), western sage grouse (*Centrocercus urophasianus*), loggerhead shrike (*Lanius ludovicianus*), northern goshawk (*Accipiter gentilis*), black tern (*Chlidonia niger*), Pacific western big-eared bat (*Plecotus townsendii*), and Columbia pebblesnail (*Fluminicola columbiana*). The bald eagle is listed by both the state of Washington and the U.S. Fish and Wildlife Service as threatened. The peregrine falcon is listed by both as endangered. The American white pelican, sandhill crane, and pygmy rabbit are listed by the State as endangered. The ferruginous hawk is listed by the State as threatened and as a candidate for federal listing. The black tern, western sage grouse, loggerhead shrike, northern goshawk, Pacific western big-eared bat, and Columbia pebblesnail are candidates for federal listing. These last five are also candidates for State listing. A Bald Eagle Site Management Plan has been prepared to meet Endangered Species Act consultation requirements.

To protect species of concern, potential habitat should be avoided during certain times of the year. Table S-1 shows areas of potential habitat and avoidance times for each species. Please note that the degree of avoidance depends on the human and wildlife activity. Best professional judgement by qualified people is critical in identifying the needs of threatened and endangered species protection during site characterization and eventual cleanup.

Table S-1. Areas of Use, Avoidance Times, Potential Impacts, and Avoidance Strategies for Threatened, Endangered, and Candidate Species.

Species of concern	Areas of use	Times of concern	Potential impacts	Avoidance strategies
Peregrine falcon	Columbia River, islands, and shoreline	All year	Unlikely to affect; rare occurrence	Limit activities near river, islands, and shoreline
Bald eagle	100 Areas, Columbia River, islands, and shoreline	Wintering (Nov. 15 - March 15) Nesting (Jan. 1 - Aug. 31)	Physiological stress, habitat loss, nest desertion	Adhere to buffer zones and temporal restrictions
American white pelican	Columbia River, islands, and shoreline	All year	Physiological stress, habitat loss	Limit activities near river, islands, and shoreline
Sandhill crane	Columbia River islands	All year	Unlikely to affect; rare occurrence	Limit activities near river, islands, and shoreline
Pygmy rabbit	If rabbits occur onsite, dense sagebrush stands with deep, loose soils	All year	Habitat destruction, physiological stress, fire (if rabbits are present)	Avoid destroying dense sagebrush habitat
Ferruginous hawk	300, 600 Areas, open grasslands	Mar. 1 - Aug. 1	Nest desertion, habitat loss, fire, loss of prey base	Adhere to buffer zones and temporal restrictions around nests, maintain prey base
Western sage grouse	Sagebrush-dominated areas, on the Arid Lands Ecology Reserve	All year	Habitat destruction, physiological stress, potential nest desertion, fire (if grouse are present)	Avoid destroying or disturbing sagebrush habitat and river shoreline (former habitat)
Pacific western big-eared bat	Possibly 100, 200, 300 Area buildings	All year	Physiological stress, habitat loss (if bats are present)	Avoid loud noises (e.g., impact drilling) in and around buildings used as roosting sites
Columbia pebblesnail	Columbia River	All year	Water quality reduction and therefore habitat loss	Do not alter existing water quality
Loggerhead shrike	Hanford Site	Mar. 1 - Sept. 30	Fire, loss of native shrub communities, nest desertion, loss of prey base	Avoid disturbing sagebrush and trees used for nesting and foraging
Northern goshawk	Arid Lands Ecology Reserve	All year	Unlikely to affect; rare occurrence	--
Black tern	Columbia River	Fall and spring	Unlikely to affect; rare occurrence	--

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1.0 INTRODUCTION

The U.S. Department of Energy's (DOE) Hanford Site has been placed on the National Priorities List, which requires that it be remediated under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) or Superfund. Potentially contaminated areas of the Hanford Site were grouped into operable units, and detailed characterization and investigation plans were formulated. The DOE Richland Operations Office requested Westinghouse Hanford Company (WHC) to conduct a biological assessment of the potential impact of these characterization activities on the threatened, endangered, and sensitive wildlife species of the Hanford Site. Additional direction for WHC compliances with wildlife protection can be found in the *Environmental Compliance Manual* (WHC 1988). This document is intended to meet these requirements, in part, for the CERCLA characterization activities, as well as for other work comparable in scope (e.g., similar activities under waste site cleanup, facility decommissioning and decontamination, old trash dump and other debris removals, revegetation, and ongoing Hanford Site monitoring surveys). Other supporting biological assessments for plants and state wildlife species of concern are in Sackschewsky (1992) and Stegen (1992).

This report documents the biological assessment and describes the pertinent components of the Hanford Site as well as the planned characterization activities. Also provided are accounts of endangered, threatened, and federal candidate wildlife species on the Hanford Site and information as to how human disturbances can affect these species. Potential effects of the characterization activities are described with recommendations for mitigation measures.

2.0 SITE DESCRIPTION

The Hanford Site is located in south-central Washington State along the Columbia River near the city of Richland (Figure 2-1). Flow in the Columbia River is regulated by 11 dams within the United States: 7 dams upstream from the Hanford Site and 4 dams downstream. The Hanford Reach, which extends for 83 km (52 mi) from Priest Rapids Dam to the head of Lake Wallula (created by McNary Dam), is the only stretch of the Columbia River within the United States above Bonneville Dam that is not impounded by a dam.

Between 1943 and 1963, nine water-cooled, graphite-moderated, plutonium production reactors were constructed by the U.S. Government at the Hanford Site. Eight of the reactors are now retired from service (B, C, D, DR, F, H, KE, and KW); they have been declared surplus by the DOE and are available for decommissioning. The ninth, N Reactor, has also recently been declared retired.

Currently more than 1,500 waste sites have been identified on the Hanford Site. These waste sites are grouped into four aggregate areas (100, 200, 300, and 1100) by the type of facility and operation. For example, the 100 Area consists of inactive nuclear reactor sites. Each area is further subdivided into operable units according to waste disposal practices, geology, hydrogeology, and other pertinent characteristics. These operable units will be considered source units (facilities that are

Figure 2-1. Location of the Hanford Site and Eagle Nesting Sites.

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potential sources of radiological or hazardous substance contamination) or groundwater units, which include the groundwater underlying the area. Other, isolated waste units, such as trash dumps, vehicle maintenance areas, and anti-aircraft gun emplacements, are scattered throughout the 600 Area of the Hanford Site. The following sections describe the facilities and operable units for the production reactor sites and the 200, 300, and 1100 Areas.

2.1 100-B/C AREA

The 100-B Area contains two reactors: B Reactor, which operated from 1944 through 1968, and C Reactor, operating from 1952 until 1969. The only active facilities in the 100-B Area are the 181-B Pumphouse, 182-B Water Reservoir and Pumphouse, 151-B Substation, and part of the water transport system. Of the 39 structures originally built, 9 are still standing. Within the 100-B Area are five operable units: the source units 100-BC-1, 100-BC-2, 100-BC-3, and 100-BC-4, and the groundwater unit 100-BC-5. The 100-B Area lies on a flat bench south of the Columbia River and covers approximately 2.33 km² (0.93 mi²). The elevation of the area ranges from approximately 149 m (490 ft) along the southern border to 131 m (430 ft) near the Columbia River. The average slope across the area is approximately 1%. Erosion has created a steep embankment that drops approximately 9 m (30 ft) to elevation 122 m (400 ft) along the Columbia River.

Surface soil around the reactors has been disturbed and reworked by construction activities. Two types of soil have been identified in and around this area, Ephrata Stony Loam and Burbank Loamy Sand. Ephrata Stony Loam has large hummocky ridges, made up of debris released from melting glaciers. Large boulders, several feet in diameter, are found between the hummocks. Burbank Loamy Sand has a dark-colored surface and coarse-textured subsoils underlain by gravel (Hajek 1966).

Significant topographic features near the 100-B Area include Gable Butte, which separates this area from the southern portion of the Hanford Site.

Vegetation within the 100-B Area includes a thick stand of willow (*Salix* spp.) upstream along the western shoreline; white mulberries (*Morus alba*), elms (*Ulmus pumila*), and junipers (*Juniperus scopulorum*) downstream; and mostly cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola kali*), and tumblemustard (*Sisymbrium altissimum*) inside the 100-B/C Area fences (Sackschewsky 1992).

2.2 100-D AREA

The 100-D Area contains the D and DR Reactors and their operational support facilities. The D Reactor operated from 1944 to 1967, and the DR Reactor operated from 1950 to 1964. Most of the ground facilities have undergone some degree of decommissioning and in many instances have been demolished. Twenty of the original buildings are still standing. The 100-D Area is located approximately 2.4 km (1.5 mi) east-northeast of the 100-N Area and covers approximately 2.6 km² (1.0 mi²). The area contains four operable units: three source units (100-DR-1, 100-DR-2, and 100-DR-3) and one groundwater unit (100-HR-3). The 100-D Area is situated on an essentially flat, semiarid bench immediately southeast of the Columbia River. The elevation of the land surface near the center of the area is approximately 142 m (466 ft) above mean sea level (amsl), with land surface sloping to the northeast (about a 1% gradient) to an elevation of approximately 134 m (440 ft). A steep embankment of about 18 m (60 ft) is present at the river's edge along the northwestern margin

of the unit. The area around the production reactor area has been extensively disturbed; therefore, the surface is relatively flat.

Ephrata Stony Loam is one type of soil found in this area. The soil contains large hummocky ridges, with large boulders between the hummocks. Burbank Loamy Sand, Ephrata Sandy Loam, and Rupert Sand have also been identified in this area. Burbank Loamy Sand is dark colored, and the subsoil is coarse textured, underlain with gravel. Ephrata Sandy Loam is also dark colored with a subsoil that is medium-textured soil, underlain by gravel. Rupert Sand is a coarse-sand, alluvial deposit (Hajek 1966).

The shoreline adjacent to the 100-D Area contains a large stand of mature elm trees, surrounded by cheatgrass, sand dropseed (*Sporobolus cryptandrus*), and tumbled mustard. The northeast corner of 100-D Area is a mixed community dominated by big sagebrush (*Artemisia tridentata*). There are two abandoned apricot orchards and a considerable amount of cheatgrass in this area. To the east of the 100-D Area is a very sandy, dune-type community dominated by sagebrush (*Artemisia* spp.) and gray rabbitbrush (*Chrysothamnus nauseosus*) (Sackschewsky 1992).

In the center of the Columbia River just north of the area is a small island approximately 0.4 km (0.2 mi) long and up to 0.15 km (0.1 mi) wide. An effluent pipeline transporting reactor cooling water runs across this island. Removal of speck contamination and vent pipes on the island, as well as stabilization or removal of the discharge pipelines, has been identified in the draft *Tentative Agreement on Tri-Party Agreement Negotiations* (DOE et al. 1993).

2.3 100-F AREA

The 100-F Area has one reactor that was operational from 1945 through 1965. Additionally, from 1945 to 1976, laboratory research on plants and animals was conducted in the area. Most of the facilities associated with the reactor were retired in 1965. Currently, three of the original facilities have not been decontaminated and decommissioned. The two source operable units in the 100-F Area are 100-FR-1 and 100-FR-2. The 100-F Area covers approximately 7.4 km² (2.9 mi²) and lies in a broad, essentially flat, semiarid plain on the eastern portion of a bend in the Columbia River. Elevation is approximately 122 m (400 ft) across the entire area. The river bank, which forms the northeast boundary of the area, drops steeply, approximately 9 m (30 ft).

The soil in this area has been extensively disturbed by construction activities. Pasco Silt Loam, Burbank Loamy Sand, and Ephrata Sandy Loam have been identified around this area. The Pasco Silt Loam has fine sandy loam and clay with variable subsoil consisting of stratified layers. Both Burbank Loamy Sand and Ephrata Sandy Loam have a dark-colored surface soil, with Burbank subsoil having a coarse texture and Ephrata subsoil having a medium texture. Both subsoils are underlain by gravel (Hajek 1966).

The vegetation in this area is mainly dominated by cheatgrass with some interspersed rabbitbrush (*Chrysothamnus* spp.) and sagebrush. Studies are being conducted to better define the plant species in this area.

2.4 100-H AREA

The 100-H Area was used from 1949 to 1965 to produce plutonium for nuclear weapons. These operations resulted in the release of chemical and radioactive wastes into the soil, air, and water. The H Reactor and most of the operational support facilities have undergone some degree of decommissioning, and in many instances the facilities no longer exist. For cleanup purposes, the 100-H Area has been divided among three operable units: 100-HR-1, 100-HR-2, and 100-HR-3. The groundwater unit, 100-HR-3, is under the H and D Reactor areas and covers an area approximately 23 km² (9 mi²). The other two operable units (100-HR-1 and 100-HR-2) cover approximately 5.86 km² (2.26 mi²). The 100-H Area is on a semiarid bench, with elevation ranging from 116 to 140 m (380 to 460 ft) amsl. The land surface slopes downward gradually (about 1 % gradient) toward the Columbia River, with an embankment of up to 9 m (30 ft) at the river's edge. Small groundwater seeps have been observed along this stretch of the river.

At least two different types of soil have been identified in and around the 100-H Area. Burbank Loamy Sand has a dark-colored surface, and the subsoil is coarse textured and underlain by gravel. The surface soil can range from 41 to 76 cm (16 to 30 in.) deep. The ground has been extensively disturbed from construction activities; consequently, the depth and content of surface soils vary. River-wash consisting of sand, gravel, and boulder deposits is also scattered along the shore of this area (Hajek 1966).

The 100-H Area contains two stands of black locust (*Robinia pseudo-acacia*). Between the stands of trees is a cheatgrass/tumblemustard community with several large giant wildrye (*Elymus cinereus*) individuals. The shoreline is dominated by reed canarygrass (*Phalaris arundinacea*) and bluegrass (*Poa* spp.). Much of the remaining area within 100-H is dominated by gray rabbitbrush and cheatgrass (Sackschewsky 1992).

2.5 100-K AREA

The 100-K Area has two reactors, KW and KE. The KW Reactor operated from 1955 through 1970, and the KE Reactor operated from 1955 until 1971. Of the original 49 structures, 16 are still active and 3 have been completely demolished or partially dismantled. The 100-K Area has four operable units: the 100-K-1, 100-K-2, and 100-K-3 source operable units, and the 100-K-4 groundwater unit. The source units cover approximately 1.89 km² (0.74 mi²), with 100-K-4 extending more than 2.5 km (1 mi) downriver of the reactors. The source units are 152 to 305 m (500 to 1,000 ft) from the Columbia River. Ground elevation in this area varies from 122 to 152 m (400 to 500 ft) amsl, with a land surface slope averaging about 5 % toward the northwest boundary.

The elevation in the area around the production reactors is relatively level because the surface has been extensively reworked during construction activities. Ephrata Stony Loam, Ephrata Sandy Loam, and Burbank Loamy Sand have been identified in and around this area. Ephrata Stony Loam contains large hummocky ridges in the soil, with large boulders between the hummocks. Ephrata Sandy Loam and Burbank Loamy Sand are dark colored, with a medium- (Ephrata Sandy Loam) to coarse- (Burbank Loamy Sand) textured subsoil, underlain by gravel (Hajek 1966).

The 100-K Area is mostly dominated by cheatgrass with some stands of sagebrush and Sandberg's bluegrass (*Poa sandbergii*). Studies are currently being conducted to further define the plant species present in this area.

2.6 100-N AREA

The 100-N Area contains one reactor, the last to be constructed as a major production reactor at the Hanford Site. The N Reactor went into production in December 1963 and operated on a continuous basis until December 1987 when it was placed on standby status. In 1988, it was placed on cold standby; it received retirement notice in 1991. The N Reactor differs from the other reactors on the Hanford Site in that it was designed as a dual-purpose reactor. The N Reactor was capable of producing special nuclear materials in addition to electricity from steam production.

The 100-N Area contains three operable units: 100-NR-1, 100-NR-2, and 100-NR-3. The 100-N Area covers 650 acres, with the 100-D Area on the northeast boundary and the Columbia River on the northwest boundary. Elevations in the 100-N Area range from 119 m (390 ft) amsl at the Columbia River to approximately 135 m (450 ft) amsl on the east side of the area.

Most of the ground surface has been extensively reworked as part of construction of the reactor buildings and related facilities. This ground disturbance allowed for the invasion of cheatgrass, which is now the dominant vegetation in the area. Studies are currently being conducted to get a more complete species list for this area.

The surface is relatively flat and disturbed with an elevation of approximately 135 m (450 ft) amsl. The 100-N Area is surrounded by hummocky terrain, which is perhaps the result of catastrophic flooding associated with Pleistocene glaciation. Areas between the hummocks contain large boulders several feet in diameter and Ephrata Sandy Loam, which has a dark color with a medium-textured subsoil, underlain by gravel (Hajek 1966).

2.7 200 AREAS

The primary function of the 200 Areas was to process irradiated fuel for separation and recovery of desirable isotopes such as plutonium and uranium. The 200 Areas are divided into the 200 East, the 200 West, and the 200 North Areas. The 200 East Area covers approximately 20 km² (7.68 mi²), the 200 West Area is approximately 23 km² (8.9 mi²), and the 200 North Area is about 3.5 km² (1.5 mi²). The 200 Areas are divided into 43 operable units. They lie on a terrace known as the 200 Area Plateau. The elevation ranges from 190 to 245 m (623 to 803 ft) amsl. The terrace decreases in elevation to the north, northwest, and east toward the Columbia River, sloping steeply, with elevation changes between 16 and 33 m (50 and 100 ft).

The surface of the 200 Areas has undergone minimal erosion since its formation by floodwaters 13,000 years ago. The surface is veneered with loess and sand dunes of varying thickness (Hajek 1966).

The 200 Area Plateau is characterized by native shrub-steppe interspersed with large areas of disturbed ground. The dominant shrub is big sagebrush with the understory dominated by the native Sandberg's bluegrass and cheatgrass. The vegetation in and around the ponds and ditches on the 200 Area Plateau is significantly different from that of the surrounding dryland areas. Several tree species are present, including cottonwood (*Populus trichocarpa*) and willow.

2.8 300 AREA

In 1943, construction began on a fuel fabrication complex in the 300 Area. In the early 1950's, construction began on research and development facilities. As the reactors shut down in the mid-1960's, fuel fabrication activities decreased and research activities increased.

The 300 Area contains four operable units: 300-FF-1, 300-FF-2, 300-FF-3, and 300-FF-5. (The Fast Flux Test Facility in the 400 Area is the 300-FF-4 Operable Unit and is separated geographically from the 300 Area.) The 300 Area lies within the regional topographic low of the Pasco Syncline, a broad depression in the southeastern portion of the Pasco Basin. The elevation of the area is from 116 to 119 m (380 to 390 ft) amsl. Surface topography in the area is generally flat and slightly irregular. The land slopes downward gradually to the east and south. There is a steep embankment at the river's edge of approximately 12 m (40 ft). Small groundwater seeps are found along this embankment.

A thin veneer of fine- to coarse-grained eolian sand deposits covers most of the 300 Area. The thickness of these deposits varies, ranging from 0 to 4.6 m (0 to 15 ft). Many of these deposits were removed during construction activities. The subsoil is medium-textured soil, which is underlain by gravelly material and may continue for many feet (Hajek 1966).

The 300 Area is characterized by bitterbrush (*Purshia tridentata*)/sagebrush with some areas being primarily cheatgrass.

2.9 600 AREA

All of the Hanford Site not included in other areas is considered the 600 Area. This area includes the Arid Lands Ecology Reserve; the "North Slope," leased to the state of Washington and the U.S. Fish and Wildlife Service (USFWS) for wildlife refuges; the Washington Public Power Supply System; and two abandoned townsites. While some of the 600 Area DOE facilities were generators of radioactive waste, some were involved in waste management operations. In many cases, waste sites in the 600 Area are low priority when compared to other sites at Hanford. The waste site classification include hazardous waste, radioactive waste, municipal landfill, and site services.

2.10 1100 AREA

The 1100 Aggregate Area is subdivided into three operable units: 1100-EM-1, 1100-EM-2, and 1100-EM-3. This area has been used as a maintenance area, warehouse facility, and equipment storage yard in support of operations at the Hanford Site. It is approximately 0.8 km (0.5 mi) west of the north Richland well field. The area is largely industrial; however, in parts of the area, such as the old Horn Rapids landfill, natural and introduced vegetation have become established.

The 1100 Area lies on an elongated north-south plateau at an elevation of approximately 122 m (400 ft) amsl. The land surface slopes generally to the southwest toward the Yakima River and to the east toward the Columbia River. The area is characterized by southwest-trending sand dunes with low to moderate relief. The dunes are up to 3 m (10 ft) thick and are largely stabilized by vegetation or have been reworked by grading and excavation for facilities. Surficial deposits consist primarily of eolian sands and silts.

Vegetation in this area has been historically defined as the bitterbrush/sagebrush/Sandberg's bluegrass climax community, but most of the vegetation has been reworked and the area is covered with asphalt.

3.0 ACTIVITIES

Operable unit characterization activities include intrusive, nonintrusive, and other types of activities for the 100 Area production reactor sites, 200 Areas, 300 Area, and 1100 Area. Activities may be conducted in stages, consisting of source evaluation and nonintrusive surveys, source sampling and test pit soil sampling, and additional work based on preceding sampling efforts. Timing of these activities will depend on the availability of equipment and coordination of schedules. The weather and time of year can also limit some of these activities. Characterization activities planned for each area are listed by task in Table 3-1. While this document addresses specific CERCLA characterization activities, it is intended to also cover waste site cleanup work, facility decontamination and decommissioning activities, old trash dump and other debris removals, revegetation, and traditional Hanford activities that are comparable in scope as well.

3.1 NONINTRUSIVE ACTIVITIES

Nonintrusive activities include topographic mapping, surface radiation surveys, ground-penetrating radar surveys, electromagnetic induction/magnetometer (EMI/MAG) surveys, process effluent pipeline integrity assessments, soil and sediment sampling, soil-gas surveys, geologic investigations, and surface water and sediment sampling. The amount of time spent on these activities will vary, depending on the location and size of the area where the activities are conducted.

3.1.1 Topographic Mapping

Site maps of the operable units will be established from aerial photographs. No field activities will be conducted for this task.

3.1.2 Surface Radiation Survey and RAD Rover

The surface radiation surveys are designed to locate any areas of elevated radiation in the surface soil. These surveys are conducted for selected areas and shorelines. This activity usually involves a three- to five-person crew and one to two vehicles. For CERCLA characterization, 61-m² (200-ft²) grids are established in each reactor area, and the crew walks throughout the grid on 8-m (25-ft) transects, using Ultrasonic Ranging and Data System (USRADS) equipment (carried in a backpack). This activity can take up to 3 months for an operable unit.

The Mobile Surface Contamination Monitor (MSCM II) was developed to survey vast outdoor areas to verify the presence or absence of surface radiological contamination and/or uncharted radiological burial grounds. These surveys will be conducted by two people year round in selected areas, depending on accessibility and vegetation. The MSCM II is a 9-ton, four-wheel-drive tractor with a dual cab design equipped with a modified front-end loader. This modified loader consists of a header to support three pairs of plastic scintillator detectors and a caster wheel assembly to support

Table 3-1. Dominant Activities.

Activities	Areas								
	B	D	F	H	K	N	200	300	1100
Topographic mapping	X	X	X	X	X	X	X	X	X
Surface and shoreline radiation surveys	X	X	X	X	X	X	X	X	X
Electromagnetic induction/magnetometer survey	X	X	X	X	X	X	X	X	X
Ground-penetrating radar survey	X	X	X	X	X	X	X	X	X
Process effluent pipeline integrity assessment				X					
Soil-gas survey	X	X	X	X	X	X	X	X	X
Geologic investigations	X	X	X	X	X	X	X	X	X
Surface water and sediment investigations	X	X	X	X	X	X	X	X	X
Surface water and sediment sampling	X	X	X	X	X	X		X	X
Vadose investigation	X	X	X	X	X	X	X	X	X
Trenches and test pits ^a	9	4	4	0	4	1			
Vadose boreholes ^a	5	18	6	5	4	6	31	51	
Groundwater investigations	X	X	X	X	X	X	X	X	X
Wells ^a	26	9	21	13	7	2	9	31	
Air investigations	X	X	X	X	X	X	X	X	X
Ecological investigations	X	X	X	X	X	X	X	X	X
Cultural resources investigations	X	X	X	X	X	X	X	X	X
Isolated waste site cleanup (600 Areas)									
Facility decontamination and decommissioning	X	X	X	X	X	X	X	X	X

^aThe numbers in these rows represent the approximate number of test pits, vadose boreholes, and groundwater wells that are planned for each area for CERCLA characterization. The location and number of sites will be modified during rescoping of the work plans.

the detector pairs. The six detectors are each 34 by 11 by 1.5 in. in size, are lead shielded, and ride 6 in. off the ground. The vehicle travels at approximately 30 ft²/second.

3.1.3 Ground-Penetrating Radar Survey

This activity determines the locations and boundaries of solid waste landfills, cribs, and other buried features that are currently uncertain, and other facilities that are not yet adequately identified. These surveys are usually conducted in the operable unit areas, on an as-needed basis. They involve a two- to three-person crew and require 3 to 7 days per unit. An antenna, 0.19 m² (2 ft²), weighing approximately 13.62 kg (30 lb), will be hand drug along transects in the area. Each area has different transect dimensions, depending on the type of facility that needs to be identified.

3.1.4 Electromagnetic Induction/Magnetometer Survey

The objective of the EMI/MAG survey is to screen large areas for potential contamination for subsequent sampling and to precisely locate buried facilities. EMI equipment measures the electrical conductivity of subsurface materials. Magnetometer equipment detects ferronickel metallic objects, such as pipelines, buried beneath the surface. Both types of equipment are hand-held. The MAG survey is primarily used to look for unknown subsurface pipelines and to better define the locations of known pipelines. When there is uncertainty in the location or the location is not well defined, the EMI survey is conducted. For small facilities, the EMI survey is conducted on a grid on 3-m (10-ft) intervals. For the larger facilities, the EMI survey is conducted on 7.6-m (25-ft) intervals to determine the length and the width of the facility. These activities involve two- to four-person crews.

3.1.5 Process Effluent and Discharge Pipeline Integrity Assessment

This activity involves inspecting pipelines for breaches where leaks may have occurred. Some process effluent pipelines will be inspected by a remote camera, gaining access through an expansion box. This activity requires from 2 to 4 weeks, depending on the configuration and length of the pipelines. During this time, three to six people and up to four or five vehicles are on the site. A 5- by 6-m (17- by 20-ft) greenhouse will be placed over the expansion box opening to keep contaminants from spreading. This greenhouse will be moved to the pipelines being investigated as the inspection continues. The task will take place between March and November to take advantage of good weather conditions. Initially, the assessment will be conducted only in the 100-H Area. The results will determine if process effluent pipelines and discharge pipelines will be inspected in other areas.

3.1.6 Soil and Sediment Sampling

This activity includes collecting samples to determine if hazardous or radioactive substances are present. The sampling is conducted for liquids, sludge, some building materials, and materials deposited on soils. Possible sampling methods include sampling thief, sampling trier, hand augers, Veihmeyer sampler, scoop/spade/shovel, hand corer, and the soil/sediment punch. This activity generally lasts 1 day per activity location and involves one to three samplers.

3.1.7 Soil-Gas Survey

Soil-gas surveys are conducted to identify areas where petroleum products or organic solvents may have been released. A two- to three-person crew will hammer probes into the soil at selected areas to extract soil gas. Probes for the soil-gas survey will be installed on a grid with about 7.6-m (25-ft) intervals, to about 1- to 2-m (3- to 7-ft) depth at all locations. A hand-held pump will then retrieve the samples out of the probes. The sample will then be taken to a portable laboratory in a trailer that will be set up near the site being sampled.

3.1.8 Geologic Investigations

This task further characterizes the geologic structure and stratigraphy of the area. It includes compilation of existing literature associated with geologic and vadose zone soils and field mapping of all operable units. The mapping is conducted in summer months and involves two to three people in walking surveys. The surveys are nonintrusive.

3.1.9 Surface Water and Sediment Sampling

This sampling assesses the impact of past facility operations and waste disposal activities on the quality of Columbia River water, nearby springs, and sediment. Sampling takes place on and near the shoreline and from active springs or seepage areas. Sampling usually coincides with low flow conditions from late summer to early winter. Sampling involves four to five people in the field, usually less than a day at each location.

3.2 INTRUSIVE ACTIVITIES

Intrusive activities include test pit soil sampling and borehole and well drilling.

3.2.1 Trenches and Test Pit Soil Sampling

Trenches and test pits are open, shallow excavations, typically longitudinal (if a trench) or rectangular (if a pit), to determine the shallow subsurface conditions for engineering, geological, and soil chemistry exploration and/or sampling purposes. These pits are excavated manually or by machine (i.e., backhoe). Samples are taken typically from materials in the equipment bucket.

Test pits normally have a minimum cross section of 1.2 to 3.0 m (4 to 10 ft) square; test trenches are usually a minimum of 1 to 2 m (3 to 6 ft) wide and may be extended for any length required to reveal conditions along a specific line. The depths of trenches and test pits vary, depending on the waste unit being characterized. The maximum depth is not expected to exceed 9.1 m (30 ft). Duration of this activity depends on the size of the waste unit and the type of equipment used and may occur at any time of the year, but most frequently within the 100, 200, or 300 Areas.

3.2.2 Borehole and Well Drilling

Vadose boreholes and groundwater monitoring wells are drilled using several techniques. Cable tool drilling is the predominant method used in the 100 Areas. The diamond core method is used when drilling through structural materials, such as concrete.

Measurements were taken that showed drill rig noise is predominantly impulse/impact-type, with some intermittent noise from the diesel-powered drill rig. Measurements indicated that total noise exposures to the drill rig crew immediately around the well head [within 6 m (20 ft) of the borehole] exceeded 85 dBA. Noise exposure outside this zone was below 85 dBA. The maximum peak noise level measured next to the borehole was 129 dBA. Diesel engine noise was typically 70 dBA at a distance of 6 m (20 ft) from the borehole.

Borehole soil sampling is used to determine the nature of vertical and horizontal distribution of contamination present in the vadose zone soils, determine the physical characteristics of the soils, and evaluate contamination movement. Around the borehole location, an area approximately 9 m² (100 ft²) is cleared of all vegetation. There is usually one drill rig and a trailer at each site, along with a few smaller vehicles. The average vadose borehole is 9 to 15 m (30 to 50 ft) deep. Activity at drill sites varies, ranging from 2 weeks to 2 months. There are 5 to 10 people at drill sites, depending on where the drilling is taking place (about 5 for sites away from the waste disposal area, 10 when drilling through radiation zones). A 0.09-m² (1-ft²) cement pad is left in place upon completion of a vadose borehole.

Groundwater wells are drilled to test for the distribution and concentration of groundwater contaminants and to evaluate movement into and beneath the Columbia River. Three to nineteen people work at each well, depending on where the drilling is taking place (as few as three people at nonhazardous, nonradioactive sites, and as many as nineteen at hazardous, radioactive sites). A cable-tool drilling rig, six to eight trailers, and various other small vehicles may be located on a site. A drill pad is used to provide a solid, level, clean work area, free of surface contamination. The maximum dimensions for the pad are 10 m² (100 ft²). Depending on the location of the drill site, a road may be constructed to obtain access. These 3- to 3.6-m- (10- to 12-ft) wide roads are usually scraped and gravel is placed on top. If numerous borings are needed, a 2,090-m² (22,500-ft²) storage area may also be built, as well as a 2,090-m² (22,500-ft²) central site (for support and lunch trailers). Each well can take 2 weeks to 3 months to drill, depending on the depth of the well, the type of conditions, and the number of chemical samples required. A 0.4-m² (4-ft²) cement pad with a brass well marker is left in place upon completion of the well.

3.3 VARIOUS OTHER INVESTIGATIONS

Other types of investigations that may be conducted in the course of characterization and cleanup activities include air, ecological, and cultural resources investigations.

3.3.1 Air Investigation

This is minimal in scope, confined to health and safety air monitoring for volatile organic chemicals, radionuclides, and particulates.

3.3.2 Ecological Investigations

Ecological investigations, conducted on an aggregate-area-wide scale, will identify possible biotic contaminant transport pathways and evaluate the existing concentrations of contaminants in the biota. These investigations involve bird, mammal, and vegetation surveys, and some biotic sampling. These surveys involve two to three people walking transects. Vegetation surveys are limited to the growing season; bird surveys will be conducted during the winter and spring breeding/migration times. Mammal surveys can be performed in spring and summer. Sampling most frequently occurs during the spring and summer growing season.

3.3.3 Cultural Resources Investigations

A complete cultural resources survey of the reactor areas and the land between the reactor areas and the Columbia River is being conducted. Activities include consultations with Indian elders, site recording and registration, and evaluation of structures from the original Manhattan Project. These activities involve approximately two to three people walking the 100 Areas and the land between the reactor areas and the Columbia River. If artifacts are found, a backhoe or hand digging may be used for excavation.

3.3.4 Isolated Waste Site Cleanup

Isolated waste sites are scattered throughout the 600 Area of the Hanford Site, away from the 100, 200, 300, 400, and 1100 Areas. These sites are typically old landfills, weapons firing ranges, hazardous and radioactive wastes, old cisterns, asbestos dumps, former vehicle maintenance sites, gun emplacements, and pesticide disposal sites. Less than 10 of these sites have been identified within 1/2 mi of the Columbia River, and most of these are on the North Slope (that area of the Hanford Site north of the Columbia River). Cleanup of these sites, while still not decided, would involve (at the level of most physical disruption) complete removal of all debris, using hand labor and heavy machinery (e.g., backhoes, dump trucks). At each site several days may be required to remove debris. Disturbed areas are to be revegetated with native plants.

3.3.5 Facility Decontamination and Decommissioning

Part of the Hanford Site's ongoing activities has included removal of structures no longer needed. Over the past decades, a significant number of unused buildings have been removed at the reactor areas. However, some buildings are still standing and require eventual demolition. The time involved depends on the size of the building and may last several months at any one building. The removal of the reactor buildings is not covered in this biological assessment because of the potentially large amount of disturbance and long period of activity at each site.

4.0 ACCOUNTS OF ENDANGERED, THREATENED, AND CANDIDATE WILDLIFE SPECIES ON THE HANFORD SITE

Both the Washington Department of Wildlife (WDW) and the USFWS have the authority to declare a species as threatened or endangered. Those species listed as state threatened or endangered by the WDW may or may not also be listed by the USFWS as federal threatened or endangered, and vice versa. Each agency has its own laws regarding protection of threatened and endangered species on its list.

The WDW designates endangered, threatened, and candidate wildlife under Washington Administrative Code (WAC) 232-12-014 and -011. This law also has implications for habitat protection and cooperative land management agreements between the WDW and the landowner.

The various categories for listing a species are as follows. A threatened species is one that is likely to become endangered in the near future because of various threats to its populations. An endangered species is one that is in danger of extinction or extirpation throughout all or a significant part of its range. A candidate level 1 species is a species for which USFWS has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. A candidate level 2 species is one for which there is some evidence of vulnerability, but for which there are not enough data to support listing proposals at this time.

This section discusses the biology of state and federally classified endangered or threatened species that may occur on the Hanford Site. Table 4-1 lists federal candidate and state and federal threatened and endangered species. The Aleutian Canada goose, a federally listed threatened species, and black terns and northern goshawks, both federally listed candidate species, occur only rarely on the Hanford Site, and will not be affected by characterization work. Therefore, they are not discussed in detail. Cadwell (1994) presents all state and federally listed species, including all state candidate and monitor species.

Federal candidate species, level 2, are also covered in this report. These candidates can easily become listed as threatened or endangered (sometimes within a few days; the last changes were made in January 1992). State candidate species are not discussed here, because the state candidate selection criteria do not necessarily mean the candidate is going to be upgraded to endangered or threatened status in the very near future. Much work remains to determine the distribution and abundance of the state candidates.

4.1 PEREGRINE FALCON (*Falco peregrinus*) - STATE AND FEDERAL ENDANGERED

The peregrine falcon is the only raptor in Washington listed as endangered. While the historic information regarding peregrines in Washington is sketchy, at least 12 historical nest sites are known, and it appears the present populations have declined from historical levels. In addition to severe impacts from pesticides, other factors such as shooting and loss of habitat have also contributed to the reduction of peregrines from historical levels. To reverse this downward trend, measures must be taken to protect both nesting and foraging habitat, protect nest sites from disturbance, and continue the ban on the introduction of chlorinated hydrocarbons into the environment.

Table 4-1. Threatened, Endangered, and Candidate Wildlife of the Hanford Site.

Species	Status ^a
Peregrine falcon (<i>Falco peregrinus</i>)	FE, SE
Aleutian Canada goose (<i>Branta canadensis leucopareia</i>)	FT, SE
Bald eagle (<i>Haliaeetus leucocephalus</i>)	FT, ST
American white pelican (<i>Pelecanus erythrorhynchos</i>)	SE
Sandhill crane (<i>Grus canadensis</i>)	SE
Pygmy rabbit (<i>Brachylagus idahoensis</i>)	FC2, SE
Ferruginous hawk (<i>Buteo regalis</i>)	FC2, ST
Western sage grouse (<i>Centrocercus urophasianus</i>)	FC2, SC
Pacific western big-eared bat (<i>Plecotus townsendii</i>)	FC2, SC
Columbia pebblesnail (<i>Fluminicola columbianus</i>)	FC2, SC
Loggerhead shrike (<i>Lanius ludovicianus</i>)	FC2, SC
Northern goshawk (<i>Lanius ludovicianus</i>)	FC2, SC
Black tern (<i>Chlidonia niger</i>)	FC2

^aFT - Federal Threatened
 FE - Federal Endangered
 ST - State Threatened
 SE - State Endangered
 FC2 - Federal Candidate, Level 2
 SC - State Candidate for potential listing as Threatened or Endangered (only included for those species that also have federal listing).

The peregrine falcon occurs worldwide, with three subspecies occurring in North America. These subspecies (all endangered in Washington) include the tundra or Arctic peregrine (*F.p. tundrius*), the American (*F.p. anatum*), and the Peale's falcon (*F.p. pealei*). All are crow-sized birds, with the female up to one-third larger than the male. Peregrine falcons are distinguished from other falcons by their black head with dark "moustache" strip extending below the eye. The upper body parts are blue-grey in color, with the underparts light with dark barring. The tail is long and the wings pointed and long, with no difference in the plumage between males and females.

Peregrines generally prefer open country such as marshes, coastal and river shorelines, estuaries, wide meadows, and farmlands. These types of habitat suit their style of hunting, which requires long sight distances. Peregrines feed on a variety of songbirds, shorebirds, and waterfowl. When they sight their prey, peregrines are able to dive several hundred feet in the air at speeds up to 200 mi/h to capture their prey on the wing. In some portions of their range, birds may forage up to 16 km (10 mi) or more.

Peregrines prefer to nest on cliff faces in undisturbed areas. In addition, these birds have also been known to nest on river banks, abandoned raptor nests, buildings, and bridge abutments. Rather than build a nest, they form a shallow depression or scrape in which to lay three to four eggs in the spring of the year.

During at least a portion of the year, all three North American peregrine subspecies occur in Washington. During the fall and spring, the tundra peregrine is seen migrating along the coast. The American subspecies winters and breeds on both the east and west side of the Cascade Mountains and along the coast of Washington and inland river valleys. While the Peale's and American falcons were at one time more numerous in Washington, they are now rare. Peale's falcon breeds along the coast of Washington and near shore islands and also winters along the coast.

Observations of peregrines on the Hanford Site are few. This may be related to the species secretive nature and the lack of any systematic surveying for it. The recorded observations are as follows (the subspecies were not identified).

1. March 3, 1983, a peregrine was observed at the Columbia River shoreline of the 300 Area (Landeem et al. 1991).
2. A peregrine was observed chasing gulls on Island 18, adjacent to the 300 Area, on March 9, 1983 (R. E. Fitzner, personal observation).
3. Two peregrine falcons were observed on Island 19, across from the Tri-Cities Branch Campus of Washington State University on March 4, 1985 (R. E. Fitzner, personal observation).
4. An adult male was observed approximately 0.8 km (0.5 mi) southeast of the Arid Lands Ecology (ALE) headquarters on November 3, 1987 (R. E. Fitzner, personal observation).
5. An immature peregrine was observed chasing rock doves near Coyote Rapids on May 2, 1988 (R. E. Fitzner, personal observation).
6. A peregrine was observed in flight on April 20, 1993, near the Wye Barricade (D. S. Landeen, observer, personal communication).
7. A peregrine was observed on May 3, 1993, near the Columbia River by White Bluffs (A. R. Johnson, observer, personal communication).

4.2 ALEUTIAN CANADA GOOSE (*Branta canadensis leucopareia*) - FEDERAL THREATENED, STATE ENDANGERED

The Aleutian Canada goose is federally listed as threatened and state listed as endangered. This subspecies of Canada goose breeds on only a few of Alaska's Aleutian Islands, and winters primarily in the San Joaquin Valley of California. They have been recorded from Washington during migration, usually west of the Cascade Mountains, but at least one sighting exists for the Hanford Site (L. Fitzner, Washington Department of Wildlife, personal communication).

4.3 BALD EAGLE (*Haliaeetus leucocephalus*) - STATE AND FEDERAL THREATENED

The bald eagle is federally listed as threatened in 5 of the lower 48 states, including Washington, and endangered in the other 43. Within Washington, eagles breed primarily west of the Cascade Mountains, with the greatest percentage in San Juan County. A few isolated nests are known to occur on the east side of the state.

The bald eagle is a common wintering raptor at Hanford and has been the subject of much study. Fitzner and Hanson (1979) compared 12 years of bald eagle winter survey data from Hanford, with waterfowl numbers and chinook salmon (*Oncorhynchus tshawytscha*) redd counts, and provided statistical evidence that eagle numbers in winter varied dependently with salmon redd counts, but not with waterfowl numbers. Eagle numbers increased from a low of 4 to 6 eagles wintering at Hanford in the 1960's to 25 birds in 1979 (Fitzner et al. 1980). Eagle numbers have continued to rise in the 1980's with a maximum count of 55 birds being observed in the winter of 1987-1988 (Gray and Rickard 1989). Subsequently, bald eagle numbers have declined, and currently about 45 birds winter in the Hanford Reach. Table 4-2 shows the numbers of adult and young eagles observed on the Hanford Reach from 1961 to 1992.

Beginning in the late fall, eagles concentrate near water bodies where sizeable fish runs or waterfowl populations are present or, if food such as carrion or rabbits is available, away from water bodies. Bald eagles roost communally during the winter. Day roosts may be along waterways, the birds perching there when not feeding, while night roosts tend to be inland in more protected areas to avoid the elements. Eagles usually construct their nests within 3.2 km (2 mi) and more often within 0.8 km (0.5 mi) of a large water body. These water bodies provide the food resources necessary for the adults to rear their young. Trees where eagles nest must be large enough to support the heavy and bulky stick nests the eagles build. Old-growth Douglas fir or other large-statured trees is where eagles construct their nests in Washington. The nests may be placed near the top of the tree and, while the same nest may be used in successive years, several alternative nests are occasionally constructed nearby.

Bald eagles begin courting in February and continue through March, with birds mating for life. On the average, two eggs are laid per breeding season. Depending on human disturbance, prey availability, weather, and environmental contaminants, the birds may not nest every year. Both the male and female incubate the eggs and tend the young. By mid-July, the young are able to fly and forage for themselves.

While historical data for Washington are unreliable, it appears eagles were widespread and abundant in the mid-1800's. Population levels began declining as the state became settled, with bald eagles becoming uncommon to rare by the early 1900's. Since 1978, bald eagles appear to be gradually recovering to pre-1900 levels. As of 1985 there were 290 known bald eagle territories in Washington. Washington is also a very important wintering area, with the highest densities of eagles in the northwest portion of the state.

Factors contributing to the decline of bald eagles throughout North America include the presence of chlorinated hydrocarbons (i.e., DDT, DDE) in the environment, loss of habitat, a reduction in food supply, electrocution, and shooting. For the species to recover, the eagle's habitat must be preserved and protected, including nest trees, roost trees, foraging areas, and wintering areas.

Table 4-2. Maximum Numbers of Adult and Young Eagles on the Hanford Reach, 1961 to 1992.

Year	Total	Adults	Juveniles
1961	6	5	1
1962	3	2	1
1963	2	2	0
1964	4	2	2
1965	6	4	2
1966	3	3	0
1967	5	5	0
1968	5	4	1
1969	5	3	2
1970	4	1	3
1971	5	2	3
1972	9	2	7
1973	11	3	8
1974	4	4	0
1975	24	8	16
1976	16	7	9
1977	22	9	13
1978	18	6	12
1979	25	8	17
1980	20	7	13
1981	22	9	13
1982	26	10	16
1983	20	10	10
1984	42	10	32
1985	42	10	32
1986	43	11	32
1987	55	23	32
1988	36	15	21
1989	34	15	19
1990	43	23	20
1991	35	19	16
1992	49	27	22

*Each year designated covers October of that year through March of the next year.

The winter habitat used by the bald eagle on the Hanford Site includes perch sites, night roosts, and foraging areas. Eagles have also constructed nests at the Hanford Site; however, these nests have been unsuccessful to date. These activities are discussed in the following sections.

4.3.1 Perch Sites

During daylight hours, bald eagles perch along the Hanford Reach of the Columbia River and in inland areas within a few kilometers of the river. The primary perching areas occur from the Hanford townsite upstream to Vernita Bridge; all trees, whether single or in groves, may be used for perching. Some of these perching areas also serve as secondary night roosts for small numbers of eagles. Most of the perch sites are old trees planted by early settlers of the Hanford Site. Figure 4-1 shows the primary perching areas on the Hanford Site.

4.3.2 Night Roosts

Six primary night roosts exist in the larger groves of trees on the Hanford Site, and numerous secondary roosts are in smaller groves and single trees. An important communal night roost consisting of a group of decadent black locust (*Robinia pseudo-acacia*) and living white poplars (*Populus alba*) occurs on the White Bluffs Peninsula (Figure 4-2). This grove of trees is also the site of a great blue heron (*Ardea herodias*) nesting colony. In the winter, the herons move away from the nesting colony, and their abandoned nests and nesting trees serve as perches for the night-roosting eagles. Late-evening surveys have shown that as many as 25 eagles have used this site as a communal night roost.

A second roosting site has been noted in another heron nesting colony below the 100-F Area (see Figure 2-1). This roost is in a grove of black locust trees situated on the bank of the river. The location is in Section 10, Township 13N, Range 27E. Up to six birds have been observed using this site for a night roost (in 1992 it was also the site of a nesting attempt). A wildfire in the spring of 1992 destroyed about half the trees and up to 19 heron nests. (Current DOE policy for the Hanford Site is to suppress all wildfires.)

Two other major roosting sites exist along the Benton County bank of the Columbia River between the 100-D and 100-H Areas (Figure 4-3), in Section 12, Township 14N, Range 26E. These roosting areas are very similar, being in tall, old, black locust trees. These roosting sites are within 500 m of one another, and birds often move back and forth between the roosting sites.

A fifth roosting area is located immediately adjacent to the 100-K Area, on the bank of the Columbia River. Two adult eagles have been seen using this site for roosting since the mid-1980's. The 100-K roost is adjacent (within 100 m) to the 100-K Area perimeter fence. Human activities within the 100-K Area have occurred since 1952 and continue today. These support activities will continue as part of maintenance of the 100-K facility. Figure 4-4 shows an aerial view of this site. The sixth roosting area is located north of the Hanford townsite. This roost is in a tall Siberian elm situated along the bank of the Columbia River. One or two roosting eagles have been noted here. Other trees and the steep bluffs adjacent to Locke Island are also used by eagles as roost sites.

Figure 4-1. Bald Eagle Use Areas on the Hanford Site.

S9109014.2

Figure 4-2. Bald Eagle Roost on White Bluffs Peninsula.

Figure 4-3. Bald Eagle Roost Between 100-D and 100-H Areas.

Figure 4-4. Bald Eagle Roost at the 100-K Area.

4.3.3 Foraging Areas

Bald eagles forage throughout the Hanford Reach, but most of their foraging is done from the Hanford townsite upstream to the abandoned 100-B Reactor. This area contains 10 islands and a variety of shoreline habitat. The primary spawning grounds of the chinook salmon on the Hanford Site also occur through this area (Dauble and Watson 1990). This area is closed to hunting and is not heavily used by recreationists during the winter months. However, some Hanford-related activities have been conducted over the last five decades on and near the river, mostly inside the reactor areas shown in Figure 2-1. This relative seclusion from human disturbance is likely a major attractant to the eagles (Fitzner et al. 1980). Much of the foraging area is out of the line of sight of areas with concentrated human activity because of high bluffs along the river's edge.

4.3.4 Nesting Areas

Bald eagles have exhibited nesting behavior at Hanford for several years, but to date, most birds depart the site prior to egg laying. The reasons for nest failure are uncertain but may be related to human disturbance during nest building and/or egg laying, and/or natural phenomena (i.e., prey base, weather). In 1991, a nest was constructed in Section 29, Township 14N, Range 27E, at the White Bluffs boat launch. A second nest was constructed in Section 9, Township 13N, Range 27E. To our knowledge, no eggs were laid. All nests appeared to be fully constructed, and the nest bowls were lined with fine material. We do not know whether the birds that attempt to nest on the Hanford Site are the same ones that winter on the Site, or if the same birds attempt to nest each year.

In 1992 a new nest was constructed in a heron rookery in Section 10, Township 13N, Range 27E. While this nest was also lined with down, the eagles abandoned it in April, possibly from the commotion of herons attempting to return to their rookery. The herons resumed residency after the eagles left, but a spring fire destroyed about half the nesting trees. No evidence of the eagle nest was found after the fire.

In 1993, bald eagles again exhibited nest-building behavior in the same location as in 1991 at the White Bluffs boat launch. The birds exhibited a tenacity for the site between January and March; however, they departed in mid-March, having altered the existing nest only slightly during their residence.

4.4 AMERICAN WHITE PELICAN (*Pelecanus erythrorhynchos*) - STATE ENDANGERED, NOT FEDERALLY LISTED FOR WASHINGTON STATE

Pelicans are surveyed along the Hanford Reach during the annual bald eagle surveys, and several surveys were also conducted during the summers of 1990 and 1991 by R. E. Fitzner. These surveys have shown that the white pelican is a winter resident along the Hanford Reach of the Columbia River. For over two decades, a small flock of 10 to 12 birds has wintered between Ringold and the Vernita Bridge, foraging for scrap fish (carp, suckers). During the summer of 1989, nearly 300 pelicans frequented the Hanford Reach. These birds are believed to have been part of a nesting colony that failed near Stillwater, Nevada. Other sources could have been from birds previously using the lakes of Klamath and Lake Counties in southern Oregon. As of 1992, approximately 70 pelicans wintered in the Hanford Reach (R. Mazaika, pers. comm.).

Although the number of white pelicans found in Washington State was never large, regular breeding pairs were commonly found until the early part of this century. The last confirmed nesting site was in the Moses Lake Potholes area in 1926. At present, the only pelicans found in Washington are nonbreeders. During the summer, flocks of 30 to 40 birds are commonly seen throughout the Columbia Basin. In the spring and fall, migrating birds pass through the Basin, with birds overwintering on the Snake and Columbia Rivers.

The primary reason for the decline from breeders to nonbreeders and an overall decline in numbers is attributed to a loss of habitat from land reclamation and irrigation projects. Other factors include shooting during migration, destruction of existing breeding colonies, and harassment by recreationists. It appears to be feasible to reestablish white pelicans in Washington, with the Columbia Basin the most likely area where habitat requirements could be met.

Pelicans occur throughout the Reach around the islands from the White Bluffs boat ramp upstream to the 100-D Area. The islands are afforded protection currently, because of their use by nesting Canada geese. Extending protection of the islands for nesting by pelicans would have little impact on existing operations at Hanford because the birds spend the majority of their life activities in and around the water. They do not venture onto drylands to forage and would not impact operations centered on the mainland.

During the nesting season, the birds seek out isolated islands or gravel bars to avoid human disturbance. Nest sites must be located near foraging areas (e.g., shallow water bodies or marshy areas). The birds nest in colonies, with the individual nest usually located in an unlined, shallow depression in the ground. An average of two eggs are laid, and both adults incubate the eggs. During the remainder of the year, they will roost on islands within large bodies of fresh water. They may be found during migration in other water bodies (such as estuaries, coastal bays, and inlets) in salt or brackish waters. While other pelicans may dive for food, white pelicans feed from the water surface, often in groups. They may feed on a variety of fish, amphibians, and crustaceans.

4.5 SANDHILL CRANE (*Grus canadensis*) - STATE ENDANGERED, NOT FEDERALLY LISTED FOR WASHINGTON STATE

Numerous observations have been made of sandhill crane flocks passing over the Hanford Site from late September through early October and again in mid-March through April. However, few observations have been made of birds landing on the Site. Fitzner and Rickard (1975) sighted six individuals at REDOX Pond (decommissioned in 1973) on October 5, 1972. These birds were believed to be greater sandhill cranes (*Grus canadensis tabida*). On October 11, 1990, seven sandhill cranes were observed on the upper end of Island 19 (Figure 2-1). On April 1, 1991, 19 sandhill cranes were observed walking about and feeding on the upper end of Locke Island (Figure 2-1). These birds were identified as greater sandhill cranes (R.E. Fitzner, personal observation). On May 11, 1993, six sandhill cranes were seen on Island 12 in the Hanford Reach by R. Mazaika (PNL pers. comm.). During the spring of 1993, 12 sandhill cranes were observed "resting" on Island 12. Subsequent observations were recorded during the fall of 1993 when approximately 200 birds were observed passing over the Reach (B. Tiller, pers. comm.).

By 1941, nesting sandhill cranes were eliminated in Washington. Two of the six North American subspecies of sandhill crane occur in Washington. Lesser sandhill cranes (*G.c. canadensis*) can be seen in the state during the spring and fall migration. Greater sandhill cranes are also found in the state during the migration period, but in lower numbers. Both subspecies are state endangered. The only known nesting cranes are on Conboy National Wildlife Refuge in south-central Washington. These birds have been nesting there since 1975, but breeding success has been low. There is a possibility that sandhill cranes are nesting on the higher elevation meadows of the Yakima Indian Reservation, but this has yet to be confirmed.

Sandhill cranes generally prefer open habitats such as prairies, grain fields, shallow lakes, marshes, and ponds. During the breeding season they nest in the drier parts of grassy/marshy areas. Open, flat areas such as shallow lakes or ponds serve as traditional staging areas during migration and the remainder of the year. Forage includes frogs, small fish, crustaceans, insects, small birds, small mammals, berries, and grains.

Habitat loss, illegal shooting, and collisions with power lines appear to be the primary factors in their decline. Heavy predation on eggs in some areas has also contributed to the reduction. The birds are very habitat-specific and do not adjust well to alterations in their environment. Recovery efforts have been somewhat successful, but only in areas where the birds and their habitat have been afforded protection. Future management of this species will focus on finding and protecting isolated open areas the birds require for staging and breeding.

4.6 PYGMY RABBIT (*Sylvilagus idahoensis*) - STATE ENDANGERED, FEDERAL CANDIDATE

This small lagomorph is extremely rare in Washington, occurring in the Great Basin portion of the Lower Columbia Basin. The only confirmed population occurs in parts of Douglas County. A pygmy rabbit colony was last observed on the Hanford Site in 1984 before a large fire burned off much of the sagebrush on the Site (R. E. Fitzner, personal observation). Before then, a small population of pygmy rabbits inhabited a dense stand of sagebrush (several hundred hectares) at the 800-m (0.5-mi) level on Rattlesnake Mountain, above Snively Springs. In 1985, after the fire, the rabbits could not be found. There has been no other confirmed documentation of this small lagomorph on the Hanford Site. However, as of October 1992, Pacific Northwest Laboratory has begun a census of pygmy rabbits to determine their presence on the Hanford Site.

Pygmy rabbits are relatively slow and vulnerable in open habitats (Weiss and Verts 1984) and seem reluctant to cross extensive open areas (Bradfield 1974). This makes populations very susceptible to isolation because of the fragmentation of habitat.

The pygmy rabbit is restricted to dense stands of big sagebrush on deep soils (Orr 1940; Weiss and Verts 1984). Sagebrush is also an important food of this rabbit, especially in winter (Fisher 1979; Green 1978; Wilde 1978). Burrows are constructed in loose soils, usually on the lee side of a hill (Wilde 1978). Pygmy rabbits are the only rabbits in the northwest that excavate their own burrows; however, they may use the burrows of marmots and badgers. The burrows provide a safe haven to raise young, as well as protection from predators and severe weather (Bradfield 1974). To burrow, the rabbits require deep, workable soils of low soil strength (Weiss and Verts 1984).

4.7 FERRUGINOUS HAWK (*Buteo regalis*) - STATE THREATENED, FEDERAL CANDIDATE

The ferruginous hawk was uncommon at Hanford before 1988. In 1988, surveys showed an increase in nesting attempts by this species (Fitzner and Newell 1989). Eight nests were located that year, seven in transmission towers. Five nests were found in 1989, four in transmission towers. In 1990, nine nests were found at Hanford. In 1991, 10 nests were observed, with 8 being situated in transmission towers and 2 in trees (R. E. Fitzner, personal observation). In 1993, 11 nesting pairs were observed; 8 of the pairs were on transmission towers (R. Mazaika, pers. comm.). Figure 4-5 shows the location of these nests. Transmission towers had not been reported previously as nesting substrate for ferruginous hawks in Washington (Fitzner and Newell 1989).

These birds nest in the open country of the Canadian prairie provinces south to Oregon, Nevada, Arizona, and Oklahoma. They avoid human disturbance during nesting, preferring rocky outcrops or scattered trees in the open prairies and sagebrush plains. Within Washington, the birds are primarily summer residents, rarely wintering here. The birds prey on small mammals such as hares, rabbits, and rodents, and an occasional bird or reptile. Highest levels of foraging activity occur just before dawn and just after sunset, with birds hunting from the ground, air, or a perch.

Figure 4-5. Location of Ferruginous Hawk Nests on the Hanford Site, 1993.

Arrival in Washington begins in early spring when migrating birds begin to nest in the arid shrub-steppe habitat of Adams, Benton, Columbia, Franklin, Lincoln, and Walla Walla Counties. The majority of ferruginous hawk nests in Washington are in Franklin County. Nests are built in early March on small cliffs, rocky outcrops, or occasionally in juniper (*Juniperus* spp.) trees. The nests are made of sticks and are often lined with cow or horse dung. Nests are often used over several years. The eggs are laid in early April, with the young hatching in late April or early May. The female does the majority of the incubating. Ferruginous hawks are highly likely to desert the nests if disturbed by humans. In western North America, breeding success of the ferruginous hawk appears to be closely linked to mammal populations. In one area the annual production varied between 0.6 and 3.0 young per pair, depending on the abundance of black-tailed jackrabbits (*Lepus californicus*), while in another area, when jackrabbit numbers declined 79% over a period of 1 year, there was a corresponding 47% reduction in breeding success of hawks (Newton 1979).

Because of their limited abundance, the ferruginous hawk was most likely never abundant in Washington; however, at one time they were common in localized areas. With only 50 actively breeding pairs in the state, the hawk is considered a rare and uncommon eastside resident and a rare breeder in Washington. The population is currently thought to have stabilized at a reduced level.

Loss of habitat is the primary factor affecting the ferruginous hawk population in Washington. With the advent of irrigation, the majority of the arid, shrub-steppe habitat in eastern Washington continues to be converted to agricultural use. Off-road vehicle use has impacted some of the juniper forest areas [32 km (20 mi) east of Pasco, Franklin County], while overgrazing is a problem in other areas. Habitat degradation also affects the ferruginous hawk's prey base, in turn affecting hawk population numbers. While the ferruginous hawk will tolerate some alterations to its habitat (e.g., they will nest on power poles, introduced trees, or haystacks), they will not tolerate any close association with humans during the breeding season.

Future status of this species remains uncertain because of the continuing loss of shrub-steppe habitat. To rebuild the ferruginous hawk nesting population in Washington, this habitat must be preserved and nest sites protected from human disturbance.

4.8 WESTERN SAGE GROUSE (*Centrocercus urophasianus*) - FEDERAL AND STATE CANDIDATE

Currently, sage grouse are found only at upper elevations of Rattlesnake Mountain. Their numbers are low, with only one or two birds observed annually. A female and brood were recorded in Snively Canyon (Rotenberry et al. 1979) in the spring of 1976. No broods have been seen since. The removal of sagebrush habitat from much of the Hanford Site by the 1984 fire has likely affected the potential for reestablishment of the species on the Site. The sage grouse once occupied the southern and western parts of the Hanford Site, but disappeared by mid-1960. W. H. Radke, Columbia National Wildlife Refuge (NWR), reported observing a small lek on the Saddle Mountain NWR in 1985. Only a few birds were observed at that time. An evaluation of the current suitability of sage grouse habitat on the Hanford Site is under way, and experiments with sagebrush revegetation have begun.

The sage grouse historically occurred throughout the northwestern United States and southern Canada. Today it is found only in parts of Washington, Oregon, Idaho, Montana, Alberta, Saskatchewan, North Dakota, California, Nevada, Utah, Wyoming, Colorado, and Nebraska (Autenrieth 1986). In Washington, it occurs east of the Cascade Mountains in Grant, Douglas, Lincoln, Yakima, Benton, and Kittitas Counties.

Sage grouse require year-round access to sagebrush for food, nesting, and cover. They move around throughout their home range and utilize different types of habitat according to their annual cycle. Males arrive on their leks (breeding ground) in late February, followed by females a few weeks later. Leks are usually small open sites such as meadows, low-sage zones, roads, grassy swales, cultivated or natural fields, or disturbance areas created by livestock (Call 1979; Call and Maser 1985). These leks usually range from 0.1 to 10 acres in size, but may be as large as 100 acres (Call 1979). The leks are usually located within 1.6 to 3.2 km (1 to 2 mi) of their winter range (Autenrieth 1986).

Sage grouse begin egg laying about mid-April and may continue until mid-May. Hatching usually occurs from the last week of May through July. The hen usually constructs her nest beneath or between sagebrush plants, usually within 3.2 km (2 mi) of a lek. Nests in sagebrush stands with 20% to 40% canopy cover and 60-cm (24-in.) height, with residual grass cover, have the greatest success (Autenrieth 1986; Call and Maser 1985).

Juvenile sage grouse survival is higher in areas with good sagebrush-grass production and where forbs are a common component of the spring range. The broods move less in these areas, reducing exposure to predators and conserving energy. Insects, especially beetles and ants, are important foods for young sage grouse. Succulent forbs become important as food for maturing chicks (Connelly et al. 1988).

When spring and summer ranges dry, the sage grouse will move to wet areas that support forbs (Autenrieth 1986; Connelly et al. 1988). Low-elevation native or irrigated meadows, stream bottoms, or high-elevation drainages and meadows may be selected (Call and Maser 1985). Sparse, low-growing sagebrush stands located within 3.2 km (2 mi) of feeding sites are used for cover and roosting (Patterson 1952). During winter, sage grouse switch from meadows and drainages to stands of sagebrush. They feed almost entirely on the leaves of sagebrush for food during the winter. Areas with the greatest canopy cover receive the most use in winter. Canopy coverage of at least 15% is apparently required by the grouse for winter habitat (Call and Maser 1985).

4.9 PACIFIC WESTERN BIG-EARED BAT (*Plecotis townsendii*) - FEDERAL AND STATE CANDIDATE

Recent surveys in several 100 and 200 Area buildings for the Pacific western big-eared bat did not reveal any individuals at the Hanford Site (Becker 1993) (some buildings of potential use by bats were not surveyed). Reactor buildings along the Columbia River provide suitable roosting areas for several other species of bat.

This small bat occurs in the western United States, central Appalachians, Ozarks, and northern Mexico. In Washington, the species occurs both east and west of the Cascade Mountain range (Larrison 1970). The bat is usually associated with the Sonoran Life Zone (Ingles 1965). The species frequents caves, lava tubes, and abandoned buildings.

4.10 COLUMBIA PEBBLESNAIL (*Fluminicola columbiana*) - FEDERAL AND STATE CANDIDATE

The Columbia pebblesnail (a gastropod mollusk) has a whorled shell and is about 6 mm (.24 in.) high. Four to five whorls are typical of the species. At present, there are only two remaining sizeable populations of the Columbia pebblesnail: in the Methow and Okanogan Rivers in Washington. Smaller populations survive in the Hanford Reach and the lower Salmon River, Idaho, and possibly in the middle Snake River, Idaho, and Grande Ronde, Oregon (see Neitzel and Frest 1993 for survey sites).

Historically, Columbia pebblesnails occurred in Columbia River tributaries from northwestern Montana to tributaries near the mouth. Today, nearly 100 dams impound waters of the Columbia River Basin and its tributaries, rendering many stream reaches unsuitable as snail habitat. Not all loss of mollusks habitat is attributable to dam impoundment; other stream alterations occurred with irrigation, flood control, logging, grazing, and farming practices that added to erosion and siltation. Surveys of Columbia River Basin streams during the late-1980's indicate pebblesnails are found in limited reaches of about 5 to 10 streams throughout the Basin.

Taylor (1982b, 1985) regards the pebblesnail as particularly characteristic of large rivers and rapids habitat. Our findings necessitate modification of this characterization. Certainly, this pebblesnail does not occupy the wide range of habitats utilized by the closely related *F. hindsii*, which occupies springs and streams of all sizes with permanent flow and sufficient oxygenation. While absent from springs, the Columbia pebblesnail can thrive in small rivers such as the Methow, located in northeast Washington. It is most common at rapids edges or immediately downstream from white-water areas, and becomes much less common or absent in major rapids. It occupies areas with sufficient flow, oxygenation, and stable substrate even in the absence of rapids or whitewater areas. In most streams, the species originally existed (before human modification) as a single continuous population occupying suitable habitat bands parallel to shore on both sides of the stream. The Columbia pebblesnail avoids lakes, areas of slow flow, areas with mud or silt substrate, areas with bare bedrock substrate, stream reaches with unstable substrate such as rivers with high gradients, streams with glacial flour, and the central deep areas in strong channelized streams. Current populations have been segmented by human modification of streams, including dams and impoundments and increased siltation from grazing and agriculture.

The Columbia pebblesnail, like many other gastropod mollusks, has about a 1-year life cycle. Egg deposition occurs during the spring as water temperatures rise. Growth of young pebblesnails is most rapid during the summer and early fall.

4.11 LOGGERHEAD SHRIKE (*Lanius ludovicianus*) - FEDERAL AND STATE CANDIDATE

This species breeds in central and north-central Washington, wintering in north to northwestern Washington. On the Hanford Site, it builds its nest in sagebrush and in trees planted by early settlers (now near abandoned homesites and farms). Once a nest site has been established, it may be occupied for many years (Porter et al. 1975). Poole (1992) conducted her Master's research on the Hanford Site and reported approximately 300 active nesting territories alongside roads on the Site over a 2-year period. More nesting territories are expected to occur in areas away from established roads. Poole (1992) also reported that while some shrikes are year-round residents, most are on the

Hanford Site from March to September. Nest building and courtship begin in early March, with the earliest egg-laying date reported of March 26.

A limiting factor contributing to the decline of the species over its historical range is the availability of grassland habitats with nest trees or shrubs that offer perch sites and cover from predators (WDW 1992). The conversion of native shrub-steppe habitat to agriculture may affect shrikes, which utilize suitable nest sites in shrub-steppe areas more frequently than in cultivated areas (Porter et al. 1975). Agriculture also reduces vertebrate and invertebrate prey availability to shrikes. Herbicides and pesticides may also affect shrike populations by causing toxicosis and death, and sublethal levels can interfere with normal development and behavior (Busbee 1977). Pesticides can also reduce prey availability to the shrikes. Pesticides and herbicides should not be applied to areas where loggerhead shrikes nest or forage. Chemical spraying should also be avoided where it might drift into shrike habitat (WDW 1992).

4.12 NORTHERN GOSHAWK (*Accipiter gentilis*) - FEDERAL AND STATE CANDIDATE

Goshawks breed mostly in dense stands of old-growth conifers and favor north-facing slopes. They do not nest on the Hanford Site, but have been rarely found wintering around Rattlesnake Springs and in shrub-steppe habitat on the ALE Reserve (Fitzner and Rickard 1975).

Winter habitat has not been studied to any extent in the northwest. The migratory habits of this species are also poorly understood. It would be safe to say, however, that heavy cover associated with riparian areas provides suitable winter habitat for the species.

4.13 BLACK TERN (*Chlidonia niger*) - FEDERAL CANDIDATE

This is a rare species on the Hanford Site, but is reported elsewhere along the Columbia River near the Tri-Cities (Ennor 1991). This species could also occur around West Lake and B Pond, where bullrushes provide nesting habitat. However, no nesting attempts have been reported for Hanford.

5.0 EFFECTS OF HUMAN DISTURBANCE ON ENDANGERED AND THREATENED SPECIES

This section discusses the effects of human disturbance on those threatened, endangered, and candidate species that reside on the Hanford Site. For each species, a discussion of known effects of disturbance is presented.

5.1 PEREGRINE FALCON

The only disturbance information for peregrine falcons relates to the nesting season. Because no nests have been documented for Hanford, and the peregrine is only an occasional migrant, it will not be discussed further.

5.2 BALD EAGLE

Much research has been conducted on the effects of human disturbance on bald eagles. Anthony et al. (1982), Knight and Knight (1984), and Stalmaster and Newman (1978) conducted specific studies that were designed to analyze the effects of humans on bald eagles. Anthony et al. (1982) found that human activities around eagle nest trees during the nesting season can disturb eagles and cause nest abandonment or reduced reproductive success. Grubb (1976, 1980) found productive bald eagle nests were farther from human activity, an average of at least 120 m (394 ft), than were unproductive nests. The author points out this value is similar to the U.S. Forest Service criteria, which prohibits activity within 100 m (328 ft) of nests and allows only minor activity within 200 m (656 ft) during the nonbreeding season (Mathisen et al. 1977).

Fraser et al. (1983) found eagle nests were farther from the shoreline in developed areas and farther from clusters of houses than from random points. They also found that 79% of eagles flushed from the nest at the approach of a pedestrian within 300 m (984 ft). Stalmaster (1976) and Servheen (1975) found that eagles consistently used the river bank with the least human activity. Eagles avoid areas of human activity (e.g., campgrounds and housing developments). Steenhof (1976) noted 80 cars per day passing within 34 m (112 ft) of an eagle perch with no apparent disruption to the eagles. Airplanes passing over eagles at 30 to 90 m (98 to 295 ft) rarely disturb eagles (Krauss 1977), while boats and snowmobiles are highly disturbing to eagles (Ingram 1965). The sound of gunshots usually cause an eagle to leave an area, and chainsaw activity within 1.2 km (0.75 mi) has driven eagles from a Wisconsin roost (Steenhof 1976).

Knight and Knight (1984) documented the responses of wintering bald eagles to boating activity on the Nooksack and Skagit Rivers. They found when eagles were perched in trees above the river, a buffer distance of 350 m (1,148 ft) would protect (not result in a flush response) 90% of the birds, while 90% of those eagles on the ground would not flush if the researchers stayed at least 450 m (1,476 ft) away. Boating has been found to be very disturbing to foraging eagles on the lower Columbia River (McGarigal et al. 1991; Watson et al. 1991).

Stalmaster and Newman (1978) also documented the behavioral responses of wintering bald eagles to human activity. They found feeding birds were sensitive to human disturbance, and a significant difference was noted in tolerance of adults and juveniles to human activity. Adults were almost always more sensitive and preferred areas of low human activity. The sound of gunshots was highly disruptive, while noises were not as disruptive. Adults were more tolerant of human activity when vegetation buffered the eagles' line-of-sight to an activity. Vegetation buffer zones were recommended as an effective means to reduce disruption. They recommended a buffer zone of 250 m (820 ft) in open country around perched eagles. Stalmaster (1980) later reported this distance could be shortened to 75 to 100 m (246 to 328 ft) if at least 50 m (164 ft) of this contained dense, shielding vegetation.

Anthony and Isaacs (1989) recommended that habitat alterations not occur within 400 m (0.25 mi) of nests and that disturbing activities within 800 m (0.5 mi) should be restricted from January 1 to August 31. These distances are based on their research and that of Harris (1984). The USFWS Pacific Bald Eagle Recovery Plan recommends establishing buffer zones around individual nest areas and excluding activities comparable to logging, construction, habitat improvement, and other activities during critical periods of eagle use. Activities such as picnicking, blasting, using firearms, and operating aircraft at low levels should not be allowed within 400 m (0.25 mi) out of line-of-sight of nests and roosts during periods of eagle use. These activities should be regulated up to 800 m (0.5 mi) line-of-sight from nests and roosts. Key wintering areas need protection from

disturbance from approximately November 15 to March 15. Permanent structures that would be occupied during periods of eagle use should not be constructed near nesting or wintering areas. Buildings should be no closer than 400 m (0.25 mi) from the shorelines of feeding waters (USFWS 1986). Washington Department of Wildlife suggests minimizing risks to bald eagle nesting by avoiding activities within buffer zones from January 1 through August 15 and restricting activities in roosting areas from November 1 through April 1. In feeding areas, they recommend leaving strips of tall perch trees from 50 to 100 m (164 to 328 ft) wide along the shorelines of major feeding areas and, where little screening material is available, establishing buffer zones of 250 to 300 m (820 to 984 ft) (similar to recommendations by Stalmaster 1987). On the Hanford Site within the 100 Areas, a significant amount of the river is screened by the height of the cliffs (30 to 70 ft high) and location of activities out back from the edge of the cliffs (Fitzner and Weiss 1993). Recommendations for buffer zone sizes and temporal restrictions to minimize human disturbances at Hanford closely follow the above suggestions and findings. Temporal restrictions near primary roosts are slightly different, with November 15 to March 15 being the time when most eagles winter on the Site. January 1 to August 15, or when the birds have fledged, is recommended as the critical time for nesting (Fitzner and Weiss 1994).

5.3 AMERICAN WHITE PELICAN

White pelicans do not nest in the state of Washington, but the Hanford Site does provide islands that may be suitable for the species' reintroduction into the state. Also, recent increases in white pelican use of the Hanford Site provide hope that this species may soon begin nesting in the region. Should that happen, nest-site-specific recommendations will be developed so that the pelican can be provided with an undisturbed environment conducive to nesting.

Perhaps the most limiting factor to white pelicans in Washington is nest failure caused from unintentional harassment (USFWS 1984). Within Washington, isolated, secure, and unvisited islands are rare; consequently, breeding populations of pelicans are not found in the state. The USFWS (1984) recommends that potential nesting islands be at least 1.4 acre in size, with 1-acre or larger islands being preferred.

Nesting white pelicans are very sensitive to human disturbance and need a buffer zone of 400 to 800 m (0.25 to 0.50 mi) closed to all human activity. The critical nesting period is from March 15 to August 31, and human activities should be restricted during this time.

5.4 SANDHILL CRANE

Much of the developed portions of the Hanford Site in Benton County do not provide nesting areas suitable for the sandhill crane. The Saddle Mountain National Wildlife Refuge and the Wahluke Slope Wildlife Recreation Area in Franklin and Grant Counties do contain wetlands that could serve as nesting sites for this species. Sandhill cranes do utilize islands in the Hanford Reach for feeding and loafing during migration.

All new construction or traffic increases should be avoided within 800 m (0.50 mi) of feeding areas (WDW 1991). Sandhill cranes have only been reported feeding near islands in the Columbia River on the Hanford Site; thus, characterization activities will likely have no impact on this species.

5.5 PYGMY RABBIT

Activities that alter native habitats of sagebrush, bluebunch wheatgrass (*Agropyron spicatum*), and bluegrass should be avoided in potential pygmy rabbit range. Grazing of pygmy rabbit habitat should be avoided, and all practices that damage sagebrush such as bulldozing or spraying of herbicides should also be avoided. Corridors of sagebrush habitat should be left or allowed to return between known and historical pygmy rabbit colonies (WDW 1991). Land-use practices that alter soils or threaten burrows through plowing, bulldozing, or heavy livestock grazing should be avoided. Prevention of wildfires by limiting off-road vehicle traffic in potential pygmy rabbit habitat during the fire season should be initiated.

5.6 FERRUGINOUS HAWK

Gilmer and Stewart (1983) found that the distribution of ferruginous hawk nests suggested that land-use patterns influenced habitat selection by this species. Land use within 100 m (328 ft) of nests situated on the ground was undeveloped pasture. Land use within 1 km (0.62 mi) of nests in trees was 76.5% pasture and haylands, while land use within 1 km (0.62 mi) of ground nests was 94.8% pasture and haylands. From these findings, the authors suggested tree-nesting hawks were more tolerant of activity than were ground-nesting hawks, and nesting appeared to be done in areas of low human activity. Few pairs nested in areas where 75% of the land was in cultivation.

Using various controlled disturbances, White and Thurow (1985) quantified the levels of disturbance and the size of the buffer zones needed to maintain nesting success and productivity of undisturbed hawks. Disturbance methods included (1) approach on foot, (2) approach in a vehicle, (3) continuous operation of a 3.5-hp gasoline engine near the nest, and (4) firing of a 0.22 caliber rifle every 20 m (66 ft) approaching from 500 m (1,640 ft) or using a sound-producing device (80 dB) 30 to 50 m (98 to 164 ft) from the nest, which represented common noise at a construction site. The investigators would approach only until the bird flushed and then would leave the area immediately. Success of experimental and control nests was determined. This particular study is the only controlled disturbance study known for ferruginous hawks and has tremendous management application for this and other buteo hawks.

The study showed that adults did not flush 60% of the time if the activities were more than 120 m (394 ft) away from the nest and 90% of the time if activities were more than 250 m (820 ft) from nests. None of the disturbance treatments produced significantly different effects on the birds, but their effects were significantly different from those of the control nests ($P < 0.05$). Only 52% of the territories containing disturbed nests ($n=24$) were occupied the subsequent year, while 93% of the territories containing control nests ($n=38$) were occupied the following year. Of the nests where adults flushed, 40% in 1978 and 36% in 1979 resulted in nest desertions. The control nests fledged one more fledgling per nest than disturbed nests. The investigators attributed this to inattentance of the nests by the parents because of their preoccupation with the disturbance.

While concealed noises (no human activity) usually resulted in less disturbance, one test with a concealed noisemaker (100 dB-B weighted), activated as a female hawk returned to the nest, resulted in nest desertion. A female hawk would usually not desert a nest once eggs began to hatch or if nestlings were present. In addition, food abundance appeared to affect abandonment rate. When food was high and adults were healthy, desertion was lower than when food was scarce and adults were unhealthy.

Based on White and Thurow's (1985) study, a buffer zone of 250 m (807 ft) is recommended to protect 90% of the nesting adults (see Figure 4-5). This recommendation assumes food is not limited and adults are healthy. If food is limited and/or adults are in poor condition, the buffer zone should be increased accordingly. However, the study was a short-term disturbance where the researchers left the area immediately. Long-term disturbances would significantly alter the desertion rate, because adults tend to reject eggs once they have cooled, and require an increase in the size of buffer zones.

Other researchers (Sullivan 1988) recommend that any development should be at least 200 to 500 m (656 to 1,640 ft) from nest sites and specific development such as drilling should be at least 800 m (0.5 mi) from ferruginous hawk habitats all year and 1.6 km (1.0 mi) from nests from March through July 16. To protect the habitat of the prey of ferruginous hawks, fire-prevention measures should be strictly enforced during the fire season.

5.7 WESTERN SAGE GROUSE

The key to saving populations of sage grouse in Washington is the preservation of key habitat, particularly "strutting grounds," nesting areas, and wintering areas. The WDW (1991) has established guidelines for those who intend to control sagebrush within the range of the sage grouse. These WDW management recommendations, when applied to the Hanford Site, would indicate that any site management that involves new construction or activities that disrupt sagebrush habitat should be avoided when possible. Characterization activities are not expected to destroy sagebrush and will likely have little impact on this species. Fire-prevention measures should be strictly enforced during the fire season.

5.8 PACIFIC WESTERN BIG-EARED BAT

This bat species is extremely sensitive to human disturbance (Graham 1966; Humphrey and Kunz 1976; Pearson et al. 1952). Disturbance can simply mean visiting that portion of a cave or building used by the bats. Following an intrusion, they will readily abandon nursery colonies, leaving with their young at night and travelling to a new site (if one is available). Thus, all visitation to nursery areas should be avoided from May 1 to August 30 (Perkins and Levesque 1987).

At hibernacula, disturbance of the sleeping colony can cause bats to stir, warm themselves, and become active. Such activity may cost them an excessive portion of their limited winter energy reserves. If repeated, it may cause reproductive failure, abandonment of the site, or death from starvation. Therefore, caves and buildings used for hibernation should be closed to people and other sources of disturbance from November 1 to April 1 (Perkins 1985).

Pesticides or herbicides, which could reduce the bat's food resources, should not be applied near the entrances of nursery or roost caves and buildings. Applications of pesticides and herbicides should also be avoided in areas that are likely foraging sites for bats, such as ponds (Perkins and Levesque 1987).

5.9 COLUMBIA PEBBLESNAIL

This species would be negatively impacted by activities that altered water flow or water quality (Taylor 1982). Water pollution may be one factor responsible for the extirpation of the pebblesnail from the Snake River (Taylor 1982). Therefore, activities that could pollute the water should not occur near the Hanford Reach. Characterization activities will not alter aquatic habitats or have any negative impact on this species.

5.10 LOGGERHEAD SHRIKE

This species could be impacted by land-use activities that alter prey availability and nesting habitat. Wildfire, pesticides, herbicides, and other chemicals that could reduce prey, cause mortality to shrikes, destroy the shrub-steppe habitat, or alter their behavior should be carefully managed to eliminate potential problems. Habitat containing nesting and foraging areas should be avoided and left undisturbed. If such areas must be disturbed, remediation activities will require mitigation.

5.11 ALEUTIAN CANADA GOOSE, NORTHERN GOSHAWK, AND BLACK TERN

Because of the rare migratory occurrence of these species on the Hanford Site, they will not be discussed further.

6.0 RECOMMENDATIONS TO MINIMIZE DISTURBANCE ON THREATENED AND ENDANGERED SPECIES

This section discusses recommendations to minimize disturbance of protected species on the Hanford Site during the characterization activities. These recommendations are based on past studies of others on these species (see Section 5.0) and observed effects noted on various species in studies conducted on the Hanford Site. Only those activities with the possibility of an effect are discussed. As cleanup progresses, appropriate regulatory requirements (e.g., NEPA, CERCLA) documentation must be developed and followed for each project.

Shrub-steppe habitat is extremely important to many species of special concern, such as sage grouse, pygmy rabbits, loggerhead shrikes, and ferruginous hawks. This habitat type has been continually degraded across eastern Washington and on the Hanford Site, and is now a limiting factor for these species. Thus, efforts will continue to be made to minimize the impact on this habitat from CERCLA activities, such as from wildfire and off-road vehicle traffic. However, a careful balance must be made to not destroy habitat unnecessarily in the name of fire protection, such as through large drill pad construction or extra-wide access roads. In addition, upon conclusion of waste site final cleanup actions and other related disturbed areas such as access roads, native vegetation will be reseeded to restore the shrub-steppe.

6.1 NONINTRUSIVE ACTIVITIES

The nonintrusive activities that could affect protected species are described in Section 3.0. Nonintrusive activities will not cause noticeable disruption to vegetation or soils, and thus no loss of wildlife habitat will occur. However, potential impacts could result from human presence.

Most human activities have the potential to increase fire frequencies at Hanford. The sagebrush component of shrub-steppe habitat is especially vulnerable to fire and is slow to recover. Fire can be an extremely important issue when it alters habitats utilized by threatened and endangered species. Efforts are currently made, especially during summer, to minimize the possibility of wildfire and fight fires once begun.

Section 5.0 of this report describes many instances where the presence of humans near a nest site or use area has caused an impact to an endangered or threatened species. Most wildlife species avoid humans and tend to stay away from areas frequented by humans. There are also critical times in the annual life cycle of each species when human presence is not tolerated. In the case of ferruginous hawks and bald eagles, territory initiation, courtship, and egg-laying periods are very sensitive times when the presence of people within the birds' territory can cause nest desertion.

Some species are more tolerant to human presence than others. Section 5.0 discusses the effects of human presence on each endangered and threatened species treated here. This section provides the recommendations of spatial and temporal restrictions that will minimize potential human impacts to sensitive species.

- Peregrine falcon: Because of the light, occasional seasonal use of the Hanford Site by peregrines, no recommendations for adjusting human activities are warranted at this time.
- Bald eagle: Nonintrusive activities will be scheduled to avoid bald eagle communal night roosting and nest sites. These areas are denoted in Figure 4-1. Eagle usage of the sites ranges from November 15 to March 15. The nest sites, if occupied, will be strictly avoided from January 1 to August 15 or until the adults have abandoned the nest or the young have fledged. In Figure 4-1, buffer zones (exclusion zones) have been drawn around roosts and nest sites to help in the planning of radiation surveys and other non-intrusive work. Activities that may adversely affect the bald eagle will require a consultation (formal or informal) with the USFWS.
- White pelican: Field crews will avoid those areas where white pelicans rest on islands and along the shoreline of the Columbia River. Most characterization activities are not planned to occur near pelican high-use areas.
- Sandhill crane: Sandhill cranes occasionally stop over during migration, with most recent observations being reported on islands in the Columbia River. If these areas are avoided, there should be little conflict with the sandhill crane.
- Pygmy rabbit - Sage grouse: Because the pygmy rabbit and sage grouse are not known to exist anywhere onsite (except possibly on the ALE Reserve), conflicts with field work are unlikely. However, large areas of sagebrush will be protected as much as possible to allow for natural reestablishment of these species.
- Ferruginous hawk: All ferruginous hawk nest sites will be avoided by field workers from March 1 through August 1. Workers will not encroach upon an active nest any closer than 1 km (0.6 mi) except for safety or emergency requirements.
- Loggerhead shrike: Requirements in appropriate NEPA documentation will be followed to protect shrike nests and habitat.

6.2 INTRUSIVE ACTIVITIES

6.2.1 Trench and Test Pit Soil Sampling

The pit sampling will likely have little effect on threatened or endangered species, similar to the nonintrusive activities (Section 6.1). The primary difference relates to the disturbance of soil and surface vegetation. Digging activities may remove habitat for some threatened and endangered species if in undisturbed habitat. Native vegetation disturbance should be kept to a minimum. Any surface areas in which disturbances remove vegetation will be revegetated with native plant species. Temporal restrictions should be placed on this activity when there is a potential for interaction with a threatened or endangered species. Buffer zones discussed in Section 5.0 of this report will be followed.

6.2.2 Borehole and Well Drilling

The borehole and well drilling activities have the greatest potential of all characterization activities for impacting threatened and endangered wildlife on the Hanford Site. Adherence to the temporal restrictions and buffer zone exclusion areas is recommended (see Sections 5.0 and 6.1 of this report). The borehole and well drilling at an individual site will occur over a 1- to 3-month period, and will involve noisy equipment, a large number of field personnel, disturbance of land [9.3-m² (100-ft²) storage areas], and road construction. One of these activities by itself could impact a threatened or endangered species. All of them combined have some likelihood of impacting a threatened or endangered species. Special care will be needed by Hanford Site contractors to schedule borehole and test well drilling around the critical times if endangered and threatened wildlife are identified as being near a planned test site. Because this activity could impact sensitive species, each threatened and endangered species is discussed below. Specific attention is paid to temporal restrictions and potential effects of the proposed action.

- **Peregrine falcon:** The peregrine falcon would likely not be impacted by this action, because peregrines are migrants through the Hanford Reach and do not nest on the Site.
- **Bald eagle:** Perch sites, foraging areas, and night roosting areas could be impacted by this action in several ways. The high level of noise involved in well drilling can be very disturbing to the eagles. The presence of workers will also disturb the birds. An 800-m (0.5-mi) buffer around the night roosts will be adhered to from November 15 through March 15. Jogging and lunchtime sightseeing will not be allowed within the buffer zone (exclusion area). Activities that may adversely affect the bald eagle will require a consultation (formal or informal) with the USFWS.

Nest sites should have an 800-m (0.5-mi) buffer (exclusion) zone placed around them (Fitzner and Weiss 1994). Noise from drilling and human presence would impact nesting birds, likely causing nest desertion. If these activities disrupt nesting, the operations will be suspended and the size of buffer zone reevaluated. All occupied nest sites will be avoided from January 1 through August 15, or until the adults have abandoned the nest or the young have fledged. There should be no alteration of native habitat or trees within 400 m of nest sites at any time.

- **White pelican:** Efforts should be made to avoid drilling near the shoreline of the Columbia River, particularly from the White Bluffs boat ramp upstream to the 100-N Area and from the 100-F Area downstream to the Hanford powerline.

If a drill site does occur nearer to the river than 800 m (0.5 mi), we recommend the following:

1. Keep workers from the river shoreline and restrict their activities to the work site
2. If pelicans are noted nesting near a proposed drill site or roadway [within 800 m (0.5 mi)], reschedule the action so that it would not interfere with the pelican's nesting season (March 15 through August 31).

- **Sandhill crane:** Same recommendations as for the white pelican.
- **Pygmy rabbit - sage grouse:** Both of these species depend on extensive, dense stands of sagebrush. The sage grouse could also utilize areas along the Columbia River for foraging. Site-wide work is in progress to map stands of sagebrush potentially suitable for sage grouse and pygmy rabbits. Activities that disturb areas with adequate sagebrush should be surveyed for these species by biologists before beginning work. If either species is found near the proposed work site, the site should be relocated. In addition, any such disturbed ground should be reclaimed and planted to native vegetation after the project is completed.
- **Ferruginous hawk:** This species is very sensitive to human disturbance (see Sections 3.0 and 5.0) and would be impacted by this activity if it were to occur near a nest site. Adherence to the March 1 through August 1 temporal restriction for disturbance minimization and a 1-km (0.6-mi) buffer zone should provide adequate protection for nesting birds.

The creation of drill pads, storage areas, and roadways will remove land from productivity and could eliminate foraging areas utilized by this species. Care must be taken to reduce any major land-disturbing activity within 1 km (0.6 mi) of a nest, or affecting foraging habitat on the Hanford Site. Impacts to the foraging area can be minimized and/or mitigated by reclaiming the disturbed ground. Removal of the gravel pads and roadways and revegetation with native plants are recommended.

- **Pacific western big-eared bat:** This species is easily disturbed by noise and human presence. Characterization activities that can be detected within a building being utilized by this species should be avoided. However, some buildings have thick walls, and drilling even directly adjacent to them will likely not be detectable.
- **Loggerhead shrike:** Nesting and foraging areas could be impacted by CERCLA intrusive activities in several ways. Noise could be very disturbing to nesting birds; however, little is known about the effects of human presence or noise on this species.

Removal of habitat could cause a reduction in prey base and nest sites. Many nesting territories are known for the Hanford Site. Locations are listed in a computer database, and potential conflicts with CERCLA activities can be determined by surveying an area before any planned activity.

- Northern goshawk and black tern: No impact would result to goshawks or black terns from CERCLA activities. Most of the sightings of goshawks have taken place on the ALE Reserve. There are no sightings of black terns on the Hanford Site, but they are seen during migration along the Columbia River just downstream from Hanford.

6.3 OTHER INVESTIGATIONS

6.3.1 Air Investigations

Impacts to threatened and endangered species from air monitoring is unlikely. Care should be taken, however, to keep any motor-driven monitoring devices away from nesting areas of sensitive wildlife. The temporal restrictions discussed in Sections 5.0, 6.1, and 6.2 apply to any action that would generate noise or require human presence near a threatened or endangered species use area.

6.3.2 Ecological Investigations

Biotic surveys (bird surveys, vegetation surveys) are a necessary part of this Biological Assessment. Care should be taken, however, to avoid disturbing threatened and endangered wildlife. Adhering to recommended buffer zones and temporal restrictions will reduce the chances of any conflicts.

6.3.3 Other Investigations

Cultural resource investigations could have an impact on threatened or endangered species. This work must also adhere to the buffer zones and temporal restrictions.

7.0 DETERMINATION OF EFFECT

7.1 BALD EAGLES

With the buffer zone closures implemented as described around the primary roost sites and nesting site(s), the characterization and other comparable activities are not likely to adversely affect the eagles. The eagle wintering population and nesting attempts will continue to be monitored to evaluate any unanticipated effects. Other activities that may adversely affect bald eagles will require a formal or informal consultation with the USFWS.

7.2 PEREGRINE FALCONS

Because of the light, seasonal use of the Hanford Site by peregrines, the activities as described are not likely to adversely affect the falcons.

7.3 FEDERAL CANDIDATE AND STATE-LISTED SPECIES

With the described protection of ferruginous hawk nests and the shrub-steppe habitat, the described activities are not likely to adversely affect any of the federal candidate or state-listed species described. Continuing studies, fire protection, and fire-suppression activities, and biological evaluations conducted for specific work activities through the National Environmental Policy Act (NEPA) requirements will help ensure that the species and their habitat are protected.

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	R. E. Champion	S0-98
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	T. W. Ferns (5)	H6-26
	G. E. Fitzgibbon	H6-07
	K. A. Gano (2)	X0-21
	H. B. Hathaway	B4-64
	G. C. Henckel III	H6-04
	R. P. Henckel	H6-02
	L. C. Hulstrom	H6-03

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D. S. Landeen	H4-14
R. J. Landon	H6-22
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C. L. Looney	N3-06
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J. A. Rivera	B2-16
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S. W. Seiler	B4-64
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