E5.0 BOTANICAL AND WILDLIFE RESOURCES

This section on the terrestrial resources (plants and wildlife) associated with the Klamath Hydroelectric Project (Project) contains the following elements:

- A description of the existing botanical and wildlife resources in the study area (see Figure E5.1-1)
- A discussion of agency consultation related to terrestrial resources
- Summaries of the studies conducted by PacifiCorp on wildlife and vegetation
- A summary of proposed enhancement measures
- A discussion of continuing impacts

E5.1 HISTORICAL TERRESTRIAL RESOURCES

The terrestrial resources in the Project vicinity historically have been affected by humans for a long period of time. Much of the information on Native American use of the Klamath River Canyon comes from the archaeological investigations conducted by Gleason (2001). Native Americans have been part of the Klamath River ecosystem for at least the last 7,500 years (Gleason, 2001). The Upland Takelma, Shasta, Klamath, and Modoc tribes all used various portions of the study area; the Yurok Tribe historically used the lands along the Lower Klamath River. Before settlement by Europeans, Native Americans affected terrestrial resources through clearing vegetation for villages; harvesting plants and animals for food, medicine, and other uses; and using fire to manage vegetation. The most intensive uses occurred close to the river. Apparently, many of the flat terraces in the canyon were used at one time or another as village-sized settlements. The existing Topsy Grade Road is near the site of a Native American trail. Beginning in about 1870, homesteaders established ranches in the Klamath River Canyon. Apparently, the canyon was mostly unoccupied by any Native American tribes after this time. The following sections provide a brief discussion of historical botanical and wildlife resources.

E5.1.1 Botanical Resources

Native Americans used botanical resources in the area in a variety of ways, and plant gathering was important for food most of the year. Numerous species were used, with foliage, fruit, geophytes, seeds/nuts, or other products being harvested (Gleason, 2001). Most of the plant resources were obtained from known localities that were visited regularly. Fires were used by the Native Americans for many reasons, but especially the management of various subsistence resources (Gleason, 2001). Fire frequently has been suggested as a major tool used by Native Americans, especially in oak habitat. Many of the ecosystems in arid areas (e.g., oak [*Quercus* spp.] woodlands, chaparral, and ponderosa pine [*Pinus ponderosa*] forests) are created and maintained by periodic wildfires (Franklin and Dyrness, 1988). Increased fire frequency generally would have increased oak productivity, decreased conifer germination, and decreased shrub undergrowth.

With European settlement, livestock grazing substantially increased in the open range of the study area. Livestock grazing has had the greatest impact on botanical resources in the area. Beginning in the late 1800s, cattle and sheep were grazed in the area; however, only cattle have been grazed since the early 1900s.

By approximately 1890, commercial logging was initiated in the Klamath River Canyon vicinity. Evidence of previous logging is common throughout the area. As timber operations increased, logs were slid down adjacent slopes to the Klamath River and transported to the old town of Klamathon. In the upper portion of the canyon, ponderosa pine and Douglas-fir (*Pseudotsuga menziesii*) were the dominant tree species in the early 1900s, representing 22 to 60 percent of the trees (BLM, 1996). Approximately 100 years ago, white fir (*Abies amabilis*) represented less than 10 percent of the trees. In some areas, the combination of logging and fire suppression has decreased the numbers of ponderosa pine and increased the numbers grand fir (*Abies grandis)*) and white fir (BLM, 1996, 1998). The forest inventory data collected by the U.S. Bureau of Land Management (BLM) (BLM, 1996) in the Pokegama landscape analysis showed a 15 to 78 percent reduction of ponderosa pine by 1996 compared to historical densities. Other impacts of logging include the increase of chaparral species, such as manzanita (*Acrtostaphylos patula*), wedgeleaf ceanothus (*Ceanothus cuneatus*), and rabbitbrush (*Chrysothamnus nauseosus*), but also an increase in shrub decadence under the more dense overstory (BLM, 1996).

The combination of logging, grazing, and general wildfire suppression has resulted in forest stands that have high levels of fire fuel (dense and decadent shrubs and overstocked forests with abundant dead wood) that are more susceptible to high severity disturbances, such as stand-replacement wildfire, diseases, and insect attacks than what occurred before European settlement (Morgan et al. 1993). Before European influence, frequent low intensity fires burned most of the coarse woody debris (CWD) in complex mosaics in ponderosa pine forests and kept the severity of fires lower than after European settlement (Agee, 1993).

Lithosol meadows provide habitat for the numerous geophytic plant species (Gleason, 2001). These meadows are distributed throughout the watershed, but are most abundant on the plateau above the canyon and north of Copco and Iron Gate reservoirs.

Noxious weeds were introduced into the western United States mostly from Eurasia and were not present in the Klamath River study area before European settlement in the late 1800s (BLM, 1996). The early homesteaders who moved into the Klamath River cleared the river terraces for cultivation of crops, such as alfalfa and timothy, and ranching purposes (Gleason, 2001). Beginning in the 1940s, non-native plant species were introduced for grazing, forestry, transmission line rights-of-way (ROW), and road cuts. Some areas were seeded with non-native grasses, such as bulbous bluegrass (*Poa bulbosa*) and *Pleum pratense,* that out-competed native species, while in other areas non-native species spread through natural propagation. Cheatgrass (*Bromus tectorum*) and yellow starthistle (*Centaurea solstitialis*) now dominate areas that receive heavy grazing pressure. Yellow starthistle was introduced into California by beekeepers and has infested many thousands of acres in the western United States. Even though noxious weeds have come to dominate many areas in the Klamath Canyon (the area between Copco reservoir and J.C. Boyle dam), there are many refugia for native plant communities (Gleason, 2001).

Figure

E5.1-1 Terrestrial resources study area

11 x 17

front

Back of Figure

An assessment of pre-Project conditions conducted by PacifiCorp for purposes of developing an understanding of ecological factors influencing current conditions and for identifying opportunities for potential protection, mitigation, and enhancement (PM&E) measures found that, as is the case with most semi-arid rivers, historically riparian habitat was dominated by a mixture of shrub and tree species, and was restricted primarily to narrow bands along the Klamath River before Project construction (see Terrestrial Resources Final Terrestrial Report [FTR], Section 3.7). The average riparian vegetation width along the Klamath River was 23 feet (7 m), 101 feet (31 m), and 27 feet (8 m) at sections of river now occupied by Iron Gate, Copco, and J.C. Boyle reservoirs, respectively. Only along sections of the river just upstream of the present-day Copco dam was the riparian vegetation wide. Historically, riparian and wetland vegetation bordered 28 percent (J.C. Boyle reservoir), 49 percent (Copco reservoir), and 68 percent (Iron Gate reservoir) of the river and major tributary shoreline under historical conditions. Review of historical aerial photos for river reaches downstream of the dams indicates that riparian vegetation historically was quite narrow, especially in what is now the Copco No. 2 bypass. In the Keno Canyon and J.C. Boyle bypass and peaking reaches, there have been relatively minor shifts in the overall distribution and extent of riparian vegetation relative to historical conditions, although non-native plant species were likely less common in the riparian zone before European settlement and subsequent development. Substantial changes in riparian conditions have occurred in the Link River. Before Project development, much of the riparian zone was devoid of native trees and included several orchards and human settlements.

E5.1.2 Wildlife Resources

The Klamath River Canyon is a natural wildlife migration corridor through the Cascade Mountains. The diverse terrain and plant communities support a large number of wildlife species. The various species have been affected by direct harvest and habitat manipulation during the thousands of years of human habitation in the area. Before European settlement, Native American tribes hunted year-round for deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), antelope (*Antilocopra americana*), bighorn sheep (*Cervus canadensis*), black bear (*Ursus americanus*), grizzly bear (*Ursus arctos horribilis*), and mountain lion (*Felis concolor*), with deer and elk being the most commonly sought after prey (Gleason, 2001). Small mammals used by the Native Americans included bobcats (*Felis rufus*), gray squirrels (*Sciurus griseus*), ground squirrels (*Spermophilus beecheyi*), rabbits, beaver (*Castor canadensis*), mink (*Mustela vison*), and otter (*Lutra canadensis*). The Native Americans also hunted for waterfowl and quail and collected eggs from various species. Turtles were eaten and the carapaces used as bowls. It is thought that the tribes employed a “conservation principle” toward the natural resources of the area.

Shortly after settlement by Europeans, species such as the grizzly bear and gray wolf (*Canis lupus*) were systematically eradicated from the Klamath River area. Beaver were nearly eradicated by trapping and only recently have returned to many areas. Europeans also released horses (*Equs caballus*) into the environment that roamed the area in the hundreds (Dow, 1977 as cited in Gleason, 2001). These feral horses still occur today as the Pokegama wild horse herd and are federally protected. Pigs (*Sus scrofa*), turkeys (*Melagris gallopavo*), and pheasants (*Phosianus colchicus*) also have been introduced in the region. Historically, irrigation of river terraces attracted waterfowl during the spring (Gleason, 2001). Review of historical photography indicates that before each dam was constructed, large portions of the land near the river already had been developed—primarily for agricultural purposes—which would have eliminated some wildlife habitat. Approximately 19 percent of the upland and riparian area that existed under what is now occupied by Iron Gate, Copco, and J.C. Boyle reservoirs was used as pastures, orchards, or other agricultural and residential uses in the years before Project development (see Terrestrial Resources FTR, Section 3.7, for additional discussion of pre-Project vegetation).

It is thought that the long-term logging and fire suppression that has occurred since European settlement has had large-scale impacts on wildlife species in the study area. For example, the reduction of ponderosa pine has reduced the availability of the most suitable bald eagle (*Haliaeetus leucocephalus*) nest sites (Anthony and Isaacs, 1989; BLM, 1996). This management also has caused a general decline in the quality of shrublands for wildlife. Past timber harvests have reduced the availability of large-diameter trees suitable for spotted owl (*Strix occidentalis*) nesting, although fire suppression may have contributed to an increased understory development creating multi-storied stands that owls use.

Historically, large anadromous fish runs of at least several million fish occurred in the Klamath River before construction of Copco and Iron Gate dams (Hardy and Addley, 2001). There is no information available on how wildlife species may have used this food resource. However, based on existing literature that demonstrates the linkage of wildlife with anadromous fish (e.g., Cedarholm et al. 2000, 2001), it is probable that bald eagles and carnivores, such as bears, may have been attracted to the river during certain times of the year to prey on live and dead anadromous fish. This food resource was probably also important for some aquatic mammals, such as river otter and mink.

E5.2 EXISTING TERRESTRIAL RESOURCES AND FACTORS AFFECTING TERRESTRIAL RESOURCES

In the course of study and in the interim between the draft license application and this final application, PacifiCorp made a few changes to the proposed Project. The newly proposed Project begins at the J.C. Boyle Development and continues downstream to the Iron Gate Development. The Spring Creek diversion is now included in the Fall Creek Development. The East Side, West Side, and Keno developments are no longer part of the proposed Project. Keno dam will remain in operation, but is not included in the proposed FERC Project because the development does not have generation facilities, and its operation does not substantially benefit generation at PacifiCorp’s downstream hydroelectric developments.

The following sections describe existing wildlife and botanical resources on lands surrounding the Project reservoirs and river reaches affected by the Project. To provide additional ecological content, the information herein describes current conditions for not only the proposed Project, but also areas surrounding Keno reservoir and the East Side and West Side Developments, which are proposed by PacifiCorp to be removed from the Project. Information presented later in the sections describing proposed PM&E measures and analysis of continuing effects is generally limited to the new proposed Project (complete study area results are available in the Terrestrial Resources FTR).

The terrestrial resources study area is divided into primary area and secondary study areas, collectively referred to as the study area (see Figure E5.1-1). The primary study area includes the following:

- Project reservoirs and facilities
- 0.25-mile-wide (0.4-km-wide) buffer around the river reaches from Link River to Iron Gate dam
- The Klamath River and riparian/wetland communities along the Klamath River from Link River to the mouth of the Shasta River

The secondary study area extends beyond the primary area to include the Klamath River Canyon rim-to-rim from the J.C. Boyle dam to the eastern end of Copco reservoir and includes all PacifiCorp-owned land near the Project. For a regional perspective on selected wildlife species that have large home ranges, information was summarized for the area within approximately 5 miles (8 km) of the Project facilities and affected river reaches. For many of the resources, the study area (primary and secondary) was divided into the following 11 study area sections (see Figure E5.1-1). (Note that in the FTRs, these "study area sections" are referred to as "Project sections.")

- Link River—The 2,600 feet (792 m) of river from the Link River diversion dam (river mile [RM] 254.5) to Lake Ewauna and lands within 0.25 mile (0.4 km) of the East Side and West Side canals, forebays, and flowlines.
- Keno reservoir—All lands within 0.25 mile (0.4 km) of the reservoir including Lake Ewauna shoreline from the Link River to Keno dam
- Keno Canyon—The 5 miles (8 km) of the Klamath River between Keno dam (RM 233.4) and the J.C. Boyle reservoir
- J.C. Boyle reservoir—All lands within 0.25 mile (0.4 km) of the reservoir shoreline
- J.C. Boyle bypass reach—The 4 miles (6 km) of the Klamath River between the J.C. Boyle dam (RM 224.5) and the J.C. Boyle powerhouse (RM 220.4) plus all lands within 0.25 mile (0.4 km) of the river and J.C. Boyle canal.
- J.C. Boyle peaking reach—The 22 miles (35 km) of the Klamath River from the J.C. Boyle powerhouse (RM 220.4) downstream to the Copco reservoir and lands within the Klamath River Canyon
- Copco reservoir—Lands within 0.25 mile (0.4 km) of Copco reservoir
- Copco No. 2 bypass—Lands within 0.25 mile (0.4 km) of the Copco No. 2 forebay and flow line to the Copco No. 2 powerhouse
- Fall Creek—The area within 0.25 mile (0.4 km) of Fall Creek from the PacifiCorp diversion (RM 1.5) to confluence with Iron Gate reservoir
- Iron Gate reservoir—All lands within 0.25 mile (0.4 km) of the reservoir shoreline
- Iron Gate-Shasta—The 13 miles (21 km) of river between Iron Gate dam (RM 190) and the Shasta River (RM 176.7) as well as the adjacent riparian and upland habitat

The information on existing botanical and wildlife resources presented in this section is based on the results of the 2002-2003 relicensing studies. Scientific names and additional information on the studies conducted for these resources are provided in the Terrestrial Resources FTR. The first three sections listed above are not part of PacifiCorp's proposed Project, but are included in the following sections to provide additional context.

E5.2.1 Botanical Resources

The Project is located near the confluence of several mountain ranges (Siskiyou/Klamath and Cascade) and within several different eco-regions or physiographic provinces, resulting in a diverse mix of flora and fauna. In Oregon, the Oregon Diversity Plan (ODFW, 1993) refers to these eco-regions as the East Slope Cascades (the Basin and Range physiographic province in Franklin and Dyrness [1988]) and the West Slope Cascades (the High Cascades physiographic province in Franklin and Dyrness [1988]). In California, the Project is within the Southern Cascades and the Modoc Plateau physiographic provinces (Ayres Associates, 1999). It is also within the Cascade-North Sierra floristic region of the California floristic province (Barbour and Major, 1988). The Upper Klamath River forms a corridor between the Great Basin and California floristic provinces, creating a transition zone. Within Oregon, the area is generally within the interior valley, ponderosa pine, and mixed conifer vegetation zones (Franklin and Dyrness, 1988). The Klamath River Canyon has the greatest botanical diversity of any section of the river (Todt, 1998).

The area east of J.C. Boyle dam generally includes vegetation typical of the East Slope Cascades physiographic province. In the Klamath River basin, non-forested areas in the valley are generally sagebrush steppe vegetation, wetlands, or cultivated. From J.C. Boyle dam to the eastern end of Copco reservoir, the Klamath River cuts through several vegetation zones as it bisects the Cascade Range, forming a steep canyon. Montane vegetation typical of the Cascades is mixed with high desert and interior valley plant communities. The area downstream of the canyon is composed of vegetation similar to that found in the interior valley of Oregon with oak and grasslands dominating.

The BLM described the Klamath River Canyon as being a mosaic of pine, oak, juniper, and mixed conifer forest communities, with ponderosa pine and Oregon white oak (*Quercus garrayana*) being the dominant tree species (BLM, 1996). Limited areas of oak savannahs also occur. Narrow riparian habitats dominated by oak, birch (*Betulua occidentalis*), and white alder (*Alnus rhombifolia*) occur along the river and tributaries. Overall oak production in the Klamath River Canyon was reported to be less than 20 percent of the potential productivity, although the better-producing trees tend to be in the canyon while the poor-production trees are outside of the canyon (Gleason, 2001).

E5.2.1.1 Plant Communities

Vegetation cover type mapping was completed for the 52,870-acre (21,451-ha) terrestrial resources study area (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). Approximately 54 percent or 28,317 acres (11,470 ha) of the study area was mapped as one of the upland tree habitat types. Other common cover type groups include upland shrub cover types, which occupy 5,042 acres (2,042 ha); upland herbaceous (4,841 acres, [1,961 ha]); agricultural (5,746 acres, [2,327 ha]); and aquatic habitats (5,077 acres, [2,056 ha]). Riparian communities (606 acres, [246 ha]), wetlands (2,238 acres, [907 ha]), and barren habitats (1,003 acres, [406 ha]) are the least abundant cover type groups in the study area.

Table E5.2-1. Acreage of cover types in each study area section of the Klamath River Hydroelectric Project study area.

Cover Type	Study Area Section											
	Iron Gate-Shasta	**Iron Gate Reservoir**	**Copco No. 2 Bypass**	**Fall Creek**	**Copco Reservoir**	**J.C. Boyle Peaking Reach**	**J.C. Boyle Bypass**	**J.C. Boyle Reservoir**	**Keno Canyon**	**Keno Reservoir**	**Link River**	**Grand Total**
Upland Tree Habitat												
Juniper	1.0	463.5	22.5	21.4	27.6	212.5	132.4			150.0	237.3	1,268.3
Mixed Conifer					8.8	98.4	581.6	10.8	134.0			833.5
Lodgepole Pine							55.2	9.2				64.4
Montane Hardwood Oak	101.1	1,424.4	162.8	88.0	1,254.9	1,971.8	68.0					5,070.8
Montane Hardwood Oak - Conifer			257.1	387.4	585.4	7,374.3	34.2					8,638.4
Montane Hardwood Oak - Juniper	33.0	1,584.6	196.2	195.3	1,282.3	5,619.5	57.4					8,968.1
Ponderosa Pine			75.8			124.4	536.4	1,116.8	1,465.4	154.6		3,473.4
Subtotal	**135.1**	**3,472.5**	**714.4**	**692.1**	**3,159.0**	**15,400.9**	**1,465.2**	**1,136.8**	**1,599.4**	**304.6**	**237.3**	**28,316.9**
Percent of section	**9.7%**	**52.7%**	**59.4%**	**74.6%**	**51.2%**	**75.3%**	**70.6%**	**59.1%**	**78.0%**	**3.2%**	**42.2%**	**53.6%**
Upland Shrub Habitat												
Mixed Chaparral	205.8	478.4	251.7	102.6	791.2	1,851.2	285.9	47.5	257.0	35.5	88.7	4,395.5
Rabbitbrush									2.3	536.2		538.4
Sagebrush								72.5		35.8		108.3
Subtotal	**205.8**	**478.4**	**251.7**	**102.6**	**791.2**	**1,851.2**	**285.9**	**120.0**	**259.3**	**607.5**	**88.7**	**5,042.2**
Percent of section	**14.8%**	**7.3%**	**20.9%**	**11.1%**	**12.8%**	**9.1%**	**13.8%**	**6.2%**	**12.6%**	**6.4%**	**15.8%**	**9.5%**
Upland Herbaceous Habitat												
Annual Grassland	353.5	1,381.1	80.4	27.8	962.5	1,624.2	12.9			32.3		4,474.6
Perennial Grassland		2.7		0.9		51.6	96.7	171.6	24.7	14.5	3.4	366.0
Subtotal	**353.5**	**1,383.8**	**80.4**	**28.7**	**962.5**	**1,675.8**	**109.6**	**171.6**	**24.7**	**46.8**	**3.4**	**4,840.6**
Percent of section	**25.5%**	**21.0%**	**6.7%**	**3.1%**	**15.6%**	**8.2%**	**5.3%**	**8.9%**	**1.2%**	**0.5%**	**0.6%**	**9.2%**
Wetland Habitat												
Palustrine Aquatic Bed		0.9		0.6		0.1		37.6		254.1		293.3
Palustrine Emergent	0.4	11.2	1.4	8.0	18.9	89.8	8.3	63.2	5.1	1,589.4	0.2	1,795.9
Palustrine Forested		38.8	3.1	2.2	57.1		5.0			9.5	2.9	118.6
Palustrine Scrub-Shrub	0.2	9.2		2.7	3.2		0.8	4.2		7.8	2.5	30.6
Subtotal	**0.6**	**60.1**	**4.5**	**13.5**	**79.2**	**89.9**	**14.1**	**105.1**	**5.1**	**1,860.8**	**5.6**	**2,238.5**
Percent of section	**0.0%**	**0.9%**	**0.4%**	**1.5%**	**1.3%**	**0.4%**	**0.7%**	**5.5%**	**0.2%**	**19.5%**	**1.0%**	**4.2%**

Table E5.2-1. Acreage of cover types in each study area section of the Klamath River Hydroelectric Project study area.

Cover Type	Study Area Section											
	Iron Gate-Shasta	**Iron Gate Reservoir**	**Copco No. 2 Bypass**	**Fall Creek**	**Copco Reservoir**	**J.C. Boyle Peaking Reach**	**J.C. Boyle Bypass**	**J.C. Boyle Reservoir**	**Keno Canyon**	**Keno Reservoir**	**Link River**	**Grand Total**
Aquatic Habitat												
Lacustrine Unconsolidated Bottom		940.5	5.3	0.8	999.5	4.6	0.0	299.4		2,072.8	10.6	4,333.5
Lacustrine Unconsolidated Shore		6.3									2.5	8.8
Riverine Unconsolidated Bottom	214.6	18.1	4.7	0.1		269.9	43.7		92.3	63.8	19.2	726.4
Riverine Unconsolidated Shore	3.9				0.1	2.6	1.8					8.4
Subtotal	**218.5**	**964.9**	**10.0**	**0.9**	**999.6**	**277.1**	**45.5**	**299.4**	**92.3**	**2,136.6**	**32.3**	**5077.1**
Percent of section	**15.8%**	**14.7%**	**0.8%**	**0.1%**	**16.2%**	**1.4%**	**2.2%**	**15.6%**	**4.5%**	**22.4%**	**5.7%**	**9.6%**
Riparian Habitat												
Riparian Deciduous	87.9	40.3	23.1	2.1	20.6	170.0	0.5			0.8	19.8	365.1
Riparian Grassland	6.9	0.0			2.2	13.8	20.2	0.4	13.4		2.7	59.6
Riparian Mixed				37.8	1.9	12.0						51.7
Riparian Shrub	56.3	1.5			0.9	32.5	11.4	0.4	6.9		11.3	121.1
Subtotal	**151.1**	**41.8**	**23.1**	**39.9**	**25.6**	**228.3**	**32.1**	**0.8**	**20.3**	**0.8**	**33.9**	**597.5**
Percent of section	**10.9%**	**0.6%**	**1.9%**	**4.3%**	**0.4%**	**1.2%**	**1.6%**	**0.0%**	**1.0%**	**0.0%**	**6.0%**	**1.1%**
Barren Habitat												
Rock Talus	5.6	35.8	14.5		47.2	428.8	27.5					559.3
Exposed Rock	11.8	27.3	68.1	38.3	14.2	116.2	68.5	10.2	12.3			366.9
Subtotal	**17.4**	**63.1**	**82.6**	**38.3**	**61.4**	**545.0**	**96.0**	**10.2**	**12.3**	**0.0**	**0.0**	**926.2**
Percent of section	**1.3%**	**1.0%**	**6.9%**	**4.1%**	**1.0%**	**2.7%**	**4.6%**	**0.5%**	**0.6%**	**0.0%**	**0.0%**	**1.7%**
Agricultural/ Developed												
Developed /Residential	89.9	44.3	1.4	0.6	79.0	11.3	4.9	0.5	18.5	696.4	152.2	1,099.0
Barren-Disturbed	18.9	20.4	2.0	0.0	3.0	2.2	10.0	6.0		6.5	7.8	76.8
Industrial		27.9	32.1	11.1	0.0		12.6	1.8	4.7	640.1	1.0	731.3
Pasture/Irrigated Hayfield	164.2				13.7	365.6				3,138.9		3,682.4
Recreation	31.4	27.7			0.6	0.5	0.5	72.4	14.0	93.9		241.0
Subtotal	**304.4**	**120.3**	**35.5**	**11.7**	**96.3**	**379.6**	**28.0**	**80.7**	**37.2**	**4,575.8**	**161.0**	**5,830.5**
Percent of section	**22.0%**	**1.8%**	**3.0%**	**1.3%**	**1.6%**	**1.8%**	**1.3%**	**4.2%**	**1.8%**	**48.0%**	**28.6%**	**11.0%**
Totals Acres	**1,386.4**	**6,585.1**	**1,202.2**	**927.7**	**6,174.7**	**20,447.8**	**2,076.1**	**1,924.5**	**2,050.6**	**9,532.9**	**562.1**	**52,869.5**

Upland tree-dominated cover types are most abundant in nine of the 11 study area sections, occupying between 42 and 78 percent in all sections except in Keno reservoir and the Iron Gate-Shasta section. In the Iron Gate-Shasta section, riparian cover types occupy approximately 25 percent. Developed and agricultural lands dominate the Keno reservoir section (48 percent). Upland shrub cover types occupy a low of 7 percent of the Iron Gate reservoir to a high of 21 percent near Copco No. 2 bypass. Upland herbaceous cover types are common along the Iron Gate-Shasta section, Iron Gate reservoir, and Copco reservoir, occupying between 16 and 26 percent of the three study area sections. Agricultural habitat (excluding general grazing allotment areas) occupies more than 20 percent of the Iron Gate-Shasta, Keno reservoir, and Link River sections, but represents less than 2 percent in all other study area sections.

The relative and absolute cover of wetlands is greatest around Keno reservoir with nearly 20 percent or 1,861 acres (754 ha) of wetland habitat that was mapped during the terrestrial resources studies. The relative cover of wetland cover types in the other study area sections ranges from 0.2 percent or 5.1 acres (2.1 ha) in Keno Canyon to 5.5 percent or 105 acres (43 ha) at J.C. Boyle reservoir (Table E5.2-1).

The following describes the upland and riparian/wetland plant communities. Sections 2.0, 3.0, 7.0, and 8.0 in the Terrestrial Resources FTR provide additional detail on cover types.

Upland Plant Communities

Upland communities include upland tree, upland shrub, and upland herbaceous groups of cover types. The following sections describe individual cover types documented in each of the three upland communities relative to the study area sections.

Forest/Woodland Types. There are seven upland forest/woodland cover types in the study area. Forest/woodland types, which are defined as having more than 10 percent tree cover, are present in all study area sections, but are especially common from Keno Canyon to Iron Gate reservoir. These include montane hardwood oak (MHO), montane hardwood oak-conifer (MHOC), montane hardwood oak-juniper (MHOJ), ponderosa pine forest (PP), juniper woodland (J), Klamath mixed conifer (KMC), and lodgepole pine (LP). Of these, montane hardwood oak-juniper is the most common, followed closely by montane hardwood oak-conifer. All of the forest/woodland types occur near the proposed Federal Energy Regulatory Commission (FERC) Project; only ponderosa pine has a substantial proportion of its acreage upstream of J.C. Boyle reservoir. The following sections describe each of the upland forest/woodland cover types.

- Montane Hardwood Oak (MHO) - The MHO vegetation cover type occupies 5,071 acres (2,054 ha) or 9.6 percent of the study area from the Iron Gate-Shasta section east to the downstream parts of the J.C. Boyle bypass (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). The MHO cover type is most abundant around Iron Gate reservoir, Copco reservoir, and in the J.C. Boyle peaking reach. Oregon oak is most often the only species in the tree layer, but black oak (*Quercus kelloggii*) occurs in more mesic MHO stands in the J.C. Boyle peaking reach and near Copco reservoir. A small amount of ponderosa pine, Douglas-fir, and western juniper (*Juniperus occidentalis*) may occur as well. The overall tree canopy cover averages 53.2 ± 23.6 percent while tree heights are 37.3 ± 16.5 feet (11.4 +/- 5.0 m).

Shrub cover is moderately dense (19.7 ± 23.9 percent) and, depending on location, includes species such as western juniper, Oregon oak (*Quercus garryana*) saplings, three-leaf sumac (*Rhus trilobata*), deerbrush (*Ceanothus integerrimus*), birchleaf mountain mahogany (*Cercocarpus betuloides*), and wedgeleaf ceanothus. The herb layer in MHO averages 54.9 ± 22.9 percent and generally ranged from 44 percent to 79 percent. Common species in the herbaceous layer include: Oregon oak seedlings, bulbous bluegrass, hairy brome (*Bromus japonicus*), hedge parsley (*Anthriscus cacaulis*), Idaho fescue (*Festuca idahoensis*), blue wildrye (*Elymus glaucas*), and cheatgrass. The invasive/exotic species, yellow starthistle, and medusahead (*Taeniatherum caput-medusae*) were present in 24 percent and 28 percent of sampled stands, respectively. Approximately 34 percent of the MHO habitat has evidence of recent grazing, while 4 percent has evidence of recreational impacts, and 8 percent has evidence of erosion.

As a result of the historical grazing and their proximity to annual grasslands, many of northwest California oak woodlands contain high cover of non-native species (Jimerson and Carothers, 2001). Throughout California, researchers have documented a lack of natural regeneration by oaks, which is a concern for wildlife managers because of the large number of species dependent on this habitat (CalPIF, 2002). The reasons for this may include fire suppression (Biswell, 1989; Stephens, 1997) and overgrazing (Fleischner, 1994; Belsky et al. 1999), both of which contribute to invasion of non-native annual grasses and cause long-term changes in habitat structure (Barnhart et al.1996). Annual grasses tend to outcompete native perennials and young oak seedlings for soil moisture, while grazing by livestock can adversely affect oak sapling development (Hamilton, 1997). Natural regeneration of black oak and tanoak (*Lithocarpus densiflorus*) occurs most often and in larger numbers beneath the crowns of parent trees with only scattered individuals found elsewhere (McDonald and Tappeiner, 2002). Within the study area, oak seedlings were noted in 68 percent of MHO plots and oak saplings were found in 28 percent. Thus, it appears that some regeneration is occurring.

- Montane Hardwood Oak-Conifer (MHOC) - The MHOC cover type occupies more than 8,638 acres (3,499 ha) or 16.9 percent of the study area in five study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). This type was by far the most abundant in the J.C. Boyle peaking reach followed by Copco reservoir, Fall Creek, Copco No. 2 bypass, and J.C. Boyle bypass study area sections.

  Tree cover averages 65.9 ± 30.6 percent and includes ponderosa pine, Oregon oak, and black oak. Other tree species in MHOC include western juniper, incense cedar (*Calocedrus decurrens*), and bigleaf maple (*Acer macrophyllum*). The shrub layer averages 14.1 ± 16.6 percent cover (see Terrestrial Resources FTR, Section 2.0, Table 2.7-5). Western juniper, deerbrush, western juniper, western serviceberry (*Amelanchier alnifolia*), Oregon oak saplings, poison oak (*Toxicodendron diversilobum*), birchleaf mountain mahogany, snowberry (*Symphorocarpus alba*), and bitter cherry (*Prunus emarginata*) are common species that occur in various MHOC stands. The herb layer in MHOC averages 31.6 ± 23.5 percent (see Terrestrial Resources FTR, Section 2.0, Table 2.7-4). Regeneration of oak appears to be occurring regularly because Oregon oak seedlings occurred in the herb layer in 94 percent of sampled stands. There are eight common herb layer species: foxtail fescue (*Vulpia myuros*), bulbous bluegrass, ponderosa pine seedlings, large-flowered collomia (*Collomia grandiflora*), western serviceberry, western juniper, Idaho fescue, and birchleaf mountain mahogany. Approximately 24 percent of the MHOC habitat has evidence of recent grazing, while 18 percent has evidence of recreational impacts, and 6 percent has evidence of erosion. Oak regeneration was noted in 94 percent of the MHOC plots, although oak saplings were present in only 24 percent of the plots.

- Montane Hardwood Oak – Juniper (MHOJ) - The MHOJ cover type is the most abundant type in the entire study area, covering 8,968 acres (3,633 ha) or 17 percent of the study area (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). In addition to western juniper and Oregon oak, ponderosa pine and sugar pine (*Pinus lambertiana*) occasionally are present in the tree layer. Shrub cover averages 15.9 ± 16.1 percent and includes western juniper, wedgeleaf ceanothus (53 percent of sampled stands including 80 to 100 percent of the Iron Gate and Copco No. 2 bypass sections), and birchleaf mountain mahogany (40 percent of the stands).

  The herb layer cover in MHOJ averages 66.4 ± 17.4 percent. A core group of species is present in more than 50 percent of the plots: Oregon oak, bulbous bluegrass, hairy brome, Idaho fescue, squirreltail (*Elymus elymoides*), and large-flowered collomia. The invasive/ exotic species yellow starthistle and medusahead each was present in 45 percent of stands, primarily around Iron Gate reservoir, Copco reservoir, and Copco No. 2 bypass reach. Approximately 45 percent of the MHOJ habitat has evidence of recent grazing, while 5 percent has evidence of erosion. Oak regeneration was noted in 60 percent of the MHOJ plots, although oak saplings were present in only 30 percent of the plots. The oak-juniper community is hypothesized to have resulted either from juniper invasion in response to fire suppression or from a mosaic of fire-prone and fire-safe microsites in an area that allows the fire-resistant oaks and fire-susceptible junipers to co-exist (BLM, 2002a).

- Ponderosa Pine (PP) - Ponderosa pine forests occupy 3,473 acres (1,407 ha) or 6.7 percent of the study area from the lower end of Keno reservoir downriver to the lower end of the J.C. Boyle peaking reach (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Table 2.7-1). The ponderosa pine cover type is most abundant in the J.C. Boyle reservoir (1,117 acres [452 ha]) and Keno Canyon (1,465 acres [593 ha]) study area sections. Approximately 46 percent of the ponderosa pine acreage occurs upstream of J.C. Boyle reservoir in areas not associated with the proposed Project.

  Ponderosa pine is the only species present in 100 percent of the stands in this cover type. Other tree layer species include Oregon oak (J.C. Boyle peaking reach), Douglas-fir, and western juniper (J.C. Boyle reservoir and Keno Canyon). Tree canopy cover averages 49.1 ± 21.7 percent. Many of the stands near Keno Canyon, Keno reservoir, and J.C. Boyle reservoir have been commercially thinned and thus had tree cover as low as 12 percent. Average tree diameters at breast height (dbh) range from 13.2 inches (28 cm) in Keno Canyon to 24.5 inches (51.8 cm) near the lower end of Keno reservoir. Shrub cover in ponderosa pine forest is relatively low averaging 19.1 ± 13.1 percent, but climbs to 35 percent in the J.C. Boyle peaking reach. Common shrub layer species include ponderosa pine, snowberry, and western serviceberry. Less common species are Douglas-fir, deerbrush, and Oregon oak. Greenleaf manzanita (*Acrtostaphylos patula*), Oregon grape (*Berberis aquifolium*), mock orange (*Philadelphus lewisii*), and gray rabbitbrush (*Chrysothamnus nauseosus*) are present in J.C. Boyle bypass. Birchleaf mountain mahogany, western chokecherry (*Prunus virginiana*), and Sierra plum (*Prunus subcordata*) occur in pine stands near Keno Canyon. The herb layer cover averages 29.9 ± 21.3 percent and has a small core group of common species: western serviceberry, ponderosa pine seedlings, Kentucky bluegrass (*Poa pratensis*), blue wildrye, large-flowered collomia, squirreltail, and small-flowered collinsia (*Collinsia parviflora*). Approximately 7 percent of the MHO habitat has evidence of recent grazing, while 43 percent has evidence of recreational impacts, and 7 percent has evidence of erosion.

- Juniper Woodland (J) - Western juniper typically occupies sites that are intermediate in moisture between ponderosa pine and steppe/shrub-steppe zones (Driscoll, 1964). Juniper woodland is distributed over 1,268 acres (514 ha) or 2.3 percent of the study area (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). Juniper woodland was mapped in all study area sections except J.C. Boyle reservoir and Keno Canyon, and was most abundant in the Link River and the J.C. Boyle peaking reach study area sections. Approximately 31 percent of the juniper woodland acreage occurs upstream of J.C. Boyle reservoir in areas not associated with the proposed Project. The extent of juniper coverage in the study area has not been assessed relative to historical levels. However, like many other areas of arid western North America, juniper has expanded because of the reduced fire frequency resulting from fire suppression.

  Total tree cover in juniper woodlands averages 21.4 ± 20.2 percent, but sometimes is open with areal cover of the tree layer barely reaching 10 percent. In addition to western juniper, Oregon oak and sugar pine are occasionally present. The juniper woodlands around Iron Gate reservoir, Copco reservoir, Keno reservoir, and Link River are more pure juniper while stands in the middle reaches often have other tree species present.

  In the juniper woodland type, no single shrub layer species occurs in all seven of the study area sections. Western juniper occupied the shrub layer in 45 percent of all stands. Oregon oak, poison oak, three-leaf sumac, wedgeleaf ceanothus, mock orange, Sierra plum, birchleaf mountain mahogany, and gray rabbitbrush are shrub layer species in the juniper woodlands. The average areal cover of the shrub layer is variable between sections and ranges from 18 percent cover in the J.C. Boyle bypass to 70 percent cover at the Link River.

  The herb layer has a small core group of species with more than 50 percent but less than 85 percent overall frequency: cheatgrass (82 percent), willowherb (*Epilobium brachycarpum*) (64 percent), squirreltail (64 percent), bulbous bluegrass (64 percent), and blue bunch wheatgrass (*Pseudoroegneria spicata*) (55 percent). The average herb layer cover ranges from 12 to 70 percent. Most herbaceous species in juniper stands are graminoids because forbs usually do not constitute major components of undisturbed juniper communities (Franklin and Dyrness, 1988). Approximately 28 percent of the juniper woodland habitat has evidence of recent grazing, while 28 percent has evidence of recreational impacts, and 9 percent has evidence of erosion.

- Klamath Mixed Conifer (KMC) - Klamath mixed conifer stands (mixed conifer) are distributed over 834 acres (338 ha) or 1.6 percent of the study area in five study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). Approximately 70 percent of the mixed conifer stands are in the J.C. Boyle bypass. Approximately 16 percent of the KMC acreage occurs upstream of J.C. Boyle reservoir in areas not associated with the proposed Project. Douglas-fir is frequently the dominant tree layer species (more than 50 percent cover). However, ponderosa pine, incense cedar, and white fir (J.C. Boyle peaking reach) often are present.

Tree canopy cover in mixed conifer averages 68.3 ± 11.3 percent. The tree canopy was often two-layered with older ponderosa pine and Douglas-fir ranging from 115 to 141 feet (35 to 43 m) in height over the second tree layer, which contains short conifers and oak only 23 feet (7 m) tall. The average tree diameters are surprisingly low in the Copco reservoir (4.5 inches [11.4 cm]) and J.C. Boyle peaking reach (5.0 inches [17.7 cm]) sections. Average tree diameters in the other two study area sections are also fairly low compared to other upland, tree-dominated stands: 11.2 inches (28.4 cm) dbh in the J.C. Boyle bypass and 10.7 inches (27.2 cm) dbh in the J.C. Boyle reservoir section.

Overall, KMC shrub cover averages 26.8 ± 16.3 percent. Oregon grape, western serviceberry, birchleaf mountain mahogany, Oregon oak, incense cedar, and deerbrush are the most common shrub layer species. The herb layer has relatively poor constancy in KMC plots. Small-flowered collinsia was the only species that occurred in 100 percent of sampled stands. Other herbaceous species include bulbous bluegrass, false solomons seal (*Smilacina racemosa*), Virginia strawberry (*Fragaria virginiana*), moehringia (*Moehringia grandiflora*), blue wildrye, large-flowered colomia, Idaho fescue, and prostrate ceanothus (*Ceanothus prostratus*). The average herb cover was 21.4 ± 22.2 percent. There is no evidence of recent grazing, but 17 percent of the KMC habitat has evidence of recreational impacts.

- Lodgepole Pine (LP) - Lodgepole pine stands occur in the J.C. Boyle bypass reach and at J.C. Boyle reservoir as a result of replanting following timber harvest. The stands are distributed over 64.4 acres (26 ha) or 0.12 percent of the study area in those two study area sections. The trees in these young plantations are typically small, averaging 6 inches (13 cm) dbh in the two reaches.

  The dominant tree species is always lodgepole pine and the tree layer cover was 10 percent in the one stand. The shrub layer cover was 5 percent and the most common shrub layer species were Bloom's ericameria (*Ericameria bloomeri*) and western serviceberry. The most common herb layer species include cheatgrass, bluebunch wheat grass, yarrow (*Achillea millefolium*), and blue wildrye. The herb layer cover was 80 percent under the sparse tree and shrub layers. There was no evidence of grazing or recreation use.

Upland Shrub Communities

In total, upland shrub communities occupy 5,042 acres (2,040 ha) in the study area. Approximately 19 percent of the upland shrub acreage occurs upstream of J.C. Boyle reservoir in areas not associated with the proposed Project. The following sections summarize the three upland shrub types: mixed chaparral (MXC), sagebrush (SB), and rabbitbrush (RB).

- Mixed Chaparral (MXC) - Mixed chaparral stands are distributed over 4,396 acres (1,781 ha) or 8.3 percent of the study area in ten of 11 study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). Approximately 60 percent of the mixed chaparral stands occur in the J.C. Boyle bypass (1,851 acres [750 ha]) and around Copco reservoir (791 acres [320 ha]); only 9 percent occurs upstream of J.C. Boyle reservoir. The mixed chaparral cover type requires that two or more shrub species occur in the stand and that they have 5 percent or more areal cover.

Tree cover averages 2.1 ± 5.2 percent and typically includes widely scattered juniper, Oregon oak, or ponderosa pine. Shrub cover averages 51.2 ± 23.8 percent and height averages 4.8 ± 1.6 feet (1.5 ± 0.5 m). The widespread distribution of this cover type results in a range of species dominance among the study area sections. There are 15 shrub layer species that range in frequency from 3 to 40 percent (see Terrestrial Resources FTR, Section 2.0, Table 2.7-7). Birchleaf mountain mahogany is present in 40 percent of all mixed chaparral plots in six of the study area sections, while wedgeleaf ceanothus and Sierra plum are present in 33 and 27 percent, respectively. Oak shrubs also occur in 24 percent of the MXC plots. Western juniper (trees or shrubs) is also ubiquitous. Wedgeleaf ceanothus is most prevalent and abundant in the lower portions of the study area from the Iron Gate-Shasta section up through the peaking reach. Three-leaf sumac and poison oak form dense stands in many low-lying ravine bottoms along the Iron Gate-Shasta section, Iron Gate reservoir, and in Fall Creek. Several species—gray rabbitbrush, antelope bitterbrush (*Purshia tridentata*), Sierra plum, poison oak, chokecherry, snowberry, and bitter cherry—are present only in upper sections of the study area. The most frequent herb layer species in mixed chaparral are cheatgrass, bulbous bluegrass, willowherb, squirreltail, yellow starthistle (especially downriver of J.C. Boyle bypass), hairy brome, large-flowered collomia, and wall bedstraw (*Galium parisiense*). Approximately 37 percent of the MXC habitat has evidence of recent grazing, while 3 percent has evidence of recreational impacts, and 30 percent has evidence of erosion.

- Sagebrush (SB) - Sagebrush-dominated shrubland is limited to 108 acres (44 ha) or 0.2 percent of the study area near J.C. Boyle reservoir and Keno reservoir (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). Approximately 36 acres (15 ha) of the SB habitat is located near Keno reservoir and not associated with the proposed Project. Sagebrush (*Artemisia* sp), green rabbitbrush (*Chrysothamnus viscidiflorus*), linear–leaf ericameria (*Ericameria linearifolia*), and ponderosa pine and juniper saplings were found in the shrub layer in the sagebrush stands. Shrub cover averages 55.0 ± 28.0 percent and 3.1 ± 0.7 feet (0.9 ± 0.2 m) tall.

  Overall, the herb layer averages 1.0 ± 0.3 foot (0.3 ± 0.1 m) tall and 19.3 ± 9.8 percent in total cover (see Terrestrial Resources FTR, Section 2.0, Table 2.7-4). Cheatgrass occurred in all four of the sampled stands. Other herbaceous species include: squirreltail, Kentucky bluegrass, lupine (*Lupinus* sp.) and the sub-shrubs, Bloom's ericameria, one-sided bluegrass (*Poa secunda*), basin wildrye (*Leymus cinereus*), and plateau gooseberry (*Ribes velutinum*). Approximately 50 percent of the SB habitat has evidence of recent grazing.

- Rabbitbrush (RB) - Rabbitbrush stands occupy 538 acres (218 ha) or 1.0 percent of the study area (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Table 2.7-3) at Keno reservoir and Keno Canyon; none is associated with the proposed Project. Total shrub cover in rabbitbrush averages 55 ± 14.1 percent. Gray rabbitbrush is the dominant shrub species in most areas and Sierra plum is the only other shrub species present. The herbaceous layer averages 60.0 ± 7.1 percent and includes species such as cheatgrass, elated buckwheat (*Eriogonum elatum*), hairy brome, phacelia (*Phacelia* sp.), bluebunch wheatgrass, spikerush (*Eleocharis* sp.), fescue (*Festuca* sp.), saltgrass (*Distichlis spicatum*), Baltic rush (*Juncus balticus*), and narrow-leaf pyrrocoma (*Pyrrocoma lanceloata*) depending on soil moisture. Applegate's milkvetch (*Astragalus applegatei*), a threatened, endangered, or sensitive (TES) plant species, grows in a seasonally moist site with rabbitbrush and saltgrass along Keno reservoir. Approximately 50 percent of the RB habitat has evidence of recent grazing.

Upland Herbaceous Communities

The following sections summarize the two upland herbaceous types: annual grassland (AGL) and perennial grassland (PGL).

- Annual Grassland (AGL) - Annual grasslands are distributed over 4,475 acres (1,813 ha) or 8.5 percent of the study area in eight of 11 study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). More than 88 percent or 3,968 acres (1,607 ha) of the annual grasslands occur around Iron Gate and Copco reservoirs and in the J.C. Boyle peaking reach. All but 32 acres (13 ha) are associated with the proposed Project. The AGL cover type gives way to the PGL cover type both upslope and upriver. In general, AGL vegetation is the result of centuries of non-native plant species introductions and ground-disturbing land uses.

  Total shrub cover is less than 1 percent. Overall herb cover averages 93.0 ± 7.8 percent and height averages 1.8 ± 0.9 feet (0.5 +/- 0.3 m) in height. Nine of the 11 most frequent species are introduced species; two of them are the exotic/invasive species—medusahead and yellow starthistle. The other seven species are bulbous bluegrass, hairy brome, wall bedstraw, cheatgrass, Spanish clover (*Lotus purshianus*), storksbill (*Erodium cicutarium*), and hedge parsley. The two most common native species were willowherb and lagophyllum (*Lagophylla ramosissima*). Medusahead, hairy brome, and yellow starthistle dominate grasslands downriver of J.C. Boyle peaking reach. Bulbous bluegrass is an early-season dominant. Cheatgrass becomes relatively more abundant in annual grasslands in the J.C. Boyle bypass and upriver to Keno reservoir. Approximately 86 percent of the AGL habitat has evidence of recent grazing, while 5 percent has evidence of recreational impacts, and 14 percent has evidence of erosion.

- Perennial Grasslands (PGL) - Perennial grasslands are limited to 366 acres (148 ha) or 0.7 percent of the study area in eight of 11 study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Table 2.7-3 and Figure 2.7-1). More than 87 percent or 320 acres (130 ha) of the PGL habitat occurs in the J.C. Boyle peaking reach and bypass and around J.C. Boyle reservoir. All but 43 acres (17 ha) are associated with the proposed Project. Many of the grasslands from the Fall Creek and the J.C. Boyle peaking reach upriver to the J.C. Boyle reservoir have an abundant component of naturalized, upland perennial grass species planted as forage species for cattle production. In the J.C. Boyle peaking reach, perennial grasslands adjacent to irrigated pastures take on the species composition of pasture that are tolerant to drier, upland soil conditions.

  Shrub cover averages 1.8 ± 5.5 percent and includes a wide variety of species depending on location in the study area. A total of 31 graminoid species occurs in the sampled stands; five introduced annuals, 11 introduced perennials, two native annuals, 11 native perennials, one native rush, and two native sedges. Bulbous bluegrass and hairy brome are the only two species that occur in more than 50 percent of sampled grasslands. Bulbous bluegrass, hairy brome, willowherb, Kentucky bluegrass, cheatgrass, spiny lettuce (*Lactuca serriola*), lagophyllum, blue bunch wheatgrass, colonial bentgrass (*Agrostis capillaris*), and blue wildrye are other common species. Average herb layer cover across all sampled stands ranges from 70 to 99 percent cover and averages 80.4 ± 22.2 percent (see Terrestrial Resources FTR, Section 2.0, Table 2.7-5). Approximately 39 percent of the PGL habitat has evidence of recent grazing, while 15 percent has evidence of recreational impacts, and 15 percent has evidence of erosion.

Wetlands and Riparian Plant Communities

Wetland and riparian cover types occupy a total of 2,836 acres (1,148 ha) or 5 percent of the study area. More than 1,926 acres (779 ha), or 68 percent, of the wetland/riparian habitat is not associated with the proposed Project. The following sections describe various wetland and riparian communities in the study area and examine the relationship between hydrology and plant communities. Wetland types include palustrine aquatic bed (PAB), palustrine emergent (PEM), palustrine scrub-shrub (PSS), and palustrine forested (PFO) wetlands. Riparian deciduous (RD), riparian shrub (RS), riparian grass (RG), and riparian mixed deciduous conifer (RM) total 605 acres (245 ha) or 1 percent of the study area. See Section E5.2.1.2 for a more detailed discussion of various wetland and riparian vegetation types documented along Project reservoirs and affected river reaches.

- Palustrine Emergent Wetland (PEM) - Palustrine emergent wetlands occupy 1,796 acres (727 ha) or 3.3 percent of the study area in all 11 study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). More than 88 percent or 1,589 acres (644 ha) of the PEM occurs adjacent to Keno reservoir, where wetlands associated with the State of Oregon Klamath Wildlife Area and the undiked wetlands to southwest of the Klamath Wildlife Area are located. The emergent wetland near Sportsmen's Park at J.C. Boyle reservoir is the largest single emergent wetland associated with the proposed Project and covers more than 63 acres (25.5 ha).

  The average areal cover of the herb layer in emergent wetland stands is 98.0 ± 17.3 percent. Species composition varies greatly among study area sections. At Iron Gate and Copco reservoirs, hardstem bulrush (*Scirpus acutus*), waterpepper (*Polygonum hydropiperoides*), and occasionally hornwort (*Ceratophyllum dermersum*) are dominant species. Immediately upslope of the bulrush zone, there is often a weedy zone. Isolated wetlands in the Copco No. 2 bypass are typically intermittently or seasonally inundated, often disturbed by cattle, and dominated by species such as Baltic rush, dog-fennel (*Anthemis cotula*), yellow starthistle, and chicory (*Cichorium intybus*). Fall Creek wetlands include fringed willowherb (*Epilobium ciliatum*), curly dock (*Rumex crispus*), Kentucky bluegrass, western goldenrod (*Eupatorium occidentalis*), timothy (*Phelum pratensis*), Canada thistle (*Cirsium arvense*), mat muhly (*Muhlenbergia richardsonis*), sword-leaf rush (*Juncus ensifolius*) devil's beggarstick (*Bidens frondosa*), Modoc eryngo (*Eryngium alismaefolia*), teasel (*Dipsacus sylvestris*), bird's foot trefoil (*Lotis corniculatus*), and bulrush (*Scirpus acutus*). The PEM wetlands in the J.C. Boyle peaking reach are diverse with species such as fringed willowherb, seep monkeyflower (*Mimulus guttatus*), velvet grass (*Holcus lanatus*), timothy, common rush, and colonial bentgrass. The dominant species in wetter meadows were often sedges including clustered field sedge woolly sedge (*Carex lanuginosa*), Nebraska sedge (*Carex nebrascensis*), short-beaked sedge (*Carex simulata*), as well as several other species of sedge, sword-leafed rush (*Juncus ensifolius*), straight-leaf rush (*Juncus orthophyllus*), Scouler's hypericum (*Hypericum scouleri*), Bigelow's sneezeweed (*Helenium bigelovii*), bay forget-me-not (*Myosotis laxa*), pendulous bulrush (*Scirpus pendulus*), and fowl bluegrass (*Poa palustris*). Species growing in relatively drier meadows or portions of meadows include Baltic rush, Kentucky bluegrass, dense-flowered willowherb (*Boisduvalia densum*), Gairdner's perideridia (*Perideridia gairdneri*), and Oregon checkerbloom (*Sidalcea oregano*). Wetlands that were adjacent to the river had reed canarygrass (*Phalaris arundinacea*), hardstem bulrush, devil's beggarstick, and rice cutgrass (*Leersia oryzoides*).

At J.C. Boyle reservoir, common species in PEM habitat include Nebraska sedge, stipitate sedge (*Carex stipitata*), marsh spikerush (*Eleocharis macrostachya*), common rush (*Juncus effuses*), fringed willowherb, bull thistle (*Cirsium vulgare*), colonial bentgrass, foxtail barley (*Hordeum jubatum*), dandelion (*Taraxicum officionalis*), mullien (*Verbascum thapsus*), western goldenrod, wild mint (*Mentha arvense*), bugle hedgenettle (*Stachys ajugoides*), seep monkeyflower, and duckweed (*Lemna minor*).

The wetlands at Keno reservoir have high species diversity. Common species in the more deeply flooded habitats include hardstem bulrush, cattail (*Typha latifolia*), climbing nightshade (*Solanum dulcamera*), waterpepper, and broad-fruited bur-reed (*Sparganium eurycarpum*). Other species include prickly sowthistle (*Sonchus asper*), spear saltbrush (*Atriplex patula*), silver cinquefoil (*Potentilla anserina*), short-podded thelypodium (*Thelypodium brachycapum*), stinging nettle (*Urtica dioica*), western goldenrod, catnip *(Nepeta cataria)*, prickly lettuce (*Lactuca serriola*), Eaton's aster (*Aster cf. eatonii*), Canada thistle, poison hemlock (*Conium maculatum*), bull thistle, teasel, and Bigelow's sneezeweed. Approximately 36 percent of the PEM habitat in the study area has evidence of recent grazing, while 16 percent has evidence of recreational impacts.

- Palustrine Scrub-Shrub Wetlands (PSS) - Palustrine shrub-scrub wetlands are limited to 30 acres (12 ha) or 0.06 percent of the study area in eight of 11 study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). More than 80 percent or 24.4 acres (10 ha) of the PSS wetlands occurs adjacent to the four Project reservoirs.

  Average tree cover is 36.8 ± 39.6 percent while shrub cover averages 55.9 ± 44.7 percent. The areal cover of the herb layer averages 53.4 ± 34.5 percent. Coyote willow (*Salix exigua*) (also know as narrowleaf willow), Oregon ash *(Fraxinus oregana)*, and arroyo willow (*Salix lasiolepis*), are the primary hydrophilic shrubs in PSS wetlands. Coyote willow often grows in dense stands with many stems per acre. Coyote willow is the dominant shrub layer species in 75 percent of the sampled PSS wetlands from J.C. Boyle reservoir to Iron Gate reservoir. Other shrub layer and tree layer species growing in PSS wetlands around Iron Gate reservoir include trees of Oregon ash, trees and saplings of shining willow (*Salix lucida* ssp *lasiandra*), and shrub growth forms of Himalayan blackberry (*Rubus discolor*), poison oak, three-leaf sumac, and Oregon oak. Oregon ash is ubiquitous in Fall Creek and at Iron Gate and Copco reservoirs, but not at J.C. Boyle reservoir and the Link River. Arroyo willow is more abundant upriver and upslope; this species was most frequent at Fall Creek, J.C. Boyle reservoir, and at Keno reservoir. The Fall Creek reach also had arroyo willow, Himalayan blackberry, and three-leaf sumac in addition to Oregon oak trees. The only shrub layer species in the Link River wetland is arroyo willow. The PSS wetlands at J.C. Boyle reservoir are among the most diverse and have many species unique to the shrub layer. The Spencer Creek wetland is dominated by arroyo willow, coyote willow, Douglas' spiraea (*Spiraea douglasii*), red osier dogwood (*Cornus sericeus*), chokecherry, and mock orange.

  There were 11 herb layer species documented in PSS wetlands: teasel, bull thistle, western goldenrod, cheatgrass, hairy brome, Kentucky bluegrass, mullien, colonial bentgrass, gray rabbitbrush, prickly lettuce, and Canada thistle. Approximately 44 percent of the PSS habitat has evidence of recent grazing, while 19 percent has evidence of recreational impacts, and 12 percent has evidence of erosion.

- Palustrine Forested Wetland (PFO) - Palustrine forested wetlands are distributed over 119 acres (48 ha) or 0.2 percent of the study area in seven of 11 study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). More than 80 percent or 95.9 acres (38.8 ha) of the PFO wetlands occurs adjacent to Copco and Iron Gate reservoirs.

  Oregon ash, white alder, coyote willow, and shining willow are the primary hydrophilic trees in PFO wetlands; weeping willow (*Salix babylonica*) is the dominant tree layer species in one of the Keno reservoir wetlands. The average height of the tree layer is 37.4 ± 14.8 feet (11.4 ± 4.5 m). The average aerial cover for the tree layer is 65.8 ± 22.7 percent.

  Total shrub cover is 35.1 ± 22.7 percent. PFO wetlands at Copco and Iron Gate reservoirs shared the following shrub layer species: Oregon ash, three-leaf sumac, western juniper, coyote willow, Oregon oak, and poison oak. Brown dogwood *(Cornus glabrata)* and arroyo willow are the only shrub layer species in the two Copco No. 2 bypass wetlands. The two Keno reservoir wetlands have no shrub layer. There were five herb layer species that occur in more than 30 percent but less than 60 percent of the sampled stands: hedge parsley, blue wildrye, Oregon grape, curly dock, and cheatgrass.

- Palustrine Aquatic Bed (PAB) – PAB communities occur in all Project reservoirs and slow-moving sections of river. Dominant species include pondweeds (*Potomogeton* spp.), coontail (*Ceratophyllum demersum*), and other species.

- Riparian Grass (RG) - The riparian grass cover type occupies 60 acres (24.3 ha) or 0.001 percent of the study area (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1) in seven study area sections. Reed canarygrass is relatively common in RG habitat in at least four of the river reaches: Iron Gate-Shasta, J.C. Boyle peaking reach, Keno Canyon, and Link River. Other common species include: hardstem bulrush, climbing nightshade, curly dock, rice cutgrass, and water smartweed (*Polygonum amphibium*). Total herbaceous cover averages 89.3 ± 13.1. Approximately 8 percent of the RG habitat has evidence of recent grazing, while 17 percent has evidence of recreational impacts, and 17 percent has evidence of erosion.

- Riparian Shrub (RS) - The riparian shrub habitats are distributed over 121 acres (49.0 ha) or 0.2 percent of the study area in eight of 11 study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). The sections with the most riparian shrub are the Iron Gate-Shasta section and J.C. Boyle peaking reach. Coyote willow, arroyo willow, and Oregon ash saplings are the primary hydrophilic shrubs in riparian shrub habitats; they occur in 62 percent, 54 percent, and 23 percent of sampled stands, respectively. Himalayan blackberry is abundant in stands in the Link River and the Iron Gate-Shasta sections. Herb cover averages 89.3 ± 13.1 percent and is dominated by reed canarygrass in Keno Canyon, J.C. Boyle bypass, J.C. Boyle peaking reach, and Link River. Approximately 8 percent of the RS habitat has evidence of recent grazing, while 62 percent has evidence of recreational impacts, and 31 percent has evidence of erosion.

- Riparian Deciduous (RD) - Riparian deciduous forest occurs over 365 acres (148 ha) or 0.7 percent of the study area in nine of 11 study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). Most of the riparian deciduous habitat is in the J.C. Boyle peaking reach and Iron Gate-Shasta sections. Oregon ash, coyote willow, western birch (*Betula occidentalis*), and white alder are the primary hydrophilic trees in riparian deciduous forest. Oregon oak often occurs in riparian stands downstream of the J.C. Boyle peaking reach. Western birch is present only in the Copco No. 2 bypass and the Link River reaches. The average height of the tree layer in riparian deciduous strands is 47.6 ± 16.7 feet (14.5 ± 5.1 m) and the average areal cover for the tree layer is 54.9 ± 26.3 percent.

  Shrub cover averages 55.6 ± 25.8 percent. Oregon ash saplings, three-leaf sumac, Himalayan blackberry, and brown dogwood are common species. Himalayan blackberry is particularly abundant in many sites along the Iron Gate-Shasta section, J.C. Boyle peaking reach, and the Link River. Brown dogwood is most common in the Copco No. 2 bypass, the peaking reach, and the Link River. There are ten common herb layer species: curly dock, bur chervil (*Athriscus cacaulis*), reed canarygrass, ripgut brome (*Bromus diandrus*), blue wildrye, field pepperweed (*Lepidium campestre*), bugle hedgenettle, mullien, common rush, and velvet grass. Approximately 26 percent of the RD habitat has evidence of recent grazing, while 21 percent has evidence of recreational impacts, and 32 percent has evidence of erosion.

- Riparian Mixed Deciduous-Coniferous (RM) - Riparian mixed deciduous-coniferous habitats are distributed over 52 acres (20.9 ha) or 0.10 percent of the study area in three of 11 study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). There are 37.8 acres (15.3 ha) of RM habitat mapped at Fall Creek 12.0 acres (4.9 ha) in the J.C. Boyle peaking reach and 1.9 acres (0.8 ha) around Copco reservoir. A total of eight tree, 12 shrub, and 49 herbaceous plant species was documented in riparian mixed habitat. Depending on the location, the dominant tree species include Douglas-fir, white alder, Oregon ash, and western birch (present in three stands). The average tree diameters range from 5.9 to 12.6 inches (12.6 to 26.7 cm) dbh. Riparian deciduous habitats averages 284.0 ± 134 trees per acre.

  Shrub layers in riparian mixed habitats include western serviceberry, white alder saplings, arroyo willow, dense-flowered spiraea *(Spiraea douglasii)*, poison oak, ninebark (*Physocarpus capitatus*), and snowberry. Total shrub cover in the RM plots averages 54.0 ± 19.8 percent. Total herb cover averages 29.0 ±30.7 percent and height averages 2.2 ± 0.5 feet (0.7 +/- 0.2 m). Common species are Oregon grape, blue wildrye, velvet grass, poison oak, California grape (*Vitis californic*a), Idaho fescue, and California lomatium (*Lomatium californica*). A taller herb layer with reed canarygrass and devil's beggarstick is often present along the river.

  The average height of the tall, coniferous tree layer in the Fall Creek stands is 65.6 ± 9.2 feet (20.0 ± 2.8 m). The average height of the tree layer in all stands is 34.1 ± 8.2 feet (10.4 ± 2.5 m). The average total tree layer cover is 80.6 ± 22.3 percent. Approximately 20 percent of the RM habitat has evidence of recent grazing.

Barren Habitats

The following sections describe the two naturally unvegetated cover types: rock talus (RT) and exposed rock (ER), and other cover types that do not support much vegetation that include: developed/residential (1,099 acres [445 ha]), barren-disturbed (69 acres [28 ha]), industrial (731 acres [296 ha]), and recreational areas (241 acres [98 ha]). All but 12 acres (5 ha) of the barren habitats are associated with the proposed Project.

- Rock Talus (RT) - Rock talus habitats occupy 559 acres (226 ha) or 1.1 percent of the study area in six of 11 study area sections and are particularly abundant in the J.C. Boyle peaking and J.C. Boyle bypass reaches (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). Most rock talus habitats are barren with small patches of vegetation where the talus is thin or at the margins of the talus patch. A total of two tree, seven shrub, and 23 herbaceous plant species was documented in the rock talus habitats sampled in 2002. Poison oak, deerbrush, western serviceberry, hedge parsley, woolly sunflower (*Eriophyllum lanatum*), squirreltail, cheatgrass, bluebunch wheatgrass, and orange honeysuckle (*Lonicera ciliosa*) are common species associated with RT. The average shrub cover for the RT habitats is 13.8 ± 10.9 percent; the herb layer cover is 7.0 ± 12.0 percent, and the tree layer cover is 5.3 ± 9.8 percent.

- Exposed Rock (ER) - ER habitats are distributed over 375 acres (226 ha) or 0.71 percent of the study area in nine of 11 study area sections; no exposed rock was mapped in the Keno reservoir and the Link River sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). ER habitat is most abundant in the J.C. Boyle peaking reach, the J.C. Boyle bypass, and Copco No. 2 bypass. A total of four tree, three shrub, and 51 herbaceous plant species was documented in ER habitats. A wide variety of species occurs in exposed rock habitats, including cheatgrass, bulbous bluegrass, gray rabbitbrush, and bluebunch wheatgrass, naked-stemmed buckwheat, woolly sunflower, spectacular penstemon (*Penstemon speciosus*), foxtail fescue, variable-leaf phacelia, western juniper saplings, wedgeleaf ceanothus, and three-leaf sumac. The average herb layer cover for the ER habitats is 35.0 ± 23.9 percent; the shrub layer cover is 22.0 ± 16.1 percent, and tree cover is less than 3 percent.

Developed and Disturbed Habitats

Developed and disturbed habitats include five types: developed/residential, barren-disturbed, industrial, pasture/irrigated hayfield, and recreation. Of these, only the pasture/irrigated hayfield (P/IH) was characterized.

Pasture/Irrigated Hayfield (P/IH) - Pastures and irrigated hayfields are distributed over 3,675 acres (1,488 ha) or 6.9 percent of the study area in four of 11 study area sections (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). More than 85 percent or 3,139 acres (1,312 ha) of the pasture/irrigated hayfields was mapped around Keno reservoir, outside of the area associated with the proposed Project. The other two study area sections with substantial amounts of this cover type are J.C. Boyle peaking reach (358 acres [145 ha]) and the Iron Gate-Shasta section (164 acres [66 ha]). Yellow starthistle, prickly lettuce, timothy, curly dock, common knotweed (*Polygonum arenastrum*), plantain (*Plantago lanceolata*), morning glory (*Convolvulus arvensis*), and bull thistle are the most frequent pasture species, but graminoid species were under-represented because of grazing or hay cutting at the time of sampling.

Riverine and Lacustrine Habitats

Riverine and lacustrine habitats occupy approximately 5,077 acres (2,055 ha) or 9.6 percent of the study area (see Table E5.2-1; Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). The reservoirs represent the entire lacustrine habitat in the study area and cover 4,333 acres (1,754 ha); 2,083 acres (843 ha) are created by Keno reservoir and the Link River dam and are not part of the proposed Project. Riverine unconsolidated bottom, which includes the semi-permanently flooded flowing water of the Klamath River, totaled 726 acres (294 ha), of which 76 percent is associated with the proposed Project. Riverine and lacustrine unconsolidated shoreline or "gravel" bar habitats cover a total of 17.2 acres (7.0 ha). Several of the reservoirs and river reaches have pockets of submerged aquatic vegetation. In total, approximately 293 acres (119 ha) of aquatic bed habitat were mapped, but many more areas that were too small to effectively map had submerged aquatic vegetation. Most of the acreage was at Keno reservoir. Dominant species include pondweeds (especially *Potamogeton crispus*) and coontail.

E5.2.1.2 Habitats of Special Concern

The primary habitats of special concern include: (1) riparian and wetland habitats, (2) late-successional conifer forest, (3) snag and coarse wood rich habitats, (4) caves, cliffs, and talus, and (5) willows and reed canarygrass. The following sections briefly describe each of these communities.

Riparian and Wetland Habitats

Wetlands provide habitat for numerous plant and wildlife species, collect and hold water, buffer the effects of floods, and conserve moisture for drier seasons of the year. Wetlands are federally protected under the Clean Water Act (CWA), and management of this resource is within the jurisdiction of the U.S. Army Corps of Engineers (COE). Similarly, riparian areas provide critical diversity and stability in forested ecosystems, including: (1) multiple vegetation layers that provide a variety of nesting sites, cover areas, and food sources for wildlife, (2) vegetation that absorbs nutrients and sediment, (3) vegetation roots that stabilize streambanks, lake shores, and adjacent slopes, and (4) vegetation that shades streams and maintains low water temperatures (USFS, 1990a). Riparian areas have been shown to support more wildlife species than adjacent uplands, particularly in arid environments, and are particularly important for breeding birds (Kauffman et al. 2001; CalPIF, 2002; RHJV, 2000).

Within the entire area mapped for the terrestrial resources studies, wetland habitat occupies approximately 2,239 acres (906 ha) and riparian habitats occupy 598 acres (242 ha). Under current conditions, between 19 and 30 percent of the shorelines along the three Project reservoirs—J.C. Boyle, Copco, and Iron Gate—are bordered by riparian/wetland habitat. Currently, wetland and riparian vegetation along reservoirs is limited mostly to small patches in protected locations and near inlets/tributaries. There are, however, several large wetland and riparian habitats associated with J.C. Boyle reservoir and tributaries and seeps near the Project reservoirs. As hydroperiod is widely considered to be a major influencing factor in many riparian and wetland ecosystem processes (Gregory et al. 1991; Poff et al. 1997), each study area section with differing hydrology has wetland and riparian habitats that differ in composition and function.

The riparian/wetland study conducted by PacifiCorp provides information that: (1) quantifies the potential relationship between riparian and wetland vegetation patterns and flow regimes, and (2) investigates how riparian vegetation patterns relate to fluvial geomorphic processes including sediment flow and deposition in the Klamath River reaches. These data come from 1,085 plots distributed among 113 sampling sites in the 11 study area sections. The following sections describe the riparian communities in each of the study area sections. See the Terrestrial Resources FTR, Section 3.0, for a detailed discussion of the wetland/riparian study.

<u>J.C. Boyle Reservoir</u>. Approximately 30 percent of the J.C. Boyle reservoir shoreline currently is bordered by riparian/wetland vegetation. The J.C. Boyle reservoir riparian/wetland zone is restricted to herbaceous types, but is wider and more diverse than Iron Gate and Copco reservoirs. The fact that little woody riparian vegetation occurs along the J.C. Boyle shoreline seems consistent with the historical conditions that were present along the Klamath River before dam construction. The pre-Project aerial photography indicated that only a narrow band of riparian/wetland vegetation with few trees or shrubs bordered the Klamath River in this area and only occurred along about the same proportion of the river shoreline as currently exists along the reservoir (see Terrestrial Resources FTR, Section 3.7). Although some woody riparian vegetation does occur in PSS wetlands in Spencer Creek, a major tributary to the reservoir, the limited historical occurrence of willow in the area may explain why there are generally few willows along J.C. Boyle reservoir today.

The current wetland/riparian zone at J.C. Boyle reservoir averages 136 ± 68 feet (41 ± 21 m) wide and is composed of six vegetation types: (1) Kentucky Bluegrass/Teasel/Beardless Ryegrass/Canada Thistle, (2) Sedge/Baltic Rush/Bentgrass/Kentucky Bluegrass, (3) Hardstem Bulrush/Stinging Nettle/Cattail, (4) Hardstem Bulrush/Broad Fruited Bur-reed/Duckweed/Knotweed, (5) Marsh Spikerush/Bentgrass/American Speedwell, and (6) Needle Spikerush/Canadian Smartweed (Figure E5.2-1). The wetland and riparian vegetation types occur in a narrow elevational range relative to the normal full pool (-0.85 ± 1.57 feet [-0.3 ± 0.5 m]). This vertical range is substantially less than what was found at the other three reservoirs studied by PacifiCorp and could be the result of, at least partially, the greater daily water level fluctuations and the much more gradual bank slopes along much of the shoreline.

Reed canarygrass was relatively uncommon at J.C. Boyle reservoir and occurred at elevations that are inundated 14 to 93 percent of the growing season (average = 58 ± 23 percent).

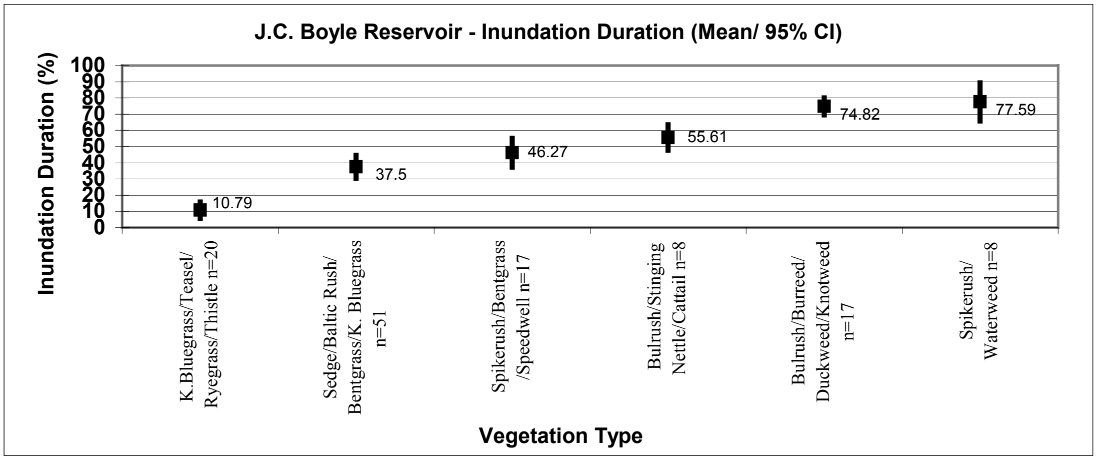


Figure E5.2-1. Inundation duration of vegetation communities at J.C. Boyle reservoir.

<u>J.C. Boyle Bypass and Peaking Reaches</u>. The riparian/wetland community in the J.C. Boyle bypass and peaking reaches is composed of 11 vegetation types: (1) Perennial Ryegrass (2) Kentucky Bluegrass/Yarrow/Field Cress, (3) Kentucky Bluegrass/Timothy/Colonial Bentgrass, (4) Mock Orange, (5) Oregon Ash/Colonial Bentgrass/Woolly Sedge, (6) Oregon Ash/ Himalayan Blackberry, (7) Oregon Oak/Western Serviceberry/Snowberry, (8) Coyote Willow/ Reed Canarygrass/Colonial Bentgrass, (9) Mock Orange/Reed Canarygrass, (10) Reed Canarygrass, and (11) Hardstem Bulrush/Reed Canarygrass (Figure E5.2-2).

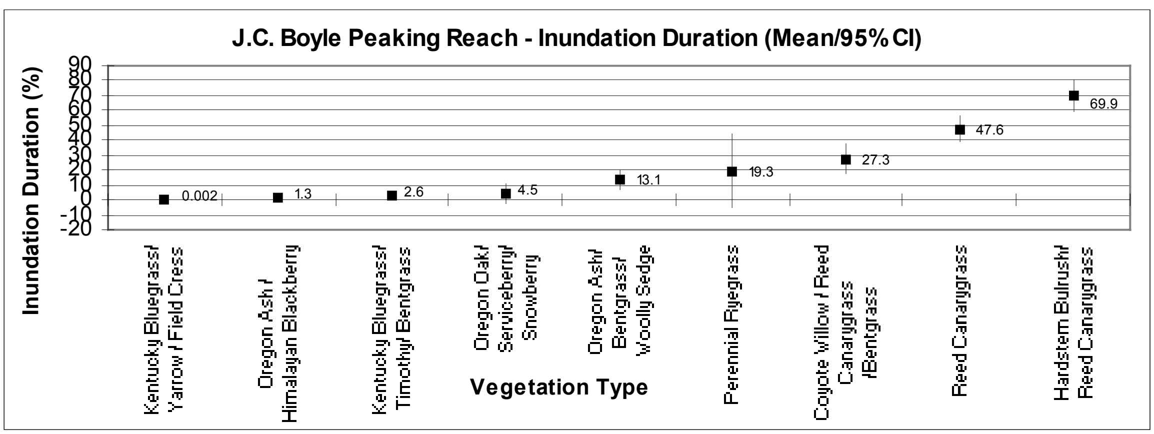


Figure E5.2-2. Inundation duration of vegetation communities at J.C. Boyle peaking reach.

Within the J.C. Boyle bypass reach, discharge and inundation duration performed best as explanatory variables for the distribution of riparian/wetland vegetation types (Terrestrial Resources FTR, Section 3.0, Table 3.7-3). The Reed Canarygrass vegetation type that grows in the active channel and also extends upslope among the large boulders has high inundation duration values. There is evidence that other herbaceous species, such as sedge (*Carex* sp.) (possibly *Carex* cf. *nudata*), are reproducing in the area. Significant changes to geomorphology were observed in the J.C. Boyle bypass reach (see Water Resources FTR, Section 6.7.6). Major channel changes appear to be a result of the sidecast material generated from original Project canal and road construction, and, more recently, from erosion associated with the emergency spillway. The material has constricted the channel and has altered the riparian vegetation along much of the reach, although the most significant effects are limited to the downstream-most 0.5

mile (0.8 km) of the reach below the emergency spillway. The geomorphological changes have caused a slight narrowing of the riparian zone; the effects were minimal because of the naturally narrow floodplain.

In the J.C. Boyle peaking reach, young willows grow at several locations on the higher elevation portions of mid-channel islands; Douglas' spiraea was observed growing on larger terraces. High percentages of plots representing the (1) Coyote Willow/Reed Canarygrass/Bentgrass, (2) Reed Canarygrass, and (3) Hardstem Bulrush/Reed Canarygrass vegetation types occur within or below the "varial zone" (350 to 3,000 cfs [9.9 to 85.0 cms]) (see Terrestrial Resources FTR, Section 3.7, Figure 3.7-15). Between 65 and 100 percent of the remaining peaking reach riparian/ wetland vegetation types occur above the varial zone. The plots representing the (1) Coyote Willow/Reed Canarygrass/Bentgrass, (2) Perennial Ryegrass, and (3) Oregon Ash/Colonial Bentgrass/Woolly Sedge vegetation types are the most equitably distributed vegetation types across the upper boundary of the varial zone. The pattern of reed canarygrass abundance within the varial zone of the peaking reach appears to be positively correlated with elevation (as represented by discharge and inundation in Figures E5.2-3 and E5.2-4, respectively). Reed canarygrass density peaks at an average of 1,967 cfs (55.7 cms), 15.5-hour inundation frequency, and 35.5 percent inundation duration. Almost no vegetation plots sampled above the varial zone contained dense reed canarygrass, indicating the conditions created by the daily ramping are favorable to this species and may hinder germination and growth of native plant species. Reed canarygrass seeds germinate best immediately following maturation and some seed remains viable throughout the winter and following summer (Vose, 1962), giving this species a competitive advantage over many species. Kercher and Zedler (2004) suggest that added nutrients and increasing flood intensities may increase the invasiveness and aggressiveness of reed canarygrass.

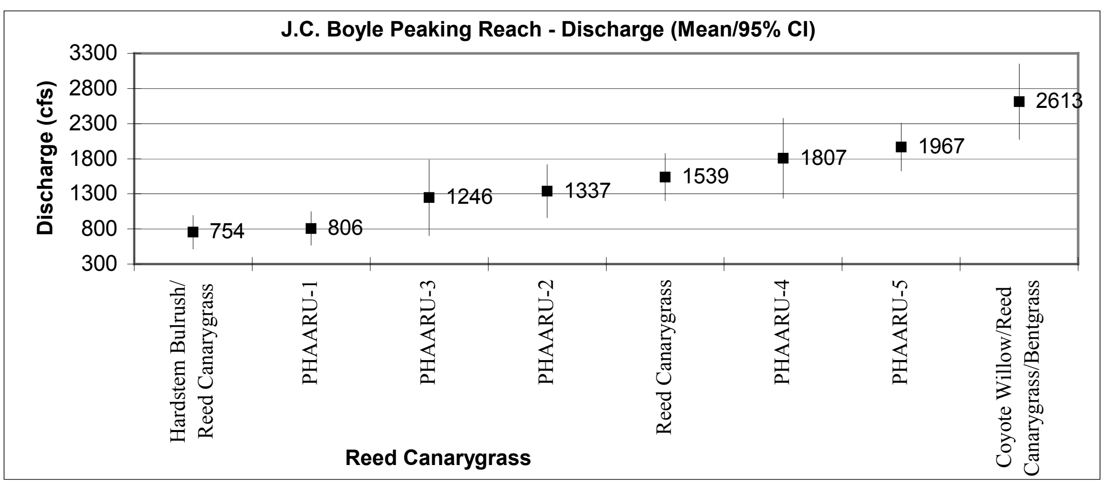


Figure E5.2-3. Discharge for reed canarygrass (PHAARU) cover classes (1 = less than 5 percent, 2 = 6 to 25 percent, 3 = 26 to 50 percent, 4 = 51 to 75 percent, and 5 = 76 to 100 percent) and vegetation communities in the J.C. Boyle peaking reach within the varial zone dominated by reed canarygrass. Discharge is positively related to river stage (i.e., elevation).

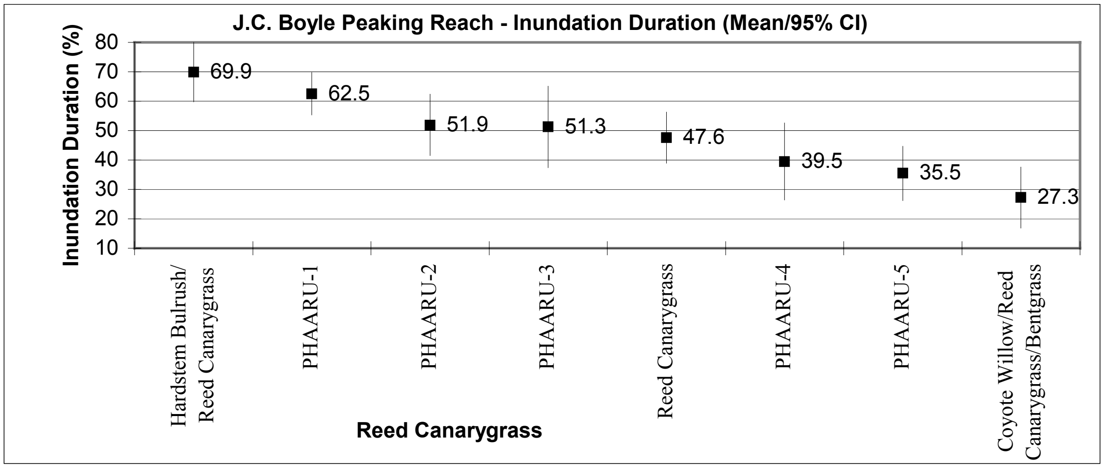


Figure E5.2-4. Inundation duration for reed canarygrass (PHAARU) cover classes (1 = less than 5 percent, 2 = 6 to 25 percent, 3 = 26 to 50 percent, 4 = 51 to 75 percent, and 5 = 76 to 100 percent) and vegetation communities dominated by reed canarygrass in the J.C. Boyle peaking reach within the varial zone. Inundation is negatively related to elevation.

There was no strong association between coyote willow abundance and position along the inundation/elevation gradient within the varial zone of the peaking reach (willow generally occurs at elevations above the varial zone). Willow seed is viable only for about 1 week after dispersal and germinates on moist, bare mineral soil (Hansen et al.1988a; Ware and Penfound, 1949). Along with the presence of reed canarygrass that may prohibit willow germination by shading, the daily peaking may inhibit willow germination by flooding seed and seedlings before they can develop.

In the reach from J.C. Boyle powerhouse to Frain Ranch, the channel did not change significantly from 1955 to 2000, although there were minor changes on some alluvial features (see Water Resources FTR, Section 6.7.6). In the steep gradient sections of the J.C. Boyle peaking reach, there has been essentially no change in channel shape or geomorphology.

The section of river near the mouth of Shovel Creek in the J.C. Boyle peaking reach is an example of local changes in channel form and associated riparian vegetation. In this reach, the mid-channel island and small side channel just downstream of the bridge at Shovel Creek changed significantly between 1955 and 2000 (see geomorphology discussion in the Water Resources FTR, Section 6.7). The mid-channel island increases in area while the side channel appears to decrease in length. Also, the outside bend just downstream of the "Miller Bridge" appears to be more undercut in 2000 than in 1955. Distribution and density of riparian vegetation does not appear to have changed significantly from 1955 to 2000, except where new surfaces associated with channel form changes have been colonized. The patterns of erosion, deposition, and consequent vegetation recruitment and establishment appear to be typical of what would be expected in a natural river system with similar geomorphology. However, colonizing species such a coyote willow may not colonize new areas from seed, but instead may invade new areas by vegetative suckering and possibly by root fragments.

Copco Reservoir. The average riparian/wetland zone at Copco reservoir is 39 ± 12 feet (11.9 ± 3.7 m) wide. Only about 19 percent of the Copco reservoir shoreline is bordered by wetland and riparian habitat. This lack of significant riparian and wetland habitat is largely the result of the generally steep slopes along the shoreline. The bank slope in sampled sites averaged about 19 percent compared to 3 percent at J.C. Boyle reservoir. Only along low-gradient shorelines, especially near inlets, is the topography suitable for riparian and wetland vegetation development. Residential development at the upper portion of the reservoir reduces shoreline available for native vegetation. Currently, most of the wetland and riparian habitat is herbaceous, although in some areas coyote willow is abundant. There is strong circumstantial evidence that herbivory (and trampling) could be responsible for some mortality of willow in some locations along the reservoir. The absence of bare substrates at elevations suitable for willow seed germination may be the most important factor limiting the distribution of willow.

There were four riparian/wetland vegetation types identified at Copco reservoir during relicensing studies: (1) Starthistle/Medusahead/Hairy Brome, (2) Coyote Willow, (3) Hardstem Bulrush/Broad Fruited Bur-reed/Duckweed/Knotweed, and (4) Hardstem Bulrush/Stinging Nettle/Cattail (Figure E5.2-5). Copco reservoir, like the other reservoirs, has a high incidence of weedy species around the reservoir. Reed canarygrass is uncommon, but occurred in plots with 25 to 67 percent inundation (mean = 37 ± 13 percent).

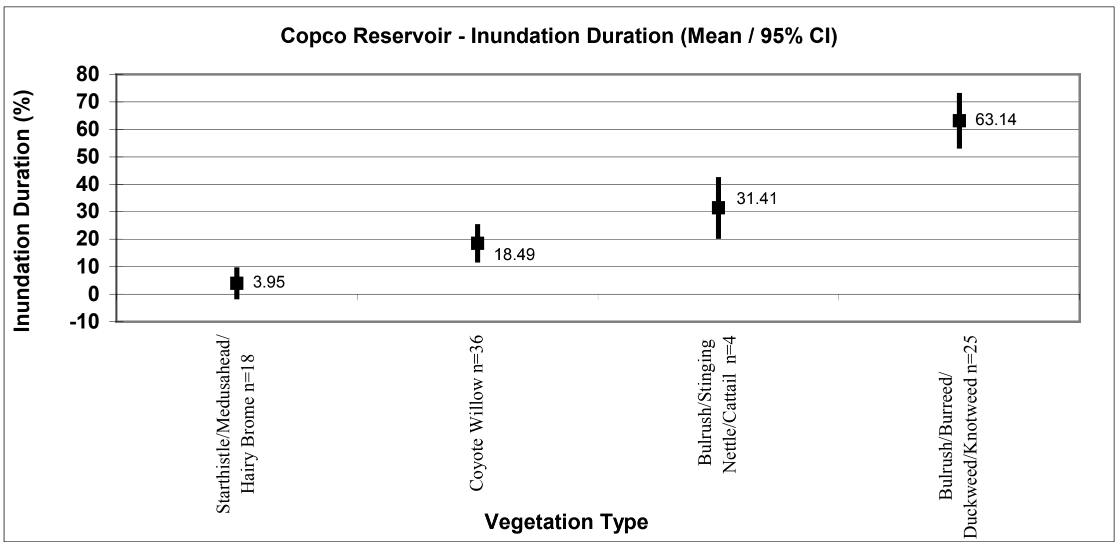


Figure E5.2-5. Inundation duration of vegetation communities at Copco reservoir.

<u>Copco No. 2 Bypass</u>. The riparian vegetation at Copco No. 2 bypass is unique compared to other Project river reaches for the many large white alder that dominate the tree canopy. The Copco No. 2 bypass reach has four primary riparian/wetland vegetation types (1) Devil's Beggarstick/ Knotweed, (2) White Alder/Rice Cutgrass/Hairy Willowherb, (3) White Alder/Oregon Ash, and (4) Oregon Ash/Himalayan Blackberry/Blue Wildrye. The Copco No. 2 bypass vegetation types sort by elevation despite the fact that seepage from the adjacent penstock intercepts the left bank in many places and creates many wetlands habitats in the former active river channel. The encroachment of vegetation into the channel is obvious with numerous mature alder occupying what was formerly in-channel islands and bar. Copco dam predates the first available aerial photographs for this reach (1955) by approximately 30 years. It is clear that much woody vegetation has encroached into the narrow river channel since the diversion of all but 10 cfs (0.3 cms) began. Some additional encroachment is evident when comparing 1955 and 1994 aerial photos.

Iron Gate Reservoir. Currently, approximately 22 percent of the Iron Gate reservoir shoreline is bordered by riparian and wetland vegetation. As with Copco reservoir, the steep shorelines that border much of the reservoir—riparian transects averaged 23 percent slope—are not conducive for extensive riparian and wetland development. Trampling and grazing by cattle along the shorelines likely contributes to the degraded nature of the wetland/riparian communities in some sections of the reservoir. Historically, the river in this area was bordered by narrow bands of riparian shrub and deciduous vegetation (approximately 68 percent of shoreline) with oak and grassland types interspersed. Five wetland/riparian vegetation types were classified at Iron Gate reservoir: (1) Starthistle/Medusahead/Hairy Brome, (2) Coyote Willow, (3) Hardstem Bulrush/ Broad Fruited Bur-reed/Duckweed/Knotweed, (4) Sedge/Baltic Rush/Bentgrass/Kentucky Bluegrass, and (5) Marsh Spikerush/Bentgrass/American Speedwell (Figure E5.2-6). There are many narrow patches of coyote willow along the sections of low-gradient shoreline, particularly in protected inlets, and along steeper shorelines where surrounding uplands have slumped or eroded into the water creating a shelf that provides the appropriate substrate and inundation pattern. Reed canarygrass was not common, occurring in only two plots with inundation durations of 9 and 28 percent.

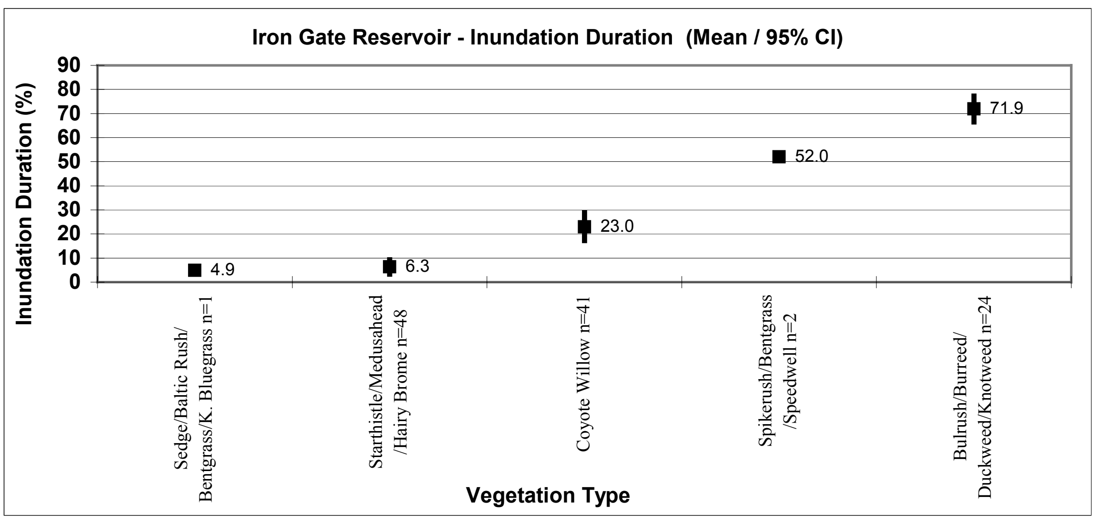


Figure E5.2-6. Inundation duration of vegetation communities at Iron Gate reservoir.

Fall Creek. Ordination of plot data resulted in four vegetation types along Fall Creek: (1) Oregon Ash/Western Birch, (2) Oregon Ash/Douglas' Spiraea, (3) White Alder, and (4) Ponderosa Pine/ Douglas-fir/Western Serviceberry. These communities are influenced by a combination of Fall Creek flows and seepage from the Fall Creek canal. Seepage from the Fall Creek canal results in wetland vegetation at higher elevations along Fall Creek than would be encountered if there were no canal seepage. However, in downstream portions of Fall Creek where the creek is not influenced by canal seepage, the gradient of the creek steepens and the riparian vegetation becomes narrow. The relatively long history of upstream diversion since 1903 (Spring Creek and Fall Creek canal) and seepage from the Fall Creek Canal have created a riparian vegetation with both wetland and upland species growing in close proximity to one another.

Iron Gate to Shasta River Reach. There were 12 vegetation types identified along the Iron Gate to Shasta River segment: (1) Chicory/Tall Fescue, (2) Oregon Oak/Blue Wildrye, (3) Oregon Ash/Colonial Bentgrass/Kentucky Bluegrass, (4) Coyote Willow/Poison Hemlock, (5) Coyote Willow/Himalayan Blackberry, (6) Oregon Ash/Colonial Bentgrass/Woolly Sedge, (7) Coyote

Willow/Rice Cutgrass, (8) Coyote Willow/Knotgrass, (9) Rice Cutgrass/Hardstem Bulrush, (10) Curly Pondweed, (11) Hardstem Bulrush/Duckweed, and (12) Medusahead/Cheatgrass (Figure E5.2-7).

This river reach appears to have had increased riparian development since the construction of Iron Gate dam as evidenced by several vegetated bars that now occur. Some of the development is also likely a function of changes in channel form as a result of the I-5 construction and irrigation return that was not present historically. Downstream of Iron Gate dam, the most significant channel changes were observed immediately downstream of the dam, and near tributary and mainstem mining sites (see Water Resources FTR, Section 6.7). Many of the most significant changes appeared to be associated with the construction of the fish hatchery on the alluvial fan of Little Bogus Creek just downstream of the dam. Some minor local channel changes were apparent in a reach near Klamathon between 1944 and 1994 (see Terrestrial Resources FTR, Section 6.0, Figures 6.7-21 and 6.7-22). In this reach, the fringe of bank vegetation appears to be better developed in 1994 than in 1944. Also, a bar upstream of the railroad bridge appeared large and more densely vegetated in 1994 than in 1944.

There is no obvious reason that reed canarygrass is not common on the river reach downstream of Iron Gate dam. The current flow regime mandated by the Biological Opinion (BO) for TES fish protection appears to be consistent with maintaining native riparian communities.

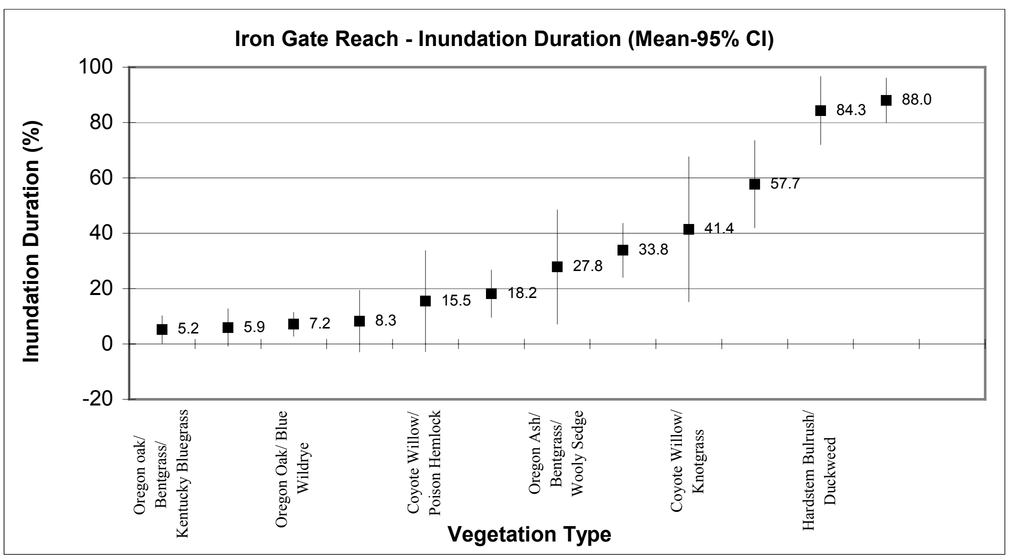


Figure E5.2-7. Inundation duration of vegetation communities at Iron Gate-Shasta reach.

Late-Successional Conifer Forest

Late-successional forests are considered to be highly important as wildlife habitat for a large number of wildlife species. Both eastside and westside forests tend to have more species associated with large trees and especially multi-canopy stands (Olson et al. 2001). In the Klamath River study area, only 13 acres (5 ha) of forests (all in the J.C. Boyle peaking reach not near any Project facilities) were classified as having large-diameter (more than 24 inches [61 cm] dbh) trees. There are 8,435 acres (3,414 ha) of forests with small to moderately large trees (11 to 24 inches [28 to 61 cm] dbh). The Project has no effect on late-successional conifer forest.

Snag and Coarse Wood Rich Habitats

The importance of snags and down wood to wildlife is well documented (Butts and McComb, 2000; Bull et al.1997). In Douglas-fir forests of southern Oregon, species richness of terrestrial vertebrates taken as a single group increases with increasing volumes of CWD with species richness of small mammals, insectivores, and amphibians all correlated positively with CWD volume; rodent richness shows no significant relationship with CWD (Maquire, 2002). The Klamath Falls Resource Area Resource Management Plan (BLM, 1995) calls for maintaining the number of snags needed to support at least 60 percent of the maximum biological potential of cavity-nesting species over time. It should be noted that more recent research indicates that greater numbers of snags are needed to provide for wildlife habitat needs and ecosystem function than were previously thought (Rose et al. 2001).

The study area habitats provide sufficient snags to meet at least 60 percent of the maximum population needs for all six cavity-nesting species that occur—downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Picoides villosus*), pileated woodpecker (*Dryocopus pileatus*), acorn woodpecker (*Melanerpus formicivorus*), Lewis' woodpecker (*Melanerpes lewis*), and red-breasted sapsucker (*Sphyrapicus ruber*) (see Terrestrial Resources FTR, Section 2.7.3). Riparian deciduous, riparian mixed, and riparian shrub types all greatly exceed the density of snags needed to provide for 100 percent of the maximum biological potential for all species except acorn, pileated, and Lewis' woodpeckers, which require snags more than 17 or 25 inches (43 or 63 cm) dbh (see Terrestrial Resources FTR, Section 2.0, Table 2.7-8). However, 20 sampled forested wetlands meet the 60 percent level for all species except the hairy woodpecker. Scrub-shrub wetlands have adequate snags for all species except pileated woodpecker. The density of snags suitable for downy woodpeckers (more than 11 inches [27.8 cm] dbh) ranged from zero snags/acre in non-forested cover types to 10.1 ± 14.3 snags/acre (25 ± 35.3 snags/ha) in riparian mixed deciduous-coniferous forest, but overall, averages 1.4 ± 5.2 snags/acre (3.5 ± 12.8 snags/ha) across all plots in all cover types (see Terrestrial Resources FTR, Section 2.0, Table 2.7-9). This density greatly exceeds the number needed to maintain downy woodpecker populations (see Terrestrial Resources FTR, Section 2.0, Table 2.7-8). The density of snags more than 25 inches (62.5 cm) dbh is low in all cover types except the Klamath mixed conifer, riparian mixed, and lodgepole pine forest.

The Northwest Forest Plan (USFS and BLM, 1994) calls for at least 120 linear feet (36 m) of logs greater than 16 inches (41 cm) diameter and 16 feet (4.9 m) in length per acre (0.4 ha) in matrix lands. This standard considers only logs of composition classes 1 and 2. Only in the Klamath mixed conifer cover type is there sufficient down wood to meet that standard, although oak-conifer and riparian deciduous stands are close to meeting it (see Terrestrial Resources FTR, Section 2.0, Table 2.7-10). Most of the other cover types have low numbers of large downed wood with few areas having logs more than 16 inches (41 cm) diameter.

One potential way to evaluate the CWD availability is to compare estimates to the criteria listed for federal lands. The Klamath Falls Resource Management Plan standard for CWD retention in matrix land on the Klamath River matches the Northwest Forest Plan eastside management criteria that call for a minimum of 50 feet (15.2 m) of logs per acre greater than 12 inches (30.5 cm) diameter and 8 feet (2.4 m) long (BLM, 1995). There are four cover types—MHO, J, PP, and KMC—that have mean values that exceed these criteria as calculated for all decay classes combined (see Terrestrial Resources FTR, Section 2.0, Table 2.7-11).

In terms of CWD volume, sampling in the study area found widely varying amounts of wood depending on cover type (see Terrestrial Resources FTR, Section 2.0, Table 2.7-12). In many habitats, the volume of downed wood appears to be comparable to regional estimates. For example, in ponderosa pine forests, the CWD volume of 362 $feet^3$/acre (25.3 m^3/ha) is identical to the volume for all CWD reported for Oregon and Washington for all successional stages combined (Ohmann and Waddell, [in press] as cited in Rose et al. 2001). Juniper woodland habitat had 101 $feet^3$/acre (7.1 m^3/ha) compared to 106 $feet^3$/acre (7.4 m^3/ha) in the Northwest. The Klamath mixed conifer forest plots have CWD volume that is between the volume estimates for total wood in early- and mid-successional stands of eastside mixed conifer in Oregon and Washington (Ohmann and Waddell [in press] as cited in Rose et al. 2001). The abundance of CWD in the montane hardwood-oak/conifer type was 475 $feet^3$/acre (33.2 m^3/ha) compared to 733 $feet^3$/acre (51.3 m^3/ha) for all westside white oak/Douglas-fir forests (Ohmann and Waddell [in press] as cited in Rose et al. 2001).

The Project does not affect CWD or snag availability except at a minor level as a result of occasional hazard tree removal and vegetation clearing conducted along transmission lines, roads, and Project facilities.

Riparian communities are important in providing wood to riverine areas for fish and wildlife habitat. In the Klamath River study area, abundance of CWD varies significantly among riparian habitats along reservoirs and river reaches. At the two extremes were the Link River and Fall Creek, where there were zero and 561 feet/acre (423 m/ha), respectively. The other river reaches were intermediate in log abundance. The Keno Canyon and J.C. Boyle reaches had 87 and 119 feet/acre (66 and 90 m/ha), respectively, but the Iron Gate to Shasta River reach had only 20 feet/acre (15 m/ha). Much of the J.C. Boyle peaking reach is bordered by forested habitat (either upland or riparian) that can supply the system with logs, but most of the immediate river shoreline is lacking in CWD. Apparently, logs that reach the river are quickly transported downstream.

Along reservoirs, log abundance was extremely low. At Keno reservoir, there were no logs in sampling plots, while J.C. Boyle, Copco, and Iron Gate reservoirs had 12, 8, and 58 feet/acre (9, 6, and 44 m/ha), respectively. The lack of forested habitat upslope of most of the reservoirs limits the availability of logs along the shoreline. Recreationists likely reduce CWD availability near recreation sites along reservoirs and river segments. The Water Resources FTR, Section 6.7, Table 6.7-5, provides additional data on the availability of woody debris along river reaches.

Caves, Cliffs, and Talus

Because of their microhabitat characteristics (wet seeps, rock crevices, etc.) and inaccessibility to humans, caves, cliffs, and talus slopes often support unique wildlife and plant species. Caves are particularly important for several bat species and raptors that often nest on cliff ledges. Talus slopes provide habitat for a variety of reptiles and small mammals. The Federal Cave Resource Protection Act of 1988 and Cave Management Act of 1990 mandate the identification of significant caves on federal lands to regulate or restrict use, protect sensitive geologic features and biota, and ensure consideration of caves in land management plans. Complete inventories of the caves in the study area have not been conducted. There is one significant cave—Salt Caves—that is located well above the river channel on the south side of the river in the J.C. Boyle peaking reach between the Frain Ranch and the Oregon-California border. This cave is visited periodically by recreational boaters.

Talus slopes cover approximately 560 acres (226 ha) near the Project reservoirs and on PacifiCorp-owned lands. The study area also includes more than 375 acres (152 ha) of cliff/ exposed rock slopes. Many of these mapped talus areas as well as the numerous rock/talus and exposed rock areas contain small caves, fissures, and ledges.

The Project does not directly affect talus or cave habitat. Human activity at Salt Caves is a potential issue because of the possible disturbance of bats that use the site.

E5.2.1.3 Plant Species with Federal and/or State Status

TES refers to species considered to be declining in population and/or in danger of extinction. The following are summaries of the several tiers of protection for TES plants:

- Plants listed or proposed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) are protected under the Endangered Species Act (ESA) of 1973, as amended.
- Taxa designated by the USFWS as candidates for listing or species of concern may be proposed for listing at a future time, but are not protected by the ESA.
- Plants on the U.S. Forest Service (USFS) Regional Forester’s Sensitive Species List are given special management consideration on national forests.
- Plants designated as sensitive by the BLM are given special management consideration on lands administered by the BLM.
- Plant species listed by the California Department of Fish and Game (CDFG).
- Plant species listed by California Native Plant Society (CNPS).
- Plant species listed by the Oregon Department of Agriculture (ODA) are protected by state statute in Oregon.
- Plants considered rare or declining are monitored by the Oregon Natural Heritage Program (ONHP), but are not protected by federal or state statute unless already listed by the USFWS or ODA.

In addition to the TES species, a list of culturally sensitive plant species found in each study area section was provided to the Cultural Resources Working Group for analysis. This information is confidential.

PacifiCorp conducted a search of federal and state databases of TES plants, which indicate that 65 vascular plants, three bryophytes, and ten lichens with TES status potentially occur in the study area, including the lands surrounding the reservoirs, PacifiCorp-owned lands, and the transmission line ROW (Table E5.2-2; letter from B.G. Halstead, Project Leader, USFWS, Arcata, California, April 19, 2002; letter from J.C. Knight, Chief, Endangered Species Division, USFWS, Sacramento, California, April 13, 2001; CDFG website; letter from K.M. McMaster, State Supervisor, USFWS, Portland, Oregon, January 8, 2001; California Native Plant Society website; BLM unpublished data). This list is relatively large because the study area includes a considerable variety of habitat types and elevations. Two of the potentially occurring species—Applegate's milkvetch and slender orcutt grass (*Orcuttia tenuis*)—are federally listed as endangered and threatened, respectively. Four species are listed as threatened or endangered species by the state of Oregon. A total of 38 of the species is either List 1a, 1b, or 2 species listed by the CNPS (Table E5.2-2). Culturally sensitive (CS) species were compiled on the basis of review of a species list provided by the Cultural Resource Work Group (a confidential list) and on information from the Klamath Falls BLM archeologist. Information on the CS plants is confidential. Results of surveys conducted in the study area are summarized below.

Seventy-nine occurrences of 14 species of TES plants were documented in the study area either during 2002 surveys or previously by the BLM, ONHP, or California Natural Diversity database (CNDDB) (Table E5.2-3).

The only federally listed species documented in the study area was Applegate's milkvetch. This species was reported by the ONHP to occur near Keno reservoir. One potentially new population of Applegate's milkvetch was found within 45 to 100 feet (17 to 30 m) of Keno reservoir. The population extends along the reservoir for approximately 250 feet (76 m). The height or elevation of the site above the reservoir water surface was estimated at less than 2 feet (0.6 m).

The identification of two of the 14 TES plant species has not been confirmed; these species include red root yampah (*Perideridia erythrorhiza*) and Lemmon's silene (*Silene lemmonii*). They are included in this discussion for the following reasons: (1) these occurrences in the study area are a matter of record with the BLM Klamath Falls office, (2) in the case of red root yampah, not all of the sites have been fully assessed for the identity of the species of *Perideridia* observed growing in the sites, and (3) in the case of Lemmon's silene, the plants found, keyed best to *Campanulate silene*.

The J.C. Boyle peaking reach section had 37 occurrences of eight TES species—Greene's mariposa lily (*Calochortus greenei*), Bolander's sunflower (*Helianthus bolanderi*), pendulus bulrush (*Scirpus pendulus*), Howell's yampah *(Perideridia howelii)*, Bellinger's meadow foam *(Limnanthes floccosa)*, Lemmon's silene, mountain lady's slipper (*Cypripedium montarum*), and red root yampah. Other sections with a large number of TES plant occurrences include the Iron Gate reservoir, which had three species and 15 separate occurrences, and Keno reservoir, which had four species and ten occurrences.

One TES plant site in the J.C. Boyle peaking reach potentially affected by flood-level flows is outside of the influence of Project hydrology.

Table E5.2-2. TES plant, fungi, bryophyte, and lichen species potentially occurring in the Klamath Hydroelectric Project study area.

Common Name and Scientific Name	Federal Status	ODA Status	ONHP List	CDFG Status	CNPS List	Habitat	Potential*/Known Locations in Study Area Sections
Vascular Plants							
Slender-Stemmed Androsace *Androsace filiformis*			—		2	Wet, clay meadow soils with grasses and sedges, seen along stream bank in lodgepole pine disturbed by cattle; red fir forests; 1,800 m.	Iron Gate-Shasta
Crater Lake Rockcress *Arabis suffrutescens* var. *horizontalis*	SoC	C	1	—	—	Dry, rocky, pumice or sandy slopes, usually in sparse pine or hemlock forest; 1,500 to 2,700 m.	Keno reservoir and J.C. Boyle reservoir
Klamath Manzanita *Arctostaphylos klamathensis*	SoC	—	—	—	1B	Montane chaparral, subalpine conifer forest, upper montane conifer forest, sometimes on serpentinitic or gabbro substrates.	Fall Creek
Green-Flowered Wild-Ginger *Asarum wagneri*	BS	C	4	—	—	Conifer forests, often with *Abies* spp. or *Pinus ponderosa*.	Fall Creek to Keno Canyon
Applegate's Milkvetch *Astragalus applegatei*	LE	LE	1	—	—	Seasonally moist areas with rabbitbrush, saltgrass, dense silkybent in strongly alkaline soils; 1,250 to 1,350 m.	Known at Keno reservoir
Peck's Milkvetch *Astragalus peckii*	SoC BS	LT	1	—		Dry *Artemisia tridentata*/ *Purshia tridentata* shrublands, sometimes in *Juniperus occidentalis* or *Pinus ponderosa* woodlands; sandy soils; 900 to 1,500 m.	J.C. Boyle reservoir.
Woolly Balsamroot *Balsamorhiza hookeri* var. *lanata*	AS		1		1B	Open woods and grassy slopes, 800 to 1,000 m.	Iron Gate-Shasta J.C. Boyle bypass
Bensoniella *Bensoniella oregano*	S/M	C	1	Rare	1B	Edges of meadows near seeps and small streams in *Abies* zones, often with *Senecio triangularis*, *Mitella ovalis*, *Viola glabella*, *Asarum caudatum*; 900 to 1,400 m.	Fall Creek, J.C. Boyle reservoir
Resin Birch *Betula pumila* var. *glandulifera*			—		2	Edges of bogs, meadows and springs in lower montane to subalpine conifer forests; 1,300 to 2,200 m.	Fall Creek, J.C. Boyle reservoir
Mingan Moonwort *Botrychium minganense*	S/M	—	2	—	2	Moist conifer forests, especially riparian *Thuja plicata* wetlands (but not wet enough to support *Lysichiton*) on duff; occasionally in subalpine meadows, ski slopes and mossy boulder fields under *Acer macrophyllum* or in open shrubland.	Fall Creek

Table E5.2-2. TES plant, fungi, bryophyte, and lichen species potentially occurring in the Klamath Hydroelectric Project study area.

Common Name and Scientific Name	Federal Status	ODA Status	ONHP List	CDFG Status	CNPS List	Habitat	Potential*/Known Locations in Study Area Sections
Mountain Grapefern *Botrychium montanum*	S/M	—	2	—	2	Shady *Thuja plicata* and *Picea engelmannii* forests with sparse understory, near swamps and streams, also in drier *Pseudotsuga menziesii* forest; 950 to 1,800 m.	Fall Creek to J.C. Boyle bypass
Pumice Grapefern *Botrychium pumicola*	SoC BS	LT	1	—		Seasonally moist to dry, alpine, fine to coarse pumice gravels; open pumice fields and treeless ridges to gently rolling slopes; *Pinus contorta* basins with frost pockets; 1,800 to 2,700 m.	J.C. Boyle peaking reach and J.C. Boyle bypass
Greene's Mariposa Lily *Calochortus greenei*	SoC BS	C	1	—	1B	Clay soils in chaparral, or on volcanic outcrops and open, dry gravelly soils, white oak and juniper woodlands or thickets and wedgeleaf ceanothus thickets, 1,000 to 1,900 m.	Iron Gate-Shasta to J.C. Boyle bypass Known at Iron Gate reservoir, Copco reservoir and J.C. Boyle peaking reach
Long-Haired Startulip *Calochortus longebarbatus* var. *longebarbatus*	SoC BS	—	1	—	1B	Seasonally wet meadows within pine forests or sagebrush communities; open, grassy meadows, clay soil. 1,000 to 1,500 m.	J.C. Boyle reservoir
Single-Flowered Mariposa Lily *Calochortus monanthus*	SoC	—	—	—	1A	Meadows and seeps in riparian scrub, at +/- 740 m.	Iron Gate-Shasta
Siskiyou Mariposa Lily *Calochortus persistens*	SoC	—	1	Rare	1B	Lower montane conifer forest, north coast conifer forest, open, rocky areas. 1,000 to 1,500 m.	J.C. Boyle peaking reach
Green-Tinged Paintbrush *Castilleja chlorotica*	SoC BS	—	1	—	—	Open areas in ponderosa pine or mixed conifer forests; loose, sandy soils with *Penstemon davidsonii*, *Artemisia tridentata*, *Heuchera cylindrica*; semiparasitic on shrubs (most notably mountain big sagebrush). 1,900 to 2,500 m.	J.C. Boyle peaking reach to Keno reservoir
Bulb-Bearing Water Hemlock *Cicuta bulbifera*	AS	—	2-ex	—	—	Marshes, bogs, wet meadows, shallow ponds, 70 to 1,150 m	Iron Gate reservoir to Link River
Ashland Thistle *Cirsium ciliolatum*	AS	—	1	LE	2	Dry, rocky, grassland; open woodland on south aspects. 800 to 1,400 m.	Iron Gate-Shasta to J.C. Boyle peaking reach
Mt. Mazama Collomia *Collomia mazama*	SoC BS	—	1	—	—	Alpine meadows and slopes; dry rocky places conifer forests. 900 to 1,850 m.	J.C. Boyle peaking reach
Pallid Bird's-Beak *Cordylanthus tenuis* ssp. *pallescens*	SoC	—	—	—	1B	Lightly disturbed openings in ponderosa pine, Jeffrey pine, and mixed conifer forests; gravelly alluvium, volcanic or ultramafic soils. 1,100 to 1,700 m.	Fall Creek to J.C. Boyle reservoir

Table E5.2-2. TES plant, fungi, bryophyte, and lichen species potentially occurring in the Klamath Hydroelectric Project study area.

Common Name and Scientific Name	Federal Status	ODA Status	ONHP List	CDFG Status	CNPS List	Habitat	Potential*/Known Locations in Study Area Sections
Clustered Lady's Slipper *Cypripedium fasciculatum*	SoC S/M BS	C	1	—	4	Dry, open conifer forests, sometimes in moist riparian habitats, many soil types. 350 to 950 m (to 1,800 m in California).	Fall Creek to J.C. Boyle reservoir
Mountain Lady's Slipper *Cypripedium montanum*	TS S/M	—	4	—	4	Dry, open conifer forests, more often in moist riparian habitats, many soil types; 350 to 950 m. (to 1,800 m in California).	Fall Creek to Keno Canyon Known at J.C. Boyle peaking reach
Oregon Fireweed *Epilobium oreganum*	SoC	C	1	—	1B	Wet, gently sloping stream banks, meadows, and bogs, generally on ultramafic soil. 50 to 2,500 m.	Fall Creek to J.C. Boyle reservoir
Prostrate Buckwheat *Eriogonum prociduum*	SoC	C	1	—	1B	Basalt flows in pine woodlands, occasionally on barren volcanic tuff; with *Artemisia* spp. and *Juniperus*. 1,300 to 2,705 m.	Fall Creek to Link River
Henderson's Fawn Lily *Erythronium hendersonii*	—	—	—	—	2	Lower montane yellow pine forest. 300 to 1,600 m.	Fall Creek, Copco No. 2 bypass
Gentner's Fritillaria *Fritillaria gentneri*	LE	LE				Lower montane yellow pine forest. 300 to 1,600 m.	Fall Creek to J.C. Boyle reservoir
Newberry's Gentian *Gentiana newberryi* var. *newberryi*	AS	—	2	—	—	Meadows and seeps. Moist conditions in meadows and along streambanks. 1,200 to 2,200 m.	Fall Creek to J.C. Boyle reservoir
Klamath Gentian *Gentiana plurisetosa*	SoC	—	—	—	4	Lower and upper montane conifer forest, meadows and seeps, mesic. 1,000 to 3,000 m.	Fall Creek to J.C. Boyle reservoir
Bolander's Sunflower *Helianthus bolanderi*	TS		3			Yellow pine forest, foothill (oak) woodland, chaparral sometime in serpentine substrates or wet habitats. Zero to 1,500 m.	Iron Gate-Shasta to J.C. Boyle reservoir Known at Iron Gate and J.C. Boyle peaking reach
Salt Heliotrope *Heliotropium curvasassavicum*	TS		3			Low drying ponds on east side of Cascades.	Keno reservoir, Link River Known at Keno reservoir
Vanilla Grass *Hierochloe odorata*	TS	—	3	—	2	Meadows, seeps. 1,500 to 1,830 m.	Fall Creek to Keno Canyon
Baker's Globemallow *Iliamna bakeri*	BS	—	1	—	—	Chaparral with manzanita, mountain mahogany, open ponderosa pine forest, and juniper wood-land. Open canopies, dry sandy soils, and upper slopes, often in burned areas (Oregon) and/or volcanic lava fields (California). 1,500 to 2,000 m (2,300 m in California).	Fall Creek to Keno Canyon

Table E5.2-2. TES plant, fungi, bryophyte, and lichen species potentially occurring in the Klamath Hydroelectric Project study area.

Common Name and Scientific Name	**Federal Status**	**ODA Status**	**ONHP List**	**CDFG Status**	**CNPS List**	**Habitat**	**Potential*/Known Locations in Study Area Sections**
Pickering's Ivesia *Ivesia pickeringii*	SoC	—	—	—	1B	Lower montane conifer forest, meadows and seeps; mesic, clay, generally serpentinitic clay soils. 800 to 1,500 m.	Fall Creek to Keno Canyon
Heckner's Lewisia *Lewisia cotyledon* var. *heckneri*	SoC	—	4	—	1B	Open to partially shaded rocky slopes; +/- 1,500 to 1,600 m.	Fall Creek and J.C. Boyle peaking reach
Howell's Lewisia *Lewisia cotyledon* var. *howellii*	SoC	—	4	—	3	Oak woodlands, in rock crevices, gravel, shallow loam or duff; 150 to 400 m.	Iron Gate-Shasta to J.C. Boyle peaking reach
Bellinger's Meadow-foam *Limnanthes floccosa* ssp. *Bellingeriana*	SoC BS	C	1	—	1B	Rocky, seasonal wet meadows; at margins of damp rocky meadows often partially shaded by adjacent tree and shrub line; 1,100 to 1,200 m.	Iron Gate reservoir to J.C. Boyle reservoir Known at J.C. Boyle peaking reach
Peck's Lomatium *Lomatium peckianum*		—	—	—	2	Rocky slopes and flats or grassy slopes in ponderosa pine and black oak woodland on volcanic soils and pinyon-juniper woodland; 700 to 1,800 m.	Iron Gate-Shasta to J.C. Boyle reservoir
Jepson's Monkeyflower *Mimulus jepsonii*		—	4	—	—	Bare gravelly, sandy, pumice soils in conifer forests; more than 1,000 m.	Fall Creek to Keno Canyon
Egg lake Monkeyflower *Mimulus pygmaeus*	SoC	—	—	—	1B	Damp areas or vernally moist conditions in meadows and open woods; 1200 to 1,500 m.	Fall Creek to Keno Canyon
Northern Adder's Tongue *Ophioglossum pusillium*	SoC	—	—	—	1A	Freshwater wetlands or moist areas in forests, wetland edges. Low pastures and grassy roadside ditches 1,000 to 2,000 m.	Fall Creek to Keno Canyon
Slender Orcutt Grass *Orcuttia tenuis*	LT	—	—	LE	1B	Vernal pools. 200 to 1,100 m.	Iron Gate-Shasta to Keno Canyon
Blue-Leaved Penstemon *Penstemon glaucinus*	SoC BS	—	1	—	—	Dry, fine, ashy soils or weathered tuff in forest openings and sometimes in high intensity burn sites, ponderosa pine and lodgepole pine forest; 1,900 to 2,650 m.	J.C. Boyle reservoir
Red Root Yampah *Perideridia erythrorhiza*	SoC BS	C	1	—	—	Moist prairies, pastureland, oak or pine woodlands, often in dark wetland soils; to 1,525 m.	Fall Creek to Keno Canyon Unconfirmed occurrences at J.C. Boyle peaking reach, J.C. Boyle reservoir, and Keno Canyon

Table E5.2-2. TES plant, fungi, bryophyte, and lichen species potentially occurring in the Klamath Hydroelectric Project study area.

Common Name and Scientific Name	**Federal Status**	**ODA Status**	**ONHP List**	**CDFG Status**	**CNPS List**	**Habitat**	**Potential*/Known Locations in Study Area Sections**
Howell's False Caraway *Perideridia howellii*	TS	—	4	—	—	Moist meadows, stream banks; 300 to 1,500 m.	Fall Creek to Keno Canyon Known at Copco reservoir, J.C. Boyle peaking reach and J.C. Boyle reservoir
Cooke's Phacelia *Phacelia cookei*	SoC	—	—	—	1B	Great basin scrub, lower montane conifer forest; sandy volcanic soil; 1,400 to 1,700 m.	Fall Creek to Keno Canyon
Playa Phacelia *Phacelia inundata*	SoC	—	1	—	1B	Great basin scrub, lower montane conifer forest, playas; alkaline soils. 1,300 to 1,800m	J.C. Boyle reservoir to Link River
Moss Phlox *Phlox muscoides*	—	—	—		2	Alpine fell fields to subalpine conifer to Great basin scrub in low sagebrush with narrow leaf mountain mahogany, 1,200 to 2,700 m.	J.C. Boyle peaking reach
American Pillwort *Pilularia americana*	BA	—	2	—	—	Shallow pools, vernal pools. Zero to 1,600 m.	Fall Creek to Keno Canyon
Profuse-Flowered Mesa Mint *Pogogyne floribunda*	SoC BS	—	1	—	1B	Vernal pools and seasonal lakes sometimes dominated by *Artemisia cana*, *Poa secunda,* and *Navarretia* sp. 1,000 to 1,500 m.	Fall Creek to Keno Canyon
Newberry's Cinquefoil *Potentilla newberryi*	—	—	—	—	2	Marshes and swamps, receding shorelines, drying marsh margins, sandy volcanic soils 1,290 to 2,200 m.	Iron Gate reservoir to Keno reservoir
Western Black Currant *Ribes hudsonianum* var. *petiolare*			—		1	Riparian scrub, 1,500 to 2,200 m.	Fall Creek to Keno Canyon
Columbia Yellow Cress *Rorippa columbiae*	SoC BS	C	1	—	1B	Cobbly, gravelly silt associated with seasonal creek drainages in ponderosa pine/ juniper woodland; shores of alkaline lakes and roadside ditches, meadows, seeps, 6 to 1,500 m.	Keno reservoir Known at Keno reservoir
Fleshy Sage *Salvia dorrii* var. *incana*	—	—	—	—	3	Silty to rocky soils in Great basin scrub, pinyon and juniper woodland. 300 to 1,300 m.	Iron Gate-Shasta to Keno reservoir Known at Iron Gate-Shasta, and Iron Gate reservoir
Tracy's Sanicle *Sanicula tracyi*	SoC	—	—	—	4	Mixed conifer or oak forests. 100 to 1,000 m.	Iron Gate-Shasta to Keno Canyon
Scheuchzeria *Scheuchzeria palustris* var. *americana*	BA	—	2	—	2	Freshwater wetlands, bogs, fens, lake margins. 1,400 to 2,000 m.	Iron Gate reservoir to Link River

Table E5.2-2. TES plant, fungi, bryophyte, and lichen species potentially occurring in the Klamath Hydroelectric Project study area.

Common Name and Scientific Name	Federal Status	ODA Status	ONHP List	CDFG Status	CNPS List	Habitat	Potential*/Known Locations in Study Area Sections
Slender Bulrush *Scirpus heterochaetus*	TS		3		1B	Marshes, muddy shores of lakes at lower elevations, tolerant of alkali (like *S. acutus*). 500 m.	Iron Gate reservoir to Link River
Pendulus Bulrush *Scirpus pendulus*	—	—	2	—	2	Meadows and seeps, assorted freshwater marshes, at edge of small drainage ditch with rancid water, 800 to 1,000 m.	Iron Gate reservoir to Link River Known at Fall Creek and J.C. Boyle peaking reach
Water Clubrush *Scirpus subterminalis*	—	—	2	—	2	Marshes and swales, montane lake margins.	Iron Gate reservoir to Link River
Lemmon's Silene *Silene lemmonii*	—	—	3	—	—	Open pine woodlands; 600 to 2,850m.	J.C. Boyle peaking reach to J.C. Boyle reservoir Unconfirmed occurrences at J.C. Boyle peaking reach
Marble Mountain Campion *Silene marmorensis*	SoC	—	—	—	1B	Broad-leaved upland forest, cismontane woodland, lower montane conifer forest. 850 to 1,000 m.	Fall Creek to J.C. Boyle peaking reach
Fringed Campion *Silene nuda* ssp. *insectivora*	TS		4			Dry meadows, lake shores, *Pinus ponderosa* and juniper woodlands, loam soils, sometimes alkaline; 1,420 to 1,500 m.	Iron Gate reservoir to Link River
Short-Podded Thelypody *Thelypodium brachycarpum*	—	—	2	—	4	Meadows and open flats. 650 to 2,300 m.	Keno reservoir Known at Keno reservoir
Howell's Thelypody *Thelypodium howellii* ssp. *howellii*	—	—	2	—	1B	Alkaline adobe meadows, *Artemisia* scrub. 1,200 to 1,500 m.	J.C. Boyle reservoir, Keno reservoir
Howell's Triteleia *Triteleia grandiflora ssp. howellii*			—		2	Rocky areas in Great basin scrub, pinyon/ juniper woodland, 700 to 1,500 m.	Fall Creek to Keno Canyon
Bryophytes							
Liverwort *Ptilidium californicum*		—				Conifer forests, on *Pseudotsuga menziesii*, *Abies* spp., *Tsuga heterophylla* trunks and logs; 450 to 2,000 m.	Fall Creek to J.C. Boyle bypass
Moss *Schistostega pennata*		2				Crevices of root wads where humidity is high all year (e.g., adjacent to ponds, lakes and streams).	Fall Creek, J.C. Boyle peaking reach
Moss *Tetraphis geniculata*		3				Rotten logs.	Iron Gate-Shasta to Link River
Lichens							
Bryoria tortuosa		—				Semi-open conifer forests, on bark of conifers and hardwoods.	Fall Creek to Keno Canyon

Table E5.2-2. TES plant, fungi, bryophyte, and lichen species potentially occurring in the Klamath Hydroelectric Project study area.

Common Name and Scientific Name	Federal Status	ODA Status	ONHP List	CDFG Status	CNPS List	Habitat	Potential*/Known Locations in Study Area Sections
Hypogymnia duplicata		—				Moist conifer forests, on *Pseudotsuga menziesii* and pine twigs, and on mosses over rocks.	Fall Creek to Keno Canyon
Leptogium burnetiae var. *hirsutum* (=*Leptogium hirsutum*)		—				On deciduous tree and shrub bark, rocks, mossy rocks.	Iron Gate-Shasta to Link River
Lobaria linita		2				Moist forests, on trees, shrubs, mossy rocks.	Fall Creek to Keno Canyon
Lobaria oregona		—				Conifer forests; usually on conifer branches, occasionally on deciduous trees.	Fall Creek to Keno Canyon
Platismatia lacunose		—				On bark and wood, especially *Alnus* in riparian forests and moist cool upland sites.	J.C. Boyle peaking reach, J.C. Boyle bypass
Ramalina thrausta		—				Low elevation moist forests, especially riparian fir or spruce; old growth *Pseudotsuga menziesii* forests.	J.C. Boyle peaking reach, J.C. Boyle bypass
Teloschistes flavicans		2				Coastal headland forests, usually on *Picea sitchensis*.	J.C. Boyle peaking reach
Usnea longissima		—				Usually on riparian conifers and hardwoods at low elevations.	J.C. Boyle peaking reach

* Potential locations are noted even when suitable habitat is very unlikely and the presence of the species would constitute a significant range extension.
LE = Listed Endangered. Taxa listed by the U.S. Fish and Wildlife Service (USFWS) as Endangered under the Endangered Species Act (ESA), by the Departments of Agriculture (ODA) and Fish and Wildlife (ODFW) of the state of Oregon under the Oregon Endangered Species Act (OESA), or by the California Department of Fish and Game (CDFG) under the California Endangered Species Act (CESA).
LT = Listed Threatened. Taxa listed by the USFWS, ODA, or CDFG as Threatened.
PE = Proposed Endangered. Taxa proposed by the USFWS to be listed as Endangered under the ESA or by CDFG or ODA under the OESA.
PT = Proposed Threatened. Taxa proposed by the USFWS to be listed as Threatened under the ESA or by CDFG or ODA under the OESA.
C = Candidate taxa for which USFWS has sufficient information to support a proposal to list under the ESA, or which is a candidate for listing by the ODA under the OESA.
Rare = A plant is "rare" in California when, although not presently threatened with extinction, the species, subspecies, or variety is found in such small numbers throughout its range that it may be endangered if its environment worsens.
SoC = Species of Concern. Former C2 candidates that need additional information in order to propose as Threatened or Endangered under the ESA. These are species that USFWS is reviewing for consideration as Candidates for listing under the ESA.
S/M = Survey and Manage Species, Category A and C plant species with potential to occur in the study area. (USFS and BLM, 2001).
Bureau of Land Management: BS = sensitive plant species, TS = tracking plant species, AS = assessment plant species
Oregon Natural Heritage Program (ONHP) List (ONHP, 2001): List 1 contains taxa that are threatened with extinction or presumed to be extinct throughout their entire range. List 2 contains taxa that are threatened with extirpation or presumed to be extirpated from the state of Oregon. List 3 contains species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range. List 4 contains taxa that are of conservation concern but are not currently threatened or endangered.
California Native Plant Society (CNPS) Listing Categories (Skinner and Pavlik, 1994).
List 1A: Plants presumed extinct in California. List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere. List 2: Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere. List 3: Plants About Which We Need More Information - A Review List. List 4: Plants of Limited Distribution - A Watch List
Sources: letter from J.C. Knight, Chief, Endangered Species Division, UFWS, Sacramento, California, April 13, 2001; http://www.dfg.ca.gov/whdab/nddbsis.pdf; ; letter from K.M. McMaster, State Supervisor, USFWS, Portland, Oregon, January 8, 2001; California Native Plant Society http://www.northcoast.com/~cnps/cgi-bin/cnps/sensinv.cgi/, BLM unpublished data.

Table E5.2-3. Number of TES plant species occurrences by study area section.

TES Plant Species	Iron Gate-Shasta	Iron Gate Reservoir	Fall Creek	Copco Reservoir	J.C. Boyle Peaking Reach	J.C. Boyle Bypass	J.C. Boyle Reservoir	Keno Canyon	Keno Reservoir	Total
Fleshy Sage	1	4								**5**
Greene's Mariposa Lily		10	1		12					**23**
Bolander's Sunflower		1			2					**3**
Pendulus Bulrush			1		2					**3**
Howell's Yampah				1	7		1			**9**
Bellinger's Meadow Foam					1					**1**
Lemmon's Silene					3					**3**
Mountain Lady's Slipper					1					**1**
Red Root Yampah					9	2	2	3		**16**
Egg Lake Monkeyflower						2	3			**5**
Applegate's Milkvetch									1	**1**
Salt Heliotrope									5	**5**
Columbia Yellow Cress									1	**1**
Short-Podded Thelypodium									3	**3**
Total Occurrences	**1**	**15**	**2**	**1**	**37**	**4**	**6**	**3**	**10**	**79**

E5.2.1.4 Noxious Weeds

A target list of noxious weeds was developed through consultation with the BLM staff (Table E5.2-4). Noxious weed surveys were conducted in the study area in 2002. A total of 14 noxious weed species and 112 infestations covered more than 558 acres (226 ha) in the study area. However, three of the species were detected only near Keno reservoir. This acreage does not include the extensive infestations of yellow starthistle, cheatgrass, and medusahead. Noxious weed and non-native invasive plants occurred in 74 percent of the vegetation characterization plots distributed in random polygons of all cover types, with a low of 42 percent at J.C. Boyle reservoir and a high of 95 percent along the Iron Gate-Shasta section. The frequency of weeds was highest—88 percent of plots—in the upland deciduous habitats, primarily Oregon oak woodlands. Noxious weed and non-native invasive plants occurred in 62 percent of the sampled riparian/wetland sites and ranged from a low of 17 percent at J.C. Boyle reservoir sites to 93 percent and 92 percent at Iron Gate reservoir and Keno reservoir sites, respectively.

Along the 113 riparian/wetland transects sampled in the study area, noxious weed and non-native invasive plant species occurred in 14 percent of plots that were positioned in the riparian and wetland habitats; all on the upland edge of the transects. Noxious weed species occurred in 62 or 56 percent of the 109 "upland" plots along the riparian/wetland transects.

Several of the noxious weeds were documented near Project facilities where maintenance activities create suitable habitat for invasive species by removing native vegetation or disturbing the ground. Vegetation maintenance around facilities is conducted annually and consists of both mechanical vegetation removal and spraying. Hazard trees near facilities are cleared as needed. Campground fire breaks are created annually by using a bulldozer to scrape a road-width fire break. Other than standard facility vegetation maintenance, no other fire/fuels management activities are conducted. Substation grounds are kept clear of vegetation. ROW vegetation management follows guidelines in PacifiCorp's ROW vegetation management plan. Some spread of noxious weeds may occur from Project vehicles and equipment transporting seed to previously uninfested areas.

Table E5.2-4. Noxious weed and non-native invasive plant species potentially occurring in the study area.

Scientific Name	Common Name	California Weed Rating[1]	Oregon Weed Rating[2]	Locations in Study Area
Acroptilon repens	Russian knapweed	B	B	J.C. Boyle peaking reach
Bromus tectorum[3]	Cheatgrass	na	na	All study area sections
Cardaria draba	Hoary cress	B	na	Iron Gate-Shasta section, Iron Gate reservoir, J.C. Boyle peaking reach, J.C. Boyle reservoir, Keno reservoir, Link River, Keno Canyon, Copco No. 2 bypass, Copco reservoir
Carduus acanthoides	Plumeless thistle	A	A	
Carduus nutans	Musk thistle	A	B	
Carduus pynchnocephala	Italian thistle	C	B	
Cenchrus spp.	Sandbur grass	C	na	
Centaurea diffusa	Diffuse knapweed	A	B	J.C. Boyle reservoir
Centaurea maculosa	Spotted knapweed	A	T	
Centaurea solstitialis[3]	Yellow starthistle	C	T	All study area sections
Centaurea squarrosa	Squarrose knapweed	A	T	
Chorispora tenella	Purple mustard	B	na	
Chondrilla juncea	Rush skeletonweed	A	B	
Cirsium arvense	Canada thistle	B	B	Iron Gate-Shasta section, J.C. Boyle reservoir, Keno reservoir, Link River
Cirsium ochrocentrum	Yellowspine thistle	A	na	
Cirsium vulgare[3]	Bull thistle	na	B	Iron Gate reservoir, Copco reservoir, J.C. Boyle peaking reach, J.C. Boyle reservoir, Keno reservoir, Link River
Crupina vulgaris	Common crupina or bearded creeper	A	B	
Cytisus scoparius	Scotch broom	C	B	Keno reservoir, J.C. Boyle bypass
Euphorbia esula	Leafy spurge	A	T	
Gypsophila paniculata	Baby's breath	B	na	
Halogeton glomeratus	Halogeton	A	B	
Hypericum perforatum	Klamath weed or St. John's wort	C	B	J.C. Boyle reservoir, J.C. Boyle bypass, J.C. Boyle peaking reach Copco reservoir, Fall Creek, Keno Canyon, Keno reservoir, Link River
Isatis tinctoria	Dyer's woad or Marlahan mustard	B	B	Iron Gate-Shasta section, Iron Gate reservoir, J.C. Boyle peaking reach
Lepidium latifolium	Perennial pepperweed or tall whitetop	B	B	Keno reservoir
Linaria dalmatica[3]	Dalmatian toadflax	A	B	Keno reservoir, J.C. Boyle reservoir, J.C. Boyle bypass Reach, J.C. Boyle peaking reach and Copco reservoir, Link River
Lythrum salicaria	Purple loosestrife	B	T	
Onopordum acanthium	Scotch thistle	A	B	Keno reservoir
Onopordum tauricum	Taurium thistle	A	na	

Table E5.2-4. Noxious weed and non-native invasive plant species potentially occurring in the study area.

Scientific Name	Common Name	California Weed Rating[1]	Oregon Weed Rating[2]	Locations in Study Area
Physalis virginiana var. subglabrata	Smooth ground cherry	na	na	
Polygonum cuspidatum	Japanese knotweed	B	B	
Polygonum sachalinense	Giant knotweed	B	B	
Salsola sp	Russian thistle	A or C[4]	na	
Salvia aethiopis	Mediterranean sage	B	B	Keno reservoir
Senecio jacobea	Tansy ragwort	B	T	
Sonchus arvensis	Perennial sow thistle	A	na	
Sorghum halpense	Johnson grass	C	B	
Taeniatherum caput-medusae[3]	Medusahead	C	B	Iron Gate-Shasta section, Iron Gate reservoir, J.C. Boyle peaking reach, Fall Creek, Copco reservoir
Tribulus terrestris	Puncture vine	C	B	Iron Gate reservoir, J.C. Boyle peaking reach
Xantium spinosum	Spiny cocklebur	na	B	J.C. Boyle peaking reach, Iron Gate reservoir

[1] OREGON NOXIOUS WEED CONTROL RATING SYSTEM

"A" designated weed—a weed of known economic importance which occurs in the state in small enough infestations to make eradication/containment possible; or is not known to occur, but its presence in neighboring states make future occurrence in Oregon seem imminent. Infestations are subject to intensive control.
"B" designated weed—a weed of economic importance which is regionally abundant, but which may have limited distribution in some counties (Table 2).Where implementation of a fully integrated statewide management plan is not feasible, biological control shall be the main control approach ("B" weeds targeted for biological control agents are identified with an asterisk). Limited to intensive control at the state or county level as determined on a case-by-case basis.
"T" designated weed—a priority noxious weed designated by the State Weed Board as a target weed species on which the Department will implement a statewide management plan.

[2] CALIFORNIA NOXIOUS WEED CONTROL RATING SYSTEM

"A" Eradication, containment, rejection, or other holding action at the state-county level. Quarantine interceptions to be rejected or treated at any point.

"B" Eradication, containment, control or other holding action at the discretion of the commissioner.

"C" State endorsed holding action and eradication only when found in a nursery; action to retard spread outside of nurseries at the discretion of the commissioner; reject only when found in a crop seed for planting or at the discretion of the commissioner.

[3] Common or widespread in study area
[4] *Salsola tragus* is a category C and *Salsola vermiculata* is a category A weed in California.

E5.2.2 Wildlife Resources

A variety of wildlife species occurs in the diverse habitats surrounding the Project. The study area is located near the confluence of several mountain ranges (Siskiyou/Klamath and Cascade) and within several different eco-regions or physiographic provinces, resulting in a diverse mix of flora and fauna. These physiographic provinces are described in Section E5.2.1. In 2002-2003, PacifiCorp biologists documented wildlife use in the study area through specific surveys and review of literature, databases, and consultation with agency biologists. For purposes of describing the existing condition of these resources, this discussion has been divided into the following broad categories: (1) big game, (2) other mammals, (3) waterfowl and other water-related birds, (4) raptors, vultures, ravens, and owls, (5) passerines, woodpeckers, and gamebirds, (6) reptiles and amphibians, and (7) TES wildlife species. Where appropriate, historical information has been included in the discussion.

E5.2.2.1 Big Game

Big game mammals include those species that are managed by Oregon and California state wildlife agencies primarily for sport-hunting purposes. Big game mammals that are present in the Project area include mule and black-tailed deer (*Odocoileus hemionus*), elk, black bear, and cougar (*Felis concolor*).

Deer and Elk

Black-tailed deer and mule deer (*O. h. hemionus*) both occur in the study area. Black-tailed deer typically occur to the west of the Cascade crest, and mule deer occur to the east. However, within the study area, hybrid deer may be the most common. The Oregon Department of Fish and Wildlife (ODFW) does not distinguish between the two species when managing populations on the Keno Management Unit (Collom, pers. comm., 2003).

Within the 1,039-mile^2 (2,691-km^2) Keno Management Unit located north of the Klamath River in Oregon, the ODFW has identified a winter mule/black-tailed deer population goal of 3,200 individuals. The population structure would include 15 bucks for every 100 does (after the hunting season), and 35 fawns for every 100 adults (ODFW, 2002). In the mid-1980s, approximately 3,000 black-tailed deer wintered in the Keno Management Unit area; this number was reduced by at least 40 percent during the severe winter of 1992-1993 (BLM, 1996) and the population has been slow to recover. Currently, the winter deer population is at 37 percent of the management objective or approximately 1,200 individuals (Collom, pers. comm., 2003).

Most of the deer that winter in the Keno Management Unit are also resident during the summer. Additionally, approximately 10 percent of the 13,400 deer that winter in the Rogue Management Unit (the adjacent management unit to the west) also spend their summers in the Keno Management Unit (Collom, pers. comm., 2003).

Deer and elk populations in California have been adversely affected during the last century by a combination of habitat loss and degradation, timber harvest, livestock grazing, wildfire and fire suppression, reservoirs, predation, regulated hunting, poaching, diseases, weather patterns, highway mortality, and competition with non-native wildlife species (CDFG, 1998). In recent years, the deer population in the Cascade-North Sierra Nevada Deer Assessment Unit (Oregon border south to Lake Almanor and Feather River drainage) has dropped from 65,000 to 75,000 individuals to 35,000 to 45,000 individuals (CDFG, 1998). The primary reasons for the decline are considered to be the loss of high quality early-successional habitat and a hard freeze several years ago that killed desirable browse species in some parts of the summer range (CDFG, 1998). Decadent shrub (shrubs with a high proportion of dead wood) fields dominate much of the range, and in some areas, shrub stands may be the climax community (CDFG, 1998). In addition, deer productivity in Shasta and Tehama counties has been linked to the timing and quantity of fall rains that promote the germination of annual vegetation (CDFG, 1998).

The ODFW manages elk based on management objectives for population size and bull ratios for each management unit. The target bull ratio in the Keno Management Unit in 1992 was ten bulls/100 cows (ODFW, 1992). The winter management objective for the Keno Management Unit is 700 elk (Collom, pers. comm., 2003). Currently, about 400 elk winter in the Keno Management Unit (Collom, pers. comm., 2003). Most elk have an affinity for certain ranges and generally will use the same summer and wintering grounds throughout their life (ODFW, 2002a). The severity of winter often will influence how far and to what elevation elk will move to avoid adverse weather conditions (ODFW, 2002a). Studies in the central Oregon Cascades have shown that elk often winter on the west slope of the Cascades and cross to central Oregon in the summer (ODFW, 2002a).

Elk wintering survival is affected by three main factors; availability of forage, thermal cover, and hiding cover (ODFW, 2002a). Factors affecting elk security are topographic relief, vegetation density, and proximity to human activity (ODFW, 2002a). These factors are especially important in areas where predator density is high (ODFW, 2002a), which is the case around the Project.

Deer and elk habitat use, population levels, and movement patterns near the study area are largely affected by elevation that affects snowfall in the winter and the pattern of forage and cover habitats throughout the area. The long-term changes in management of forests and shrublands that occurred in the study area since the early 1900s have caused a decline in the disturbances that perpetuate early-successional habitats, which provide important deer habitat (CDFG, 1998). Since the 1960s, a combination of intensive timber harvest and fire suppression (or in some cases inappropriate prescribed fire timing) has brought about more forage-limited, second-growth forests and more decadent shrublands that have unavailable or low quality browse and little herbaceous vegetation (CDFG, 1998). The recent wide-scale reductions in timber harvest on federal lands of northern California and southern Oregon likely are reducing deer forage habitat in some areas. However, logging on privately owned land in the Pokegama Cooperative Habitat Management Area (PCHMA) continues to create early-successional habitat. Forage condition on winter range also is declining because of infestations of exotic weeds (BLM, 2002; ODFW, 2003).

From a regional perspective, the canyon and mid-elevation hillsides and plateaus between the J.C. Boyle powerhouse and Iron Gate dam are considered critical deer winter range by the BLM, ODFW, and CDFG. This area represents one of the largest contiguous areas of winter range in the southern Oregon and northern California region. In the study area, south-facing lower canyon walls and hillsides are some of the most critical habitat for wintering the migratory Pokegama black-tailed deer herd as well as for resident deer (City of Klamath Falls, 1989) (see Terrestrial Resources FTR, Section 6.0, Figure 6.7-1).

Currently, within the terrestrial resources study area, there are 18,452 acres (7,467 ha) of habitat that have wedgeleaf ceanothus and mountain mahogany—major deer browse species—as a major component. These two shrub species are estimated to be a major component in 14 vegetation cover types, especially in the montane hardwood oak-juniper (7,209 acres [2,917 ha]), mixed chaparral (4,418 acres [1,788 ha]), montane hardwood oak-conifer (4,327 acres [1,751 ha]), and montane hardwood oak (1,223 acres [495 ha]). There are 2,235 acres [904 ha] of habitat with these two preferred shrubs surrounding Iron Gate, but where it occurs close to the reservoir, it is relatively widely scattered and the better habitat is near the BLM/CDFG Horseshoe Ranch Wildlife Area (HRWA). There is substantial acreage of the desirable browse in the Copco No. 2 bypass (1,136 acres [460 ha]), Fall Creek (780 acres [316 ha]), and J.C. Boyle peaking reach (10,517 acres [4,256 ha]) study area sections.

Near the Project, two wildlife management areas play important roles in the provision of deer winter range. These include the HRWA, located northwest of Iron Gate reservoir, and the PCHMA, located along the north side of the river from J.C. Boyle dam to north of Copco reservoir (see Terrestrial Resources FTR, Section 6.0, Figure 6.7-1). The Pokegama Cooperative Habitat Management Project is an agreement among the ODFW, BLM, and several private landowners (including PacifiCorp) that provides road closures during the winter and promotes habitat enhancement projects to benefit the Pokegama deer herd. The goals of the PCHMA are to improve big game winter range and reduce illegal take and harassment of wildlife on critical winter ranges (BLM, 1996).

Studies of the Pokegama deer herd conducted for the Salt Caves Project during the winters of 1985 and 1986 resulted in the following conclusions (City of Klamath Falls, 1986):

- The areas with the highest deer use were the farthest west portions of the management area, close to the California border.
- Winter densities were much greater in the Ward Steppe, Copco Canyon, and Copco Steppe than close to the river in the J.C. Boyle peaking reach section.
- The highest use of the area was in November through January and declined to low densities by March.
- Deer use was most intense during the winter in the mid and upper slopes of the canyon as opposed to habitats immediately along the river.

Cover/forage habitat mapping of the BLM- and CDFG-managed HRWA and lands surrounding it indicate that much of habitat immediately adjacent to Iron Gate reservoir is of low quality (BLM, 2003b). There are, however, numerous patches of moderate and high quality habitat in the drainages north of Iron Gate reservoir. In addition to the deer population, approximately 50 to 60 elk use the HRWA or the area just to the east along the Oregon border during the winter. However, no special management goals for this elk herd have been set by the CDFG (BLM website).

Deer movement has not been studied extensively in the immediate study area. However, the south Cascades deer study documented movement from the wintering range on the HRWA to the Cascade Mountains northeast of the Project (Jackson and Kilbane, 1996). This study also showed at least some movement south across the Klamath River or across Iron Gate reservoir (see

Terrestrial Resources FTR, Section 6.0, Figure 6.7-1). The degree to which animals attempt to move across the river or reservoirs is not known, although based on the anecdotal information available, only a small number of animals likely cross. During relicensing studies, deer commonly were observed during early spring in the oak woodlands, mixed chaparral, and annual grasslands associated with Iron Gate and Copco reservoirs. Continuing residential development on private lands along these two reservoirs is continuing to eliminate deer winter range. There has been only rare documentation of deer drowning or falling through ice on Project reservoirs. Project personnel have, on a few occasions in the last 10 years, observed deer fall through ice on J.C. Boyle reservoir. This problem does not appear to be common, especially on Copco and Iron Gate reservoirs, which are at lower elevations and rarely freeze.

CDFG elk telemetry data showed a long-range migration pattern of one elk between the Shasta Valley in California and the forests to the west of Upper Klamath Lake in Oregon (see Terrestrial Resources FTR, Section 6.0, Figure 6.7-1; Callas, pers. comm., 2003). In Oregon, analysis of data from 20 radio-collared elk in 1994 demonstrated summer ranges in the upper portions of the Long Prairie Creek and Jenny Creek areas as well as several areas at higher elevations north of the river (BLM, 1996). No data exist on elk wintering near the Project reservoirs. Based on the previous studies, it is likely that a small number of elk crosses the study area (central part) during the migration periods, but the elk do not appear to remain close to Project reservoirs for long periods of time during any season.

<u>Black Bear and Mountain Lion</u>

The black bear is a resident of most forested ecosystems in southern Oregon and northern California. Black bear were observed by PacifiCorp biologists in the J.C. Boyle bypass and Link River study area sections, but likely occur throughout the study area. In 1993, the black bear population in Oregon was estimated to be 25,000 individuals. In relation to the average bear population in Oregon, bear density in the study area is described as high on the western end of the Project and medium on the eastern end (ODFW, 1993). In 1998, the California black bear population was estimated to be 17,000 to 23,000 individuals. It is estimated that approximately half of the California population inhabits the north coast/Cascade portion of the state (CDFG, 1998a). Eighty-six percent of bear habitat is considered to be of high value, 12 percent is medium value, and 2 percent is considered low value. Bear populations in California are expected to be highest in montane hardwood, montane chaparral, and mixed conifer forests (CDFG, 1998a).

The mountain lion population has increased substantially after being nearly extirpated from Oregon and much of California. The mountain lion is now a common resident of most habitats near the Project. Mountain lions either were documented during relicensing studies or reported by Project personnel throughout the Project (see Terrestrial Resources FTR, Section 7.0). In 1992, mountain lion populations near the Project were categorized as medium when compared with the Oregon state average (ODFW, 1993a). The 2003 mountain lion harvest quota for the southwest Cascades region of Oregon was 133 individuals (the highest of any region in Oregon) (ODFW website). The mountain lion is a specially protected mammal under California law and no take is allowed except under depredation/nuisance circumstances (CDFG website).

E5.2.2.2 Other Mammals

In addition to the big game discussed in Section E5.2.2.1, 26 species of mammals are known to occur near the Project (see Terrestrial Resources FTR, Appendix 7A, Table 7A-1). This includes five species of furbearers that are closely associated with aquatic and riparian habitats, several medium-size mammals, and numerous small mammal species.

Five aquatic fur-bearing mammal species—raccoon (*Procyon lotor*), beaver, muskrat (*Ondatra zibethica*), mink, and river otter—are common in various parts of the Project. Overall, four muskrat, 20 beaver, six river otter, and nine mink sightings were documented during relicensing field studies as well as incidentally during other activities in the area during 2002-2003. According to ODFW (2000), muskrats are particularly common along Keno reservoir and the adjacent Klamath Wildlife Area, where the large patches of emergent wetland provide ample habitat. River otter or their sign were noted downstream of Iron Gate and J.C. Boyle dams. PacifiCorp employees also have observed river otter in the beaver pond wetlands near Copco No. 2 village.

Beaver signs are common along all river reaches and in the portions of Project reservoirs where there are well-developed riparian and wetland habitats, such as near Jenny and Camp creeks on Iron Gate reservoir and along Spencer Creek on J.C. Boyle reservoir. River otters and beavers are known to be present at Keno reservoir, but are seen only occasionally in the Klamath Wildlife Area (ODFW, 2000). Mink are reported as uncommon in the Klamath Wildlife Area, but are sighted consistently from year-to-year (ODFW, 2000). Mink and raccoons are common throughout the Project along the Klamath river and its tributaries. Mink have been documented in the West Side canal during fisheries investigations. Historically, anadromous fish occurred above Iron Gate reservoir, and piscivorous and scavenger species likely benefited from the concentration of spawning or dead fish. Currently, given the seemingly healthy resident fish populations in the Klamath River, most fish-eating furbearer species probably have suitable prey.

Medium-sized mammals that are common in the Project include: bobcat, gray fox (*Urocyon cinereoargenteus*), yellow-bellied marmot (*Marmota flaviventris*), and coyote (*Canis latrans*). Yellow-bellied marmots are restricted to areas upstream of J.C. Boyle dam while the other species are found throughout the Project.

A wild horse herd roams throughout the area from near Fall Creek to near J.C. Boyle dam. This herd is known as the Pokegama Wild Horse Herd and occurs primarily on a formally established wild horse herd management area controlled by the BLM. No accurate population estimate is available, but the BLM goal is to keep the herd near 30 animals (BLM, 2000).

Wild pigs have been reported by local ranchers during the last several decades near the Klamath River. No evidence of wild pigs was found during 2002-2003 field surveys.

E5.2.2.3 Birds

A summary of species occurrence, habitat associations, relative abundance, and distribution in the study area is provided below. Detailed results from bird surveys conducted during relicensing studies in 2002 are described in the Terrestrial Resources FTR, Sections 5.0 and 7.0. The following sections provide discussions of avian species in three groups: waterfowl and other water-related birds; raptors, vultures and owls; and passerines, woodpeckers, corvids, and game birds.

Birds were found in all habitats surveyed in the study area. Rock talus and mixed riparian survey plots had the lowest avian relative abundances at approximately 13.50 individuals detected per survey; plots generally defined by sagebrush, wetland and pasture habitat resulted in the highest relative abundance at 43, 41, and 39 birds per survey, respectively. The number of species recorded in plots in different habitats was similar. The only statistically significant difference ($P \leq 0.05$) in the average number of species recorded per survey among general plot habitat types was between riparian/wetland scrub-shrub plots (12.2 ± 3.4 species per survey) and montane hardwood oak-conifer plots (8.4 ± 2.3 species per survey). The relatively small variation across general plot habitat types is likely largely influenced by the heterogeneous vegetation communities existing within each survey plot.

Species found to be relatively abundant in riparian and wetland habitats Project-wide included the red-winged blackbird (*Agelaius phoeniceus*), song sparrow (*Melospiza melodia*), and yellow warbler (*Dendroica petechia*)—the latter two are Riparian Focal Species (RFS) (see Terrestrial Resources FTR, Section 7.7.2).

Seven species were found to be ubiquitous during avian surveys across all 11 study area sections included in relicensing studies. In order of total relative abundance, the seven avian species detected in all study area sections include the western wood pewee (*Contopus sordidulus*), song sparrow, yellow warbler, brown-headed cowbird (*Molothrus ater*), black-headed grosbeak (*Pheucticus melanocephalus*), Brewer's blackbird (*Euphagus cyanocephalus*), and mourning dove (*Zenaida macroura*) (see Terrestrial Resources FTR, Appendix 7A, Table 7A-3). Notably, all of these species were associated with riparian and/or wetland habitat and three—song sparrow, yellow warbler, and black-headed grosbeak—are designated RFS (see Section E5.2.2.6).

Common species detected in or near the disturbed habitats surrounding Project facilities include the cliff swallow (*Hirundo pyrrhonota*), Brewer's blackbird, red-winged blackbird, and brown-headed cowbird. The brown-headed cowbird, a native brood parasite species that often causes declines in productivity among other passerines (Mayfield, 1977; Brittingham and Temple, 1983; Robinson et al. 1995), was found to be relatively common and abundant throughout the study area during both plot (0.7 bird per plot survey; see Terrestrial Resources FTR, Appendix 7A, Table 7A-3) and facility surveys (see Terrestrial Resources FTR, Appendix 7A, Table 7A-4). Some research has shown that habitat fragmentation, such as is caused by ROW, roads, and other development, may increase edge habitat benefiting cowbirds. The presence of artificial structures, such as transmission line poles and wires, also may provide perches that allow female cowbirds to more easily observe hosts and locate host nests for laying eggs (Robertson and Norman, 1975). Cowbirds were documented during PacifiCorp avian surveys in eight cover types including riparian/wetland habitat (highest relative abundance), open areas, and juniper woodland. It was the fourth most commonly detected species in riparian forest/shrub habitat. The high detection rate of cowbirds in PacifiCorp's plots relative to that reported from surveys conducted in the region by the Klamath Bird Observatory (KBO) could be the result of PacifiCorp's focus on riparian forest, differences in habitat quality, or presence of more development near the Project compared to sites studied by the KBO. PacifiCorp surveys found cowbirds in all Project segments with detections being most common in the Keno reservoir and Copco No. 2 bypass segments. In the case of Keno reservoir, the cowbird abundance likely is related to the predominance of agricultural areas surrounding the reservoir. Several of the survey stations in the Copco No. 2 bypass were close to Project facilities and housing complexes, which could increase habitat for cowbirds. Cowbird abundance was relatively low along Iron Gate, Copco, and J.C. Boyle reservoirs and Fall Creek canal.

The greatest effect of the Project on passerine birds is the effect on the distribution and connectivity of riparian and wetland habitat. In the J.C. Boyle bypass and peaking reaches, the dominance of reed canarygrass—a condition that is at least partially related to the flow regime—may limit habitat quality for birds by out-competing native plant species that may offer more suitable structure. Along Project reservoirs, there are large gaps in the wetland and riparian vegetation and the habitat patches are mostly small, which may limit their usefulness compared to larger, more contiguous habitat. Willow flycatchers (*Empidonax traillii*) are known to use dense willow habitat (RS or PSS habitat types) for breeding. Optimum patch sizes for breeding male willow flycatchers, are believed to be 5,651 square feet (525 m^2) (Scully, 1995). Approximately 59 percent (20.7 acres of the 35.3 total acres) of RS/PSS habitat mapped in the proposed FERC boundary is in patches that meet the 5,651-square-foot (525 m^2) size criteria. However, most individual RS or PSS patches (240 of 325 polygons) are smaller than the size criteria and may provide only suboptimal breeding habitat for the willow flycatcher. Information on riparian habitat distribution in the study area is presented in the Terrestrial Resources FTR, Section 6.7.6.1.

<u>Waterfowl and Other Water-Related Birds</u>

Approximately 67 percent (13,958) of all bird detections made during 2002-2003 field surveys was waterfowl and other water-related birds. Forty-seven species (27.2 percent of the total number of species) of water birds were observed. Twenty species of waterfowl were documented near the Project (Table E5.2-5). Of these, five—Canada goose (*Branta canadensis moffitti)*, wood duck (*Aix sponsa)*, mallard (*Anas platyrhynchos*), blue-winged teal (*Anas discors*), and common merganser (*Mergus merganser)*—are permanent or summer residents and have been documented breeding near the Project.

Table E5.2-5. The status, abundance, and location of waterfowl species observed in the study area.

Species	Status[1]	Abundance[2]	Locations (study area section)[3]
GEESE, SWANS, AND CRANES			
Western Canada Goose (*Branta canadensis moffitti*)	PR	V	L,I,F,C,R,J,K,N
Greater White-Fronted Goose (*Anser albifrons*)	MI	V	K
Snow Goose (*Chen caerulescens*)	MI	V	K,N
DABBLING DUCKS			
Mallard (*Anas platyrhynchos*)	PR	V	A,L,I,C,B,J,Y,K,N
Blue-Winged Teal (*Anas discors*)	MI	O	J
Cinnamon Teal (*Anas cyanoptera*)	SR	R	K
Northern Pintail (*Anas acuta*)	MI	U	J
Gadwall (*Anas strepera*)	WR	U	J,K
American Wigeon (*Anas Americana*)	WR	C	I,C,J,K
Wood Duck (*Aix sponsa*)	SR	U	B,L,I,J,C,Y,N,R
DIVING DUCKS			
Canvasback (*Aythya valisineria*)	MI	C	J,K
Redhead (*Aythya Americana*)	MI	U	K
Ring-Necked Duck (*Aythya collaris*)	WR	U	I,C,L
Lesser Scaup (*Aythya affinis*)	WR	V	I,C,J,K
Common Goldeneye (*Bucephala clangula*)	WR	C	I,K
Barrow’s Goldeneye (*Bucephala islandica*)	WR	U	I,C,K

Table E5.2-5. The status, abundance, and location of waterfowl species observed in the study area.

Species	Status[1]	Abundance[2]	Locations (study area section)[3]
Bufflehead (*Bucephala albeola*)	WR	C	I,C,J,K,N
Ruddy Duck (*Oxyura jamaicensis*)	WR	U	C,J,K,L
MERGANSERS			
Common Merganser (*Mergus merganser*)	PR	V	L,I,C,R,J,Y,K,N
Hooded Merganser (*Lophodytes cucullatus*)	WR	R	C

[1] **Status:** PR – permanent resident, SR - summer resident, WR - winter resident, MI - migrant.

[2] **Abundance:**
V – very common; 50 or more, C - common; 10 to 49 observed per day, U - uncommon; zero to 9 observed per day.
R - rare; 5 or less observed per year, O -occasional; not seen annually, but occurs periodically.

[3] **Study Area Section Codes:**
A = Copco (No. 2) bypass; B = J.C. Boyle bypass; C = Copco reservoir; F = Fall Creek;
I = Iron Gate reservoir; J = J.C. Boyle reservoir; K = Keno reservoir; L = Iron Gate-Shasta;
N = Link River; R = J.C. Boyle peaking reach; Y = Keno Canyon.

Project reservoirs are important for many waterfowl and water-related birds. Among Project reservoirs, the largest number of birds was recorded on Keno reservoir with 5,372 total detections and an average of 895.3 detections per survey (see Terrestrial Resources FTR, Appendix 7A, Table 7A-5). Canada goose and sandhill crane (*Grus canadensis*) nesting was documented in 2003 in wetland habitat along J.C. Boyle reservoir. Wood duck and common merganser broods were noted during waterfowl surveys of reservoirs and incidentally during other surveys of river reaches. Wood duck breeding seems most common from J.C. Boyle reservoir to Camp Creek along Iron Gate reservoir.

Nineteen species of open-water, marsh, and wading birds other than waterfowl were documented near the Project during 2002-2003 (through April 2003) (see Terrestrial Resources FTR, Appendix 7A, Table 7A-5). Commonly observed species on this list include four species of grebes—western (*Aechmophorus occidentalis*), Clark's (*A. clarkii*), pied-bill (*Podilymbus podiceps*), and eared (*P. nigricollis*)—American white pelican (*Pelecanus erythrorhynchos*), common loon (*Gavia immer*), double-crested cormorant (*Phalacrocorax auritus*), American coot (*Fulica americana*), great blue heron (*Ardea herodias*), great egret (*Casmerodius albus*), Forster's tern (*Sterna forsteri*), black tern (*Chlidonias niger*), Caspian tern (*Sterna caspia*), ring-billed gull (*Larus delawarensis*), and killdeer (*Charadrius vociferus*). American avocets (*Recurvirostra americana*) and black-necked stilts (*Himantopus mexicanus*) were seen occasionally in the eastern portion of the study area. Small numbers of coots were observed in the spring at Iron Gate, but most were observed at all four reservoirs during the winter. Ring-billed gulls and double-crested cormorants are year-round residents, although they are not always observed at each reservoir. Only one common loon was observed; this observation occurred at Iron Gate reservoir during 2002. Small numbers of Caspian and Forster's terns were commonly observed foraging on Project reservoirs during the spring.

Small groups of American white pelicans were regularly observed April to June 2002 on all Project reservoirs. Herons, cranes, and shorebirds included black-crowned night heron (*Nycticorax nycticorax*), great blue heron, green heron (*Butorides virescens*), great egret, sora rail (*Porzana carolina*), sandhill crane, spotted sandpiper (*Actitis macularia*), and killdeer. One black-crowned night heron roost occurs in willow trees near the East Side powerhouse.

Use of the reservoirs by water-related species was disproportionate throughout the year. During April-June, the peak number of waterfowl, waterbirds, and shorebirds was greatest at Keno reservoir with 152 waterfowl and 665 waterbirds, wading birds, and shorebirds. Copco, J.C. Boyle, and Iron Gate reservoirs ranked second through fourth in terms of total detections, respectively. During the winter, the peak waterfowl counts were 311, 429, 495, and 1,889 birds at Iron Gate, Copco, J.C. Boyle, and Keno reservoirs, respectively. The large number of waterfowl and other water birds associated with Keno reservoir is the result of its large surface area, the presence of large wetlands along portions of its shoreline, and its location between several major waterfowl use areas (Lower and Upper Klamath National Wildlife Refuges) and the extensive agricultural areas nearby that provide foraging opportunities. The Klamath Irrigation District has documented extensive waterfowl use of irrigated fields located to the southeast of Keno reservoir (O'Neill, 2000).

Five of the six most commonly observed species were waterbirds or diving ducks—American coot, lesser scaup (*Aythya affinis*), ring-billed gull, common merganser, and double-crested cormorant. These species are most abundant, largely because of large concentrations during the winter.

During the spring breeding season, the most common species are ring-billed gull, Canada goose, western/Clark's grebe, American white pelican, and lesser scaup. During the breeding season, small numbers of broods of Canada geese, mallards, wood ducks, and common mergansers were regularly observed.

Raptors, Vultures, and Owls

The wide variety of habitats in the study area supports a diverse population of birds of prey. Nineteen species were detected during 2002-2003 relicensing field studies. This included six species of hawk, two eagle species, three falcon species, seven owl species, and one species of vulture. Northern goshawk (*Accipiter gentilis*), northern spotted owl, and great gray owl (*Strix nebulosa*) surveys specifically targeted birds of prey. In addition to these surveys, raptors, vultures, and owls were recorded during avian point count surveys, reservoir surveys, bald eagle prey remains surveys, and incidentally throughout the field data collection effort. See Sections E5.2.2.5 through E5.2.2.8 for more discussion of TES species of raptors.

Passerines, Woodpeckers, Corvids, and Game Birds

Surveys were conducted during May and June 2002 to document use by passerines, woodpeckers, gamebirds, and corvids near the Project. Surveys were conducted in 149 plots distributed among all major habitats using point count and area search methods. A total of 93 passerine, eight woodpeckers, and five gamebirds was documented in the study area (see Terrestrial Resources FTR, Appendix 7A, Table 7A-1). Brief descriptions of the species groups are provided in the following sections.

Few of the 93 passerine species were confirmed as breeding (actual nests or young observed) because survey techniques focused on detecting individuals. However, a high percentage of these species were observed during the May-June surveys, indicating that they likely breed in the area.

Seven species were found to be ubiquitous across all 11 study area sections: western wood pewee, song sparrow, Brewer's blackbird, yellow warbler, brown-headed cowbird, black-headed grosbeak, and mourning dove (see Terrestrial Resources FTR, Appendix 7A, Table 7A-3). All of these seven species are associated with riparian and/or wetland habitat, providing an indication of the importance of these habitat types to wide-ranging, abundant species occurring near the Project. The abundance of brown-headed cowbirds is consistent with a regional pattern of cowbirds occupying agricultural areas and riparian forests near human activities.

The riparian/palustrine scrub-shrub habitat was found to support 56 passerine species, while riparian/palustrine forest, palustrine emergent wetland, and riparian grass had 48, 47, and 40 passerine species, respectively. In terms of average number of species detected per survey, the Klamath mixed conifer, montane hardwood oak, rock talus, pasture, and sagebrush each had three or more species detected per survey (Table E5.2-6).

Table E5.2-6. Number of passerine species and most common species by cover type.

Cover Type	Average Number Species/Survey	Dominant Passerine Species
Grassland	2.1	Red-winged blackbird
Juniper	2. 5	Brewer’s blackbird
Klamath Mixed Conifer	3.0	Western tanager
Montane Hardwood Oak	3.1	Tree swallow
Montane Hardwood Oak-Conifer	2.4	Western tanager
Montane Hardwood Oak-Juniper	2.6	Western wood-peewee
Mixed Chaparral	2.5	Western wood-peewee
Pasture	3.8	Cliff swallow
Palustrine Emergent Wetland	1.3	Cliff swallow
Ponderosa Pine Forest	1.5	Yellow-rumped warbler
Riparian/Palustrine Forest	1.1	Red-winged blackbird
Riparian/Palustrine Scrub-Shrub	1.1	Cliff swallow
Riparian Grassland	1.4	Cliff swallow
Riparian Mixed Forest	1.8	Western wood-peewee
Rock/Talus	4.0	Western wood-peewee
Sagebrush	3.0	Cliff swallow

The largest numbers of individual passerine detections were recorded in pastures, riparian/ palustrine scrub-shrub wetland, and riparian grass, and sagebrush habitats (see Terrestrial Resources FTR, Appendix 7A, Table 7A-8). This was largely because of the abundance of several species of swallows and species, such as red-winged blackbirds and Brewer’s blackbirds. Surveys conducted in rock talus and mixed riparian habitats resulted in the lowest passerine relative abundances.

The most common species detected in each cover type varied (Table E5.2-6). Cliff swallow was the most abundant species detected in pastures, emergent wetlands, riparian/palustrine scrub-shrub, riparian grass, and sagebrush habitats. Western wood peewee was the most common species in four widely different habitats, while western tanager (*Piranga ludoviciana*) and yellow-rumped warbler (*Dendroica coronata*) were the dominant species in conifer dominated habitats.

Five gamebird species occur in the study area—wild turkey, blue grouse (*Dendragapus obscurus*), California quail (*Callipepla californica*), mountain quail (*Oreortyx pictus*), and mourning dove. The wild turkey has been introduced and now occurs in most forested and woodland habitats that have oak and ponderosa pine trees. Mourning doves were observed in most of the study area. California and mountain quail were observed in forested habitats from J.C. Boyle bypass to below Iron Gate dam.

During 2002-2003, eight species of woodpeckers were observed in the study area: acorn woodpecker, white-headed woodpecker (*Picoides albolarvatus*), Lewis' woodpecker, red-shafted flicker (*Colaptes auratus*), red-breasted sapsucker, downy woodpecker, hairy woodpecker, and pileated woodpecker. Flickers were the most widely distributed woodpecker in the study area, while the white-headed woodpecker was observed only in the J.C. Boyle bypass reach. Several nesting colonies of acorn woodpeckers were noted in oak, oak-juniper, and oak-conifer habitats and seemed to be particularly common along Copco reservoir.

<u>Avian Riparian Focal Species</u>

Avian RFS included the song sparrow, yellow warbler, yellow-breasted chat (*Icteria virens*), Swainson's thrush (*Catharus ustulatus*), Lewis' woodpecker, warbling vireo (*Vireo gilvus*), and black-headed grosbeak. The abundance of these species in riparian and wetland habitat was assessed. Habitat quality was evaluated for three species—yellow warbler, Lewis' woodpecker, and song sparrow—for which there are habitat suitability index (HSI) models.

The highest relative abundance of avian species in general was found along Keno reservoir (58.6; see Terrestrial Resources FTR, Appendix 7A, Table 7A-3), while RFS were found to be most abundant in Keno Canyon with an average of 7.4 ± 3.9 avian RFS detected per survey (Table E5.2-7). The lowest total avian RFS relative abundance was found along Copco reservoir with 0.9 ± 1.2 RFS detected per survey in this study area section.

Lewis' woodpecker detections were recorded in riparian habitat in the Iron Gate reservoir and Iron Gate-Shasta study area sections as well as in upland habitats along the J.C. Boyle peaking reach. A comparison of HSI model parameters against existing habitat features (see Terrestrial Resources FTR, Section 7.0, Figure 7.7-4) predicts high summer food HSIs in most riparian habitat with low winter food HSIs, although the adjacent oak woodlands probably increase winter habitat suitability and Lewis' woodpeckers occur in the study area throughout the year.

Willow flycatchers were recorded during surveys in riparian and wetland plots in six of the study area sections (Table E5.2-7). This species was relatively rare, but was present in some of the more dense willow patches along the river. Swainson's thrush detections were recorded in riparian forest around Iron Gate reservoir as well as in upland conifer habitats elsewhere in the study area. Swainson's thrush typically occurs in dense forests habitat, but may be found in riparian areas if tree density is sufficient. Warbling vireos were recorded in varied habitat associations. In the Project region, warbling vireos are known to be associated with both riparian and upland forests, and are especially likely to occur along the edge, but typically not within, dense stands of contiguous forest (Csuti et al. 1997). Of the 16 warbling vireo detections, eight were recorded during surveys in wetland and riparian plots with three detections recorded along Fall Creek and five detections recorded in the J.C. Boyle peaking reach (see Terrestrial Resources FTR, Appendix 7B).

Table E5.2-7. RFS relative abundance (detections per survey) in riparian and wetland plots by study area section.

		Blackheaded Grosbeak		**Lewis' Woodpecker**		**Song Sparrow**		**Swainson's Thrush**		**Warbling Vireo**		**Willow Flycatcher**		**Yellow-Breasted Chat**		**Yellow Warbler**		**Total**	
Study Area Section	**N**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**
Iron Gate-Shasta Segment	18	1.61	1.54	0.33	0.69	0.44	0.70	0.00	0.00	0.00	0.00	0.11	0.32	0.67	1.19	1.67	1.19	**4.83**	**2.79**
Iron Gate Reservoir	27	0.52	0.98	0.04	0.19	0.22	0.70	0.15	0.46	0.00	0.00	0.19	0.56	0.00	0.00	0.48	0.75	**1.59**	**2.02**
Copco Bypass	2	1.50	2.12	0.00	0.00	1.00	1.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.71	**4.00**	**0.00**
Copco Reservoir	23	0.26	0.54	0.00	0.00	0.04	0.21	0.00	0.00	0.00	0.00	0.04	0.21	0.09	0.42	0.43	0.66	**0.87**	**1.25**
Fall Creek	12	0.25	0.45	0.00	0.00	0.67	0.98	0.00	0.00	0.25	0.62	0.00	0.00	0.08	0.29	0.33	0.49	**1.58**	**1.31**
J.C. Boyle Peaking Reach	30	1.10	1.32	0.00	0.00	1.80	1.16	0.00	0.00	0.17	0.46	0.07	0.25	0.17	0.46	0.90	0.92	**4.20**	**2.17**
J.C. Boyle Bypass	11	0.55	0.82	0.00	0.00	2.27	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.64	1.36	**4.45**	**1.97**
J.C. Boyle Reservoir	4	0.00	0.00	0.00	0.00	2.75	2.06	0.00	0.00	0.00	0.00	0.25	0.50	0.00	0.00	1.25	1.50	**4.25**	**3.95**
Keno Canyon	14	0.71	0.83	0.00	0.00	3.29	1.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.36	2.06	**7.36**	**3.95**
Keno Reservoir	18	0.06	0.24	0.00	0.00	2.28	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.59	**2.67**	**1.94**
Link River	14	0.93	1.00	0.00	0.00	0.71	0.91	0.00	0.00	0.00	0.00	0.07	0.27	0.00	0.00	2.43	1.60	**4.14**	**2.03**
Total	**173**	**0.68**	**1.07**	**0.04**	**0.25**	**1.23**	**1.57**	**0.02**	**0.19**	**0.05**	**0.26**	**0.07**	**0.30**	**0.12**	**0.49**	**1.14**	**1.41**	**3.34**	**2.87**

N = Number.
S.D. = Standard deviation.

A total of 197 yellow warbler detections was recorded during surveys in wetland and riparian habitats, with the largest numbers of detections recorded in the Keno Canyon (47), Link River (34) and J.C. Boyle peaking reach (27) study area sections. Yellow warblers were noted to establish breeding territories in particularly high densities in the willow shrubs along the periphery of the river reach at the base of Keno Canyon.

An assessment of habitat suitability for the yellow warbler based on an existing HSI model (Schroeder, 1982) indicated that the extremely dense tree and shrub habitat along the Link River is most suitable for the species (HSI = 0.66) while habitat along J.C. Boyle reservoir was found to be least suitable (HSI = 0.28) relative to other study area sections (see Terrestrial Resources FTR, Section 7.0, Figure 7.7-2). Consistent with HSI habitat calculations, yellow warbler relative abundance per survey in Link River wetland and riparian plots was found to be relatively high at 2.43 ± 1.60 birds per survey. However, the relative abundance of yellow warblers along J.C. Boyle reservoir also was found to be relatively high (1.25 ± 1.50 birds per survey), even though the riparian zone at this reservoir is generally lacking in hydrophytic shrubs.

An analysis of all yellow-breasted chat detections recorded during relicensing field studies (see Terrestrial Resources FTR, Appendix 5A, Table 5A-24) indicates that only two of the 22 total detections were recorded in upland habitat, while 20 yellow-breasted chat detections were recorded during surveys in wetland and riparian plots. The highest relative abundance for chats (0.67 ± 1.19) was found along the Iron Gate-Shasta section. The large standard deviation (SD = 1.19) likely reflects the extremely high densities of yellow-breasted chats found in localized areas along the Iron Gate-Shasta section where contiguous areas of dense willow shrub were present.

The song sparrow is one of only seven species to be detected in all 11 study area sections, and song sparrows were detected in all but three habitat types. Song sparrows also were found to be the most abundant passerine directly associated with riparian and wetland habitat detected during riparian and wetland plot surveys (1.2 ± 1.6 birds per survey) (see Terrestrial Resources FTR, Appendix 7B). The song sparrow was the most abundant avian RFS at detected Project-wide (Table E5.2-7). The highest average detection densities were noted in Keno Canyon (3.3 ± 1.9 birds per survey) with the lowest densities found along Copco reservoir (0.04 ± 0.21 birds per survey) (Table E5.2-7). Shrub habitat quality for song sparrows was found to be much more variable, with HSI scores ranging from 0.18 (J.C. Boyle reservoir) to 0.91 (Link River). In general, song sparrow occurrence and distribution in the primary study area was found to largely correspond with that of the yellow warbler: the species was found to establish high nesting territory densities wherever brushy riparian willow shrub vegetation occurred along Project reservoirs and river reaches.

Black-headed grosbeaks were found in all but five habitat types and individuals were detected in all study area sections except the J.C. Boyle reservoir (see Terrestrial Resources FTR, Appendix 5F). A total of 118 black-headed grosbeaks detections was recorded during surveys in wetland and riparian and plots constituting the third most abundant RFS detected in such plots (see Terrestrial Resources FTR, Appendix 7B). This species was most abundant along the Iron Gate-Shasta section at an average of 1.6 ± 1.5 birds per survey. Large average densities of black-headed grosbeaks also were noted in the Copco No. 2 bypass and J.C. Boyle peaking reach with 1.5 ± 2.1 and 1.1 ± 1.3 birds detected per survey in each study area section, respectively (Table E5.2-7).

E5.2.2.4 Amphibians and Reptiles

Based on published range maps and habitat associations, 16 amphibian and 22 reptile species potentially occur in the study area (see Terrestrial Resources FTR, Section 4.0, Table 4.4-1). A combination of existing databases and literature and surveys of potential pond-breeding, stream, and terrestrial habitats (conducted by PacifiCorp in 2002 and 2003, and BLM in 2000-2001) documented five species of amphibians and 16 species of reptiles in the study area. Pond-breeding amphibians in the study area include Pacific treefrog (*Hyla regilla*), western toad (*Bufo boreas*), long-toed salamander (*Ambystoma macrodactylum*), and bullfrog (*Rana catesbeiana*) (Table E5.2-8). The 16 species of reptiles documented in the study area include one turtle, four lizards, and 11 snakes.

<u>Amphibians</u>

In 2002, adult pond-breeding amphibians were detected in 13 (27 percent) of the 49 sites that were hydrologically connected to the river, while 12 (63 percent) of the 19 isolated wetlands had detections of pond-breeding amphibians. Evidence of breeding (eggs or tadpoles) was noted at seven (37 percent) of the isolated sites, but only four sites (8 percent) of the wetlands adjacent to the river. This pattern may indicate a difference in the habitat quality between the two groups of breeding sites.

Additional surveys conducted in 2003 of 20 isolated wetlands, ten foothill yellow-legged frog (*Rana boylii*) survey sites, and four spotted frog (*Rana pretiosa*) survey sites documented additional amphibian breeding sites. The following sections discuss each of the pond-breeding species that were documented in the study area in 2002 and 2003.

<u>Western Toad</u>. During 2002 and 2003, western toads were documented breeding at seven different sites in the study area: (1) one along the north shore of Iron Gate reservoir, located a short distance southwest of the mouth of Scotch Creek; (2) a seasonally flooded portion of an annual grassland along Way Creek near Topsy Road; (3) a stock pond near Long Prairie Creek, which is above the rim of the immediate river canyon; (4) an irrigation ditch upstream of Shovel Creek; (5) a small swale associated with an irrigated pasture near Shovel Creek; (6) an disturbed section of Cottonwood Creek approximately 0.25 mile (0.4 km) upstream of the Klamath River; and (7) several low-flow portions of lower Willow Creek (see Terrestrial Resources FTR, Section 4.7). The Iron Gate shoreline breeding site was used by toads during 2002 and 2003, while the other sites were surveyed only during 1 of the 2 years.

Table E5.2-8. Amphibian and reptile observations in the study area[2] by study area section and habitat.

	Iron Gate-Shasta	Iron Gate Reservoir	Fall Creek	Copco No. 2 Bypass	Copco Reservoir	J.C. Boyle Peaking Reach	J.C. Boyle Bypass	J.C. Boyle Reservoir	Keno Canyon	Keno Reservoir	Link River
AMPHIBIANS (5)											
Pacific Giant Salamander			RM, RUB				RUB				
Western Toad[1]	RUB	R/PFO				MHOC, RG					
Treefrog		PEM	PEM	RD	DST	PEM, RD/PFO, RUB, GL		PEM			PEM
Bullfrog	R/PSS, PEM	R/PSS, LUB, R/PFO					RG			LUB	
Long-Toed Salamander						PUB					
REPTILES (16)											
Western Pond Turtle[1]	GL,	LUB, R/PSS	LUB, PEM		LUB	RUB, RUS		LUB		DST, LUB, PEM, PP, RG	
Southern Alligator Lizard					R/PSS	MHOC, PEM			DST, PEM, R/PSS		
Northern Sagebrush Lizard[1]		R/PFO	GL						PP, R/PSS		
Western Fence Lizard	DST, R/PSS, RG	MHOC, MHOJ, PEM, R/PSS	R/PSS	R/PFO	J, MHO, MXC, R/PFO	GL, J, KMC, MHO, MHOC, MHOJ, MXC, PEM, PP, R/PFO, R/PSS, RG, RT, RUB	DST, GL, KMC, LP, MHOJ, R/PSS	PP	KMC, PEM, R/PSS, RG	DST, PP	
Western Skink							RG				
Yellow-Bellied Racer						PA, R/PSS	DST, MXC		PP		
Sharptail Snake[1]						KMC					
Common Kingsnake[1]		DST	MHO, DST								
California Mountain Kingsnake[1]				DST							
Striped Whipsnake				DST							
Gopher Snake	DST, R/PSS					RG, PEM			RG	R/PFO	

Table E5.2-8. Amphibian and reptile observations in the study area[2] by study area section and habitat.

	Iron Gate-Shasta	Iron Gate Reservoir	Fall Creek	Copco No. 2 Bypass	Copco Reservoir	J.C. Boyle Peaking Reach	J.C. Boyle Bypass	J.C. Boyle Reservoir	Keno Canyon	Keno Reservoir	Link River
Western Terrestrial Garter Snake			DST			R/PFO, R/PSS					
Common Garter Snake						PEM, RG	R/PSS		DST, RG		R/PSS
Western Rattlesnake		R/PSS, DST				PEM, DST, RT	DST				
Rubber Boa						MHOC					
Ringneck Snake						DST	DST				

Habitat: DST=Disturbed; GL=Grassland; J=Juniper; KMC=Klamath Mixed Conifer; LP=Lodgepole Pine; LUB=Lacustrine Unconsolidated Bottom; MHO=Montane Hardwood Oak; MHOC=Montane Hardwood Oak Conifer; MHOJ=Montane Hardwood Oak Juniper; MXC=Mixed Conifer; PA=Pasture; PEM=Palustrine Emergent Wetland; PP=Ponderosa Pine; RD=Riparian Deciduous Forest; R/PFO=Riparian/Palustrine Forested Wetland; R/PSS=Riparian/Palustrine Scrub-Shrub Wetland; RG=Riparian Grassland; RM=Riparian Mixed; RT=Rock Talus; RUB=Riverine Unconsolidated Bottom; SB=Sagebrush.

[1] TES species.
[2] Observations include both PacifiCorp and BLM data.

The Way Creek site is likely the same breeding site that was documented by Roninger (2001). This site had significant off-road vehicular damage during the spring of 2002. The Iron Gate reservoir breeding site had been found previously by Southern Oregon University surveys (Parker, pers. comm., 2002). Parker (2002) also indicated that western toads use pools in upper Scotch Creek as oviposition sites. Biologists inspected several other beaches along shorelines of Iron Gate and Copco reservoirs that had gradual slope, but found no other toad use. Several wetlands and ponds associated with irrigation ditches and stock ponds in the J.C. Boyle peaking reach supported toad breeding activity in 2003. During foothill yellow-legged frog surveys, western toad tadpoles were found along the lower portions of Cottonwood and Willow creeks, which are tributaries in the Iron Gate-Shasta segment. Surveys conducted by the BLM and others found toads were documented in the Oregon portion of the J.C. Boyle peaking reach (Roninger, 2001; St. John, 1987). There are likely other breeding sites either along the reservoir shorelines or in small, isolated ponds throughout the study area.

<u>Pacific Treefrog</u>. There were 18 sites at which Pacific treefrogs were noted during 2002 surveys, including eight that were confirmed as breeding sites; at least 12 other isolated wetlands were found to have breeding treefrogs in 2003 (see Terrestrial Resources FTR, Section 4.7). Only two of the breeding sites documented in the 2 years of surveys were in wetlands directly connected to the river or reservoirs—one site along Iron Gate reservoir and one site along the J.C. Boyle peaking reach. There were numerous breeding sites associated with roadside ditches, irrigation canals, and stock ponds. Pacific treefrogs were found breeding at a number of widely scattered locations in the Oregon portion of the J.C. Boyle peaking reach in 2000 and 2001 (Roninger, 2001).

<u>Bullfrog</u>. In 2002, the non-native bullfrog was found at two locations downstream of Iron Gate dam, along Keno reservoir, and along Iron Gate reservoir (see Terrestrial Resources FTR, Appendix 4C). During 2003, bullfrogs were found along Jenny Creek 0.25 mile (0.4 km) upstream of Iron Gate reservoir and in a backwater of the Klamath River in the J.C. Boyle bypass reach. Incidental bullfrog observations were recorded on all four of the current Project reservoirs, as well as in the J.C. Boyle bypass and uppermost portion of the J.C. Boyle peaking reach. Hayes (1994) reported bullfrogs at Lake Ewauna (upper Keno reservoir), Link River, and the Klamath Wildlife Area. This species likely breeds in all Project reservoirs, slow-moving sections of river reaches, and other sites and creates substantial predatory pressure on native amphibian species.

<u>Stream-Dwelling Amphibian Species</u>. The only stream-dwelling amphibian species documented in the study area was the Pacific giant salamander (*Dicamptodon tenebrosus*). Larval Pacific giant salamanders were found above and below the Fall Creek diversion dam during amphibian surveys (see Terrestrial Resources FTR, Section 4.7) as well as in the J.C. Boyle bypass reach during electroshocking. No foothill yellow-legged frogs were found during any of the surveys including specific foothill yellow-legged frog surveys conducted in 2003. Other amphibians found during surveys of riverine habitat include: bullfrogs, treefrogs, and western toads. All of these were associated either with river margins in low gradient areas or on tributary streams with areas of slow-moving water.

<u>Terrestrial Salamanders</u>. No terrestrial salamanders were found in the study area by PacifiCorp or other investigators. The BLM, in its surveys of the Klamath River canyon below J.C. Boyle dam, found no terrestrial amphibians at any of the 50 terrestrial sample sites (Roninger, 2001). A

survey by St. John (1987) in oak habitat of Klamath County also reported no terrestrial amphibian species. Therefore, it seems unlikely that fully terrestrial amphibians occur with any regularity in the study area. The long-toed salamander, a species that breeds in small ponds and wetlands, was documented near Long Prairie Creek in a stock pond located above the canyon rim in 2003. Adult long-toed salamanders likely use various upland habitats near the Project.

Reptiles

The following is a discussion of terrestrial reptiles; the aquatic reptiles—pond turtles—are discussed in the TES species discussion (Section E5.2.2.5).

Terrestrial reptiles were surveyed in 139 wildlife survey plots, each 1.96 acres (0.8 ha) in the study area (see Terrestrial Resources FTR, Section 4.0, Figure 4.4-1) as well as near Project facilities, during small mammal trapping along Project canals in 2003, at sites identified as potential snake hibernacula, and incidentally during other surveys in 2002 and 2003. The 2002 plot data provide a standardized index to the abundance of terrestrial reptiles. On a per plot basis, the greatest number of terrestrial reptiles was detected at the Keno reservoir section, where an average of 2.25 reptiles/plot was detected (see Terrestrial Resources FTR, Section 4.0, Table 4.7-4). This was followed closely by the J.C. Boyle peaking reach with 1.95 reptiles/plot (see Terrestrial Resources FTR, Section 4.0, Table 4.7-4). The lowest number of detections occurred in the Fall Creek segment, where only one western fence lizard (*Sceloporus occidentalis*) was found in seven plots (0.14 per plot).

The data from the 36 plots located in wetland or riparian habitats along the 11 study area segments indicate that the species diversity of reptiles was greatest in the J.C. Boyle peaking reach, where 21 individual reptiles (3.5 individuals/plot) and eight species were detected (Table E5.2-7). The Keno Canyon also had a high density (3.0 individual reptiles/plot); these detections were of only two species (see Terrestrial Resources FTR, Section 4.0, Table 4.7-4). All other Project segments had between 0.75 and 1.7 reptiles/plot, except for the J.C. Boyle reservoir, where no reptiles were detected in the riparian/wetland wildlife plots.

Overall, the western fence lizard was by far the most abundant reptile species encountered in the wildlife survey plots, representing 94 of 159 detections (59 percent). An average of 0.67 western fence lizard was detected in each plot (see Terrestrial Resources FTR, Section 4.0, Table 4.7-4). Western fence lizards were detected in all Project segments except the Link River. Western fence lizards were found in a wide variety of habitats including riparian and wetland habitats, mixed chaparral, juniper, montane hardwood oak woodlands, ponderosa pine forest, Klamath mixed conifer forest, and lodgepole pine stands (see Terrestrial Resources FTR, Section 4.0, Table 4.7-3).

The next most abundant species found during the terrestrial plot surveys was the common garter snake (*Thamnophis sirtalis*). This species was noted in the J.C. Boyle peaking reach, J.C. Boyle bypass, Keno Canyon, and Link River segments, always associated with riparian habitats (see Terrestrial Resources FTR, Section 4.0, Table 4.7-3). One winter hibernaculum with numerous common garter snakes was located just downstream of the Keno dam among concrete rubble about 20 feet (6 m) from the river. Southern alligator lizards (*Elgaria multicarinata*) were found in riparian and wetland habitat in the Keno Canyon, J.C. Boyle peaking reach, and along Copco reservoir. This species also was found in montane hardwood oak-conifer forests in the J.C. Boyle peaking reach of the study area. BLM surveys found southern alligator lizards widely scattered throughout the J.C. Boyle Canyon, particularly downstream of the Frain Ranch on southern aspects (Roninger, 2001). A few of the sites documented by Roninger (2001) are close to the river, but most are farther than 0.2 mile (0.3 km).

Northern sagebrush lizards (*Sceloporus graciosus*) were found at only two sites—one in the rocky riparian shrub habitat of the Keno Canyon and one near the edge of a forested wetland along Iron Gate reservoir (see Terrestrial Resources FTR, Section 4.0, Table 4.7-3). BLM surveys found this species only near the historic Topsy Site (Roninger, 2001). However, St. John (1987) found sagebrush lizards to be quite numerous in suitable open woodlands in the immediate vicinity of the Topsy Site, BLM's Topsy Campground, and on the north side of the river upslope of the J.C. Boyle powerhouse.

Other species include western terrestrial garter snake (*Thamnophis elegans*), yellow-bellied racer (*Coluber constrictor*), gopher snake (*Pituophis melanoleucus*), and rattlesnake (*Crotalis viridus*). Rattlesnakes are known to occur throughout the study area, with a patchy distribution. There are reports of concentrations of rattlesnakes in the J.C. Boyle bypass and at various sections of the J.C. Boyle peaking reach. Surveys at sites suspected to be hibernacula failed to find concentrations of snakes. The unusually cool spring weather made it difficult to time surveys to coincide with den emergence. Monitoring of road-kill by Project personnel during the spring and summer of 2003 found rattlesnakes and gopher snakes to be periodically observed basking on roads and also to be killed by vehicles on the main public roads in the study area.

During small mammal trapping along Project canals conducted in 2003, some reptiles were observed in close proximity to the J.C. Boyle canal, either immediately along the northern canal wall or on the rocky slope between the canal and the Klamath River. Species detected at the J.C. Boyle Canal include northern alligator lizard (*Elgaria coerulea*), western fence lizard, northern sagebrush lizard, rattlesnake, yellow-bellied racer, ringneck snake (*Diadophis punctatus*), and California mountain kingsnake (*Lampropeltis zonata*). Although not standardized on the basis of unit effort, these data seem to indicate a high concentration of terrestrial reptiles near the J.C. Boyle canal. Other observations of reptiles in the study area include the following:

- Common Kingsnake (*Lampropeltis getual*)—There were four observations in the J.C. Boyle Canyon and one found dead on the paved county road north of the Iron Gate-Shasta River section in 2002.

- Striped Whipsnake (*Masticophis taeniatus*)—One found dead on the county road near the Copco No. 1 village in 2002. There were also anecdotal reports of striped whipsnakes being seen in 2003 along the Copco Road just northeast of the Fall Creek powerhouse. Roninger (2001) reported this species from a site near Keno dam and a site 0.5 mile (0.8 km) north of the river not far from the Oregon-California border.

- Sharptail Snake (*Contia tenuis*)—BLM (Roninger, 2001) reported three locations, none of which was closer than about 0.1 mile (0.2 km) from the river.

- Ringneck Snake—The BLM (Roninger, 2001) reported only one location—approximately 0.1 mile (0.2 km) west of the river and northwest of the Frain Ranch. St. John (1987) reported one dead ringneck snake on the Topsy Road adjacent to steep, rocky slopes dominated by shrubs, oaks, ponderosa pine, and western juniper.

- Western Skink (*Eumeces skiltonianus*)—One skink was found in riparian grass habitat in the J.C. Boyle bypass reach during 2003 foothill yellow-legged frog surveys. Skinks were found by the BLM (Roninger, 2001) at approximately seven locations in the canyon, including two sites immediately north of the river just upstream of the Oregon-California border and at other widely scattered sites 0.2 to 0.8 mile (0.3 to 1.3 km) from the river.

- Rubber Boa (*Charina bottae*)—One was found by the BLM east of the Topsy Road outside of the canyon (Roninger, 2001). St. John (1987) found one rubber boa near the BLM's Topsy Campground.

- California Mountain Kingsnake—California mountain kingsnakes were found in 2000 and 2001 at five locations in the J.C. Boyle Canyon by the BLM, including one site near the BLM's Klamath River Campground (Roninger, 2001). The other four sites are located approximately 0.25 mile (0.4 km) from the river. St. John (1987) found one California mountain kingsnake near the Way Ranch and reports that there are other recent records in the canyon several miles downstream of the J.C. Boyle powerhouse. St. John (1987) speculated that in Klamath County, this species is restricted to the Klamath River Canyon.

The primary Project effects on amphibians are (1) poor breeding habitat available along Project reservoirs as a result of water level fluctuations and large predator populations (fish and bull frogs), and (2) large gaps in riparian habitat connectivity that are a result of the existence of the reservoirs. For reptiles, the J.C. Boyle canal may create a local barrier for reptile movement. Although only documented through limited survey data and anecdotal information, a major source of snake mortality appears to be caused by vehicles or being intentionally killed by the public along roads and Project and non-Project recreation facilities.

E5.2.2.5 Threatened, Endangered, and Sensitive Wildlife Species

For the purpose of describing wildlife resources associated with the Project, TES wildlife species were defined as any species listed, protected, or given special management consideration by the USFWS, BLM, ODFW, ONHP, or CDFG.

The following are summaries of the several tiers of protection for TES wildlife:

- Wildlife listed or proposed as threatened or endangered by the USFWS are protected under the ESA of 1973, as amended.

- Taxa designated by the USFWS as candidates for listing or species of concern may be proposed for listing at a future time, but currently are not protected by the ESA.

- Wildlife considered to be species of concern by the USFWS.

- Wildlife on the BLM Sensitive Species List, Tracking List, or Assessment Species List are given special management consideration on BLM-administrated lands.

- Survey and manage (S/M) species identified in the Northwest Forest Plan (USFS and BLM, 1994, 2000, and 2001).
- Wildlife listed as threatened or endangered by the ODFW are protected under the authority of the Oregon ESA of 1987 (ORS 496.176).
- Species listed as sensitive by the ODFW are not protected by state statute, but actions to prevent their further decline are encouraged by administrative rule (OAR 635-100-040).
- Wildlife considered rare, declining, or of conservation concern are monitored by the ONHP, but are not protected by federal or state statute unless already listed by the USFWS or ODFW.
- Species protected by the California Endangered Species Act (CESA) (CDFG Code Sections 2050-2116)

PacifiCorp conducted a search of federal and state databases of TES wildlife in 2001 and consulted with agency biologists familiar with TES species occurrence information. This review indicated that 107 vertebrate and 22 invertebrate TES species potentially occur in the Project vicinity (letter from B.G. Halstead, Project Leader, USFWS, Arcata, California, April 9, 2002; J.C. Knight, Chief, Endangered Species Division, USFWS, Sacramento, California, April 13, 2001; CDFG website; letter from K.M. McMaster, State Supervisor, USFWS, Portland, Oregon, January 8, 2001; CNPS website; BLM, unpublished data). Of these 107 species, five species—the bald eagle, western snowy plover (*Charadrius alexandrinus nivosus*), northern spotted owl, Canada lynx (*Lynx canadensis*), and gray wolf—are federally listed as threatened or endangered. Currently, the bald eagle is proposed for delisting (64 FR 36453-36464, July 6, 1999).

Surveys conducted during 2002 and 2003 documented 48 of the 107 vertebrate TES species. These included one amphibian, five reptiles, 40 birds, and two mammals in the study area (Table E5.2-9). In addition to these species, the western big-eared bat (*Corynorhinus townsendii townsendii*) is known to occur and several other TES species are reported from the general vicinity of the Project, but were not detected during 2002-2003 surveys (Table E5.2-9). The habitats in which each TES species was found are presented in Table E5.2-10. The following section presents information on species that are federally listed as threatened or endangered, federal candidates for listing, or federal species of concern.

E5.2.2.6 Federally Listed Species

The bald eagle and northern spotted owl are the only federally listed species documented in the Project vicinity. The other three federally listed species—western snowy plover, Canada lynx, and gray wolf—were not observed during field surveys in 2002 or 2003 and have not been reported from any other known sources as occurring in the Project vicinity. The western snowy plover is a shorebird that typically nests in sandy substrate along the Pacific Coast (National Geographic Society, 1999). However, a small inland population, consisting of less than 1,000 birds in Oregon, is known to nest along the margin in alkaline lakes (Csuti et al. 1997). No suitable breeding habitat for the snowy plover exists in the study area. However, the species has a potential for occurrence along the shoreline of Project water bodies during migration (Csuti et al. 1997).

Table E5.2-9. TES wildlife species occurring or potentially occurring in the Klamath Hydroelectric Project study area.

Scientific Name/ Common Name	Federal Status[1]	ODFW Status[2]	ONHP List[3]	CDFG Status[4]	California Status[5]	Study Area Sections with Documented Occurrence Within the Study Area
Amphibians (11)						
Ambystoma californiense California Tiger Salamander	C	—	—	SSC	—	None
Rhyacotriton variegatus Southern Torrent (=seep) Salamander	SoC	SV	4	SSC	—	None
Plethodon elongatus Del Norte Salamander	SoC S/M-D	SV	2	SSC	—	None
Plethodon stormi Siskiyou Mountains Salamander	SoC S/M-C	SV	2	—	LT	None
Aneides ferreus Clouded Salamander	—	SU	3	—	—	None
Ascaphus truei Tailed Frog	SoC BLM-T	SV	2	SCC	—	None
Bufo boreas Western Toad	BLM-T	SV	4	—	—	Iron Gate reservoir, J.C. Boyle peaking reach, Iron Gate-Shasta
Rana aurora draytonii California Red-Legged Frog	LT	SC	1	SSC	—	None
Rana cascadae Cascades Frog	SoC BLM-T	SV	2	SSC	—	None
Rana pretiosa Oregon Spotted Frog	C	SC	1	—	—	None
Rana boylii Foothill Yellow-Legged Frog	SoC BLM-A	SV	2	SSC	—	Historical records in J.C. Boyle bypass [5]
Reptiles (5)						
Clemmys marmorata marmorata Northwestern Pond Turtle	SoC BLM	SC	1	SSC	—	Iron Gate-Shasta, Iron Gate reservoir, Fall Creek, Copco reservoir, J.C. Boyle peaking reach, J.C. Boyle reservoir, Keno reservoir, Link River
Sceloporus graciosus graciosus Northern Sagebrush Lizard	SoC BLM-T		4	—	—	Iron Gate reservoir, Fall Creek, J.C. Boyle peaking reach, J.C. Boyle bypass Reach, Keno Canyon
Contia tenuis Sharptail Snake	BLM-T	SV	4	—	—	J.C. Boyle peaking reach
Lampropeltis getula Common Kingsnake	SoC BLM-T	SV	2	—	—	Iron Gate-Shasta, Iron Gate reservoir, Fall Creek, J.C. Boyle peaking reach
Lampropeltis zonata California Mountain Kingsnake	SoC BLM-T	SV	3	—	—	Copco No. 2 bypass, J.C. Boyle peaking reach, J.C. Boyle bypass reach

Table E5.2-9. TES wildlife species occurring or potentially occurring in the Klamath Hydroelectric Project study area.

Scientific Name/ Common Name	Federal Status[1]	ODFW Status[2]	ONHP List[3]	CDFG Status[4]	California Status[5]	Study Area Sections with Documented Occurrence Within the Study Area
Birds (67)						
Gavia immer Common Loon	SoC	—	—	SSC-HP	—	Iron Gate reservoir
Podiceps auritus Horned Grebe	BLM-T	SP	2	—	—	None
Podiceps grisegena Red-necked Grebe	—	SC	2	—	—	None
Pelecanus erythrorhynchos American White Pelican	BLM-A	SV	2	SSC-HP	—	Iron Gate-Shasta, Iron Gate reservoir, Copco reservoir, J.C. Boyle peaking reach, J.C. Boyle bypass, J.C. Boyle reservoir, Keno Canyon, Keno reservoir
Ixobrychus exilis hesperis Western Least Bittern	SoC BLM-A	SP	2	SSC-TP	—	None
Nycticorax nycticorax Black-Crowned Night Heron	SoC	—	—	—	—	Iron Gate-Shasta, Link River, Keno Canyon, Keno reservoir
Egretta thula Snowy Egret	BLM- A	SV	4	—	—	Keno Canyon, Link River
Casmerodius albius Great Egret	BLM-T	—	—	—	—	J.C. Boyle bypass, J.C. Boyle reservoir, Keno Canyon, Keno reservoir, Link River
Plegadis chihi White-Faced Ibis	SoC	—	4	SSC-HP	—	J.C. Boyle reservoir, Keno reservoir, Link River
Histrionicus histrionicus Harlequin Duck	SoC	SU	2	SSC-TP	—	None
Bucephala islandica Barrow's Goldeneye	BLM-T	SU	4	—	—	Iron Gate reservoir, Keno reservoir
Bucephala albeola Bufflehead	BLM-A	SU	4	—	—	Iron Gate reservoir, Copco reservoir, J.C. Boyle reservoir, Keno reservoir, Link River
Pandion haliaetus Osprey	—	—	—	SSC-SP	—	Observed in all study area sections
Circus cyaneus Northern Harrier	—	—	—	SSC-SP	—	Iron Gate-Shasta, Keno reservoir
Aquila chrysaetos Golden Eagle	—	—	—	SSC-TP	—	Iron Gate reservoir, Copco No. 2 bypass, J.C. Boyle peaking reach, Link River
Haliaeetus leucocephalus Bald Eagle	LT	LT	2	—	LE	Observed in all study area sections
Accipiter striatus Sharp-Shinned Hawk	—	—	—	SSC-TP	—	Copco reservoir, J.C. Boyle peaking reach, J.C. Boyle bypass

Table E5.2-9. TES wildlife species occurring or potentially occurring in the Klamath Hydroelectric Project study area.

Scientific Name/ Common Name	Federal Status[1]	ODFW Status[2]	ONHP List[3]	CDFG Status[4]	California Status[5]	Study Area Sections with Documented Occurrence Within the Study Area
Accipiter cooperii Cooper's Hawk	—	—	—	SSC-TP	—	Iron Gate-Shasta, J.C. Boyle peaking reach, J.C. Boyle bypass
Accipiter gentilis Northern Goshawk	SoC BLM CC	SC	2	SSC-TP	—	J.C. Boyle peaking reach
Buteo swainsoni Swainson's Hawk	SoC BLM-T	SV	4	SSC-HP	LT	Observed incidentally several miles from Keno reservoir outside of the study area
Buteo regalis Ferruginous Hawk	SoC BLM	SC	2	SSC	—	None
Falco columbarius Merlin	BLM-A	—	2	SSC-HP	—	J.C Boyle peaking reach, J.C. Boyle reservoir
Falco mexicanus Prairie Falcon	—	—	—	SSC-TP	—	J.C. Boyle peaking reach, J.C. Boyle bypass, Keno reservoir
Falco peregrinus anatum American Peregrine Falcon	BLM-S CC	LE	2	—	LE	None observed. Historical records in J.C. Boyle bypass, Keno reservoir
Bonasa umbellus Ruffed Grouse	—	—	—	SSC-TP	—	None
Tympanuchus phasianellus columbianus Columbian Sharp-Tailed Grouse	SoC	—	1	SSC-HP	—	None
Centrocercus urophasianus phaios Western Greater Sage Grouse (southeast populations)	SoC	SV	1	SSC-TP	—	None
Oreortyx pictus Mountain Quail	SoC BLM-T	SU	4	—	—	J.C. Boyle bypass, J.C. Boyle reservoir, Fall Creek
Coturnicops noveboracensis Yellow Rail	SoC BLM	SC	2	SSC-HP	—	None
Grus canadensis tabida Greater Sandhill Crane	SoC BLM-T	SV	4	—	LT	J.C. Boyle reservoir (nesting), Keno reservoir
Charadrius alexandrinus nivosus Western Snowy Plover (Interior populations)	LT	LT	1	SSC-SP	—	None
Numenius americanus Long-Billed Curlew	SoC CC	—	4	SSC	—	None
Bartramia longicauda Upland Sandpiper	SoC	SC	2	—	—	None
Sterna caspia Caspian Tern	CC	—	—	—	—	Iron Gate-Shasta, Iron Gate reservoir, Copco reservoir, J.C. Boyle bypass, J.C. Boyle reservoir, Keno Canyon, Keno reservoir, Link River

Table E5.2-9. TES wildlife species occurring or potentially occurring in the Klamath Hydroelectric Project study area.

Scientific Name/ Common Name	Federal Status[1]	ODFW Status[2]	ONHP List[3]	CDFG Status[4]	California Status[5]	Study Area Sections with Documented Occurrence Within the Study Area
Sterna forsteri Forster's Tern	BLM-T	—	—	—	—	Iron Gate reservoir, Copco reservoir, J.C. Boyle peaking reach, J.C. Boyle reservoir, Keno reservoir, Link River
Chlidonias niger Black Tern	SoC BLM-T	—	4	SSC-	—	J.C. Boyle reservoir, Keno reservoir
Coccyzus americanus occidentalis Western Yellow-Billed Cuckoo	C CC	SC	2	—	LE	None
Asio flamneus Short-Eared Owl	SoC	—	—	SSC-SP	—	None
Asio otus Long-Eared Owl	—	—	—	SSC-SP	—	None
Strix nebulosa Great Gray Owl	BLM-T S/M-C	SV	4	—	LE	Fall Creek, J.C Boyle peaking reach
Strix occidentalis caurina Northern Spotted Owl	LT*	LT	1	—	—	J.C. Boyle peaking reach
Otus flammeolus Flammulated Owl	BLM CC	SC	4	—	—	J.C. Boyle peaking reach, J.C. Boyle bypass
Athene cunicularia hypugea Western Burrowing Owl	SoC	SC	2	SSC-SP	—	None
Cypseloides niger Black Swift	—	SP	2	SSC-TP	—	None
Chaetura vauxi Vaux's Swift	—	—	—	SSC	—	Fall Creek, Copco reservoir, J.C. Boyle peaking reach, J.C. Boyle bypass, J.C. Boyle reservoir
Melanerpes formicivorus Acorn Woodpecker	SoC BLM-T	—	4	—	—	Iron Gate-Shasta, Iron Gate reservoir, Fall Creek, Copco No. 2 bypass, Copco reservoir, J.C. Boyle peaking reach, J.C. Boyle bypass, J.C. Boyle reservoir
Picoides albolarvatus White-Headed Woodpecker	SoC BLM CC	SC	4	—	—	J.C. Boyle bypass
Melanerpes lewis Lewis' Woodpecker	SoC BLM CC	SC	4	—	—	Iron Gate-Shasta, Iron Gate reservoir, J.C Boyle peaking reach
Sphyrapicus thyroideus Williamson's Sapsucker	BLM-T	SU	4	—	—	None observed. Known to occur in the general Project vicinity.
Picoides tridactylus Three-Toed Woodpecker	BLM-S	SC	4	—	—	None

Table E5.2-9. TES wildlife species occurring or potentially occurring in the Klamath Hydroelectric Project study area.

Scientific Name/ Common Name	Federal Status[1]	ODFW Status[2]	ONHP List[3]	CDFG Status[4]	California Status[5]	Study Area Sections with Documented Occurrence Within the Study Area
Picoides arcticus Black-Backed Woodpecker	BLM	SC	4	—	—	None
Dryocopus pileatus Pileated Woodpecker	BLM-T	SV	4	—	—	Fall Creek, J.C. Boyle peaking reach, J.C. Boyle bypass, J. C. Boyle reservoir, Keno Canyon
Contopus cooperi (=*borealis*) Olive-Sided Flycatcher	SoC BLM-T CC	SV	4	—	—	J.C. Boyle peaking reach, J.C. Boyle reservoir, Keno Canyon, Keno reservoir, Link River
Empidonax traillii adastus (=*E. adastus*) & *E. t. brewsterii* Willow Flycatcher	SoC BLM-T	SU	4	SSC-HP	LE	Iron Gate-Shasta, Iron Gate reservoir, Copco reservoir, J.C. Boyle peaking reach, J.C. Boyle reservoir, Link River
Sayornis nigricans Black Phoebe	BLM-T	—	—	—	—	Iron Gate-Shasta, J.C. Boyle bypass, J.C. Boyle reservoir, J.C. Boyle peaking reach
Lanius ludovicianus Loggerhead Shrike	—	—	4	SSC	—	None
Gymnorhinus cyanocephalus Pinyon Jay	BLM-T	—	—	—	—	None
Progne subis Purple Martin	SoC	SC	2	—	—	Fall Creek
Riparia riparia Bank Swallow	SoC BLM-T	SU	4	SSC-SP	LT	None
Parus atricapillus Black-Capped Chickadee	—	—	—	SSC-TP	—	Iron Gate reservoir, Copco reservoir, Link River
Sitta pygmaea Pygmy Nuthatch	BLM-T	SV	4	—	—	J.C. Boyle reservoir, Keno reservoir
Polioptila caerulea Blue-Gray Gnatcatcher	BLM-T	—	—	—	—	Iron Gate reservoir
Sialia mexicana Western Bluebird	—	SV	4	—	—	Iron Gate reservoir, Fall Creek, Copco No. 2 bypass
Dendroica petechia Yellow Warbler	—	—	—	SSC-SP	—	Observed in all study area sections
Icteria virens Yellow-Breasted Chat	SoC	—	4	SSC	—	Iron Gate-Shasta, Fall Creek, Copco reservoir, J.C. Boyle peaking reach
Amphispiza bilineata Black-Throated Sparrow	BLM-T	SP	2	—	—	None
Agelaius tricolor Tricolored Blackbird	SoC BLM-A	SP	2	SSC	—	None

Table E5.2-9. TES wildlife species occurring or potentially occurring in the Klamath Hydroelectric Project study area.

Scientific Name/ Common Name	Federal Status[1]	ODFW Status[2]	ONHP List[3]	CDFG Status[4]	California Status[5]	Study Area Sections with Documented Occurrence Within the Study Area
Mammals (23)						
Sorex preblei Preble's Shrew	SoC	—	4	—	—	None
Myotis ciliolabrum Western Small-Footed Myotis (bat)	SoC BLM-T	SU	4	—	—	None
Myotis yumanensis Yuma Myotis (bat)	SoC BLM-T	—	4	—	—	J.C. Boyle peaking reach, J.C. Boyle bypass, Copco reservoir, Copco No. 2
Myotis volans Long-Legged Myotis (bat)	SoC BLM-T	SU	4	—	—	None
Myotis thysanodes Fringed Myotis (bat)	SoC BLM-T	SV	2	—	—	None
Myotis evotis Long-Eared Myotis (bat)	SoC BLM-T	SU	—	—	—	None
Lasionycteris noctivagans Silver-Haired Bat	SoC BLM-T	SU	4	—	—	None
Euderma maculatum Spotted Bat	SoC BLM	—	2	SSC	—	None
Corynorhinus townsendii townsendii & P. t. pallascens Pacific Western Pale and Big-Eared Bat	SoC BLM	SC	2	SSC-SP	—	J.C. Boyle peaking reach
Antrozous pallidus pacificus Pacific Pallid Bat	SoC BLM-T	SV	2	SSC	—	None
Brochylagus idahoensis Pygmy Rabbit	SoC	SV	2	SSC-TP	—	None
Lepus americanus tahoensis Sierra Nevada Snowshoe Hare	SoC	—	—	SSC-TP	—	None
Lepus townsendii White-Tailed Jackrabbit	BLM-T	SU	4	—	—	None
Sciurus griseus Western Gray Squirrel	BLM-T	SU	3	—	—	Fall Creek, Copco reservoir, J.C. Boyle peaking reach
Arborimus (=*Phenacomys*) *albipes* White-Footed Vole	SoC	SU	4	SSC-TP	—	None
Arborimus longicaudus Oregon Red Tree Vole	SoC S/M-C	—	3	—	—	None
Vulpes vulpes necator Sierra Nevada Red Fox	SoC	—		—	LT	None

Table E5.2-9. TES wildlife species occurring or potentially occurring in the Klamath Hydroelectric Project study area.

Scientific Name/ Common Name	Federal Status[1]	ODFW Status[2]	ONHP List[3]	CDFG Status[4]	California Status[5]	Study Area Sections with Documented Occurrence Within the Study Area
Bassariscus astutus Ringtail	BLM-T	SU	4	—	—	None
Martes americana American Marten	SoC BLM-T	SV	4	—	—	None
Martes pennanti pacifica Pacific Fisher	SoC BLM	SC	2	SSC-TP	—	None
Gulo gulo luteus California Wolverine	SoC	LT	2	—	—	None
Lynx canadensis Canada Lynx	LT	—	2	—	—	None
Canis lupus Gray Wolf	LE	LE	2-ex	—	—	None
Mollusks (18)						
Anodonta californiensis California Floater (mussel)	SoC	—	3	—	—	None
Ancotrema voyanum	S/M-E	—	—	—	—	
Discus shimeki Striated Disc (snail)	SoC	—	—	—	—	None
Fluminicola n. sp Klamath Pebblesnail	S/M-A	—	—	—	—	None
Helminthoglypta hertleini Oregon Shoulderband	S/M-B	—	—	—	—	None
Helminthoglypta talmadgei Klamath Shoulderband	S/M-A	—	—	—	—	None
Monadenia chaceana Siskiyou Sideband	S/M-B	—	—	—	—	None
Monadenia churchi Church’s Sideband	S/M-F	—	—	—	—	None
Monadenia fidels klamathica	S/M-B	—	—	—	—	None
Modadenia fidelis ochramphalus	S/M-B	—	—	—	—	None
Monadenia troglodytes troglodytes Shasta Sideband	S/M-A	—	—	—	—	None
Monadenia troglodytes wintu Wintu Sideband	S/M-A	—	—	—	—	None
Pisidium ultramontanum Montane Peaclam	SoC	—	1	—	—	None

Table E5.2-9. TES wildlife species occurring or potentially occurring in the Klamath Hydroelectric Project study area.

Scientific Name/ Common Name	Federal Status[1]	ODFW Status[2]	ONHP List[3]	CDFG Status[4]	California Status[5]	Study Area Sections with Documented Occurrence Within the Study Area
Prophysaon coeruleum Blue-Gray Tail-Dropper	S/M-A	—	—	—	—	None
Trilobopsis roperi Shasta Chaparral	S/M-A	—	—	—	—	None
Trilobopsis tehamana Tehana Chaparral	S/M-A	—	—	—	—	None
Vespericola pressleyi Pressley Hesperian	S/M-A	—	—	—	—	None
Vespericola karokorum Karok Hesperian (=Karok Indian snail)	SoC	—	—	—	—	None
Insects (4)						
Apatania ((=Radema)) tavala Cascades Apatanian Caddisfly	SoC	—	—	—	—	None
Polites mardon Mardon Skipper Butterfly	SoC	—	—	—	—	None
Homoplectra schuhi Schuh's Homoplectran Caddisfly	SoC	—	—	—	—	None
Rhyacophila mosana Bilobed Rhyacophilan Caddisfly	SoC	—	—	—	—	None

[1] **Federal Status: LE =** Listed Endangered. Taxa listed by the USFWS as Endangered under the ESA.
LT = Listed Threatened. Taxa listed by the USFWS as Threatened under the ESA.
PE = Proposed Endangered. Taxa proposed by the USFWS to be listed as Endangered under the ESA.
PT = Proposed Threatened. Taxa proposed by the USFWS to be listed as Threatened under the ESA.
SoC = Species of Concern. Former Category 2 Candidates that need additional information in order for the USFWS to propose as Threatened or Endangered under the ESA. **CC** = Birds of Conservation Concern. USFWS Division of Migratory Bird Management.
BLM = BLM sensitive species. **BLM-T** = BLM tracking species. **BLM-A** = BLM assessment species.
S/M = Survey and Manage species, as designated by the Northwest Forest Plan Amendment. (USFS and BLM, 2001). **S/M-A** = Category A. Rare, pre-disturbance surveys practical. **S/M-B** = Category B: Rare, pre-disturbance surveys not practical. **S/M-C** = Category C: Uncommon, pre-disturbance surveys practical. **S/M-D** = Category D: Uncommon , pre-disturbance surveys not practical or not necessary. **S/M-E** = Category E: Rare, status undetermined. **S/M-F** = Category F: Uncommon or concern for persistence unknown, status undetermined.

[2] **ODFW Status: LE** = Listed Endangered. Taxa listed as Endangered by the ODFW under the Oregon Endangered Species Act (OESA).
LT = Listed Threatened. Taxa listed Threatened by the ODFW under the OESA.
PE = Proposed Endangered. Taxa proposed to be listed as Endangered by the ODFW under the OESA.
PT = Proposed Threatened. Taxa proposed to be listed as Threatened under by ODFW under the OESA.
C = Candidate. Candidate species for listing under the OESA.
SC = Sensitive Critical. Species for which listing as threatened or endangered is pending, or those for which listing as threatened or endangered may be appropriate if immediate conservation actions are not taken. Also considered critical are some peripheral species that are at risk throughout their range, and some disjunct populations.

Table E5.2-9. TES wildlife species occurring or potentially occurring in the Klamath Hydroelectric Project study area.

SV = Sensitive Vulnerable. Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. In some cases the populations are sustainable and protective measures are being implemented; in others, populations may be declining and improved protection measures are needed to maintain sustainable populations over time.

SP = Sensitive Peripheral or Naturally Rare. Peripheral species refer to those whose Oregon populations are on the edge of their range. Naturally rare species are those that had low populations in Oregon because of naturally limiting factors. Maintaining the status quo for the habitats and populations of these species is a minimum necessity. Disjunct populations of several species that occur in Oregon should not be confused with peripheral species.

SU = Sensitive Undetermined Status. Species for which status is unclear. They may be susceptible to population decline of sufficient magnitude to qualify for endangered, threatened, critical, or vulnerable status, but information is not adequate for definitive determination.

[3] **ONHP List:** Listed by the Oregon Natural Heritage Program

List 1: Taxa that are threatened with extinction or presumed to be extinct throughout their entire range.
List 2: Taxa that are threatened with extirpation or presumed to be extirpated from the state of Oregon.
List 3: Species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range.
List 4: Taxa that are of conservation concern but are not currently threatened or endangered.

[4] **CDFG: SSC** = Species of Special Concern. Animals not listed under the federal ESA or the California Endangered Species Act (CESA), but which nonetheless are believed by the CDFG to: (1) be declining at a rate that could result in listing, or (2) historically occurring in low numbers and having current known threats to their persistence. Some, but not all, SSC mammals and bird species have additional designations: **SSC-HP** = Species of Special Concern, High Priority . Species appear to have a high probability of extinction from their entire range in CA. **SSC-SP** = Species of Special Concern, Second Priority. Species that are definitely jeopardized and declining, but extinction or extirpation appears less imminent. **SSC-TP** = Species of Special Concern, Third Priority. Do not appear to be facing extinction in the near future, but are declining seriously or are otherwise highly vulnerable because of human developments. Some SSC species and have been recently listed as threatened or endangered and thus have both designations.

[5] **California Status: LE** = Listed Endangered. Taxa listed as Endangered by the California State Fish and Game Commission (CFGC) under the CESA.

LT = Listed Threatened. Taxa listed as Threatened by the CFGC under the CESA.
C = Candidates. Taxa for are candidates for listing as Endangered or Threatened by the CFGC under the CESA.

Table E5.2-10. Habitat/species matrix for TES wildlife detected during 2002-2003 terrestrial studies.

Species	**Habitat**																			
	DST	**GL**	**J**	**KMC**	**LP**	**LUB**	**MHO**	**MHOC**	**MHOJ**	**MXC**	**PA**	**PEM**	**PP**	**R/PFO**	**R/PSS**	**RG**	**RM**	**RT**	**RUB**	**SB**
TES BIRDS (37)																				
Pelagic Birds and Herons (6)																				
American White Pelican			X			X								X		X			X	
Black-Crowned Night Heron	X					X								X	X				X	
Common Loon						X														
Snowy Egret						X													X	
Great Egret	X					X						X			X				X	
White-Faced Ibis		X											X						X	
Waterfowl (2)																				
Barrow's Goldeneye						X														
Bufflehead						X														
Raptors, Gamebirds (10)																				
Osprey		X		X		X			X			X	X		X	X			X	
Northern Harrier		X														X				
Golden Eagle		X		X				X									X			
Bald Eagle						X	X						X	X	X					X
Sharp-Shinned Hawk															X					
Cooper's Hawk				X				X												
Northern Goshawk								X												
Merlin															X					
Prairie Falcon		X		X		X														
Mountain Quail				X				X							X					
Rails, Cranes, Shorebirds, Gulls, Terns and Doves (4)																				
Sandhill Crane		X				X						X								
Caspian Tern						X			X				X		X				X	X
Forster's Tern						X					X		X			X			X	
Black Tern						X														
Owls, Goatsuckers, Swifts, Hummingbirds and Kingfishers (4)																				
Great Grey Owl								X												
Northern Spotted Owl				X																
Flammulated Owl				X				X												
Vaux's Swift						X	X	X			X		X	X	X	X			X	

Table E5.2-10. Habitat/species matrix for TES wildlife detected during 2002-2003 terrestrial studies.

Species	**Habitat**																			
	DST	**GL**	**J**	**KMC**	**LP**	**LUB**	**MHO**	**MHOC**	**MHOJ**	**MXC**	**PA**	**PEM**	**PP**	**R/PFO**	**R/PSS**	**RG**	**RM**	**RT**	**RUB**	**SB**
Woodpeckers and Flycatchers (7)																				
Acorn Woodpecker		X	X				X	X	X	X		X	X	X	X		X			
White-Headed Woodpecker															X					
Lewis' Woodpecker							X			X				X	X	X				
Pileated Woodpecker				X			X	X	X				X		X		X			
Olive-Sided Flycatcher			X										X							
Willow Flycatcher												X		X	X	X				
Black Phoebe													X	X	X					
Vireos, Corvids and Swallows (1)																				
Purple Martin										X										
Wrentits, Titmice, Chickadees, and Nuthatches (2)																				
Black-Capped Chickadee		X													X	X				
Pygmy Nuthatch													X							
Wrens, Dippers, Kinglets, and Gnatcatchers (1)																				
Blue-Gray Gnatcatcher														X						
Thrushes, Starlings and Waxwings (1)																				
Western Bluebird							X	X	X											
Warblers and Tanagers (2)																				
Yellow Warbler					X		X	X	X	X	X	X	X	X	X	X	X		X	
Yellow-Breasted Chat		X											X	X	X	X				
TES AMPHIBIANS (1)																				
Western Toad								X						X					X	
TES REPTILES (6)																				
Western Pond Turtle	X	X				X						X	X		X	X				
Northern Sagebrush Lizard		X											X	X	X					
Sharptail Snake				X																
Common Kingsnake	X						X													
California Mountain Kingsnake	X																			
MAMMALS (2)																				
Western Gray Squirrel				X			X						X							
Yuma Myotis	X																			

No lynx were detected in the study area during 2002 field studies. Lynx are rare, solitary, boreal forest felines with a northern range extending south along the west coast to southern Oregon. Records for the species in Oregon are scarce; the last confirmed specimen was taken in Oregon near Corvallis in 1974 (Csuti et al. 1997). Recent observations of lynx in Oregon have been reported from the Cascades and the Blue Mountains in northeastern Oregon (Csuti et al. 1997); preliminary DNA survey results also suggest the presence of lynx in the Cascades in Oregon (Weaver and Amato, 1999). Although the Project is located at the southern extent of the species potential range (USFWS website), given the species' scarcity, lynx are unlikely to be detected in the Project vicinity.

No gray wolves were detected during 2002 field studies, and the species is highly unlikely to occur in southern Oregon and the Project vicinity. Grey wolves typically range in northern areas of tundra and wilderness (National Audubon Society, 1996). In general, the species' range includes areas north of the U.S. border and south to Colorado within the Rocky Mountain corridor (Burt and Grossheider, 1980). Although wolves recently have been documented in the far northeastern corner of Oregon, this species has little potential of ranging near the Project. The Western Distinct Population Segment of the gray wolf is being considered for delisting by the USFWS (Federal Register / Vol. 68, No. 62 / Tuesday, April 1, 2003). The following sections present a discussion of the bald eagle and spotted owl in the study area.

<u>Bald Eagle</u>

Both nesting resident and migrant bald eagles, a federally threatened species, occur in the study area. Information on bald eagle use in the area was gathered by PacifiCorp in 2002-2003 during reservoir wildlife surveys, aerial nest searches, and prey remains analyses.

In 2002, the Oregon Cooperative Fish and Wildlife Research Unit conducted aerial surveys, searched for new nests, and checked 19 previously known nesting territories near the study area, nine of which were not near Project water bodies. In 2003, the Oregon Cooperative Fish and Wildlife Research Unit conducted bald eagle aerial surveys to determine the status of the same 19 nests inspected in 2002. In addition, the 2003 aerial bald eagle surveys found a "new" inactive nest located approximately 540 feet (165 m) southeast of Copco dam. These surveys documented ten nests, including the newly discovered Copco dam nest, within approximately 7 miles (11 km) of the Project (Table E5.2-11). Other than the inactive Copco dam nest, only the Moore Park East, Topsy, and Jenny Creek nests are within 1 mile (1.6 km) of any Project facility. The Pony Express nest is approximately 7 miles (11 km) from a facility, but is immediately along the J.C. Boyle peaking reach. All nests were located in large ponderosa pine trees, consistent with the findings of Anthony and Isaacs (1989).

The eight young fledged from the eight occupied territories in 2002 equates to a production rate of 1.0 fledglings/occupied territory, which is equal to the recovery goal of 1.0 young/occupied territory (see Terrestrial Resources FTR, Appendix 5A, Table 5A-13). In 2003, eight nests were occupied and three were found to fledge young in 2003 (0.63 fledglings/occupied territory) (see Terrestrial Resources FTR, Appendix 5A, Table 5A-13). In the Klamath basin, Oregon, bald eagle nest success averaged 64 percent in 2002, with 0.98 young per occupied territory and 1.54 young per successful territory (Isaacs and Anthony, 2002).

Table E5.2-11. Bald eagle territories and nesting status through 2003 in the general vicinity of the Klamath River Hydroelectric Project.*

Territory Name	Closest Associated Study Area Section	First Year Known	Ownership	Confirmed Young Fledged 1998-2003	Young Fledged in 2002	Young Fledged in 2003	Nearest Facility	Distance to the Nearest Facility (feet)
Moore Park East (Oregon)	Link River	1992	City	5	2	2	Westside canal	4,300
Moore Park/Wocus Pass (Oregon)	Link River	1978	City/Private	7	0	2	Link River dam	7,600
Klamath River/Chase Mtn. (Oregon)	J.C. Boyle reservoir	1979	BLM	6	0	0	J.C. Boyle dam	9,300
Topsy (Oregon)	J.C. Boyle reservoir	1998	BLM	5	0	0	J.C. Boyle dam	3,900
Klamath River Canyon (Oregon)	J.C. Boyle peaking reach	1979	Private	4	0	0	J.C. Boyle powerhouse	18,800
Pony Express (Oregon)	J.C. Boyle peaking reach	2001	BLM	3	3	0	J.C. Boyle powerhouse	37,300
Lucky Springs (California)	J.C. Boyle peaking reach	1983	USFS	4	Unknown	Inactive[1]	Copco dam	27,200
Copco Dam (California)	Copco reservoir	2003	Private	-na-	-na-	Inactive	Copco dam	540
Jenny Creek (California)	Iron Gate/Fall Creek	1985	BLM	Unknown	2	0	Fall Creek canal	3,200
Black Mountain (California)	Lower River	2002	Federal	2	1	1	Iron Gate dam	30,800

* Productivity data provided by Frank B. Issacs and the Oregon Cooperative Fish and Wildlife Unit with additional data provided by C. Cheyne, District Wildlife Biologist, USFS, Goosenest Ranger District, Klamath National Forest.
[1] Inactive indicates that no eagles were observed at a nest or within a breeding territory (0 = No young fledged within an "active" breeding territory).
BLM - U.S. Bureau of Land Management.
USFS - U.S. Forest Service.

The Project occurs in two recovery zones as defined in the Pacific States Bald Eagle Recovery Plan (USFWS, 1986); these zones are the Klamath Basin and the California/Oregon Coast. In 2000, the Klamath Basin Recovery Zone had 117 occupied breeding sites, which greatly exceeded its habitat management goal of 80 (USFWS, 1986). Eagle reproduction around Upper Klamath Lake was typical (1.06 young per occupied territory) for this recovery zone during the late 1990s (Isaacs, 2002). In the California/Oregon Coast Recovery Zone, the habitat management goal is 52 bald eagle territories and 28 breeding pairs (USFWS, 1986). The nesting season for bald eagles in Oregon generally runs from February through mid-August.

Prey remains collected from under the four successful bald eagle nests near the Project that were visited in 2002 indicated a varied diet. Waterfowl and gull remains dominated the collected prey items under the Moore Park nest site. This likely indicates that this pair forages on Upper Klamath Lake, which is in direct view from the nest tree. Fish remains, which appear to be perch-like (Order Perciformes), were the only remains found under the Jenny Creek nest site. This nest is located in a remote canyon about 1 mile (1.6 km) from Iron Gate reservoir and not much farther from Copco reservoir. These two Project reservoirs likely provide foraging habitat for this pair. Prey remains collected at the Black Mountain and Pony Express nest sites were composed entirely of small mammals, tentatively identified as ground squirrels. This varied diet is consistent with other studies that showed bald eagles to be opportunistic feeders (Stalmaster, 1987). In a 1989 study of the Grizzly Butte bald eagle territory that occurs in the J.C. Boyle peaking reach (City of Klamath Falls, 1990), prey brought to the nest included 68 percent fish and 32 percent mammals, which is consistent with the varied and opportunistic diet of bald eagles (Stalmaster, 1987).

The combination of waterfowl, small mammals, and fish in the Project vicinity provides abundant forage for resident bald eagles, and at times, wintering bald eagles that congregate in the Klamath basin (especially at the Upper Klamath Wildlife Refuge). The three Project reservoirs included in the license application along with the Klamath River downstream of Iron Gate dam provide large populations of warm water fish species (see Fish Resources FTR, Section 1.0, Table 1.1-2) that are known to be species used by bald eagles in the western United States.

Within the study area, the fish resources available to eagles in the river habitat varies by reach. The Link River fisheries include blue chub (*Gila coerulea*) and flathead minnow (*Pimephales promelas*) and several species of suckers that move down from Upper Klamath Lake mostly during the late summer to avoid poor water quality. Some redband trout (*Oncorhynchus mykiss*) move upstream through the Link River during April and May. It is doubtful that the Link River has a year round population of trout because of the excessively warm (more than 77°F [25°C]) water temperatures in the summer. Yellow perch also occur in the Link River. Redband trout, tui chub (*Gila bicolor*), and Klamath smallscale sucker (*Catostomus rimiculus*) are the most abundant fish species in the Keno and J.C. Boyle bypass reaches. Native fish species known or suspected to occur in the J.C. Boyle peaking reach include redband trout, Klamath smallscale sucker, Klamath largescale sucker (*Catostomus snyderi*), shortnose sucker (*Chasmistes brevirostris*), Lost River sucker (*Deltistes luxatus*) , tui and blue chubs, lampreys (*Lampetra* sp.), sculpins (*Cottus* sp.), and Klamath speckled dace (*Rhinichthys osculus*) (City of Klamath Falls, 1986). Brown trout (*Salmo trutta*) and rainbow trout (*O. mykiss*) also are common between the Oregon-California border and Copco No. 1 reservoir. Some trout spawn and die along lower

Shovel Creek, although the number of fish carcasses potentially available for bald eagles is likely small.

The river reach downstream of Iron Gate dam supports many species of cool water or cold water species that are known to be used by bald eagles, such as chubs, suckers, trout, and salmon. Anadromous salmonids historically and currently using the lower Klamath basin downstream of Iron Gate dam include spring/summer-, fall-, and winter-run steelhead (*O. mykiss*), spring- and summer/fall-run Chinook salmon (*Oncorhynchus tshawytscha*), and coho salmon (*O. kisutch*). One or more of the anadromous fish species/life stages is present in the river downstream of the Iron Gate dam during all months of the year, although the adult coho, Chinook, and steelhead typically are present during late fall and winter months, depending on the species. Steelhead runs in the Klamath basin before the 1900s probably exceeded several million fish (Hardy and Addley, 2001). Hardy and Addley (2001) reported that in the 1980s, the hatchery-influenced summer/fall-run of steelhead throughout the Klamath and Trinity rivers consisted of approximately 10,000 fish, while the winter-run steelhead component was estimated at approximately 20,000 fish.

Data from other river systems (e.g., the Pit River in California) indicate that bald eagles make use of shallow pool tail-outs and runs to forage for fish such as suckers and chubs. It is in these types of habitats that eagles can prey on fish because of better visibility and less water turbulence. Aquatic habitat mapping indicates that even during high flows, the J.C. Boyle bypass and J.C. Boyle peaking reaches provide 56 to 80 percent pool, glide, and run habitat (Table E5.2-12). Thus, at least from a coarse habitat structure perspective, there should be ample foraging habitat in these river reaches. However, the low visibility that affects most of the Klamath River probably reduces the quality of foraging habitat in the river reaches. Copco No. 2 bypass is too heavily forested to provide foraging habitat for eagles.

Table E5.2-12. Mesohabitat availability (percent of reach) in the J.C. Boyle bypass and peaking reaches.

Habitat	J.C. Boyle Bypass (RM 220 to RM 225)	Upper J.C. Boyle Peaking Reach (RM 214 to RM 220)	Lower J.C. Boyle Peaking Reach (RM 204 to RM 214)
Pool	25.1	46.7	35.8
Glide	0.3	7.9	0
Run	30.8	21.4	44.8
Pocket water	15.6	0	0
Riffle	19.5	24.0	19.2
Cascade	8.5	0	0.3
Total	**100**	**100**	**100**

During studies for the Salt Caves Project, surveys documented that during periods of the year when waterfowl were not abundant, most bald eagle use in the J.C. Boyle peaking reach occurred when flows were low (less than 1,000 cfs [28.3 m^3/sec.]). This may indicate that at certain times of the year, Project flow fluctuations may influence the timing of bald eagle foraging in this portion of the study area (City of Klamath Falls, 1990).

Thirty-seven bald eagle detections were recorded during relicensing field surveys in 2002-2003. The largest number of bald eagle detections (11) was recorded along J.C. Boyle reservoir. Copco reservoir detections (eight) accounted for the second highest amount of bald eagle records. Bald eagles also were seen perched or flying over J.C. Boyle reservoir and Keno reservoir. There were no obvious concentrations of foraging eagles along Project reservoirs or river reaches. However, during February 2003, two adult bald eagles and three subadults were perched along the southern shoreline of Copco reservoir where they were seen diving on waterfowl. In the 1980s, the Grizzly Butte pair was documented perching and foraging along the Klamath River, most often during the winter when waterfowl were most common (City of Klamath Falls, 1990); after reservoirs thawed, most eagle use moved out of the canyon.

The largest known wintering population of bald eagles in the contiguous United States occurs in the Klamath basin. A large communal roost is located south of Klamath Falls, Oregon, in the Bear Valley National Wildlife Refuge west of Worden, California. The refuge is approximately 6 miles (10 km) south of Keno reservoir.

The City of Klamath Falls (1986) studied bald eagle occurrence along the Klamath River for its assessment of the Salt Caves Hydroelectric Project. As part of its studies, the City of Klamath Falls conducted aerial surveys to locate wintering bald eagles for the proposed Salt Caves Hydroelectric Project in the J.C. Boyle peaking reach. Relatively low numbers of wintering bald eagles were observed all along the Klamath River. Most were seen in the upper end of Keno reservoir, J.C. Boyle reservoir, Copco reservoir, and Iron Gate reservoir. A few wintering eagles also were seen immediately below J.C. Boyle dam and along several miles of the river below J.C. Boyle powerhouse. The highest numbers of bald eagles observed during single aerial surveys conducted between Klamath Falls and Iron Gate dam were in February 1982 (23 eagles) and January 1986 (30 eagles).

No winter communal roost sites were identified in the study area for the Salt Caves Project (City of Klamath Falls, 1990). Surveys conducted during 1981-1986 found that several wintering eagles used J.C. Boyle, Copco, and Iron Gate reservoirs. During that same time period, only four eagles were observed in the J.C. Boyle peaking reach (City of Klamath Falls, 1986). Virtually any of the forested habitat, up to 18 miles (29 km) from water, could be used by roosting bald eagles (Stalmaster, 1987).

Northern Spotted Owl

The northern spotted owl is a federally threatened species. During 2002 and 2003, spotted owl protocol surveys were conducted in suitable habitat within 1.2 or 1.3 miles (1.9 or 2.1 km) of Project facilities and recreation sites that are adjacent to the Project reservoirs (includes Project- and non-Project recreation sites). Areas surveyed and locations of detections are provided in the Terrestrial Resources FTR, Section 5.0, Figures 5.4-1 and 5.7-2. Five northern spotted owl detections were recorded during spotted owl surveys in 2002. Four of these detections likely represent a repeat sighting of the same breeding pair (it is assumed that the five total detections account for the detection of three individuals). The five detections included: one male detected along the J.C. Boyle peaking reach in June; and one pair detected along the J.C. Boyle peaking reach in the same general area on two separate days in July. None of the detections in 2002 was within 5 miles (8 km) of any Project facilities. In 2003 (as in 2002), five spotted owl detections were recorded during protocol surveys. A mixed gender pair of owls was detected southwest of the Beswick Ranch in the J.C. Boyle peaking reach. The location of this pair is consistent with that of a historic pair of owls monitored by the USFS. A lone female owl was detected earlier in the season approximately 0.5 mile (0.8 km) from the pair described above. This bird may have been the female from the mated pair, although the location of the detection may indicate this is a separate isolated individual female owl. Two female spotted owl detections were recorded less than 1 mile (1.6 km) southeast of J.C. Boyle reservoir. The two detections, recorded on consecutive evenings, likely represent a single female spotted owl. Although the National Council for Air and Stream Improvement (NCASI) monitors a breeding pair of owls in the upper J.C. Boyle peaking reach, the significant distance from the known breeding location to the area of detection near the J.C. Boyle reservoir may indicate the 2003 upper Project detections reflect a single isolated unpaired female.

The owl detections made during PacifiCorp surveys were within the known home ranges of the Negro Creek and Lucky Springs pairs that have been monitored by the NCASI or USFS during recent years. Both of those pairs are known to use the habitat primarily above the canyon rim (Cheyne, pers. comm., 2003).

In southern Oregon, spotted owls are known to breed successfully only in late-successional mixed coniferous forest (Csuti et al. 1997). Several breeding pairs are known to occur in the Project vicinity (Lapomardo, pers. comm., 2002; Schmalenberger, pers. comm., 2002). There are approximately 11,300 acres (4,573 ha) of potentially suitable spotted owl habitat in the study area. This includes all forested communities, except oak woodland and oak-juniper woodland, with tree size greater than 6 inches (15 cm) dbh and 40 percent canopy cover (Lint et al. 1999). Suitable habitat extends outside of the study area in the Project vicinity, including approximately 35,700 acres (14,447 ha) of spotted owl designated critical habitat in the Jenny Creek watershed (BLM, 1995a).

During the spring of 2003, one of the spotted owls that was equipped with a radio transmitter was found dead near an electrical distribution line ROW outside of the J.C. Boyle Canyon. A necropsy was performed, but was not able to determine cause of death, although there was no evidence of collision or electrocution (Rock, pers. comm., 2003).

There are no effects to spotted owls resulting from the Project.

E5.2.2.7 State Listed Species

Eight wildlife species potentially occurring in the Project vicinity that are not federally listed are listed as endangered or threatened by Oregon or California. These species are: Swainson's hawk (*Buteo swainsoni*), peregrine falcon (*Falco peregrinus anatum*), greater sandhill crane (*Grus canadensis tabida*), yellow-billed cuckoo (*Coccyzus americanus occidentalis*), great gray owl (*Strix nebulosa*), willow flycatcher, bank swallow (*Riparia riparia*), and Sierra Nevada red fox (*Vulpes vulpes necator*).

<u>Swainson's Hawk</u>

One Swainson's hawk was detected flying over agricultural fields off of Highway 97 southeast of Keno reservoir in May 2002. This detection was recorded incidental to other field studies and occurred several miles outside of the study area. The species' range generally includes grassland, sagebrush, and juniper shrub habitats east of the Project vicinity and includes the plains of the

Great basin in southeast Oregon and eastern northern California (Csuti et al. 1997). It is a rare spring and fall migrant at the Klamath Wildlife Area.

Peregrine Falcon

No American peregrine falcons were detected in the study area during 2002-2003 relicensing field studies. Specific surveys were not conducted for this species in the study area, although the 2002 and 2003 aerial bald eagle surveys would have covered much of the same area and could have detected peregrines. No active peregrine falcon nests are known in the Project vicinity (Kellam, pers. comm., 2002). An historic nest site is suspected at Secret Springs Bluff south of Frain Ranch (FERC, 1990). An historic peregrine falcon nesting aerie was known to exist at Grizzly Butte, in the same area as an active prairie falcon nest, through the mid 1970s (Pagel, 1999). The last record of successful breeding by a nesting peregrine pair at this location was in 1969, although the fledglings were taken from the nest by falconers (Pagel, 1999). A pair thought to be using the aerie frequently was noted around the nest site in 1975, although breeding was never confirmed (Pagel, 1999). Migrating and over-wintering birds occasionally may be found in a variety of habitats, including open grassland areas, forest stands, and Project reservoirs throughout the study area vicinity. They could prey on waterfowl on the Project reservoirs. The 225-foot (69-m) cliff above Salt Caves and the cliffs near the J.C. Boyle powerhouse both were rated as highly suitable for peregrine nesting (Pagel, 1999). Both sites were used by prairie falcons in the last decade. The study area is located in a management area designated for peregrine falcon recovery (Pacific Coast American Falcon Recovery Team, 1982).

Sandhill Crane

In 2002, two greater sandhill cranes were detected along the J.C. Boyle reservoir, and approximately 12 incidental detections were recorded east of Keno reservoir along Highway 97 near the Klamath Wildlife Area (see Terrestrial Resources FTR, Section 5.0, Figure 5.7-2). In 2003, an active sandhill crane nest was found in the emergent wetland bordering J.C. Boyle reservoir. Both adults were present and there were two eggs in the nest. An estimated 1,000 breeding pairs of greater sandhill cranes are reported to nest in Oregon, with an additional 500 non-breeding individuals (Csuti et al. 1997). Sandhill cranes nest in marshes and wet meadows, and occasionally in pastures and irrigated hayfields (Csuti et al. 1997). The presence of surrounding water or undisturbed habitat is a primary requirement for sandhill crane suitable nesting habitat (Ehrlich et al. 1988). Known nesting occurs at Upper Klamath Lake. The Project provides only limited habitat for this species.

Yellow-Billed Cuckoo

No western yellow-billed cuckoos were detected in the study area during relicensing field studies. Although this species is thought to breed in isolated locations along the west coast north to Oregon (National Geographic Society, 1999), consistent breeding records for the species have not been documented in the Project vicinity (Csuti et al. 1997). Cuckoos nest in dense riparian thickets often dominated by willow (Csuti et al. 1997).

Great Gray Owl

Two great gray owl detections, likely separate vocalizations by the same individual bird, were recorded during spotted owl protocol surveys conducted in 2002; no detections of this species occurred during 2003 protocol great gray owl or northern spotted owl surveys (see Terrestrial Resources FTR, Section 5.0, Figure 5.7-2). The two detections were approximately 1 mile (1.6 km) from Fall Creek. There are approximately 2,219 acres (862 ha) of potentially suitable great gray owl habitat in the study area. This includes mixed conifer, ponderosa pine, and riparian mixed forests with tree size greater than 11 inches (28 cm) dbh and 60 percent canopy cover that are within 984 feet (300 m) of a natural or manmade opening greater than 10 acres (4 ha) (BLM, 1995).

The range of the great gray owl in southern Oregon is thought to be expanding as increased forest openings are created through development and timber harvest (Csuti et al. 1997). The species is known to breed in tree cavities and in abandoned corvid or squirrel nests, typically located near suitable open grassland foraging habitat (Csuti et al. 1997).

<u>Willow Flycatcher</u>

The two distinct willow flycatcher subspecies (*Empidonax traillii adastus* and *E. t. brewsterii*) that potentially occur near the Project hold different official federal and state status, depending on regulatory jurisdiction. Field identification of *Empidonax* species is often problematic; therefore, willow flycatchers were not identified to subspecies during field surveys to minimize error during 2002 field studies.

Thirteen willow flycatcher detections were recorded in riparian or wetland habitat located peripheral to a reservoir or river reach during May and June 2002. Willow flycatchers were most abundant around Iron Gate reservoir and the Iron Gate-Shasta section. It is unknown if the detections were of breeding individuals or birds migrating through the area. If breeding is occurring, it is patchy and restricted to dense riparian shrub habitat, specifically, dense willow thickets (Csuti et al. 1997). The distribution of riparian shrub and forest habitat for this species is addressed in Terrestrial Resources FTR, Section 6.7. The Project affects the overall distribution of willow-dominated riparian and wetland habitat.

<u>Bank Swallow</u>

No bank swallows were detected in the study area during relicensing field studies. The regional occurrence and distribution of this species in southern Oregon and northern California often are disputed, but most sources include the Project vicinity along the western limit of the bank swallow's breeding range (National Geographic Society, 1988; Csuti et al. 1997). Bank swallows are colonial and nest in large numbers in small tunnels excavated in cliffs and earthen banks (Ehrlich et al. 1988). In Oregon, 12 known active nesting colonies have been monitored, but some biologists believe the bank swallows may be more abundant than records indicate (Csuti et al. 1997). No colonies are known to exist in the Project vicinity, but the species may occur in the study area during the breeding season and migration.

<u>Sierra Nevada Red Fox</u>

No red foxes were detected during 2002 field studies. Sierra Nevada red foxes are associated with lodgepole pine and red fir forests in the sub-alpine zone and the alpine fields of the Sierra Nevada Mountains (CDFG website). There are no confirmed records for the species from less than 5,000 feet (1,524 m) elevation (CDFG website). No suitable habitat for the species exists in the study area, and the species is unlikely to occur in the Project vicinity.

E5.2.2.8 Other TES Species Documented in the Study Area

Other TES species documented in the study area include one amphibian, five reptile, 35 bird, and three mammal species (Table E5.2-9). Of these species, those most closely associated with the Project are discussed below. See Terrestrial Resources FTR, Section 5.7, for a complete discussion of all TES species.

Western Toad

All five of the western toad breeding sites located during 2002-2003 are in areas that can be affected by human activities. Only the site along Iron Gate reservoir is directly affected by Project hydrology. The Iron Gate site was visited three times between April 1 and May 10, 2002. This monitoring documented large water level fluctuations (at least 2 feet during the 40-day period) that eliminated the egg masses that were present on the first visit. In 2003, this site produced many tadpoles that appeared to be developing normally. Thus, the productivity of this site may vary from year to year depending on PacifiCorp's water level management and water year type. The toad breeding site found in 2002 in flooded annual grassland along Way Creek above the J.C. Boyle peaking reach is susceptible to off-highway vehicle (OHV) damage (see Terrestrial Resources FTR, Section 5.0, Figure 5.7-2, and Appendix 5A, Table 5A-7). The two breeding sites with tadpoles were found in 2003 along the irrigation ditches upstream of Shovel Creek. Breeding sites also were found along Cottonwood and Willow creeks.

In addition, BLM biologists documented the species on April 27, 2001, during surveys at Way Creek, which flows into the J.C. Boyle peaking reach (see Terrestrial Resources FTR, Section 5.0, Figure 5.7-2, and Appendix 5A, Table 5A-7). Although only five breeding sites were found, the species may use other sections of reservoir shorelines that have gradual slopes or isolated wetlands throughout the Project vicinity. None of the known sites is directly affected by the Project, but is potentially affected by private ranching operations.

Northwestern Pond Turtle

A minimum of 650 northwestern pond turtle (*Clemmys marmorata marmorata*) detections was recorded during 2002-2003 field studies in the Iron Gate-Shasta section, Iron Gate reservoir, Copco reservoir, J.C. Boyle reservoir, J.C. Boyle peaking reach (California portion), J.C. Boyle bypass reach, and Keno reservoir (see Terrestrial Resources FTR, Section 4.0, Figure 4.7-1). The largest population was found at Keno reservoir where a peak of 265 turtles was counted between the Highway 66 bridge and the dam; only 11 basking turtles were found between the Highway 66 bridge and the Highway 140 bridge. Less than 5 percent of the turtles observed appeared to be juveniles. The number of turtles detected on the other reservoirs ranged between 12 on Copco reservoir (primarily the upstream portion) and 23 on J.C. Boyle reservoir (see Terrestrial Resources FTR, Section 4.0, Table 4.7-7).

In 2003, two survey visits resulted in a total of 22 pond turtle detections (13 adults recorded on May 29 and nine adults recorded on June 25) in the California J.C. Boyle peaking reach. The locations of all pond turtles detected during 2003 surveys are shown in the Terrestrial Resources FTR, Section 4.0, Figure 4.7-1. No turtles were found in the J.C. Boyle bypass, although survey conditions were not optimal in this reach because of poor accessibility. The detections recorded in the California J.C. Boyle peaking reach likely indicate that an aggregation of turtles (approximately ten) uses the lower, slow-moving portion of the reach just upstream of Copco reservoir. During both survey visits, groups of pond turtles were detected basking on low pilings, docks, and other structures located near the confluence of the river with Copco reservoir. Eight adult turtles were detected in this localized area during the May 29, 2003, survey, and five adults were detected in this location during the June 25, 2003, survey. Turtles recorded in the upper portions of the California J.C. Boyle peaking reach included three near the Beswick Ranch and four located downstream of the Oregon-California border (see Terrestrial Resources FTR, Section 4.0, Figure 4.7-1).

A survey of Iron Gate reservoir documented only 17 turtles. However, the beaver dam wetland near the mouth of Fall Creek is known to support at least 20 turtles as well. Only one location along the Iron Gate-Shasta section —a site between Cottonwood Creek and Interstate 5 (I-5)— was found to have basking pond turtles in 2002 (see Terrestrial Resources FTR, Section 4.0, Figure 4.7-1). However, the survey of the Iron Gate-Shasta section was ground-based and had several gaps in coverage because of private lands being inaccessible. In addition to PacifiCorp observations, the BLM documented 67 pond turtle locations in the Oregon portion of the J.C. Boyle peaking reach during amphibian and reptile field studies in 2000 and 2001 (BLM, unpublished data).

The BLM found that there are several specific sections of river in the J.C. Boyle peaking reach where turtles regularly were observed basking in 2000 and 2001, and that these sites are consistently used year after year (Roninger, pers. comm., 2003). These locations were at Frain Ranch (RM 214.8), near the old bridge crossing site (RM 216.8), an area near the BLM's Klamath River Campground (RM 217), and a site approximately 0.5 mile (0.8 km) upriver of the BLM's Klamath River Campground (RM 217.7) (see Terrestrial Resources FTR, Section 4.0, Figure 4.7-1). Bury (1995) also documented several specific areas in the canyon that are used by basking pond turtles. The sites reported by Bury (1995) are "Turtle Cove" at RM 216.2, and "Turtle Cove 2" at RM 216.6. At both of the sites studied by Bury (1995), basking habitat was provided by fallen trees that extend out of the water onto shore and by boulders. Bury (1995) characterized the two sites as having high velocity during the daytime (0900 to 1300 hours), but relatively calm flow during low water. During low water periods of the day, fallen trees are sometimes left completely out of the water at the turtle basking sites. Bury (1995) also found small numbers of turtles at RMs 221.0, 218.0, 217.2, 214.0, and 210.0.

Turtle nesting habitat suitability mapping based on observations of terrain and shoreline habitat conditions made during surveys indicates that of the 198 miles (319 km) of river and reservoir shoreline in the study area, approximately 42 miles (68 km) (21 percent) were characterized as having suitable nesting and basking habitat (see Terrestrial Resources FTR, Section 4.0, Table 4.7-8 and Figure 4.7-1). An additional 60 miles (30 percent) have suitable basking habitat structure (logs, large rocks, or patches of persistent emergent vegetation), but do not have the potential nesting habitat either because of steep slopes, developed shorelines, or shorelines with dense understory vegetation. Approximately 94 miles (151 km) (47 percent) of the entire shoreline was determined to have neither basking nor nesting habitat (see Terrestrial Resources FTR, Section 4.0, Table 4.7-8).

The water level fluctuations in the river reaches and reservoirs probably adversely affect turtles by making some basking sites unavailable, increasing the risk of predation, and reducing forage resources.

Osprey

Osprey (*Pandion haliaetus*) were commonly observed in the Project vicinity during the spring and summer. More than half of the detections were located around Copco and Iron Gate reservoirs (see Terrestrial Resources FTR, Appendix 5A, Table 5A-14). In 2002, a minimum of 16 active osprey nests, both artificial nesting platforms and natural sites, was located along the shores of Project reservoirs and river reaches including one nest site along the J.C. Boyle reservoir, one in the J.C. Boyle peaking reach, one in the Copco bypass, two along both Copco and Iron Gate reservoirs, and nine nest sites along the Iron Gate-Shasta section. Typically, ospreys were detected flying, either foraging in association with open water habitat or transiting from a reservoir to another habitat type. The Project reservoirs provide large populations of warm water fish species that form a reliable source of live prey for osprey. Human disturbance is the greatest threat to osprey populations, although osprey often habituate to areas with regular human activity (Poole, 1989). The Project likely increases habitat for osprey.

Caspian, Forster's, and Black Terns

In total, 146, 272, and 21 detections of Caspian, Forster's, and black terns (*Sterna caspia, S. forsteri,* and *Chilidonias niger*), respectively, were recorded in 2002 in the study area. All were observed flying over or foraging on Project reservoirs. Caspian terns were detected on each of the four Project reservoirs. All three species are colonial nesters known to nest along Upper Klamath Lake and other lakes in eastern Oregon. Caspian terns nest on undisturbed islands, levees, and shores (CWHRS website). The largest number of Forster's tern detections (100) was recorded along Keno reservoir. Eighty-two detections were recorded along the J.C. Boyle reservoir, constituting the second largest number of Forster's tern records. Fourteen black tern detections were made during reservoir surveys with seven total detections recorded around the J.C. Boyle reservoir (one in May 2002 and six in June 2002) and seven detections around Keno reservoir (four in May 2002 and three in June 2002).

There is one island in the Keno reservoir that could have suitable habitat for nesting. However, no terns were seen in that area in 2002.

Yellow Warbler and Yellow-Breasted Chat

Two hundred and forty yellow warbler detections were recorded during general wildlife plot surveys in 2002 (see Terrestrial Resources FTR, Section 5.0, Figure 5.7-2, and Appendix 5A, Table 5A-7). Most (63 percent) of yellow warbler detections were located in riparian/wetland scrub-shrub and riparian/wetland forest. The yellow warbler is the only avian TES species that was found to occur in all study area sections and was located in a greater variety of habitat types than any other avian TES species. In the fall, Rapid Ornithological Inventory (ROI) data indicate that yellow warblers also were detected in riparian habitat along the Iron Gate-Shasta section, Link River, Iron Gate reservoir, and J.C. Boyle peaking reach riparian habitat (see Terrestrial Resources FTR, Section 7.7.1.1). Keno Canyon was found to support the highest relative abundance of yellow warblers at 2.61 birds per survey, with the Link River a close second at 2.17 birds per survey (see Terrestrial Resources FTR, Appendix 7A, Table 7A-4). Overall, yellow warblers were found to be the ninth most abundant species detected during plot surveys (see Terrestrial Resources FTR, Appendix 7A, Table 7A-4, and Appendix 5F) with a Project-wide relative abundance of 0.81 bird per survey.

Twenty-two yellow-breasted chat detections were recorded in four study area sections during general wildlife plot surveys (see Terrestrial Resources FTR, Section 5.0, Figure 5.7-2, and Appendix 5A, Tables 5A-7 and 5A-8). The largest number of chat detections was recorded along the Iron Gate-Shasta section, while the J.C. Boyle peaking reach accounted for the second largest number of detections. These species are adversely affected by the lack of riparian vegetation in some areas of the Project.

<u>TES Bat Species</u>

Ten TES bat species (subspecies) identified as having a potential for occurrence in the Project vicinity are addressed together because many of these species share similar ecology and habitat requirements. These species are: western small-footed (*Myotis ciliolabrum*), Yuma (*Myotis yumaensis*), long-legged (*M. volans*), long-eared (*M. evotis*) and fringed myotis (*Myotis thysanodes*); silver-haired bat (*Lasionycteris noctivagans*); spotted bat (*Euderma maculatum*); pale and Pacific western big-eared bat; and Pacific pallid bat (*Antrozous pallidus pacificus*). Although some of these bats exhibit distinctive habitat preferences, in general they are found in open forests and a variety of habitats (CDFG website). For most of these bats, the availability of suitable roost sites (rock crevices, cliff ledges, and, notably, some artificial structures) limits species distribution and occurrence (Csuti et al. 1997).

Maps of regional distribution for all potentially occurring TES bat species indicate that all species could occur in the study area except the spotted bat (Csuti et al. 1997). The spotted bat often is considered one of the rarest mammals in North America, and its known distribution in Oregon is based on only two documented records (Csuti et al. 1997). In the region, the spotted bat is speculated to be rare, but widely distributed and, thus, potentially could occur in the study area. Regardless of the extent of a bat species' known range, knowledge of TES bat species distribution in the Project vicinity is based on so little specific data that all TES bat species potentially could occur in the study area.

Both the Pacific western big-eared bat and Yuma myotis have been documented in the study area. Ten of the 24 facility sites inspected for roosting bats had evidence of recent use. The largest numbers of roosting bats were noted in the Copco No. 2 dam gatehouse (300 bats), Copco No. 2 powerhouse (100 bats), Iron Gate south gatehouse (40 bats), and J.C. Boyle forebay spillway house (30 bats). None of the 14 bridges in the study area inspected for bat use had any roosting activity. Cross et al. (1998) conducted a study of bats using the Salt Caves and structures at the abandoned Hoover Ranch house, both located in the J.C. Boyle peaking reach study area section. Yuma myotis and Pacific western big-eared bats were found to use these areas as roost sites, and mixed-species groups of more than 800 bats were recorded during individual surveys (Cross et al. 1998). The Hoover Ranch structure appears to be used as a maternity site for a large colony of Yuma myotis (Cross et al. 1998). At Salt Caves, the larger cave was used by Pacific western big-eared bats as a maternity site between 1989 and 1993, which was the only known maternity site in Klamath County (Cross et al. 1998). Yuma myotis also were identified in the Copco No. 1 powerhouse and Copco No. 1 gatehouse during bat roost surveys. A vertebrate inventory of the Soda Mountain area, which is several miles north from Iron Gate reservoir, documented three species of bats: Yuma myotis, long-eared myotis, and long-legged myotis (Nelson, 1997).

A small number (three or four) of individual bats occasionally is killed accidentally during operation of mechanical equipment in the Copco No. 2 powerhouse. These bats roost in the overhead crane mechanism, which is used once per year during maintenance activities.

E5.3 MANAGEMENT FRAMEWORK FOR WILDLIFE AND BOTANICAL RESOURCES

Portions of the land surrounding Project reservoirs, facilities, and affected river reaches are bordered by land managed by federal, state, and local agencies. In addition, various regulations relate to terrestrial resources. The following subsections discuss the regulations and agency management responsibilities that relate either directly or indirectly to wildlife or botanical resources in the Project vicinity.

E5.3.1 Federal Regulations and Management Responsibilities

Federal agencies responsible for wildlife and botanical resources near the Klamath Hydroelectric Project include the FERC, USFWS, USFS, BLM, COE, and U.S. Bureau of Reclamation (USBR). The federal regulations and agency management plans that drive the various agency management responsibilities are briefly described below.

E5.3.1.1 Federal Power Act

This Federal Power Act (FPA) provides for federal regulation and development of hydroelectric power. Under this act, the FERC is authorized to re-issue the license for the Klamath Hydroelectric Project (FERC Project No. 2082). The FERC is required to coordinate with the National Oceanic and Atmospheric Administration (NOAA) Fisheries, USFWS, and state fish and wildlife agencies to ensure that licenses contain conditions that protect, mitigate, and enhance fish, wildlife, and their habitat affected by the operation and maintenance of a project. The license conditions must abide by guidelines set forth in the Fish and Wildlife Coordination Act (see Section E5.3.1.5).

E5.3.1.2 Clean Water Act

The CWA requires the COE to issue Section 404 permits before any dredging or filling of jurisdictional wetlands. Section 404 permits also include activities involving mechanized land clearing, ditching, draining, excavating, grading, and placement of pilings. These permits require prior consultation with the USFWS regarding potential impacts of dredge and fill activities on wildlife and botanical resources. CWA guidelines also direct that no permit be granted if it jeopardizes a listed threatened or endangered species or adversely affects a listed species' critical habitat. PM&E measures may be required to avoid jeopardy or adverse affects on critical habitat.

E5.3.1.3 Federal Protection of Wetlands

Wetland resources on federal lands are provided protection under Executive Order 11990. In the Klamath Project area, the order requires the USFWS, BLM, and USFS to consider the potential effects of projects on wetlands by minimizing the adverse effects on wetland habitats and to preserve and enhance the values of wetlands. This order provides protection only to wetland resources on federally owned land and does not apply to state or privately owned land.

E5.3.1.4 Rivers and Harbors Act

The Rivers and Harbors Act (RHA) requires the COE to issue permits for activities "in, over, or affecting" navigable waters. During the Section 10 of the RHA permit process, the COE evaluates potential impacts to navigation, flood control, and fish and wildlife habitat. The Section 10 and CWA Section 404 permit processes often are handled concurrently.

E5.3.1.5 Endangered Species Act

The main purpose of the federal ESA of 1973, as amended, is to protect and conserve endangered and threatened species and the ecosystems upon which they depend. The federal government also designates "species of concern" for those species whose status is in question; these species do not receive protection. The ESA is administered by the USFWS for most wildlife and plant species. NOAA Fisheries is responsible for protection of marine and anadromous species. The ESA requires consultation with the USFWS and NOAA Fisheries regarding actions that potentially affect threatened or endangered species. There are specific recovery plans for the northern spotted owl, bald eagle, and the delisted peregrine falcon.

E5.3.1.6 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) provides guidelines for cooperation with federal, state, and private agencies and organizations in the conservation of wildlife and their habitat. The FWCA requires consultation among the USFWS, CDFG, and ODFW to prevent adverse effects on wildlife resources that may be incurred by granting a federal permit or license.

E5.3.1.7 Federal Prevention of Introduction of Invasive Species

Executive Order 13112 authorizes federal agencies to prevent the introduction of invasive plant and animal species, provide for their control, and minimize the impacts of invasive species on the economic, ecological, and human health environment. This order authorized the formation of the Invasive Species Council, which developed the Federal Invasive Species Management Plan. Under this plan, the council requires federal agencies to coordinate their invasive species management efforts in a way that is complementary, effective, and minimizes cost. Federal agencies also are directed to use invasive species weed management plans that are already in place. The council also requires that federal agencies coordinate their management efforts with state and private entities to achieve invasive species management goals.

E5.3.1.8 Federal Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) implements treaties between the United States and Britain (for Canada), Mexico, Japan, and Russia. These treaties designate protected migratory bird species and contain a prohibition on "hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any . . . bird, or any part, nest or egg." The MBTA provides the federal government with authority to establish regulations on hunting and managing protected birds. The USFWS is responsible for enforcing the MBTA.

E5.3.1.9 Federal Bald Eagle Protection Act

The Bald Eagle Protection Act provides for the protection of the bald eagle and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds. The Secretary of the Interior may issue permits authorizing the taking, possession, and transportation of these eagles for scientific purposes, for the protection of wildlife, agricultural, or other interests. Management of bald eagle habitat near the Project reservoirs is partially controlled by the federal recovery plan for this species (USFWS, 1986), which is administered by the USFWS. The recovery plan has management goals for identifying and protecting habitat used for nesting, foraging, and roosting. Site-specific management plans are recommended to protect habitat and reduce disturbance. Human activities that can cause disturbance to eagles at known nest and roost sites are recommended to be excluded from the area up to 2,625 feet (800 m) during the primary nesting season (January 1 to August 31) and wintering period (November 15 to March 15).

E5.3.1.10 Northwest Forest Plan

The Northwest Forest Plan (USFS and BLM, 1994) covers all federal lands west of Keno reservoir (including BLM lands in Oregon and California, USFS lands near Copco reservoir, and possibly the designated Wild and Scenic section of the Klamath River). It is a major guiding document for federal land management in the Project area. The plan includes seven federal land allocations, the following five of which may be near the Project:

- Matrix (most BLM land from the canyon to Keno reservoir)
- Administratively Withdrawn (BLM, and Wild and Scenic reach in Oregon)
- Key Watersheds (Jenny Creek watershed down to near Iron Gate reservoir)
- Adaptive Management Area (BLM land in canyon in California)
- Late-Successional Reserve (USFS land south of Copco reservoir)

The plan includes standards and guidelines to survey and manage species. Where current land management plans exist, the guidelines in these management plans apply if they are more restrictive; otherwise, the plan guidelines apply. These standards and guidelines require federal land managers to manage known sites for rare organisms and conduct various levels of surveys for them (particularly amphibians, bryophytes, lichens, mollusks, vascular plants, fungi, and arthropods) before ground-disturbing activities. The plan also includes an Aquatic Conservation Strategy with the following four components:

- Riparian Reserves
- Key Watersheds (managed for at-risk fish)
- Watershed Analysis
- Watershed Restoration (control and restoration of road-related erosion, restoration of riparian vegetation, restoration of in-stream habitat complexity)

The stated purpose of the Riparian Reserves is to protect the health of the aquatic system and its dependent species. The reserves also provide incidental benefits to upland species, including improved travel and dispersal corridors and habitat connectivity through matrix land (where timber harvest potentially can occur). Additional BLM goals include the following:

- Enhance and maintain ecological health
- Maintain the social well being of the human population
- Enhance/maintain the outstanding and remarkable resources for which the reach was designated Wild and Scenic

On lands managed by the BLM within the range of the northern spotted owl, streams, wetlands, constructed ponds, and reservoirs are designated as riparian reserves. Management emphasis in riparian reserves is focused on riparian-dependent resources, and special standards and guidelines apply under the Northwest Forest Plan (USFS and BLM, 1994; see Section V.D.1.b(3)(a) for a summary of standards and guidelines). The widths of riparian reserves are not defined strictly by riparian vegetation, but depend on the type of water body or stream, as well as ecological and geomorphic features. For example, a riparian reserve for a permanently flowing non-fishbearing stream includes the stream and the area on each side from the stream edge to whichever of the following represents the greatest distance: (1) the top of the inner gorge, (2) the outer edges of the 100-year floodplain, (3) the outer edges of riparian vegetation, (4) a distance equal to the height of one site-potential tree, or (5) 150-foot (46-m) slope distance (USFS and BLM, 1994).

E5.3.1.11 Klamath National Forest Management Plan

The Northwest Forest Plan's (USFS and BLM, 1994) standards and guidelines are intended to improve conditions for late-successional-forest-related species beyond the protection granted in individual forest plans. However, standards and guidelines in the Klamath National Forest Plan pertaining to USFS lands in the study area generally reflect or are superceded by standards and guidelines in the Northwest Forest Plan. No Klamath National Forest land is within the Project boundary.

E5.3.1.12 Redding Area Resource Management Plan

The Redding Resource Area Resource Management Plan (RMP) does not contain quantifiable resource conditions for wildlife (BLM, 1993). However, specific objectives have been developed for three sites in the Project area—HRWA, Jenny Creek, and the Klamath River Canyon. General objectives that affect wildlife habitat on the HRWA include improving deer winter range and riparian habitat restoration. The Horseshoe Ranch includes BLM, state, and private lands managed for wildlife and is located immediately northwest of Iron Gate reservoir. Jenny Creek is a tributary of the Klamath River that enters Iron Gate reservoir from the northeast. BLM resource management objectives for the Jenny Creek Area of Critical Environmental Concern (ACEC) include protecting sensitive species habitat. Redding RMP management objectives for the Klamath River canyon upstream of Copco reservoir include improving riparian habitat. Specific actions to be implemented to achieve these goals are not stated in the RMP.

E5.3.1.13 Klamath Falls Resource Area Resource Management Plan

The Klamath Falls Resource Area RMP (BLM, 1995) includes several elements that generally address Aquatic Conservation Strategy objectives of the Northwest Forest Plan. Key watersheds identified in the plan include Spencer Creek and Jenny Creek, both tributaries of the Klamath River in the Project area. Also, an 11-mile (18-km) section of the Klamath River from J.C. Boyle dam to the Oregon-California border is designated as an ACEC. Objectives for key watersheds include reducing roads and managing riparian and wetland areas to protect, maintain, or improve habitat for wildlife and native plant diversity. The RMP also includes provisions to obtain information concerning the distribution of special attention species and to provide protection buffers for specific rare and locally endemic species. An extensive list of special attention species is included as Appendix C of the RMP (BLM, 1995). There are also objectives intended to protect habitat values for species in riparian reserves, which include intermittent and perennial streams and variable width buffers. The overall objective for riparian reserves is to enhance and maintain biological diversity and ecosystem health to contribute to healthy wildlife populations. Detailed objectives are provided. The RMP also includes specific protection objectives for TES species, including the northern spotted owl, bald eagle, northern goshawk, peregrine falcon, Pacific western big-eared bat, amphibians and reptiles, and Applegate's milkvetch (a federally listed endangered plant). Most of these measures relate to maintaining protective buffers or creating and protecting suitable breeding habitat.

E5.3.1.14 Klamath River Management Plan

The preparation plan for the Draft Upper Klamath River Management Plan Environmental Impact Statement and Resource Management Plan (BLM, 2003) covers the Klamath River from J.C. Boyle dam to Copco reservoir and includes an 11-mile (18-km) stretch of river from J.C. Boyle powerhouse to the Oregon-California border that is designated ACEC by the BLM (RMP, 1994), proposed to be included in the national Wild and Scenic River system (BLM, 1990; NPS, 1994), and as an Oregon Scenic Waterway (ORPD, 1988). In 1994, the 11-mile (18-km) stretch of river was designated as a state-administered part of the Wild and Scenic River System under the National Wild and Scenic River Act.

The preparation plan addresses management of threatened and endangered (i.e., bald eagle) and special status species (western pond turtle, western big-eared bat, white-headed woodpecker, etc.) that use the river corridor, including the habitat for these species. It also evaluates unique wildlife habitat, such as big game winter habitat and oak woodlands, as well as vegetation management objectives that may affect or enhance wildlife habitat, including the management of noxious and non-native plant species.

E5.3.1.15 Klamath Irrigation Project

USBR's Klamath Basin Area Office in Klamath Falls manages the Klamath Irrigation Project, a federal water storage project that supplies water to approximately 240,000 acres (97,125 ha) of farmland.

At the upper end of the terrestrial resources study area, the USBR regulates the elevation of Upper Klamath Lake and dictates the releases through Link River dam. At the lower end of the study area, Iron Gate dam releases are a stipulation of PacifiCorp's FERC license, but since

1997, they have become USBR's responsibility under the ESA. PacifiCorp has little effective control over the river's flow regime downstream of Iron Gate dam. PacifiCorp's hydroelectric Project can manage short-term water balancing operations at certain hydroelectric reservoirs. Water flow through PacifiCorp's Project is directly related to USBR's control of Upper Klamath Lake elevations, downstream releases out of Iron Gate, flows into and out of the Klamath Irrigation Project area in the Keno reservoir, and the relatively small active storage capabilities in PacifiCorp Project reservoirs. The relationship with the Klamath Irrigation Project is explained in detail in Exhibit B.

E5.3.2 State Regulations and Management Responsibilities

State regulations and agency management objectives that are most applicable to wildlife and botanical resources with respect to the relicensing of the Klamath Hydroelectric Project in Oregon and California are discussed below.

E5.3.2.1 California Regulations and Agency Management Objectives

California regulations most applicable to wildlife and botanical resources are discussed below. There are two California agencies that have expressed interest in terrestrial resources in the Project vicinity: the CDFG and the California State Water Resources Control Board (North Coast district).

California Endangered Species Act

The CESA is administered by the CDFG. The CESA requires state lead agencies preparing documents under the California Environmental Quality Act (CEQA) to consult with the CDFG regarding potential impacts on state-listed species; the CESA does not require consultation with the CDFG by local lead agencies or state permitting agencies not preparing CEQA documents. The CNDDB and CNPS databases contain information on state-listed plant and wildlife species that potentially occur in the Project vicinity.

CDFG Section 1601

CDFG's Section 1601 (Streambed Alteration Agreement) requires that the CDFG assess the impacts of activities in the streambed on wildlife resources.

California Wetlands Conservation Policy

The goal of California Executive Order W-59-93 is to establish a framework and strategy that will ensure no overall net loss, as well as achieve a long-term net gain, in the quantity, quality, and permanence of wetland acreage and values in California.

California Department of Fish and Game

In general, CDFG wildlife management goals include protecting and restoring wildlife populations, including state TES species, and protecting and restoring wildlife habitat quality and connectivity. CDFG goals include providing the public with hunting opportunities and access.

The CDFG has not identified specific terrestrial goals for the Project area, but did express interest in the 1991 long-range plan for the Klamath River basin.

California State Water Resources Control Board

The California State Water Resources Control Board (State Water Board) is mandated by federal and state laws to protect and enhance water quality in California. The federal CWA and the state Porter-Cologne Water Quality Control Act dictate the future direction of water quality control for protection of California water quality. The Porter-Cologne Act requires an evaluation of "Beneficial Uses" of the waters of the state that may be protected against water quality degradation. Beneficial uses include terrestrial resources such as wildlife habitat, waters that affect TES wildlife and plants, and preservation of areas of special biological significance.

Strategic Plan for Controlling Noxious and Invasive Weeds

The Siskiyou County Weed Management Association (SCWMA) through its strategic plan is attempting to manage noxious and invasive weeds in a coordinated effort with other county landowners to prevent the introduction of new weeds into the county, control current county weed infestations, and prevent these infestations from spreading to areas outside the county.

E5.3.2.2 Oregon Regulations and Agency Management Objectives

The Oregon regulations most applicable to wildlife and botanical resources are discussed below. There are seven Oregon agencies that have expressed interest in the Project vicinity: ODFW, Oregon Division of State Lands (DSL), Oregon Parks and Recreation District (OPRD), Oregon Department of Water Quality (ODW), ODA, and Oregon Department of Forestry (ODF). Oregon agencies reviewing hydroelectric projects work together as the Hydropower Assessment Resource Team (HART).

Oregon Endangered Species Program

The Oregon Endangered Species Program or "Oregon Endangered Species Act" (OESA) is administered by the ODA and ODFW. The ODA is responsible for TES plants, and the ODFW is responsible for TES fish and wildlife. The ODA and ODFW have cooperative agreements with the USFWS to promote research and conservation programs for TES species under the auspices of the ESA. The ONHP has a similar agreement for TES invertebrates. The ONHP database was reviewed to identify state-listed plant and wildlife species that potentially occur in the Project vicinity.

Oregon State Wildlife Policy

Oregon statutes direct the ODFW to manage wildlife populations. The ODFW often enters into agreements with federal land management agencies to improve habitat to meet its population goals, but has no direct control over management of federal lands. The only specific state wildlife population goals established in the Project area and vicinity address big game populations. The ODFW has a population goal of 3,200 black-tailed deer for the Keno management unit, which includes the area used by the Topsy-Pokegama deer herd (BLM, 1996a). The ODFW also has a population goal of 700 elk for the Keno unit. Additional ODFW goals noted to date include the following:

- Restore native fish/wildlife
- Protect and restore state TES species
- Restore fish and wildlife connectivity
- Restore habitat/water quality
- Improve angling/hunting opportunities and access

The ODFW is responsible for management of wildlife resources in the Project vicinity. It shares wildlife habitat management tasks with the USFS and BLM on federal lands. ODFW's overall policy is to manage wildlife, prevent serious depletion of any indigenous species, and provide for optimal recreation and aesthetic benefits for present and future generations of Oregon citizens (ODFW, 1993c). The goals of this policy are as follows:

- Maintain all wildlife species at optimum population levels.

- Develop and manage the lands and waters of the state in a manner that will enhance wildlife production and the public enjoyment of wildlife.

- Permit orderly and equitable use of wildlife.

- Develop and maintain public access to lands and waters of the state and their wildlife.

- Regulate wildlife populations and the public enjoyment of wildlife in a manner that is compatible with the primary uses of lands and waters of the state.

- Provide optimum recreational benefits.

To meet these goals, the ODFW regulates hunting, fishing, and trapping and works with the USFWS in managing habitat for threatened and endangered species. In the Project vicinity, deer, waterfowl, and upland gamebirds are the most commonly hunted wildlife.

<u>Oregon Removal/Fill Law</u>

The Removal/Fill Law protects public navigation, fishery, and recreational uses of the waters. Waters-of-the-state in the Project area include "natural waterways including all intermittent streams, constantly flowing streams, lakes, wetlands and other bodies of water in this state, navigable and non-navigable." The law applies to all landowners.

The Oregon DSL, in cooperation with the Oregon Department of Environmental Quality (ODEQ) and the COE, is responsible for administering wetland regulations in Oregon. The DSL, like the COE, implements a permit program for activities involving dredging and filling in waters of the state, including wetlands (the ODEQ does not participate directly in the permit process, but can require permit applicants to obtain water quality certification before a removal/fill permit is issued). Oregon's Removal/Fill Law regulates the deposition or removal of 50 cubic yards (38 m^3) or more of material from any one wetland location during a calendar year. Permit applicants are required to submit a compensatory mitigation form with their application. Additionally, the DSL claims ownership of all submerged and submersible lands from Keno dam to the California border (FERC, 1990).

Oregon State Forest Practices Act

The ODF is responsible for administering the timber harvest and fire protection activities on non-federal lands. A permit from the ODF is required for any activities, such as juniper removal, that involve removing trees or using certain types of equipment that may result in fire.

Strategic Plan for Controlling Noxious and Invasive Weeds

The Klamath County Weed Control participates in Oregon's Noxious Weed Strategic Plan, which is under the direction of the ODA. Weed Control coordinates management activities aimed at eradication and control of noxious weeds.

The Oregon Plan for Salmon and Watersheds

"The policy of the State of Oregon is to promote land use policies and land management practices that sustain streamside and wetland riparian functions that support desirable water quality, native fish populations, and wildlife across the landscape" (Oregon-Plan website). This plan sets the overall management objectives of various state resource agencies.

E5.3.3 Other Agencies and Plans

Other agencies and groups interested in wildlife issues include county governments and non-government organizations (NGOs). A key goal for Trout Unlimited related to wildlife is to ensure that hydrological conditions adequately protect, preserve, and restore ecological health, ecological diversity, and the physical integrity of aquatic and riparian habitats. The organization also has expressed interest in other resource areas (e.g., land management practices) that relate to its mission to protect, preserve, and restore native trout and salmon and their habitat. For the Wilderness Society, key objectives are to restore normative ecological conditions in the Klamath basin; protect and restore wetlands, forests, riparian, and other native habitats; provide adequate water (of good quality and appropriate timing) for natural wildlife refuges and the mainstem of the Klamath River; and enhance recreation opportunities. Goals for American Rivers focus on river restoration, attainment of water quality standards, habitat restoration, aquatic and terrestrial connectivity, and protection of wildlife refuges.

E5.3.4 Tribes

No reservation lands exist within Project boundaries, however, because of historic use of Project areas, tribes have an interest in botanical and wildlife resources. Most tribal goals are related to fishery protection, enhancement, and recovery. Objectives related to terrestrial resources or resource protection generally include connecting the upper and lower basins (both culturally and biologically); protecting refuges, culturally significant wildlife and botanical resources, sacred sites, and artifacts; and improving water quality.

E5.3.5 Existing Wildlife and Botanical Resource Management Plans

E5.3.5.1 Comprehensive Management Plans

The following is a list of comprehensive management plans that may affect terrestrial resources:

- Redding Resource Area Management Plan (BLM)
- Klamath Falls Resource Area Resource Management Plan (BLM)
- Klamath National Forest Management Plan (USFS)
- Upper Klamath River Management Plan EIS (BLM)
- Northwest Forest Plan (BLM and USFS)
- Wild and Scenic River Plan (BLM)
- Horseshoe Ranch Management Plan (BLM)
- Cascade-Siskiyou National Monument Management Plan (BLM)
- Siskiyou County Weed Management Area Plans (SCWMAP)

E5.3.5.2 Wildlife Management Plans

The following is a list of wildlife-related management plans that potentially pertain to the Project:

- Northern Spotted Owl Recovery Plan (USFWS)
- Bald Eagle Protection Act (USFWS)
- Oregon's Cougar Management Plan (ODFW)
- Oregon's Black Bear Management Plan (ODFW)
- Oregon's Mule Deer Management Plan (ODFW)
- Oregon's Elk Management Plan (ODFW)
- Black Bear Management Plan (CDFG)

E5.4 CONSULTATION ON BOTANICAL AND WILDLIFE RESOURCES WITH APPLICABLE AGENCIES, TRIBES, AND THE PUBLIC

PacifiCorp began its relicensing consultation effort for the Klamath Hydroelectric Project using the basic approach established by the Traditional Licensing Process. The Traditional Licensing Process was initiated in December 2000 by the distribution of the First Stage Consultation Document in which PacifiCorp provided on overview of the Project and resources in the Project area, and proposed certain studies needed to support development of the license application. The formal comments of stakeholders to this document produced more than 175 letters and conveyed broad ranging concerns with the adequacy of the study plans, PacifiCorp's decision not to study dam decommissioning, and the level of collaboration in developing study plans.

In response to these comments, PacifiCorp revised its proposed study plans and re-distributed them in the form of a draft Second Stage Consultation Document. Stakeholder response again was vigorous and reiterated the concerns expressed in the first round of comments. In response to these strong stakeholder interest and concerns, this initial process has evolved into a robust collaborative effort with more than 40 stakeholders engaged in a long-term collaborative effort to develop and approve study plans, review and interpret results, and potentially agree on PM&E measures. Details of the consultation effort to date are provided in the document titled "PacifiCorp Consultation Record for Relicensing the Klamath Hydroelectric Project" (see Appendix E-1A).

Beginning in February 2002, stakeholders developed a Process Protocol to guide the long-term collaborative effort and a collaborative structure comprised of a plenary group (all interested stakeholders) and seven technical working groups, which usually convened monthly for facilitated meetings. The plenary group served as the managing body of the collaborative process and is comprised of all participants in the collaborative process. The assignment and approval of all study plans to support relicensing and all related final consensus decisions was the responsibility of the plenary group.

One of the technical working groups is the Terrestrial Resources Work Group (TRWG). The focus of the TRWG meetings has been to develop and approve final study plans related to wildlife and botanical resources as presented in this section of Exhibit E. Studies include vegetation cover type/wildlife habitat inventory and mapping; characterization of wetland and riparian plant community; inventory of threatened, endangered and sensitive species; amphibian and reptile inventory; noxious weed inventory; grazing analysis; and a spring-associated mollusk inventory. The TRWG met nine times between December 2001 and November 2003.

Nine study plans related to terrestrial resources have been developed by the TRWG. All nine study plans have been approved by the plenary group. The study plans (and their approval dates) are as follows:

- Study Plan 2.1, Vegetation Cover Type/Wildlife Habitat Inventory and Mapping (Approval: August 2002)
- Study Plan 2.2, Wetland and Riparian Plant Community Characterization (Approval: March 2003)
- Study Plan 2.3, Threatened, Endangered, and Sensitive (TES) Species Inventory (Approval: August 2002)
- Study Plan 2.4, Amphibian and Reptile Inventory (Approval: February 2003)
- Study Plan 2.5, Wildlife Movement/Connectivity Assessment (Approval: March 2003)
- Study Plan 2.6, Wildlife Habitat Association Assessment and Synthesis of Existing Wildlife Information (Approval: August 2002)
- Study Plan 2.7, Noxious Weed Inventory (Approval: August 2002)
- Study Plan 2.8, Grazing Analysis (Approval: August 2002)
- Study Plan 2.9, Spring-Associated Mollusk Inventory (Approval: August 2002)

For additional information about consultation with applicable agencies, tribes, and the public regarding botanical and wildlife resources, refer to Appendix E-1A.

E5.5 TERRESTRIAL RESOURCES STUDIES CONDUCTED

Note that in the interim between the draft license application and this final license application, PacifiCorp made a few changes to the proposed Project boundary. The newly proposed Project boundary begins at the J.C. Boyle Development and continues downstream to the Iron Gate Development; the studies described below covered the East Side, West Side, and Keno Developments as well and referred to them collectively in the Terrestrial Resources FTR as the Project.

The following section summarizes terrestrial resources studies.

E5.5.1 Vegetation Cover Type/Wildlife Habitat Inventory and Mapping

Objectives: This study was designed to characterize and map vegetation in the study area to provide baseline habitat information needed to conduct other studies and to assist in identifying PM&E measures for terrestrial resources where necessary.

Methods: A vegetation classification system (see Terrestrial Resources FTR, Section 2.0, Table 2.4-1) initially was developed using the California Wildlife Habitat Relations System (CWHRS) (Mayer and Laudenslayer, 1988) and the National Wetland Inventory (NWI) (Cowardin et al. 1979) classification schemes. Cover types were delineated on aerial photography, field-verified, then digitized into a geographic information system (GIS) database. GIS attribute data that included information on tree and shrub cover and size or age class as well as the dominant plant species were assigned to most of the delineated polygons.

The vegetation was characterized from plot data collected in 295 0.1-acre (400-m^2) plots in polygons representing the Project cover types. The types of data collected in each plot included areal foliar cover by cover class for each species in each of the vegetation layers (i.e., tree, shrub, and herb layer); the areal cover and height of each vegetation layer in the plot; the aspect; and the slope. The number of living trees was tallied and the tree dbh was recorded. The amount of dead wood in the plot was assessed by collecting data on CWD, snags, and wood cover for pieces more than 4 inches (10 cm) in diameter. General observations were made concerning how erosion, livestock, and recreation might be affecting habitat.

Results: The study area cover type map covers approximately 52,870 acres (21,451 ha) and presents 3,145 polygons grouped into 31 cover types (see Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). The vegetation characterization data are summarized for 23 cover types and 11 study area sections (see Terrestrial Resources FTR, Section 2.0, Table 2.4-2 and Figure 2.7-1). The cover type descriptions include plant species composition and abundance, stand structure as depicted by the areal cover and height measurements of the vegetation layer(s) and tree tally data (see Terrestrial Resources FTR, Section 2.7.2). Small woody debris cover, and coarse or large wood and snag data are summarized in the Terrestrial Resources FTR, Section 2.7.3. A summary of observations related to livestock grazing, recreation use, and erosion is included in the Terrestrial Resources FTR, Section 2.7.4. The plant species composition and cover/abundance data for each cover type are summarized in more detail in the Terrestrial Resources FTR, Appendix 2B. The summary of the remaining cover type descriptors is located in the Terrestrial Resources FTR, Appendix 2C.

Reporting: Study methods and results are described in the Terrestrial Resources FTR, Section 2.0.

E5.5.2 Wetland and Riparian Plant Community Characterization

Objectives: The objectives of this study were to classify and characterize riparian and wetland vegetation using quantitative floristic and structural data and develop vegetation type descriptions that include habitat characteristics important to TES species or "focal" wildlife; investigate the potential relationship between riparian and wetland vegetation patterns and historical and existing flow regimes; investigate how riparian vegetation patterns related to fluvial geomorphic processes including sediment flow and deposition in the Klamath River reaches; and assess the overall condition of riparian/wetlands vegetation by using the vegetation types description, the potential relationships between riparian/wetland vegetation and Project flows, and also by evaluating observations of Project impacts, erosion, grazing, and recreational use in riparian/wetland sites. At the request of the TRWG, the vegetation communities that existed in the areas now occupied by the reservoirs were mapped to serve as a point of comparison and to direct PM&E development.

Methods: Between the summer of 2002 and summer of 2003, PacifiCorp's plant ecologists sampled riparian/wetland vegetation plots along Project river reaches and reservoirs. Sample sites were chosen in coordination with studies conducted by Project geomorphologists, hydrologists, and fisheries biologists to investigate the potential interactions or relationships among Project flows, fluvial geomorphic processes, and riparian vegetation.

Riparian and wetland vegetation was sampled along transects at 113 sites and data were collected in 1,135 plots. The plots along transects were 3.28 feet by 13 feet (1 m by 4 m) laid out every other meter along the transects. The data collected in these plots included species cover by cover class and species composition, substrate particle size cover by particle size class, and the height and cover of the herb, shrub and tree layer(s). Data also were collected that describe snag and down wood using BLM protocol (BLM, 1995). In some sites, trees were cored in an attempt to evaluate historical reproduction of riparian forest stands. Additional tree coring was conducted in the spring of 2003.

Historical vegetation communities at Project reservoirs were mapped using a combination of aerial photography taken before Project construction (where available), land survey maps, and oblique photography.

Results: Results of two-way indicator species analysis (TWINSPAN) were used to classify riparian/wetland vegetation types. Detrended correspondence analysis (DCA) analyses were used to evaluate patterns in species abundance; the results were used to evaluate vegetation types and potential relationships to environmental variables: inundation duration, inundation frequency, return interval, discharge, substrate particle size, and slope. The riparian/wetland vegetation was sampled at Link River, Keno Canyon, J.C. Boyle peaking and bypass reaches; Copco No. 2 bypass reach; Fall Creek; and the Iron Gate to Shasta River reaches. TWINSPAN analysis of river sites included a total of 618 plots along 52 transects and 501 species and at reservoirs included 473 plots, 41 transects, and 132 species. The following numbers of vegetation types resulted from TWINSPAN analysis: Link River—five types, Keno Canyon—nine types, J.C. Boyle bypass and peaking reaches—11 types, Fall Creek—five types, Copco No. 2 bypass—five types, Iron Gate-Shasta—12 types, and reservoirs—12 types.

DCA analysis on plots from Project reservoirs revealed that inundation duration and plot elevation best explained the separation of plots along DCA Axis 1. The separation of plots along DCA Axis 1 strongly represents the separation of vegetation types along DCA Axis 1, therefore, a strong relationship is inferred between inundation duration, plot elevation, and vegetation types.

DCA analysis was performed separately on plots from each river reach. Inundation duration and discharge were best correlated with DCA Axis 1 for river reaches (Iron Gate-Shasta, J.C. Boyle bypass, J.C. Boyle peaking reach) that were not greatly affected by seepage from Project canals and flowlines (Link River and Fall Creek) or by multiple vegetation types occurring low within the river channel that did not sort well by elevation (Keno Canyon). Hydrologic variables were not calculated for Copco No. 2 bypass, but this reach fell into the same group with Link River and Fall Creek in that seepage from the wood-stave flowline confounded the inundation/ elevation gradient that is associated with river hydrology.

Analyses of Project effects on the presence of reed canarygrass and coyote willow were evaluated on the basis of the presence of these species relative to Project hydrology, fluvial geomorphology, and their life-history strategies. Reed canarygrass appears to be invasive and highly aggressive, potentially in response to the additive effects of increase nutrient supply resulting from agricultural runoff and increasing intensity of inundation. Coyote willow reproduction appears to occur normally under Project hydrology in the Iron Gate-Shasta reach, but may be primarily restricted to vegetative reproduction in the J.C. Boyle peaking reach. Coyote willow reproduction at Copco and Iron Gate reservoirs may be most limited by the availability of bare substrates that permit willow seed germination. Herbivory and trampling by cattle, deer, and beaver at these reservoirs also may contribute to willow seedling mortality.

Mapping of historical vegetation communities now inundated by the four reservoirs found that Copco and Iron Gate reservoir shorelines have less riparian/wetland habitat, when expressed as a percent of the total shoreline, than was present along the pre-Project river reaches; J.C. Boyle reservoir has more. The mapping also documented which general types of upland communities historically occurred in each area. The mapping demonstrated that the historical riparian communities were narrow—similar to what exists along river reaches between the reservoirs—except at one area now under Copco reservoir.

Reporting: Study methods and results are described in the Terrestrial Resources FTR, Section 3.0.

E5.5.3 TES and Culturally Sensitive Plant Surveys

Objectives: The purpose of the surveys was to identify TES and culturally sensitive (CS) species that occur in the study area, assess the effect of Project operations and maintenance on TES and CS species, and determine possible PM&E measures.

Methods: Botanists identified TES and CS plants species that potentially occur in the Project area based on consultation with the BLM, ONHP, CNDDB, and CNPS occurrence records. Field surveys were conducted in 2002 and 2003 using an "intuitive controlled" approach (Whiteaker et al. 1998), which is similar to the random meander approach (Nelson, 1985). Areas immediately adjacent to Project facilities and roads were surveyed more intensely under the assumption that these areas are more likely to be directly affected by Project operations and maintenance.

Surveys were conducted by six botanists working in three teams of two botanists. Surveys took place from May 6 to 11, June 3 to 9, and July 8 to 13, 2002. Additional survey effort occurred during upland and riparian vegetation sampling (see Terrestrial Resources FTR, Sections 2.0 and 3.0) and some specific sites also were revisited in October and November 2003 in an attempt to verify the identification of late-flowering potential TES plants species found during earlier surveys. During field surveys, botanists identified all plant species they observed to the extent possible and compiled a species list. However, emphasis was put on identifying all taxa that were similar to taxa on the target TES species list (i.e., same genus). Surveys were conducted on multiple occasions for some species to better match their phenological development during the 2002 growing season.

Results: Seventy-nine occurrences of 14 species of TES plants were documented in the study area in 2002 (see Terrestrial Resources FTR, Appendix 5A, Table 5A-5, and Figure 5.7-1). Thirty of the 79 occurrences were previously documented by the BLM. CNDDB records of TES plants in the study area account for 11 of the 79 documented TES plant occurrences in the study area. Two CNDDB records coincide with BLM records. There were only two ONHP occurrences of TES plants that overlapped the study area. There are five additional ONHP occurrences that potentially overlap the study area around Keno reservoir. There are potentially 34 to 39 new occurrences of TES plants in the study area following the 2002 survey. A summary of all 79 occurrences of TES plant species, including their unique labels, their listing and status at the state and federal levels, and comments about the occurrences are provided in the Terrestrial Resources FTR, Appendix 5C.

The Project plant species list compiled by botanists during surveys for TES plants is provided in the Terrestrial Resources FTR, Appendix 5D. CS plants observed in the Project area were compiled from the Project plant species list by their occurrence in study area sections (see Terrestrial Resources FTR, Appendix 5E). The CS plant list was assessed by the Cultural Resources Work Group.

Reporting: Study methods and results are described in the Terrestrial Resources FTR, Section 5.0.

E5.5.4 <u>TES Wildlife Surveys</u>

Objectives: The purpose of the surveys was to identify TES wildlife species and reptiles and amphibians (many of which are TES species) that occur in the study area, assess the effect of Project operations and maintenance on TES species, and determine possible PM&E measures.

Methods: A variety of survey methods was employed for the various TES amphibians, reptiles, birds, and mammals; the different methods are discussed below and the results are summarized for each of the four taxa.

General amphibian surveys were performed in pond habitats in 2002 and 2003, and in instream habitats in 2002. In addition, specific surveys for Oregon spotted frog and foothill yellow-legged frog were completed in 2003. For pond breeding amphibian surveys, biologists used time- and area-constrained methods described in Olson and Leonard (1997) and Thoms et al. (1997) to conduct surveys at 68 individual sites from March through April 2002 to cover the egg and larval stages of most target pond-breeding amphibian species (see Terrestrial Resources FTR, Section 4.0, Figure 4.4-1). Twenty selected areas of suitable wetland, spring, and pond habitat were surveyed for TES amphibians in April through June 2003.

Instream amphibian surveys targeting TES amphibians associated with riverine habitat were conducted in August 2002. Biologists surveyed the first 492 feet (150 m) of a creek upstream or downstream of a Project facility or reservoir; 12 surveys were conducted in 10 different creeks (see Terrestrial Resources FTR, Section 4.0, Figure 4.4-1). Surveys were conducted during low-flow conditions when stream-dwelling amphibians are most-easily detected (Bury and Corn, 1991). Surveys involved: (1) searching the shallow-water zones for amphibians, (2) turning rocks, litter, and debris to find adult and larval amphibians, and (3) using nets to catch individuals dislodged from under cover objects and raking gravel and cobble (Corkran and Thoms, 1996; Bury and Corn, 1991; Welsh, 1987; Heyer et al. 1994). Foothill yellow-legged frog surveys were conducted in 2003 using methodology described in Seltenrich and Pool (2002). Ten sites located along the Klamath mainstem and associated tributaries were surveyed four times: April, May, June, and August 2002.

Surveys for terrestrial amphibians were conducted in March and April 2002 in two cover type polygons that contained potentially suitable mesic conifer forest in Keno Canyon (see Terrestrial Resources FTR, Section 4.0, Figure 4.4-1). Biologists used time-constrained methodology, similar to the visual encounter method (VES) described by Crump and Scott (1994). In addition, terrestrial TES amphibian species observations were recorded during avian studies conducted in the wildlife survey plots.

Oregon spotted frog surveys were conducted in potentially suitable wetland habitat at J.C. Boyle reservoir and Keno reservoir during the 2003 field season. PacifiCorp surveyed representative sites near Miller Island and the undiked wetlands south of ODFW’s Klamath Wildlife Management Area along Keno reservoir as well as wetlands along the eastern shoreline of J.C. Boyle reservoir. Each site was surveyed three times using standard VES methods to search for egg masses, juveniles, and adults. Surveys were conducted in April, June/July, and August 2003.

Terrestrial reptiles species were searched for during surveys conducted in June 2002. Surveys were conducted in 139, 1.96-acre (0.79-ha) survey plots in all habitats in the study area as well as in selected locations around Project facilities. In addition, TES reptile species observations were recorded during avian studies conducted in each of the 149 wildlife survey plots. Snake hibernacula surveys were conducted in the spring of 2003 and focused on known or presumed hibernation sites and areas supporting high densities of reptiles existing between roads, recreation sites, Project facilities and the Klamath River.

Surveys for basking pond turtles were conducted between April and July 2002 by biologists traveling by boat or vehicle along reservoirs and accessible river reaches. Biologists recorded the location of basking sites and the number of adults and juvenile turtles present at each site. In 2002, surveys were not conducted in the Oregon portion of the J.C. Boyle peaking reach because existing data on the species had been collected in this area by the BLM and Bury (Roninger, 2000; Bury and Pearl, 1999). Additional surveys took place in 2003 to document pond turtle use in the California segment of the reach and J.C. Boyle bypass. In addition to the documentation of turtle observations, each river and reservoir shoreline was mapped into segments based on the presence of suitable nesting habitat for the species.

TES birds were documented by a combination of avian point count surveys, facility surveys, reservoir surveys, ROIs, and bald eagle surveys.

A total of 149 plots was surveyed for TES avian species (see Terrestrial Resources FTR, Section 5.0, Figure 5.4-1, and Appendix 5A, Table 5A-4) in May and June 2002. Point count survey methods generally followed those described in Ralph et al. (1993). Biologists also conducted an area search by traversing the entirety of the 1.96-acre (0.79-ha) wildlife survey plot.

Facility surveys were conducted in conjunction with plot surveys (in May and June 2002), but were neither time- nor area-constrained. Facility survey protocol included an informal, yet systematic, area search around Project facilities until a representative sample of the surrounding avifauna had been detected.

Reservoir surveys were conducted from a vehicle by one or more biologists. Biologists visually inspected reservoirs from various vantages using spotting telescopes and binoculars to ensure complete coverage.

Five ROI surveys were conducted to document avian occurrence in riparian habitat during the fall migration. ROI methodology includes mist-netting and banding coupled with area searches and nocturnal call-and-response owl surveys conducted during an intensive 3-day survey period (Ralph and Hollinger, 2001). ROI surveys were conducted by KBO from August 26 through September 4, 2002.

Protocol broadcast call surveys were conducted in 2002 for northern spotted owl and northern goshawk in suitable habitat located within 1.3 miles (2.1 km) of Project facilities in California and 1.2 miles (1.9 km) of Project facilities in Oregon (see Terrestrial Resources FTR, Section 5.0, Figure 5.4-1). During 2003, protocol broadcast call surveys for northern spotted owl (three visits) were completed and great gray owl protocol surveys were conducted. Broadcast call surveys incorporate playback of taped species-specific calls in suitable habitat following applicable protocols (Kennedy and Stahlecker, 1993; Joy et al. 1994; BLM, 1995a; USFS, 1996; Lint et al. 1999). Goshawk survey stations were located 1,000 feet (305 m) apart on line transects also spaced 1,000 feet (305 m) apart in all suitable habitat. This methodology established a grid of 138 northern goshawk calling stations, spaced evenly throughout suitable habitat in the study area (see Terrestrial Resources FTR, Section 5.0, Figure 5.4-1). Suitable habitat for this species was defined as conifer or riparian forest, with a northern aspect (north, northeast, or northwest) and ≥ 6 inches (15 cm) dbh trees forming ≥ 60 percent canopy closure (Marshall, 1992). Northern spotted owl survey stations were located intuitively to ensure adequate coverage of all available habitat. Biologists surveyed 106 northern spotted owl calling stations in suitable habitat defined as riparian areas and forests with a coniferous component containing trees ≥ 6 inches dbh and a canopy closure of ≥ 40 percent (see Terrestrial Resources FTR, Section 5.0, Figure 5.4-1) (Lint et al. 1999). Great gray owl suitable habitat was defined as conifer forests with tree cover ≥ 60 percent and ≥ 42 inches (107 cm) dbh that are within 1,000 feet (305 m) of openings (BLM, 1995).

Bald eagle surveys incorporated perch, forage site inventories, and aerial surveys for nests. Helicopter surveys were conducted on March 27 and May 29, 2002, and on March 27 and May 28, 2003. Perch and forage site surveys for eagles were conducted from April through September 2002 and from January through March 2003. Methodology for these surveys included driving on study area roads to observe reservoirs and shoreline areas from several vantages. Locations of all identified nest sites were mapped and described; activity, time, and age estimations were recorded with all observations. In addition, biologists visited four successful nest sites in August 2002 to collect prey remains.

Surveys specifically targeting mammalian TES species include: winter bait station and track surveys; canal wildlife surveys and small mammal trapping; and bat roost surveys. The winter bait station and track surveys, and the small mammal trapping were conducted in 2003.

From January through March 2003, biologists conducted snow tracking for forest carnivores along the Link River, Upper Keno Canyon, J.C. Boyle canal, and at Fall Creek. Tracking sample units, sized at approximately 2 to 4 square miles (5 to 10 square km) each to accommodate the home ranges of species of interest, were established in each of these areas and biologists checked for wildlife tracks twice along a minimum of 6.2 miles (10.0 km) of roads and trails in each sample unit (Halfpenny et al. 1995). Tracks were identified using field guides (Halfpenny, 1986; Halfpenny et al. 1995; Taylor and Raphael, 1988) and measurements were recorded and, in some cases, castings made for definitive identification of unusual or problematic tracks (Taylor and Raphael, 1988; Halfpenny, 1995). All wildlife species detected during track surveys were documented.

In conjunction with the winter track surveys, PacifiCorp established photographic bait stations to document carnivores along the J.C. Boyle canal; downstream of the J.C. Boyle powerhouse; and along the Copco No. 2 bypass. The three bait stations were maintained for 7 weeks from January through March. Each station was baited with carrion and checked weekly (see Terrestrial Resources FTR, Section 6.4.2.1).

Surveys of wildlife, emphasizing TES mammal species, were conducted along the J.C. Boyle canal three times during the spring and summer of 2002 and a fourth survey was conducted in the winter of 2003 in conjunction with the track surveys. Canal wildlife surveys were conducted by a biologist who walked the length of the canal while documenting all detected wildlife species. Small mammals were surveyed with Sherman live-traps monitored during two 4-night trapping periods along the J.C. Boyle, Fall Creek, East Side, and West Side canals in 2003**.** Additional detailed information on small mammal trapping is provided in the Terrestrial Resources FTR, Section 6.4.2.2.

To document the use of Project facilities by TES bat species, the undersides of 14 bridges were inspected for evidence of bat use during the 2002 or 2003 field seasons. Inspections of all Project facilities and buildings were conducted in the summer of 2003. Information from previous surveys conducted at Salt Caves and the Hoover Ranch house (Cross et al. 1998) is summarized in the Terrestrial Resources FTR, Section 5.7.2.4.

Results: The western toad was the only TES amphibian species that was detected during field studies. Five TES reptile species—Northwestern pond turtle, northern sagebrush lizard, common kingsnake, California mountain kingsnake, and sharptail snake—originally were identified as potentially occurring within the study area (see Terrestrial Resources FTR, Appendix 5A, Tables 5A-3 and 5A-6). All five of the potentially occurring TES reptile species were detected during BLM reptile and amphibian field studies conducted in the Project vicinity during 2000 and 2001 (Roninger, 2001).

Pond turtle surveys conducted by PacifiCorp, BLM, and Bury (1995) documented numerous locations in the study area where pond turtle basking occurs. No turtle activity was noted in Fall Creek, Copco No. 2 bypass, Keno Canyon, or J.C. Boyle bypass. Keno reservoir and Lake Ewauna had large numbers of turtles, while the other reservoirs supported fewer. There are several locations along the J.C. Boyle peaking reach and Iron Gate dam-Shasta River reach that have basking habitat for turtles. Potential turtle nesting habitat occurs along much of the river and reservoir shorelines.

Sixty-seven avian TES species originally were identified as potentially occurring within the study area (see Terrestrial Resources FTR, Appendix 5A, Table 5A-3). Thirty-nine of these potentially occurring avian TES species were detected during relicensing field studies with a total of more than 2,000 individual detections (see Terrestrial Resources FTR, Section 5.0, Figure 5.7-2, and Appendix 5A, Table 5A-7). The Terrestrial Resources FTR, Table 5A-8 (in Appendix 5A), provides information on all avian TES species detected in 2002 and 2003 including associated study area section and survey methodology.

Overall, at least one avian TES species was detected in 134 of 149 avian survey plots surveyed in 2002. Avian TES species detections recorded during avian plot surveys resulted in an average of 4.08 avian TES species detections per plot survey (SD 7.24) with TES avian species recorded in all 11 study area sections.

Various types of the surveys, resulted in the following detections:

- Facility surveys: 190 avian TES detections recorded (13 species detected)
- Reservoir surveys: 950 detections (12 species detected), with avian TES species noted on each of the four Project reservoirs
- Protocol surveys: a combined 36 documented detections (24 and 12 detections recorded during northern goshawk [five species detected, but no goshawks] and northern spotted owl [four species detected, including spotted owls] broadcast call surveys, respectively)
- ROI surveys: 17 individual avian TES species detected

Of the 23 mammal species originally identified as potentially occurring in the study area, three—the western gray squirrel, western big-eared bat, and Yuma myotis—were documented in the study area.

Reporting: Study methods and results for amphibians, bird, reptiles, and mammals are described in the Terrestrial Resources FTR, Sections 4.0 and 5.0.

E5.5.5 Wildlife Movement/Habitat Connectivity Assessment

Objectives: The purpose of the wildlife movement/connectivity assessment is to describe existing impacts to wildlife caused by Project reservoirs, diversion canals, flumes, and transmission lines.

Methods: The assessment of Project impact on the movement of wildlife species included the following:

- Literature review of the effects of reservoirs and hydroelectric project operations on big game movement: This information included the importance of particular local plant communities, known migration patterns and access to wintering and fawning areas, and results of other studies that examined the direct effects of reservoirs on big game habitat use and mortality.

- Assessment of wildlife entrainment and connectivity: To determine which species are most directly affected by Project structures, PacifiCorp used a combination of data that included: (1) vegetation cover type information for areas along each facility, (2) wildlife surveys along the J.C. Boyle canal and in the general vicinity of all Project facilities, and (3) distribution and habitat association information from literature. Small mammal trapping surveys were completed in 2003 to complete the entrainment assessment.

- Assessment of transmission line effects on wildlife: The transmission lines covered under the FERC license were evaluated for electrocution and collision hazard relative to standards and guidelines for power lines described in the Edison Electric Institute's publications, "Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996" (APLIC, 1996) and "Mitigating Bird Collisions with Power Lines: The State of the Art in 1994" (APLIC, 1994). There are also distribution lines in the study area, none of which is part of the FERC Project. In 1998, PacifiCorp conducted an assessment of the avian risks of non-Project distribution lines near Project facilities.

- Assessment of the role of project habitats for regional wildlife: PacifiCorp reviewed existing literature and field data to assess ongoing Project effects on wildlife at a regional level. The focus of this assessment was on riparian-dependent species and big game species.

Results: The following is a summary of study results.

E5.5.5.1 Assessment of Project Effects on Big Game Movement

From a regional perspective, the canyon and mid-elevation hillsides and plateaus between J.C. Boyle powerhouse and Iron Gate dam are considered critical deer winter range by the BLM, ODFW, and CDFG. Within the study area, south-facing lower canyon walls and hillsides are some of the most critical habitat for wintering migratory Pokegama black-tailed deer herd as well as for resident deer (City of Klamath Falls, 1990) (see Terrestrial Resources FTR, Section 6.0, Figure 6.7-1). The long-term changes in management of forests and shrublands that occurred in the early 1900s have caused a decline in the disturbances that perpetuate early-successional habitats that provide important deer habitat (CDFG, 1998). A long history of livestock grazing also could have played a role in reducing forage availability and big game habitat use through direct competition for browse, herbaceous vegetation, and mast or indirectly because of reduced shrub flowering and subsequent seed production (CDFG, 1998; Bronson, 1992; Loft and Menke, 1988).

The South Cascades deer study documented movement from the wintering range on the HRWA to the Cascade Mountains north and south of the Project. This study showed at least some movement across the Klamath River (one individual), crossing either the river or Iron Gate reservoir. Elk telemetry data showed a single individual with a long-range migration pattern between the Shasta Valley in California and the forests to the west of Upper Klamath Lake in Oregon (see Terrestrial Resources FTR, Section 6.0, Figure 6.7-1). Analysis of 20 radio-collared elk in 1994 demonstrated summer ranges in the upper portions of the Long Prairie Creek and Jenny Creek areas as well as several areas at higher elevations north of the Klamath River (BLM, 1996). The Project facilities likely modify the movement opportunities for deer during migration by causing them to either move around canals or reservoirs, swim across reservoirs, or make them stop their migration short of a potential migration route. Given the narrowness of Project reservoirs and the relatively short length of the canals, this effect likely is not significant on a population level. There have been only a few documented cases of deer falling through ice on Project reservoirs.

E5.5.5.2 Assessment of Wildlife Entrainment in Canals

There has been little evidence of deer mortality from the attempted crossing of or entrapment in canals. Small portions (approximately 4 percent) of the J.C. Boyle canal and the entire East Side, West Side, and Fall Creek canals appear to be accessible to wildlife. Entrainment data indicate that medium and large mammals are not entrained in any Project canals with regularity. The Fall Creek canal does not appear to represent significant entrapment hazards to big game or most other wildlife because the velocity is low and the canal banks are earthen construction that allows animals to escape (see Terrestrial Resources FTR, Section 6.0, Table 6.7-4).

The 2003 small mammal trapping indicated that small mammals and snakes frequently use habitats immediately along the J.C. Boyle canal and small mammals occur along the Fall Creek canal. No TES mammals were found along any of the canals during the small mammal trapping, although several of the snake species are on the TES list. The deer mouse (*Peromyscus maniculatus*) was the most commonly caught species.

E5.5.5.3 Small Animal and Avian Connectivity

Discontinuous and patchy distributions of riparian plant species occur more often in river systems with multiple impoundments than in natural free-flowing rivers (Nilsson and Berggren, 2000). The species likely to be affected by the increased inter-riparian shoreline distances and patchy riparian plant distribution include riparian species that are closely tied to riparian habitat during all or part of their life history.

Along the flowing sections of the river, mapped riparian habitat occurs along 37 to 89 percent of the shoreline (see Terrestrial Resources FTR, Section 6.0, Table 6.7-8). The lowest percentage was in the narrow Keno Canyon, where little room exists on the floodplain for riparian vegetation. The other river reaches have at least 62 percent of their shorelines bordered by riparian vegetation (see Terrestrial Resources FTR, Section 6.0, Table 6.7-8). At Project reservoirs, riparian and wetland habitat occurs along a low of 17 percent of the Copco reservoir and a high of 53 percent of the Keno reservoir (see Terrestrial Resources FTR, Section 6.0, Table 6.7-8). The J.C. Boyle reservoir also has a relatively high percentage—44 percent—of riparian/wetland habitats. The average break between neighboring riparian habitat patches on Project reservoirs is significantly (P = 0.02) larger—between 1,773 and 3,495 feet (540 and 1,065 m) at individual reservoirs—than along natural peaking river reaches—270 to 2,134 feet (see Terrestrial Resources FTR, Section 6.0, Table 6.7-8).

The nearly 2-mile-long J.C. Boyle canal creates a situation where riparian habitat along the river is isolated from upland habitats on the opposite side of the canal. This likely affects small animals to some degree.

An inventory of roads completed by PacifiCorp found that there are 300 miles (483 km) of all roads and 18 miles (29 km) of OHV routes in the terrestrial resources study area. Approximately 93 miles (150 km), or 31 percent (see Terrestrial Resources FTR, Section 6.7), of the roads are on PacifiCorp land. Most PacifiCorp roads are located near Iron Gate reservoir, Copco No. 1 and No. 2 dams, and J.C. Boyle and Keno dams. Eight miles (13 km) of the OHV routes are on PacifiCorp land in the terrestrial resources study area. Wildlife killed along roads traveled by Project personnel were documented from March 14 through July 29, 2003, by the PacifiCorp personnel. Thirty wildlife carcasses were observed along roads in the study area. By far, the most commonly observed carcasses were California ground squirrels, although snake carcasses also were found along these roads. Five live snakes were seen basking on roads. All of the mortality occurred on roads open to the public.

E5.5.5.4 Assessment of Transmission Line Effects on Avian Species

The transmission lines associated with the Project do not appear to present a problem for avian collisions or electrocutions. Transmission lines associated with the Project are shown in the Terrestrial Resources FTR, Section 6.0, Figure 6.7-3. PacifiCorp employees have been trained to report avian mortalities associated with power lines, and a database of mortalities and remedial measures has been maintained since the late 1980s. A review of the database indicates that there have been no collisions or electrocutions documented by PacifiCorp personnel for any of the Project-related transmission lines.

A review of the configuration, spatial location, and habitat adjacent to Project lines was conducted. Project transmission lines meet the raptor-safe construction standards of 60-inch (152-cm) line separation in most cases and do not appear to present an electrocution hazard to birds. There are some distribution lines sharing the same poles as Line 15 that do not meet raptor-safe standards because of inadequate spacing between conductors, but there have been no reports of avian mortalities associated with these poles. There are several short transmission line segments that are situated over or near habitats that are used by species most susceptible to collision (waterfowl and large water birds). Lines 15 and 62, which cross the upstream end of Iron Gate reservoir, have line segments that occur near areas of regular waterfowl use: upper Iron Gate reservoir and the Jenny Creek inlet of Iron Gate reservoir (Terrestrial Resources FTR, Section 6.0, Figure 6.7-3). A third line segment, the 0.7-mile (1.1-km) Line 56-8 that crosses the Link River, also occurs in an area of high water bird use; this line is associated with the East Side powerhouse that is proposed for decommissioning. A lack of significant croplands and large wetlands near the Project transmission lines reduces the likelihood that waterfowl and other birds occurring along Project reservoirs would fly through the transmission line ROWs during flights to feeding areas and, therefore, reduces the chances of avian collisions. Project lines are configured horizontally, which presents a lower potential collision profile than vertically arranged wires. Project lines also do not have shield wires that are more likely to cause collisions than the larger conductor wires because they are less visible. Based on the location of segments and line configurations, these transmission lines do not appear to have characteristics known to cause a high risk of avian collision. There has been no evidence (dead birds or power outages caused by collisions) to indicate that avian collisions occur with any regularity on these lines.

The Terrestrial Resources FTR, Section 6.7.3, summarizes PacifiCorp's corporate program that addresses avian power line issues on all types of lines owned by PacifiCorp.

Reporting: Study methods and results for the wildlife movement/habitat connectivity assessment are described in the Terrestrial Resources FTR, Section 6.0.

E5.5.6 Wildlife Habitat Association and Synthesis

Objectives: The purpose of this assessment and synthesis is to: (1) provide habitat-based information on wildlife occurring in the Project vicinity that is not specifically addressed by other relicensing studies, (2) consolidate and summarize information on all species, (3) provide an analysis of potential threats to wildlife and habitat in the Project vicinity, and (4) document occurrence, distribution, and habitat conditions for designated RFS in the Project vicinity.

Methods: Methodology for the wildlife habitat association assessment primarily involved: (1) thoroughly reviewing literature on species distribution and known habitat associations, (2) combining data on wildlife observations collected during field surveys, and (3) assessing wildlife data along with information from other relicensing studies. Field survey results incorporated into the wildlife habitat association assessment study include data from targeted avian, amphibian, reptile, and mammalian field studies.

E5.5.6.1 Avian Field Studies

Surveys targeting general avian populations in the Project vicinity included: (1) avian plot surveys, (2) facility surveys, and (3) reservoir surveys. Specific methodologies for avian TES species field surveys including bald eagle surveys, and northern spotted owl, northern goshawk, and great gray owl broadcast call protocol surveys are described in detail in the Terrestrial Resources FTR, Section 5.4.4.3. In addition, data from avian censuses and mist-netting at Constant Effort Stations (CES) conducted by the KBO in the Project vicinity are included in the wildlife habitat association assessment. Methodology for CES surveys follows methodology described in Ralph et al. (1993) and Ralph and Hollinger (2001).

E5.5.6.2 Amphibian and Reptile Field Studies

Field surveys targeting amphibian and reptile species included: pond-breeding amphibian surveys, terrestrial amphibian surveys, instream surveys, general wildlife plot and facility reptile surveys, western pond turtle surveys, Oregon spotted frog surveys, foothill yellow-legged frog surveys, and snake hibernacula surveys. Detailed information on methodology for all field studies targeting amphibian and reptile species is provided in the Terrestrial Resources FTR, Sections 4.4.2 and 4.4.3. Detailed methodology for surveys targeting TES amphibian and reptile species is provided in the Terrestrial Resources FTR, Section 5.4.4.1.

E5.5.6.3 Mammalian Field Studies

Field studies conducted to inventory mammalian species in the Project vicinity include: photographic bait stations surveys; track surveys; wildlife surveys conducted along Project canals; and live trapping for small mammals near the West Side, J.C. Boyle, and Fall Creek canals. Detailed information on methodology for mammalian field studies is provided in the Terrestrial Resources FTR, Section 6.4.2.2.

E5.5.6.4 Riparian Focal Species Studies

Before the initiation of relicensing field studies, the TRWG developed the following list of ten RFS (or species groups):

- Western pond turtle
- Lewis' woodpecker
- Willow flycatcher
- Swainson's thrush
- Warbling vireo
- Yellow warbler
- Yellow-breasted chat
- Song sparrow
- Black-headed grosbeak
- Aquatic fur-bearing mammals (including mink, river otter, muskrat, and beaver)

These species were chosen for their known association with aquatic, riparian, and wetland habitat systems (Riparian Habitat Joint Venture [RHJV], 2000). Consistent with the objectives of the wildlife habitat association assessment, field studies and analysis for this study focused on these species as an indicator of the health and functioning of aquatic, wetland, and riparian habitat in the Project vicinity. Data on RFS were collected in avian plots, ROI plots, western pond turtle surveys, and mammalian field studies. Surveys were conducted at five ROI stations from August 26 through September 4, 2002, to collect specific information on avian RFS and to assess the migration phenology and post-breeding dispersal of study area birds in general (see Terrestrial Resources FTR, Section 5.0, Figure 5.4-1).

Surveys targeting basking western pond turtles were conducted between April and July 2002 by biologists traveling by boat or vehicle along reservoirs and accessible river reaches. Additional surveys were conducted in 2003 to document pond turtle use in the California segment of the J.C. Boyle peaking reach and bypass. In addition to the documentation of turtle observations, each river and reservoir shoreline was mapped into segments based on the presence of suitable nesting habitat for the species (see Terrestrial Resources FTR, Section 4.4.2.5).

E5.5.6.5 Wildlife Habitat Association Analysis and Data Summary

Compilation and analysis of wildlife habitat association data included a systematic review of relevant literature coupled with a quantitative and statistical analysis of data on wildlife occurrence, distribution, and abundance. Documented wildlife habitat associations and species distribution data were used to focus RFS and general wildlife relicensing surveys in appropriate habitats and regions. An analysis of habitat suitability in each study area section was conducted on the basis of existing HSI models for three RFS species.

Results: Tables showing data from the Terrestrial Resources FTR, Section 7.0, analyses are found in the Terrestrial Resources FTR, Appendix 7A. Results from field studies included in the wildlife habitat association assessment are summarized in the habitat species matrix (see Terrestrial Resources FTR, Appendix 7A, Table 7A-1). In total, 223 distinct vertebrate wildlife species were detected or confirmed to occur in the Project vicinity: four amphibian, 15 reptilian, 174 avian, and 30 mammalian species (see Terrestrial Resources FTR, Appendix 7A, Table 7A-1). The sections below provide specific detailed results on each species group.

E5.5.6.6 Avian Field Studies

One hundred and seventy-four bird species were detected in the study area during relicensing field studies with a total of more than 20,000 individual detections. More than 11,000 individuals and 53 avian species were recorded on Project reservoirs during reservoir surveys conducted in 2002 and 2003 (see Reservoir Surveys below). More than 7,800 individuals and 142 avian species were recorded during avian plot surveys. Approximately 1,300 individuals and 78 avian species were recorded during facility surveys.

Results from facility surveys provide information on a representative sample of avifauna occurring in the immediate vicinity of Project facilities. Table 7A-4 in the Terrestrial Resources FTR, Appendix 7A, provides results of avian facility surveys by surveyed facility site listed in order of decreasing species detections. Reservoir surveys resulted in a combined total of 11,836 avian detections (see Terrestrial Resources FTR, Appendix 7A, Table 7A-5).

E5.5.6.7 Amphibian and Reptile Field Studies

Four amphibian and 15 reptile species were detected in the study area during relicensing field surveys. Species detected included one TES amphibian and all five of the TES reptile species originally identified as potentially occurring in the Project vicinity. Surveys of isolated wetlands, snake hibernacula, spotted frogs, and foothill yellow-legged frogs were conducted in 2003 and documented a number of observations. Comprehensive amphibian and reptile field survey results are presented in the Terrestrial Resources FTR, Section 4.7. Specific information on the 12 potentially occurring TES amphibian species and five potentially occurring TES reptile species is included in the Terrestrial Resources FTR, Section 5.7.2.

E5.5.6.8 Mammalian Field Studies

Mammal species occurrence data were obtained from track and bait station surveys conducted near Project facilities, small mammal trapping conducted in 2003 along Project canals, as well as incidental observations of mammals recorded throughout the Project vicinity. Thirty mammalian wildlife species are known to occur in the study area (see Terrestrial Resources FTR, Appendix 7A, Table 7A-1). All mammals observed during relicensing studies are shown in Terrestrial Resources FTR, Appendix 7A, Table 7A-11. Eight wildlife and three domesticated mammalian species were detected during track surveys (see Terrestrial Resources FTR, Appendix 7A, Table 7A-12). Only two carnivore species were detected during 7 weeks of bait station surveys: bobcat and mountain lion (see Terrestrial Resources FTR, Appendix 7A, Table 7A-12). Mammals specifically associated with aquatic and riparian habitat—mink, muskrat, river otter, and raccoon—were detected in various sections of the study area. The most common small mammal species found along canals were deer mouse, montane vole (*Microtus montanus*), and least chipmunk (*Tamias minimus*).

E5.5.6.9 Riparian Focal Species Studies

All ten designated RFS were detected in the study area during relicensing field studies (including all four of the aquatic fur-bearing mammals). In general, avian RFS were found to be abundant across study area sections with the Lewis' woodpecker, yellow warbler, and song sparrow included in a group of seven species detected in each of the 11 study area sections (see Terrestrial Resources FTR, Appendix 7A, Table 7A-3).

A qualitative comparison of ROI results versus data from all avian field studies and wetland and riparian plot survey results is included in the Terrestrial Resources FTR, Section 7.7.1.1, and data are included in Appendix 7B. All data on avian RFS detections recorded during plot surveys are provided in the Terrestrial Resources FTR, Appendix 5F. Relative abundance (birds per survey) values resulting from avian RFS plot survey detections are presented in Terrestrial Resources FTR, Appendix 5G. Table 7A-14 (see Terrestrial Resources FTR, Appendix 7A) provides relative abundance data for avian RFS detected during surveys conducted in riparian and wetland survey plots (i.e., survey plots with a general habitat designation of emergent wetland, riparian/wetland forest, riparian/wetland scrub-shrub, riparian grass or riparian mixed).

Reporting: Study methods and results for the wildlife habitat association assessment and synthesis of existing wildlife information assessments are described in the Terrestrial Resources FTR, Section 7.0.

E5.5.7 Noxious Weeds

Objective: The objectives of this study were to identify noxious and non-native invasive species infestations that occur in the Project area, assess the effect of Project operations and maintenance on noxious weed and non-native invasive species, and determine possible PM&E measures.

Methods: This study focused on areas directly affected by Project operations within the vegetation cover type mapping study area (see Terrestrial Resources FTR, Section 2.4). A target list of noxious weed species potentially occurring in the study area was developed through consultation with the resource agencies and other sources of information (see Terrestrial Resources FTR, Section 8.0, Table 8.4-1). The noxious weed field inventory was completed in conjunction with the TES species plant surveys (May through July 2002); vegetation cover type verification (April through November 2002); and the vegetation characterization plots and riparian/wetland vegetation characterization studies (2002 and 2003); and was supplemented by incidental observations. A GIS coverage and database were produced to identify noxious weed infestations by species.

Results: Seventeen of the 39 target weed species were found in the study area. There were 60 infestations mapped in the study area resulting from surveys completed in 2002. Fifty-two infestations were mapped on BLM's noxious weed database. A total of 14 noxious weed species and 112 infestations covered more than 558 acres (226 ha) in the study area (see Terrestrial Resources FTR, Section 8.0, Table 8.7-1 and Figure 8.7-1). The distributions of three widespread species were not mapped, but were recorded only for their general distribution in plot data collected as part of the riparian/wetland characterization study (see Terrestrial Resources FTR, Section 3.4) and upland habitats during the vegetation cover type mapping and characterization study (see Terrestrial Resources FTR, Section 2.4).

Noxious and non-native invasive plants occurred in 74 percent of the 295 vegetation characterization plots, with a low of 42 percent at J.C. Boyle reservoir and a high of 95 percent along the Iron Gate-Shasta section (see Terrestrial Resources FTR, Section 8.0, Table 8.7-2 and Figure 8.7-1). Noxious weed and invasive plants occurred in 62 percent of the sampled riparian/wetland sites and ranged from a low of 17 percent at J.C. Boyle reservoir to 93 percent and 92 percent at Iron Gate reservoir and Keno reservoir, respectively. Most of the noxious weed detections at riparian sampling sites were near the upland-riparian transition.

Twelve of the mapped infestations are identified as being potentially directly affected by Project operations and maintenance (see Terrestrial Resources FTR, Section 8.0, Table 8.8-1). However, numerous small infestations identified part of the riparian/wetland characterization study (see Terrestrial Resources FTR, Section 3.4) and during the vegetation cover type mapping and characterization study (see Terrestrial Resources FTR, Section 2.4) are potentially directly affected by Project operations and maintenance especially in riparian habitats near Project facilities.

Noxious weed infestations are particularly severe in the annual grasslands surrounding Iron Gate and parts of Copco reservoirs. In these areas, the open rangeland currently is dominated by yellow starthistle and other non-native species that significantly reduce livestock forage and wildlife habitat quality (see Terrestrial Resources FTR, Section 8.0, Figure 8.7-2). The disturbed habitats near Project facilities may function as a source of some of the less widespread noxious weed species.

Reporting: Study methods and results are described in the Terrestrial Resources FTR, Section 8.0.

E5.5.8 Grazing Assessment

Objectives: The objectives of this assessment were to review current status of livestock grazing near the Project and to summarize evidence of grazing effects on current ecological conditions for botanical and wildlife resources (e.g., grazing impacts on shoreline erosion or riparian vegetation). This summary would be used to identify potential PM&E measures on PacifiCorp land that protect botanical, wildlife, cultural, and recreation resources.

Methods: The past and existing livestock grazing levels and systems employed on PacifiCorp and adjacent land were summarized by reviewing information provided in existing grazing assessments and documents (see Terrestrial Resources FTR, Section 9.4.1). Observations of evidence of grazing were made in 2002 as part of the riparian/wetland characterization study (see Terrestrial Resources FTR, Section 3.4) and upland habitats during the vegetation cover type mapping and characterization study (see Terrestrial Resources FTR, Section 2.4). In the riparian study, evidence of grazing impacts was recorded along the riparian/wetland vegetation characterization transects. Observations of grazing also were documented at the 295 characterization plots distributed among all cover types throughout the study area.

Results: There are 2,987 acres (1,209 ha) of upland, riparian, and wetland habitat within the original FERC Project boundary that are within an existing grazing allotment or grazing management unit (GMU). Within the terrestrial resources study area, approximately 26,206 acres (10,605 ha) are within grazing allotments. Approximately 33 to 38 percent of the upland and riparian plant communities had evidence of grazing.

Historically, livestock grazing near the study area focused on riparian areas (BLM, 1996), which resulted in a large concentration of animals in a small area and over-grazing and trampling to quickly occur. Riparian plant communities in the study area still have more grazing pressure than do most upland areas (see Terrestrial Resources FTR, Section 9.7.2.2). Up to 57 percent of all riparian sites in the J.C. Boyle peaking reach and Iron Gate-Shasta segments had evidence of grazing. No evidence of grazing was found in the Link River, J.C. Boyle bypass, and Keno Canyon riparian sampling sites.

Indirect impacts to wildlife from cattle grazing in the study area include the introduction and rapid take over of invasive weeds, the trampling and over-use of sensitive habitats, and lower water quality near riparian cattle access sites. Wedge-leaf ceanothus is a key component of deer wintering habitat in the study area (City of Klamath Falls, 1990). Mixed chaparral habitats that often contain this species had above average incidences of grazing and heavy grazing (see Terrestrial Resources FTR, Section 9.0, Table 9.7-4). Over-grazing in these habitats can lead to species composition changes and the reduction of deer winter forage (Belsky and Gelbard, 2000). Direct impacts on wildlife include competition with various herbivores for limited forage in winter months and trampling of individual amphibians, reptiles, mollusks, and small mammals.

Reporting: Study methods and results are described in Terrestrial Resources FTR, Section 9.0.

E5.5.9 Spring-Associated Mollusks

Objectives: The objectives of this study were to identify sites associated with springs and seeps in the study area that represent potential habitat for mollusk species; provide data needed to assess the potential effects of reservoir water level management, instream flows, maintenance activities, and recreational development on mollusk species; and provide information that can be used to develop PM&E measures.

Methods: The spring-associated mollusk inventory consisted of the following primary tasks:

- Literature Review - The available literature pertaining to aquatic mollusks potentially occurring in the study area was reviewed and summarized. Information on the Oregon portion of the study area was derived from the work of Frest and Johannes (1996, 1998, 2000, 2002). Aquatic mollusk information for the California portion of the Klamath River basin was gathered from the CDFG (Taylor, 1981). The information available for the Oregon portion of the basin included site-specific data and, in some cases, multiple years of sampling. The information obtained for California (Taylor, 1981) is not site-specific and is more generalized in nature.

- Mapping - Preliminary data on spring locations were obtained from the vegetation cover type mapping (see Terrestrial Resources FTR, Section 2.0) and the BLM, USGS, and other sources. In addition, all records of mollusks in the study area available from the BLM, USFS, and ONHP were mapped as a data layer in the Project GIS. Springs discovered during field investigations were documented using the global positioning system (GPS) and added to the mollusk GIS layer.

- Inventory - Protocol mollusk surveys for species listed as S/M under the Northwest Forest Plan (USFS and BLM, 2001) were not conducted at springs in the study area as part of this study. However, biologists documented presence/absence of aquatic mollusks in all springs visited as part of other field surveys. Species were not identified or collected. In addition, the current condition of springs was documented and any impacts from hydrology, recreation, grazing, or other land uses were noted.

Results: Of the 37 species that have been identified near the Project (Frest and Johannes, 1998; Taylor, 1981), eight species are associated with springs. In terms of spring-associated species, Frest and Johannes (1998) found *Juga* (Oreobasis) and *Prygulopsis* n. sp. 1 in spring and seep habitats along the western shoreline of the Link River, a short distance upstream of the West Side powerhouse. In the J.C. Boyle ramped reach, *Fluminicola* n. sp. 3, *Gyraulus parvus*, *Juga* (Oreobasis), *Pisidium variable*, and *Stagnicola montanensis* were documented (Frest and Johannes, 1998). *Juga* (Oreobasis) also was found in the Keno River reach in riverine habitat (Frest and Johannes, 1998). Frest and Johannes (1998) reported mollusks at 16 sites along the Link River. Log fleeting and lumber mills along Lake Ewauna probably eliminated historically diverse mollusk habitat in this area (Frest and Johannes, 1998). A series of about six springs near Link River-Lake Ewauna provides refuge and is the reason that mollusks (*Juga* and *Pyrgulopsis*) survive (Frest and Johannes, 1998). *Juga acutifilosa* and *J.* (Oreobasis) *nigrina* were reported in the Jenny Creek drainage, along with various river-associated species in other portions of the Klamath River basin. *J.* (Oreobasis) *nigrina* also was documented in the Fall Creek drainage by Frest and Johannes (2000). Taylor (1981) reported *J. acutifilosa* from Shoat Springs, which is associated with Spring Creek, a tributary of Jenny Creek.

A combination of mapped information obtained from the USGS, BLM, and Frest and Johannes (1998), along with observations in the field during 2002, indicate that there are approximately 180 individual sites in the study area that have spring or seep habitat (which includes several sections of intermittent tributary stream channels that were surveyed by the BLM). Of these, 53 (29 percent) were visited at least once during the 2002 relicensing survey for amphibian/reptile, TES wildlife, or vegetation. Approximately 107 of the springs are located in the J.C. Boyle peaking reach in the study area. There are few springs between the J.C. Boyle bypass and Lake Ewauna, but 18 sites occur near the Link River or along the outlet of Upper Klamath Lake. Of the surveyed sites, 45 (61 percent) had at least one species of mollusk. In addition, mollusks (probably *Juga* sp.) were documented in Fall Creek upstream and downstream of the diversion dam.

Approximately 41 of the springs/seeps/intermittent stream channels included in this inventory are at least potentially affected by river hydrology or influenced by leakage from upslope Project canals/pipelines. The 14 hydrologically affected springs in the J.C. Boyle peaking reach ranged from zero to 273 feet (zero to 83 m) from the river channel. Analysis of the instream flow habitat data indicates that the wetted river channel fluctuates by between 24 to 67 feet (7 to 20 m), depending on habitat and section of river, between flows of 400 and 3,000 cfs (11.3 to 85.0 m^3/sec), the range of flows that potentially occurs as a result of changes in J.C. Boyle powerhouse operations. None of the springs appears to be immediately in the varial zone, but the outflow from each spring flows through the varial zone. There were 47 springs where livestock grazing potentially affects habitat. There were nine springs, all in the J.C. Boyle peaking reach, located close to recreation sites or trails and may have impacts from pedestrian foot traffic or off-road vehicles.

Reporting: Study methods and results are described in the Terrestrial Resources FTR, Section 10.0.

E5.5.10 Terrestrial Resource Continuing Studies

There are no ongoing terrestrial resource studies.

E5.6 PROPOSED ENHANCEMENT MEASURES FOR BOTANICAL AND WILDLIFE RESOURCES

E5.6.1 Existing Measures

Existing terrestrial resource PM&E measures that PacifiCorp has conducted or produced include:

- Maintenance of two wildlife escapes along the J.C. Boyle water conveyance system (canal and forebay)
- Environmental training programs for PacifiCorp maintenance personnel to protect sensitive resources

E5.6.2 Associated Measures

PacifiCorp owns non-Project lands near the Project. Although not required to complete any resource PM&E measures on these lands, PacifiCorp has conducted the following:

- Commercially thinned forest stands and conducted grass forage seeding of understory for wildlife
- Cooperated with the BLM for understory prescribed burning to enhance oak stands for wildlife
- Cooperated with multiple agencies, landowners, and NGOs for wildlife enhancements in the Pokegama Wildlife Habitat Management Area.
- Fenced selected riparian areas to minimize livestock trampling and grazing damage
- Implemented a Livestock Grazing Plan to maintain grazing levels that are consistent with the carrying capacity of the PacifiCorp-owned land.

E5.6.3 Proposed Measures

PacifiCorp's proposed PM&E measures for terrestrial resources are based on the following overall goals:

- Protect or enhance botanical and wildlife resources associated with the Project—Enhance biodiversity, especially for TES species and sensitive habitat, such as riparian habitat, wetlands, and big game winter range on Project lands.

- Maintain consistency with existing local, state, federal, and tribal resource management plans, goals, and objectives—Implement PM&E measures that complement regional plans that are administered by the various resource agencies.

- Ensure consistency with other resources—Develop PM&E measures for terrestrial resources that complement and do not conflict with objectives for fisheries, water quality, cultural, aesthetics, recreation, and land use, as well as Project operation.

PacifiCorp proposes the following PM&E measures to address terrestrial resources. PM&E measures are proposed to provide enhancements to baseline conditions. Table E5.6-1 summarizes the PM&E measures and justifications. Figure E5.6-1 provides general locations of PM&E measures. The FERC boundary proposed by PacifiCorp (see Exhibit A) includes the Project facilities, and wetland and riparian habitat along the affected water bodies. The proposed boundary also encompasses recreational facilities. For ease of administration, it is PacifiCorp's intent that the terrestrial PM&E measures be packaged into no more than two overall plans—one to address botanical resources that guides land management practices on PacifiCorp-owned land in the FERC boundary and one for wildlife resources that guides wildlife enhancement measures and monitoring of the measures. Development of these plans would start within 1 year of license issuance in consultation with local, state, and federal resource agencies interested in participating. It is anticipated that development of these plans would be completed by the end of the second year following the license issuance. For each PM&E strategy, the following six items will be developed:

- Goals and objectives and enhancement strategies
- Description of existing resource conditions
- Desired future conditions
- Management actions
- Monitoring and reporting strategies
- Funding and implementation schedule

For the first 5 years after license issuance, PacifiCorp will meet annually with the resource agencies to review PM&E implementation progress. PacifiCorp will develop a monitoring summary report after the end of the fifth year and review enhancement practices with the resource agencies. PacifiCorp anticipates that the management plans may need to be updated during the course of the initial implementation period and proposes that there be a formal updating after the fifth year.

Table E5.6-1. Summary of PacifiCorp's proposed protection, mitigation, and enhancement (PM&E) measures for terrestrial resources associated with the Klamath River Hydroelectric Project.

Potential PM&E Measures	PM&E Justification
ALL PROJECTS	
Wildlife Habitat Management Plan (WHMP) • Riparian habitat restoration • Installation of wildlife crossing structures on the J.C. Boyle canal • Deer winter range management • Monitoring power lines and retrofitting poles on lines where birds have died • Development of amphibian breeding habitat along Iron Gate reservoir • Funding of aerial bald eagle surveys and protection of bald eagle and osprey habitat • Selective road closures • Installation of turtle basking structures. • Installation of bat roosting structures. • Surveys for TES species in areas to be affected by new recreation development. • Monitoring of PM&E measures	Describes all wildlife mitigation actions and provides mechanism to coordinate with PacifiCorp environmental management system (EMS)/ best management practices (BMPs); protect and monitor threatened, endangered, and sensitive (TES) species.
Vegetation Resources Management Plan (VRMP) • Roadside and power line ROW activities • Noxious weed control • Restoration of Project-disturbed sites • Protection of TES plant populations • Long-term monitoring	Describes vegetation management practices on PacifiCorp land within the Federal Energy Regulatory Commission (FERC) boundary including noxious weed management, facility area vegetation maintenance, and right-of-way coordination. Provides mechanism to coordinate with PacifiCorp EMS/BMPs; protect and monitor TES species.
J.C. BOYLE	
Develop shoreline trees/shrubs; protect wetland sites from livestock or people	Reservoir may affect riparian habitat connectivity because of lack of riparian shrub vegetation on shoreline. Water level fluctuation may affect riparian/wetlands and turtle habitat. Protecting wetlands and developing shoreline trees/shrubs will enhance riparian connectivity and enhance the wildlife value for those habitats.
Develop plan for protecting wetlands near recreational areas	Recreation impacts on wetlands occur around the reservoir. Disturbance and degradation of adjacent habitat in other areas. Protecting wetlands and developing shoreline trees/shrubs will enhance riparian connectivity and enhance the wildlife habitat value.
Riparian vegetation enhancement along the Klamath River and in Shovel Creek.	Protecting and enhancing riparian habitats in the peaking reach will promote riparian development.
Add one large-animal crossing and seven small animal crossings at suitable locations along J.C. Boyle canal.	Although there are few locations on the canal where there is a potential for entrainment, adding wildlife crossings to connect suitable habitat would eliminate the need for animals to enter the canal and would enhance connectivity. This could be particularly important for snakes.
Control noxious weeds via Noxious Weed Control Plan.	Penstock and powerhouse area is noxious weed source. Noxious weed control is required by counties. Weed populations at facilities may act as seed sources for expansion. Coordination with adjacent landowners is important to be effective.

Table E5.6-1. Summary of PacifiCorp's proposed protection, mitigation, and enhancement (PM&E) measures for terrestrial resources associated with the Klamath River Hydroelectric Project.

Potential PM&E Measures	PM&E Justification
Avoidance/awareness of protection measures. Add bat roosting structures near facilities to give bats additional options.	Potential disturbance to bats in several facility buildings as a result of ongoing operations. Awareness training and procedure will avoid injury to bats using facilities. Bat boxes can be effective for some species.
Develop Road Access Plan to minimize vehicular traffic on non-essential roads.	Reduced direct mortality to wildlife, habitat alteration, and disturbance will result.
Alter spring and summer flows in the J.C. Boyle bypass and peaking reach. Riparian vegetation enhancements along Klamath River and in Shovel Creek.	Peaking operations affect riparian vegetation distribution and composition. Spring run-of-river and increased summer minimum flows will reduce the varial zone width and improve seedling establishment. Riparian protection and enhancement will improve existing riparian habitat.
Proposed increased summer minimum flow will reduce varial zone width. Addition of basking structures at appropriate sites that are not a hazard to boaters.	Peaking operations may affect pond turtles by periodically widening the distance between the water's edge and shoreline habitat and reducing availability of basking sites. Currently, there are few basking structures. Additional structures in suitable areas may allow use during different water levels.
Site will be used for recreation. Coordinate site design. Add native vegetation screening.	Old J.C. Boyle housing site near powerhouse occupied potential wildlife habitat and has noxious weeds. Removal of non-native plants and preventing access to possible snake den area on hillside will enhance habitat conditions
COPCO NO. 1	
Protect existing riparian area in FERC boundary.	Protecting wetlands and developing shoreline trees/shrubs will enhance riparian connectivity and enhance the wildlife value for those habitats.
Avoid routine maintenance drawdown during spring/ summer amphibian and waterfowl breeding seasons.	Potential disturbance to wildlife during reservoir maintenance drawdowns. Avoidance training, procedures, and scheduling will reduce chance of impact.
Add bat roosting structures near facilities to give bats additional options.	Powerhouse maintenance may potentially disturb bats roosting in powerhouse. Awareness training and procedure will avoid injury to bats using facilities. Bat boxes can be effective for some species.
Manage riparian and upland habitats within the FERC Project boundary in manner consistent with big game objectives	A total of 1,175 acres (476 ha) of upland, riparian, and wetland habitats is included in the FERC boundary and can be managed to provide deer habitat.
COPCO NO. 2	
Protect existing riparian habitat and conduct riparian enhancement in other reaches.	Forebay reach is short and has steep rock banks that preclude much riparian vegetation. Protecting existing vegetation and enhancing riparian habitats in the other reaches will promote riparian development in the Project area.
Add bat roosting structures near facilities to give bats additional options.	Potential disturbance to bats in several facility buildings through operations or maintenance. Awareness training and procedure will avoid injury to bats using facilities. Bat boxes can be effective for some species.
IRON GATE	
Establish riparian vegetation to improve distribution. Increase width of existing riparian vegetation by fencing or redirecting human use.	Reservoir riparian vegetation connectivity affected by lack of riparian vegetation on shoreline. Protecting wetlands and developing shoreline trees/shrubs will enhance riparian connectivity and enhance the wildlife value for those habitats. Backwater areas would provide more suitable wetlands for amphibian breeding.

Table E5.6-1. Summary of PacifiCorp's proposed protection, mitigation, and enhancement (PM&E) measures for terrestrial resources associated with the Klamath River Hydroelectric Project.

Potential PM&E Measures	PM&E Justification
Construct backwater areas to establish wetland riparian vegetation and provide habitat for amphibians.	Water level fluctuation affects riparian/wetland vegetation and amphibians and reptiles.
VRMP and WHMP Road Maintenance Plan. Create setback and, if needed, create erosion control strip to protect wetland near Copco Village.	Protects wetland from road runoff.
Avoidance/awareness of protection measures; addition of bat roost structures near facilities	Potential disturbance to bats through ongoing operations and maintenance activities. Awareness training and procedure will avoid injury to bats using facilities.
Schedule routine maintenance drawdowns outside of the spring/summer breeding seasons.	Potential disturbance to wildlife can occur from routine maintenance reservoir drawdowns. Avoidance training, procedures, and scheduling will lessen chance of impact.
Add logs or rocks in selected areas for turtle basking.	Shoreline lacks pond turtle basking habitat. Turtles in the upstream portions could benefit from increased habitat structure.
Manage riparian and upland habitats within the FERC Project boundary in manner consistent with big game objectives.	Development associated with areas around the reservoir is increasing and eliminates deer winter range. A total of 1,175 acres (476 ha) of upland, riparian, and wetland habitats is included in the FERC boundary and can be protected from development. The portion owned by PacifiCorp (1,031 acres) can be managed to provide deer habitat.
VARIOUS LOCATIONS	
Coordinate with Transmission and Delivery (T&D) for avoiding TES plant sites and/or protection (fence/stake boundary) for TES plant populations in/near rights-of-way.	TES plants near power line rights-of-way (ROWs) in area. Avoidance training, procedures, and scheduling will minimize chance of impact.
Continue to support annual helicopter surveys for bald eagle nest occupancy and productivity in the Project area.	New nests could be built in the future that are closer to the Project and warrant habitat and disturbance protection; shoreline trees serve as perch sites.
Develop Road Access Management Plan and road closures. Roads owned by PacifiCorp that are not necessary for Project operation or other significant use of private property will be closed. Vehicular access on the closed roads would be limited to administrative use only.	This is not directly a Project impact, but reducing open road mileage should help reduce road-induced wildlife mortality and disturbance.

E5.6.3.1 Vegetation Resources Management Plan

Future operation of the Project will result in continued impacts to vegetation adjacent to Project facilities, roads, power lines (transmission lines), and developed recreation areas from road grading and removal of unwanted vegetation (see Section E5.7). Currently, PacifiCorp's vegetation management along Project power lines follows the corporate "Transmission & Distribution Vegetation Management Program Specification Manual" (PacifiCorp, 2002). In addition to removing hazard trees next to facilities, PacifiCorp regularly sprays herbicides to remove undesirable vegetation (e.g., yellow starthistle) in the cleared areas around recreation sites and Project residences.

Figure

E5.6-1 Proposed terrestrial PM&E site conceptual descriptions

11 x 17

front

back

To minimize impacts to vegetation resources, PacifiCorp will develop a Vegetation Resources Management Plan (VRMP) to guide land management practices on PacifiCorp-owned land within the FERC boundary. The plan will be developed in consultation with the resource agencies. The VRMP will address the 1,377 acres (557 ha) of non-aquatic habitats within the proposed FERC boundary (Figure E5.6-1). The VRMP will cover the following:

- Project facility vegetation management activities
- Noxious weed control
- Vegetation restoration of Project-disturbed sites (additional riparian enhancements are addressed in a separate PM&E measure)
- Protection of TES plant populations
- Long-term monitoring within the FERC Project boundary

The VRMP will standardize vegetation management practices on PacifiCorp land within the FERC boundary. It will allow coordination of practices with other PacifiCorp resource management activities (e.g., recreation plans, cultural site protection, ROW management, and hydroelectric operations) and with state and federal agencies/landowners. The VRMP will be integrated with PacifiCorp's environmental management system (EMS), which directs PacifiCorp operations and maintenance and best management practices for environmental issues. The following sections briefly describe the various elements of the VRMP.

<u>Project Facility Vegetation Management Activities</u>

The Project facility, road, and power line ROW management portion of the VRMP will be coordinated with the Transportation Resource Management Plan (TRMP) and Recreation Resource Management Plan (RRMP) that will be implemented by PacifiCorp and include the following topics:

- Inspection of canals and power lines
- Hazard tree removal
- Brush maintenance
- Under clearance along power lines
- Side clearance along power lines
- Access road maintenance
- Slash/debris management
- Ornamental landscape management

All activities along Project-related roads will adhere to standard procedures that will minimize impacts to vegetation resources and sidecasting of road material. PacifiCorp also will implement the VRMP at any new recreation sites or Project facilities that may be added in the future. All site-specific vegetation management will be integrated with the cultural resources protection plans to ensure that no adverse impacts are caused to sensitive sites.

Noxious Weed Prevention and Control Program

The second major component of the VRMP will be a Noxious Weed Prevention and Control Program (NWPCP). The NWPCP will be developed to follow the principles of an Integrated Weed Management Plan by establishing clear goals and objectives. PacifiCorp would focus efforts with county-based organizations called Cooperative Weed Management Areas (CWMAs). Siskiyou and Klamath counties have CWMAs with long-term weed management projects and extensive expertise in managing noxious weed populations. Similarly, the BLM has an Integrated Weed Management Program.

The existing weed inventory data collected by PacifiCorp will be used as a baseline for identifying target species and target management sites. The NWPCP will include provisions for periodic Project noxious weed inventories. Specific control methods will be identified for each target species, vegetation type, and location. Control treatments will focus on areas near Project facilities, roads, and trails. The NWPCP will require PacifiCorp to monitor the effectiveness of its actions and coordinate regularly with the resource agencies cooperatively involved in noxious weed control in the Project vicinity. The goals of coordination would be to (1) determine specific inventory and management objectives and methods, (2) coordinate with county, state, and BLM noxious weed control staffs, and (3) take advantage of landscape-level actions being coordinated by the agencies. Because early detection and eradication/control are important in managing noxious weeds, PacifiCorp will coordinate with the local weed management agencies annually.

Vegetation Restoration

The third component of the VRMP will be restoration of sites that have been disturbed by Project-related maintenance, recreational activities, or other land uses within the FERC Project boundary. This restoration will emphasize using native plant species to rehabilitate areas such as: (1) abandoned road beds on PacifiCorp land, (2) disturbed sites along the perimeter of existing Project facilities, and (3) selected uplands that have been trampled by livestock or recreational activities (OHV and pedestrian traffic). Use of acceptable non-native grasses that are known to enhance forage for wildlife or provide necessary site stability also will be considered. Riparian habitat protection and enhancement are addressed in the Wildlife Habitat Management Plan (WHMP).

TES Plant Protection

TES plant population protection is another component of the proposed VRMP. Inventories conducted by PacifiCorp documented four specific sites in the FERC Project boundary that support TES plants. None of the populations is likely affected by reservoir or water levels, but can be affected by grazing and other activities. Three of the sites are in the J.C. Boyle bypass area and one is near Long Gulch south of Iron Gate reservoir. Protection measures (e.g., public access limitations, fencing, etc.) will be implemented at each of these sites. During the course of the new license, PacifiCorp will monitor the sites and adapt management as necessary, and any new TES plant populations documented within the FERC Project boundary also will be protected, as necessary.

Monitoring

Monitoring will be an important element of the VRMP to ensure that management actions are having desired effects and to evaluate the need to alter the geographic coverage or methods. PacifiCorp will develop monitoring procedures as part of the VRMP through consultation with the resource agencies. (See Section E5.6.3.3 for reporting schedule.) If requested, a GIS database for various components of the VRMP will be made available to the resource agencies each year to facilitate coordination.

E5.6.3.2 Wildlife Habitat Management Plan

PacifiCorp will implement a WHMP that is closely coordinated with the VRMP. The WHMP will consist of the following key components:

- Riparian habitat restoration actions to improve habitat structure and connectivity along river and reservoir shorelines
- Connectivity enhancement by installing wildlife crossing structures on the J.C. Boyle canal
- Management of habitats within the FERC Project boundary in a manner consistent with deer winter range objectives
- Monitoring power lines within the FERC boundary and whenever feasible retrofit poles on lines where birds have died to improve avian protection
- Development of amphibian breeding habitat along Iron Gate reservoir
- Funding of aerial bald eagle surveys each year to document new nests and productivity of territories, and protect bald eagle and osprey habitat within the FERC Project boundary
- Closing of PacifiCorp roads that are unnecessary for Project operation or other management activities
- Installation of turtle basking structures to selected sites
- Installation of bat roosting structures near facility sites known to support roosting bats
- Surveys for TES species in areas to be affected by new recreation development
- Monitoring effectiveness of PM&E measures during the course of the new license

The following sections briefly describe each of the WHMP elements.

Riparian and Wetland Habitat Connectivity Enhancement

The distribution of riparian and wetland habitats in the study area is important for a wide variety of wildlife species (see Terrestrial Resources FTR, Sections 4.7, 5.7, and 6.7). The proposed WHMP will provide significant benefits to wildlife by expanding these habitats along reservoir shorelines and river reaches in the Project area, and protecting the resources from potential future human development and the ongoing livestock grazing.

The justification for this measure is that the ongoing operation of J.C. Boyle, Copco No. 1 and No. 2, and Iron Gate dams will result in impacts to the reservoir fluctuation zone and the varial zone and shoreline vegetation along 11.5 miles (18.5 km) of the J.C. Boyle peaking reach and the 4.4 miles (7.1 km) of the J.C. Boyle bypass, and vegetation resources adjacent to Project facilities and recreation sites. Without active management, it is unlikely that riparian habitat conditions will significantly improve in the Project area even with the proposed changes in the J.C. Boyle minimum flow releases and powerhouse ramp rates. There could be vegetative changes at the upper and lower ends of the current varial zone as plant communities adjust to the new peaking restrictions. PacifiCorp has estimated that operation of the three Project reservoirs affects up to 324 acres (131 ha) of drawdown zone that have a limited amount of wetland or riparian vegetation. Factors influencing riparian and wetland vegetation along shorelines vary among reservoirs, but can include steep shoreline topography, availability of fresh substrates for colonization, trampling from recreational use and livestock, herbivory from livestock and wildlife, and reservoir fluctuation regimes that may or may not coincide with vegetation establishment needs. Of these, recreation use and reservoir fluctuation regimes are Project-related effects.

Current operations also affect up to 58 acres (23 ha) in the varial zone in the area between J.C. Boyle powerhouse and Copco reservoir. The daily fluctuations may be contributing to conditions favoring certain species, such as reed canarygrass, in the J.C. Boyle peaking reach. The proportion of reservoir shoreline that has riparian and wetland vegetation ranges from 19 to 44 percent and is much lower than what is found along river reaches in the study area (Terrestrial Resources FTR, Section 6.0, Table 6.7-11). The distance between adjacent riparian patches ranges from 1,700 to 3,100 feet (518 to 945 m) along the three reservoirs while the river reaches have 800- to 2,100-foot (244- to 640-m) gaps between significant riparian/wetland patches.

There are approximately 244 acres (99 ha) of wetland and riparian vegetation types in the proposed FERC Project boundary (Note: 11.1 acres [4.5 ha] of the FERC boundary associated with the Spring Creek diversion were not included in PacifiCorp's vegetation mapping and likely support additional riparian and wetland habitat). Review of aerial photos of river reaches, spanning the time from before dam construction to recent years, indicate that riparian and wetland habitat was fairly continuous, but restricted to narrow bands along the Klamath River; only on a few large river bends under what is now Copco reservoir were there wide riparian forests (Terrestrial FTR, Section 6.7). In several locations (e.g., downstream of Iron Gate reservoir, at J.C. Boyle reservoir, and in the Copco No. 2 bypass), there is more riparian vegetation today than what occurred historically. The historical photography demonstrates that the riparian habitat distribution and general characteristics downstream of J.C. Boyle powerhouse have not changed significantly since Project construction, except at a few locations (e.g., near Shovel Creek). However, the riparian/wetland study found that the distribution of reed canarygrass and willows within the riparian zone may be affected by the daily peaking operations (see Terrestrial Resources FTR, Section 3.7).

PacifiCorp's proposal to release minimum flows of 100 cfs (2.8 cms) in the J.C. Boyle bypass reach plus an additional 100 cfs in the peaking reach and to reduce J.C. Boyle ramp rates (see Exhibit E4.0**)** may slightly reduce the competitive advantage that reed canarygrass has in the upper portion of the varial zone, which may enhance conditions for native vegetation. However, it is extremely difficult to predict how the altered flows will affect the already established reed canarygrass or new willow establishment.

Several researchers have reported that the closer the flows mimic the natural hydrograph (peak in late winter or spring and then a gradual decline), the more likely that conditions suitable for native plant seed dispersal, germination, and growth will be present along river systems. Note that the "natural" or historic hydrograph under which Klamath riparian communities have developed appears to have changed greatly since the Link River dam (1921) and upper basin irrigation projects have been developed. The USBR's operation of Upper Klamath Lake generally stores a portion of the winter and spring flows, but passes spring peak flows. As a result, the PacifiCorp Project does not affect the occurrence of large, channel-forming flows. In years when inflows to J.C. Boyle reservoir and J.C. Boyle powerhouse are substantial (thereby reducing daily peaking during the spring), there might be more favorable conditions for seed dispersal and germination if there were a relatively slow decline in flows as runoff decreased. However, flows entering J.C. Boyle reservoir from Keno and USBR projects are variable based on water year, so the desired results may not be attainable.

Because it is beyond the capacity of the Project to restore the "natural" hydrograph and the ongoing private non-Project land uses are expected to continue into the future, PacifiCorp proposes to protect the existing riparian and wetland habitat within the FERC Project boundary, and where necessary, restore currently degraded riparian habitat along approximately 10 miles (16 km) of reservoir and Klamath River shoreline (Figure E5.6-1). This includes margins of reservoirs (J.C. Boyle, Iron Gate, and a small amount on Copco) plus approximately 5.3 miles (8.5 km) of Klamath River shoreline upstream of Copco reservoir. Additionally, the following tributary and river reaches would be protected:

- 2.2 miles (3.5 km) of Shovel Creek/Negro Creek
- 1 mile (1.6 km) of Jenny Creek (Note that the protection zone is 100 feet [30.5 m] on each side of Jenny Creek because of its relatively well developed riparian forest habitat.)
- 1.5 miles (2.4 km) of Fall Creek
- 0.9 mile (1.4 km) of Long Gulch Creek
- 0. 5 mile (0.8 km) of Klamath River below Iron Gate dam
- 1.3 miles (2.1 km) of Bogus Creek

The large and ecologically diverse wetland along the shoreline of J.C. Boyle reservoir adjacent to the Sportsman's Park also will be a focus of habitat protection measures.

As determined on the basis of consultation with resource agencies, PacifiCorp will implement site-specific measures within the FERC Project boundary to rehabilitate and stabilize shorelines and overgrazed or otherwise damaged riparian sites. Most of this effort will focus on Iron Gate, Fall Creek, J.C. Boyle peaking reach, and portions of J.C. Boyle reservoir where PacifiCorp owns land. Restoration activities may include small-scale, site-specific removal of unwanted plant species (reed canarygrass and blackberry), inter-planting of desirable species (willows, sedges, and rushes) to increase diversity, and controlling livestock access with additional fencing where necessary. Cattle production probably would continue on lands within the FERC Project boundary that are owned by PacifiCorp as a tool for management of the property, but a priority will be to meet mitigation needs for wildlife and botanical resources. Fencing to exclude cattle from pond shorelines has been shown to be effective at increasing avian species diversity (Bull et al. 2001).

The end-result of this PM&E measure will be to effectively reduce the inter-patch distance for riparian and wetland habitat, and increase the species and structural diversity in riparian habitats.

Canal Wildlife Bridges

The Project has two sections of canal—Fall Creek and J.C. Boyle—that potentially affect wildlife. The Fall Creek canal, composed almost entirely of rock or earthern banks, is only about 6 feet (1.8 m) wide and has relatively low water velocities (see Terrestrial Resources FTR, Section 6.7). There have been no reports of wildlife mortality at the Fall Creek penstock trash rack and it is likely that most wildlife easily can jump or swim across the small canal. PacifiCorp does not propose any PM&E measures for the Fall Creek canal other than to continue to regularly monitor for Project-induced mortality.

The approximately 2-mile-long (3.2-km-long) J.C. Boyle canal has caused a small number of deer and medium-sized mammal mortalities since PacifiCorp began maintaining records in the 1980s, although in many years no mortality is documented. The degree to which wildlife are entrapped in the canal is dependent on incidences of terrestrial amphibians, reptiles, and mammals either entering the canal willingly at one of the two existing vehicle access points or along the 52 percent of the canal that has wall heights of less than 4 feet (1.2 m) along the northwestern side of the canal (Figure E5.6-2; Terrestrial Resources FTR, Section, 6.0, Table 6.7-7). Of the sections of J.C. Boyle canal with low walls, only 8 percent (854 feet [260 m]) also are bordered by gentle or moderate slopes that allow wildlife to pass along the side of the canals. Thus, it is at these sections with both low wall height and non-steep slopes that are the most likely sites of animals entering the canal and being entrapped. There are three points at which entrapped wildlife could escape the canal: two vehicle access ramps and at the forebay.

In terms of the J.C. Boyle canal creating a movement barrier for terrestrial wildlife, approximately 37 percent of the northwestern side has gentle or moderate terrain where virtually all wildlife species that occur in the area could easily pass if the canal were not there. The remaining 63 percent of the northwestern side is bordered by steep slopes that likely prevent passability of many species. In addition to the steep slopes on the northwest side of the canal, there are significant areas of boulder fields, talus, or steep slopes in the canyon on both sides of the river that limit the areas available for big game movement across the canyon (Figure E5.6-2).

To enhance connectivity for terrestrial wildlife at J.C. Boyle, PacifiCorp will install and maintain eight wildlife crossings on the J.C. Boyle canal (Figure E5.6-2). Sections prioritized for adding crossings are those that meet the following criteria:

- Are near already documented big game trails
- Have both gentle to moderate terrain and low wall height on the northwest side
- Are located where there is relatively good access to the river and riparian habitat (as opposed to sections with rock talus, boulders, or steep slopes)

Figure

E5.6-2 Proposed wildlife bridge locations for J.C. Boyle canal.

11 x 17

front

back

- Are in sections where there is adequate space for construction of access ramps on both sides of the canal

Because of the lack of big game habitat between the J.C. Boyle canal and the Klamath River, and the short overall length of the canal, PacifiCorp proposes to add one 12-foot-wide (3.6-m-wide) big game crossing near the middle of the canal (Figure E5.6-2). There are few locations along the canal where there is adequate space for a wide bridge and access ramp that big game would be most likely to use, so a site will need to be verified in the field. To enhance movement opportunities for smaller wildlife, PacifiCorp will install seven small animal bridges and ramps along the canal (Figure E5.6-2). These bridges will be approximately 2 feet (0.6 m) wide.

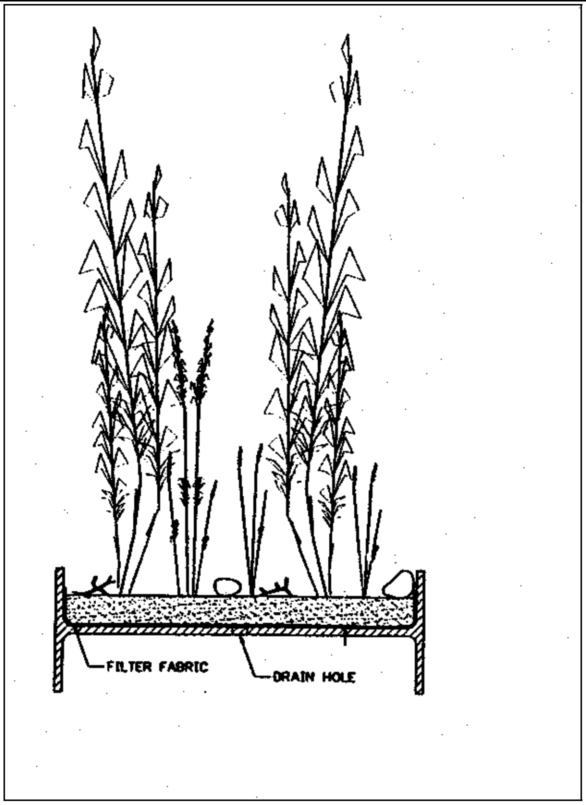
Currently, wildlife must travel around the ends of the J.C. Boyle canal. Thus, current crossing opportunities are 10,988 feet (3,349 m) apart. The large percentage of the canal that has steep slopes or rock ledges on either side probably forces some species to avoid the area immediately along the canal and instead move along the top of the canyon. With the addition of the one proposed big game bridge, the distances between big game crossing opportunities would be reduced to 5,249 feet (1,600 m) and 5,741 feet (1,750 m). This is considered by PacifiCorp to be adequate for improving movement for the small number of deer, and possibly elk, that use the area. The proposed seven small bridges and one large bridge would reduce substantially the inter-crossing distances for small wildlife species. With implementation, the distance between crossing opportunities for small wildlife would average 1,221 ± 561 feet (mean ± standard deviation) (372 ± 171 m) and range between 325 feet (99 m) and 2,434 feet (742 m).

To protect against human injury and possible fatality, warning signs and fencing may need to be installed. Conceptual designs of the big game and small wildlife bridges are presented in Figure E5.6-3, but will be modified to suit available space and terrain. PacifiCorp will implement a monitoring program developed in consultation with the resource agencies to document the use of the wildlife bridges. PacifiCorp also will continue to record any mortalities or live entrapped animals observed at the J.C. Boyle and Fall Creek canal systems. PacifiCorp will prepare periodic reports for agency review and if design-related problems occur or if mortality becomes a problem, will consult with resource agencies to implement additional measures.

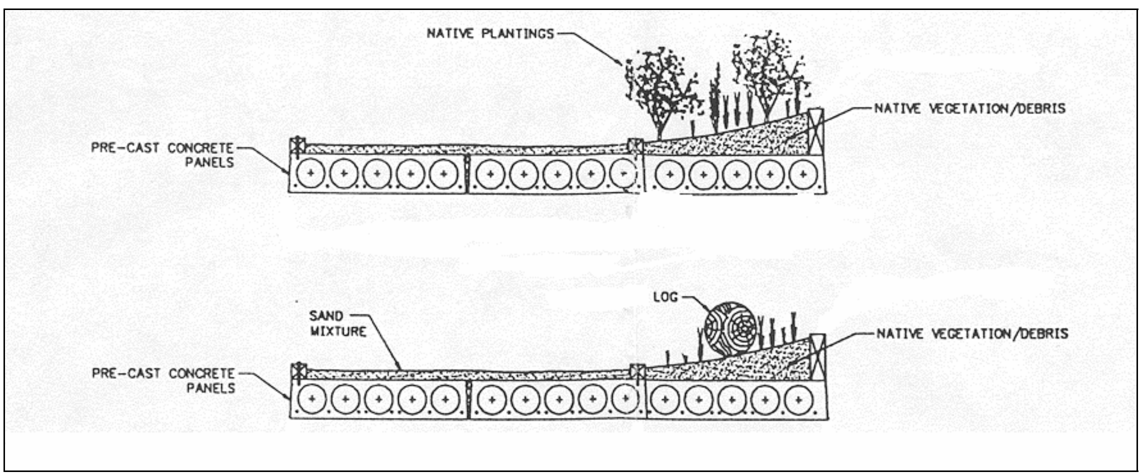
Deer Winter Range

Deer are known to winter near Iron Gate, Copco, and J.C. Boyle reservoirs, as well as along the Klamath River upstream of Copco reservoir. Upland habitats that have shrub components, such as mixed chaparral, montane hardwood, montane hardwood oak-juniper, and montane hardwood oak-conifer, are important to deer during the winter (see Section E5.2.2.1). These habitats are somewhat limited immediately surrounding Project reservoirs and facilities.

To enhance upland habitat for deer relative to existing conditions, PacifiCorp will manage approximately 1,031 acres (417 ha) of PacifiCorp-owned habitat (acreage excludes developed and disturbed sites) within the proposed Project boundary in a manner that increases forage and cover habitat for deer. This habitat occurs mostly around Iron Gate reservoir. Some of this habitat occurs near Copco No. 2, and along Fall Creek and J.C. Reservoir as well. PacifiCorp will work with resource agencies to investigate and implement habitat enhancements within the FERC boundary aimed at improving shrub forage in oak woodlands and chaparral habitats, and to reduce or eliminate livestock grazing impacts.



Small wildlife bridge (24 to 36 inches wide) (not to scale).



Large wildlife bridge (12 feet wide) (not to scale).

Figure E5.6-3. Conceptual design (cross-sections) of small and large wildlife bridges proposed for the J.C. Boyle canal.

Riparian habitats also are important to deer throughout the year. The wetland and riparian protection and enhancement measures discussed above will protect the 239 acres (97 ha) of riparian and wetland habitat that currently exists within the FERC boundary and will increase the extent of these important habitats in some areas along the reservoirs and the Klamath River between the Oregon-California border and Copco reservoir.

Transmission Lines

There have not been documented avian electrocutions on any of the transmission lines that are part of the FERC Project. As part of PacifiCorp's corporate policy on monitoring avian impacts caused by power lines (Liguori and Burruss, 2002), several problem structures in the Project vicinity that were documented to cause eagle electrocutions have been retrofitted to raptor-safe standards. Inspection of the Project transmission lines indicates that only Line 15 has a few poles that have configurations that do not meet current raptor electrocution safety standards (APLIC, 1994). Some poles on Line 15, which is located south of the Copco No. 2 bypass, have both transmission and distribution lines on the same poles; in some cases the separation between phases is not at least 60 inches (152 cm). PacifiCorp will continue to monitor all power lines within the FERC Project boundary and, whenever feasible, retrofit structures where avian electrocutions have occurred.

Only two sections of the existing FERC transmission lines are located in potential flight paths of waterfowl and other large-bodied birds that are most at risk of colliding with the transmission lines. These sites are located on Iron Gate reservoir. There has been no evidence of avian collisions occurring at either of these sites and the patterns of habitat and bird concentrations do not suggest that these line segments represent a high risk (see Terrestrial Resources FTR, Section 6.7). Therefore, PacifiCorp does not propose any PM&E measures for collisions on these lines at this time. PacifiCorp will, however, continue to document all bird mortalities that may have resulted from electrocution or collision through its corporate program that covers all power lines (Project and non-Project). PacifiCorp will continue to maintain its database of all reported electrocutions and continue to support memorandums of understanding (MOUs) with the CDFG, ODFW, and USFWS.

To enhance avian safety in the Project boundary, additional power line monitoring effort will occur during the first several years after license acceptance. Baseline monitoring surveying will be conducted once during the first year to search for dead birds under PacifiCorp-owned lines with in the FERC boundary. Remedial actions will be conducted whenever feasible where dead birds are found. A follow-up survey will be conducted the following year. If no more dead birds are found, then standard PacifiCorp monitoring/reporting (Bird Mortality Tracking System [BMTS]; Raptor Electrocution Reduction Program; Liguori and Burruss, 2002) will be the primary monitoring method thereafter.

Iron Gate Amphibian Habitat

The daily water level fluctuations of Iron Gate reservoir can adversely affect breeding western toads that deposit eggs along its shorelines. PacifiCorp will attempt to minimize Iron Gate reservoir fluctuations during the March-July time period by scheduling routine maintenance drawdown outside this time period, but the future water level fluctuations resulting from daily/weekly operation cycles are likely to be similar to those that occur currently. Therefore, to enhance conditions for western toads and other pond-breeding amphibians, PacifiCorp will create a small (less than 0.5-acre [0.2-ha]) swale near the current toad breeding site just west of Scotch Creek. This swale will be sufficiently isolated from the reservoir to prevent predatory fish from entering it and will be designed to hold surface water at a more stable level than what can occur in the reservoir. This will give egg masses, tadpoles, and larvae better conditions for development.

Bald Eagle Perch/Roost Habitat

No concentrations of bald eagles at any of the Project reservoirs or river reaches were noted during PacifiCorp surveys. There is consistent, but low level, bald eagle use on each of the reservoirs, the J.C. Boyle peaking reach, and downstream of Iron Gate dam throughout the year by nesting and wintering eagles. The availability of perch and roost sites near foraging habitat is an important habitat feature. PacifiCorp will preserve existing trees and human-made structures (that are safe) within the FERC boundary that could serve as perch or roost sites. This will be coordinated with the VRMP.

Bald Eagle Nest Surveys

There are ten known bald eagle nest sites within approximately 8 miles (12.8 km) of the Project. None of the nests that was active in 2002 or 2003 is within the FERC Project boundary or within 0.5 mile (0.8 km) of any Project facility. Although there does not appear to be any current adverse effect to nesting bald eagles, PacifiCorp will continue to assist in monitoring the regional bald eagle population (as long as cooperative monitoring for this species is conducted and remains important for species recovery) by contributing funding to the Oregon Eagle Foundation and Oregon State Cooperative Research Unit to ensure that the area within and surrounding the Project boundary is surveyed annually for nesting activity and productivity data. The annual data will be used as a monitoring tool in assessing the need for additional PM&E measures, such as protection of any newly discovered nest sites within the FERC boundary.

Road Management

Roads are known to create barriers to wildlife movement, result in direct wildlife mortality from collisions with vehicles, cause pollution, increase sedimentation, and be vectors for noxious weed spread. Monitoring conducted during the spring and summer of 2003 documented 30 wildlife mortalities on the roads traveled by Project personnel. None of the mortality was directly associated with Project facilities, but was on regularly traveled public roads. The 300 miles (483 km) of roads in the terrestrial resources study area bisect mostly the oak woodland and oak-conifer cover types, but there are 11 miles (18 km) that go through or adjacent to the more sensitive habitats (wetland and riparian and rock talus). In these areas, wildlife may be particularly affected by the presence of the roads. There are approximately 48 miles (77 km) of roads within the proposed FERC boundary, of which, approximately 54 percent are on PacifiCorp land. To enhance connectivity and reduce mortality risk, PacifiCorp will develop a TRMP that will be coordinated with the WHMP. The TRMP will assess the feasibility of closing unnecessary roads (through gating, blocking, or obliteration) and establishing seasonal restrictions on unimproved roads to prevent resource damage and disturbance to wildlife during sensitive time periods. In addition, the known sites along roads that have environmental damage and are owned by PacifiCorp will be restored.

Turtle Basking Habitat

Western pond turtles occur throughout the Project area, although use appears to be concentrated in segments where basking structures (exposed rocks and occasionally logs) are present near slack water. In some cases, turtle basking occurs in relatively close proximity to sites with high recreation use (e.g., the BLM's Klamath River Campground). It is expected that the proposed changes in operation of the J.C. Boyle powerhouse will enhance conditions for turtles in the peaking reach by increasing the amount of permanently inundated aquatic habitat, decreasing the width of the exposed varial zone that turtles would have to navigate to reach upland habitats, and slowing the ramp rate. An additional PM&E measure proposed by PacifiCorp is to add basking structures (rocks, tethered logs, or other permanent objects that cannot be flushed downstream) at selected sites on reservoirs or in backwater turtle habitat. The number and distribution of these structures would be determined on the basis of known turtle concentrations, locations of recreational activity, and suitability of adjacent uplands for nesting and overwintering.

Bat Roost Structures

Some Project buildings provide roosting habitat for numerous bats at least during the summer months. Some of the bats are Yuma myotis, although only one was actually examined in hand. Most of the buildings are used by small numbers of bats without much conflict with Project operations. However, at Copco No. 2 powerhouse, annual operation of the crane mechanism on the ceiling track sometimes kills a small number (three or four) bats that are roosting inside the mechanism. PacifiCorp will install bat roost structures outside of Iron Gate, Copco No. 1 and No. 2, and J.C. Boyle facilities to provide safer roost sites. PacifiCorp will investigate the feasibility of excluding bats from at least the most dangerous sites to minimize the chance of direct mortality and implement such measures if feasible.

Future Recreation Site Development

PacifiCorp has identified the need to expand or add five recreation sites near the Project (see the draft RRMP, Appendix E7-A, for additional information). These sites are Boyle Bluffs, Camp Creek expansion, J.C. Boyle boat takeout, Long Gulch Recreation Area, and Wanaka Springs. Overlaying the preliminary site designs of the proposed recreation areas indicates that approximately 79 acres (32 ha) of habitat potentially would be altered by the development. Most of the habitat would be montane hardwood oak-juniper (40 acres [16 ha]) and annual grassland (28 acres [11 ha]). No wetland or riparian habitat would be affected. Before ground-disturbing activities, PacifiCorp will conduct on-the-ground surveys for TES plant and wildlife species and significant wildlife habitat or use areas. The results of the surveys will be provided to the resource agencies and a site-specific mitigation plan will be developed that may include use of native plant species, potential seasonal restrictions, and if necessary, on-site or off-site habitat replacement.

Monitoring

Monitoring will be conducted as part of the WHMP to ensure that the measures being implemented are having desired effects. A focus will be on the effectiveness of the riparian and wetland habitat restoration PM&E measures. At a minimum, PacifiCorp will document the baseline conditions and then monitor the extent, width, species composition, and general structural characteristics of sites from the modified flows and specific land management actions. Use of the wildlife bridges will be monitored along with the continued tracking of wildlife mortalities. All components of the monitoring plan will be developed in consultation with the resource agencies.

E5.6.3.3 Implementation Schedule

Implementation of the VRMP and WHMP would include the tasks listed in Table E5.6-2.

Table E5.6-2. Proposed implementation schedule.

Time Period (relative to license issuance)	Action
Years 1 and 2	• Consult with resource agencies and CWMAs • Develop detailed VRMP and WHMP • Identify restoration sites and complete baseline conditions assessments • Develop riparian vegetation monitoring procedures • Initiate measures that do not require extensive lead time • Conduct baseline and follow-up avian power line monitoring • Continue noxious weed detection and control measures • Meet annually with resource agencies to review progress
Years 3 to 5	• Install riparian fencing • Conduct supplemental riparian plantings if needed • Install wildlife bridges at J.C. Boyle canal • Conduct annual noxious weed control measures • Meet annually with resource agencies to review progress
Years 6 to 30	• Continue to conduct the VRMP and WHMP practices • Monitor habitat conditions and enhancement effectiveness every 5 years • Prepare 5-year monitoring reports

CWMA = Cooperative Weed Management Area.
VRMP = Vegetation Resources Management Plan.
WHMP = Wildlife Habitat Management Plan.

E5.6.3.4 Cost Estimate

PacifiCorp estimates the following costs associated with proposed PM&E measures for terrestrial resources. The estimated capital and operations and maintenance (O&M) costs in 2003 dollars for terrestrial resources PM&E measures are presented in Table E5.6-3. These costs are conceptual-level estimates developed by the resource researchers.

Table E5.6-3. Summary of costs for PacifiCorp's proposed PM&E measures for terrestrial resources (2003 dollars).

Proposed PM&E Measure	Cost ($1,000s)			
	Capital	**Year 1-5 O&M**	**Year 6-30 O&M**	**Total**
Vegetation Resources Management Plan				
Noxious Weed Control	$0	$115	$325	**$440**
TES Enhancement	$12	$2	$8	**$21**
TES Protection	$7	$2	$10	**$19**
Implement Vegetation Management Plan	$60	$125	$625	**$810**
Wildlife Habitat Management Plan				
Bat Habitat	$20	$2	$10	**$32**
Connectivity Enhancement	$311	$8	$40	**$359**
Riparian/Wetland Protection/Enhancement	$198	$74	$100	**$371**
Road Management	$100	$25	$125	**$250**
Unique Habitat Protection	$0	$1	$3	**$3**
Upland Habitat Enhancement	$10	$1	$3	**$13**
Implement Wildlife Management Plan	$50	$100	$500	**$650**
Total	**$768**	**$508**	**$2,023**	**$3,298**

O&M = Operations and maintenance.
PM&E = Protection, mitigation, and enhancement.
TES = Threatened, endangered, and sensitive species.

E5.6.4 Decommissioning East Side and West Side Developments

Exhibit C contains the details of the deconstruction proposal for the East Side and West Side Developments. Following the decommissioning of the East Side and West Side Projects, PacifiCorp will restore the uplands currently occupied by the water conveyance systems with native vegetation. By terminating the bypass of water, the Klamath River channel likely will widen and remove some of the riparian trees and shrubs that have encroached into the channel. To a certain extent, riparian vegetation may re-establish farther up the slopes in response to the higher instream flows, although this is not expected to be significant because seepage from the West Side canal currently increases soil moisture levels high up on the slopes. The elimination of the canals and penstocks followed by revegetation will improve habitat connectivity for terrestrial wildlife and eliminate a potential source of mortality. It is unknown at this time if the Link River trail will be maintained after decommissioning, or if the area will be revegetated. Project decommissioning also will remove the 0.7-mile (1.1-km) transmission Line 56-8 that spans the Link River. This will eliminate a risk of collision for waterfowl and waterbirds that fly along the river.

E5.7 CONTINUING IMPACT ON BOTANICAL AND WILDLIFE RESOURCES

The following sections describe the continuing Project effects on terrestrial resources within the proposed FERC boundary. These effects are grouped into effects on botanical resources and wildlife resources. The PM&E measures discussed in Section E5.6 should reduce many of these impacts.

E5.7.1 Botanical Resources

Continued operation of the Project likely will result in the following general types of impacts to botanical resources:

- Vegetation management within and along the perimeter of Project facilities, on Project transmission line ROW, and along Project-related roads
- Effects of reservoir water level fluctuations on riparian and wetland vegetation
- Effects of water release patterns and dams on riparian and wetland vegetation along riverine reaches
- Effects of altered hydrology on riparian and wetland vegetation in bypass and peaking river reaches
- Impacts of recreationists on vegetation near recreation sites

The following sections describe these impacts.

E5.7.1.1 PacifiCorp Vegetation Management

The Project structures and facilities occupy or significantly disturb approximately 306 acres (124 ha) of land (Table E5.7-1). In addition, the six transmission line segments associated with the Project and dedicated solely to Project facilities affect to varying degrees 9.8 miles (15.8 km) of habitat. These lines are described in Section E5.7.1.2. A seventh line (Line 56-8) is part of the East Side Development that is proposed for decommissioning (see Exhibit A) and is not discussed in this section. There are approximately 48 miles (77 km) of roads within the FERC Project boundary, of which, approximately 54 percent is on land owned by PacifiCorp.

Table E5.7-1. Acreage occupied or disturbed by Project facilities and PacifiCorp-owned recreation sites.

Study Area Section	Acres[1]
J.C. Boyle Reservoir	74.0
J.C. Boyle Bypass	89.6[2]
J.C. Boyle Peaking Reach	34.2
Copco Lake	21.4
Copco No. 2	37.1
Fall Creek	6.7
Iron Gate	42.9
Total	**305.9**

[1] Acreage includes all physical facilities and associated footprints excluding the reservoirs themselves as well as significantly altered portions of PacifiCorp-owned recreation sites (Project and non-Project).

[2] Includes 77.2 acres of exposed rock that is disturbed along canal.

Current practices conducted by PacifiCorp include vegetation maintenance around facilities annually using both mechanical vegetation removal and herbicides. Project personnel who are registered applicators spray selected existing cleared areas around Copco facilities, houses, and old school with the herbicide Roundup. The herbicide Rodeo is used near water, such as along the Copco No. 2 flowline. Roundup is used around some J.C. Boyle facilities and at recreation sites at Iron Gate. Vegetation sometimes is removed manually along flowlines (Copco No. 2) to maintain canal safety access road. Inspections of facilities for hazard trees occur weekly. Hazard trees near facilities are cleared periodically. Roadsides are cleared of blackberry mechanically. Roundup is used on other roadside vegetation. Currently, no specific noxious weed control is conducted by PacifiCorp. PM&E measures will address vegetation management practices, including noxious weed management.

ROW/substation maintenance is administered by PacifiCorp district personnel. Substation grounds are kept clear of vegetation. ROW vegetation management generally is conducted by contractors and follows guidelines in PacifiCorp's ROW vegetation management plan (PacifiCorp, 2002).

Campground fire breaks are created annually by using a bulldozer to scrape mineral soil fire breaks around selected portions of the recreation sites. No fires have occurred near Project facilities in recent years. Other than standard facility vegetation maintenance, no other fire/fuels management activities are conducted by PacifiCorp.

The degree of impact resulting from this vegetation management is relatively minor relative to other land uses that occur in the region. However, even the local-scale removal of "danger" trees and other vegetation maintenance near facilities and recreation sites can contribute to the loss of snags and other habitat features that are important for cavity-nesting birds (Laudenslayer, 1999). Vegetation removal also contributes to the fragmentation of woodland habitat. Fragmentation along with the presence of foraging habitat can increase the presence of the non-native, nest-parasite European starling (*Sturnus vulgaris*) (Purcell et al. 2001). Removal of oak trees not only reduces habitat for terrestrial wildlife, but also may have a secondary effect of reducing soil fertility that could cause additional reductions in understory vegetation (Camping et al. 2001).

Project operation likely will result in some continued effects to habitat within the facility perimeter and potentially to botanical resources adjacent to the facility. Proposed PM&E measures, however, will address vegetation management practices to reduce or eliminate most of these impacts. The following sections describe the effects by study area section.

<u>Link River</u>

The East Side and West Side Projects are proposed for decommissioning by PacifiCorp (see Section E5.6.4). Exhibit C contains the details of the deconstruction proposal. Measures implemented as part of the decommissioning will improve botanical and wildlife resources relative to the existing conditions.

<u>Keno Reservoir and Dam</u>

The Keno Development is proposed to be removed from the FERC Project.

J.C. Boyle Reservoir

Near J.C. Boyle reservoir, 28.9 acres (11.7 ha) are occupied by Project facilities within the proposed FERC Project boundary. Approximately 5.1 acres (2.1 ha) are associated with the dam while the remaining acreage is within developed recreation sites or otherwise disturbed sites. Just outside the FERC boundary, the BLM Topsy Recreation Area, a non-Project facility, occupies 3.5 acres (1.4 ha). The facility at J.C. Boyle dam includes the main operational office and equipment storage area near the dam. This area is graveled and vegetation is controlled within the fenced area. The Sportsman's Park—a facility not associated with the Project—adjoins 29 acres (12 ha) of relatively diverse emergent wetland along the reservoir, which currently is not affected by any actual recreational activities and supports nesting sandhill cranes, a TES species. Noxious weeds near J.C. Boyle include one large population of hoary cress (*Cardaria draba*) near one recreation site and scattered noxious weeds in riparian and upland habitats in the area surrounding the Project facilities (see Terrestrial Resources FTR, Section 8.0, Figure 8.7-1). PM&E measures will address vegetation management practices including noxious weed control and protection of wetlands.

J.C. Boyle Bypass and Powerhouse

A total of 89.6 acres (36.3 ha) of land is affected directly by Project facilities in the J.C. Boyle bypass reach. Most of this acreage—77.2 acres (31.2 ha)—includes the steep exposed rock and rock/talus slope that occurs between the canal and the Klamath River (see Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). This slope was affected by side-cast material during the original Project construction that eliminated or altered the riparian vegetation. Since then, however, trees and shrubs have become established among the boulders in some sections. A 2.6-acre (1.1-ha) landslide has developed as a result of water spilling over the emergency spillway at the forebay (see Terrestrial Resources FTR, Section 2.0, Figure 2.7-1). This landslide is unstable and continues to expand, affecting additional acreage of Klamath mixed-conifer forest. Proposed flow continuation bypass valves installed at the dam will eliminate the use of the emergency spillway and reduce the cause of erosion (see Exhibit E4.0, Fish Resources). Material from this site still may contribute to development of downstream bars and substrate for riparian vegetation, but at a reduced rate.

Klamath weed (*Hypericum perforatum*) populations were noted along the canal and yellow starthistle and Scotch broom (*Cytisus scoparius*) infestations were found near the river and near the powerhouse (see Terrestrial Resources FTR, Section 8.0, Figure 8.7-1). As with the other areas, maintenance activities have the potential to spread the noxious weeds. Noxious weeds in the Project boundary will be addressed in the proposed VRMP.

J.C. Boyle Peaking Reach

There are no Project facilities downstream of the J.C. Boyle powerhouse until reaching Copco reservoir. Non-Project PacifiCorp and BLM recreational areas occupy approximately 34.2 acres (13.8 ha) in the area; approximately 25 acres (10 ha) of this land is at the Frain Ranch where informal camping occurs regularly during the summer. There are numerous populations of noxious weeds in this reach both within the proposed Project reach from the Oregon-California border to Copco reservoir and in the Oregon portion of the reach that is not included in the proposed FERC project boundary. Large areas of hoary cress occur near Frain Ranch. Yellow starthistle, puncture vine (*Tribulus terrestris*), and spiny cocklebur (*Xantium spinosum*) infestations also occur at various locations in the reach both inside and outside the Project boundary, including several near Project-related fishing access points in the California portion of the reach. The Project-related fishing access points (parking areas) in the lower portion of the reach may provide a source of noxious weeds. Non-Project recreational activities at Frain Ranch and along the Topsy Grade road likely play a role in the continued spread of noxious weeds (see Terrestrial Resources FTR, Section 8.0, Figure 8.7-1). PacifiCorp's noxious weed management practices will be coordinated with adjacent landowners (primarily the BLM) when possible.

Copco Reservoir

The developed and disturbed area that includes Copco No. 1 dam occupies slightly more than 20 acres (8.1 ha) while two recreational facilities occupy about 1 acre (0.4 ha) within the FERC Project boundary. There are two Project recreation areas—Mallard Cove and Copco Cove—in this area. Plant communities adjacent to the Project facilities include oak woodland, annual grassland, and mixed chaparral. No large-scale infestations of noxious weeds were mapped, although a high percentage of the 962 acres (389 ha) of annual grassland surrounding the reservoir is heavily infested by yellow starthistle and other noxious weeds. Most of the land surrounding Copco reservoir is privately owned. PacifiCorp's vegetation management PM&E practices will focus on recreation sites and PacifiCorp-owned land within the Project boundary.

Copco No. 2/Fall Creek

There are 37.1 acres (15.0 ha) of developed and disturbed land associated with the Copco No. 2 and Fall Creek sections of the Project. This acreage includes the 18-acre (7-ha) Copco No. 2 Village and 6-acre (2-ha) Copco No. 2 powerhouse area. The Fall Creek Falls Trail is considered part of the Project as well. Project personnel periodically conduct maintenance activities along the 1,400-foot (427-m)-long Copco No. 2 flowline and within the village that cause minor modification to adjacent vegetation. There are two mapped populations of puncture vine: one in the Copco No. 2 Village and one at Copco No. 2 dam parking area that are likely spread by Project vehicles. These will be addressed by the proposed noxious weed control practices.

Iron Gate

At Iron Gate reservoir, 47.9 acres (19.4 ha) are developed or disturbed, including 11 acres associated with the dam. There are nine developed recreation sites near Iron Gate reservoir. Virtually all of the 1,381 acres (559 ha) of annual grassland that border Iron Gate reservoir are heavily infested with noxious weeds, especially yellow starthistle and medusahead. Five recreation sites—Wanaka Springs, Camp Creek, Juniper Point, Mirror Cove, and Overlook Point—are Project facilities. There are populations of Dyer's woad (*Isatis tinctoria*) mapped near several of the recreational facilities, while hoary cress occurs in the Long Gulch area. Livestock grazing occurs throughout the Iron Gate area and contributes to the condition of vegetation along the perimeter of the developed areas. A public Siskiyou County road follows the north side of the reservoir and may continue to contribute to the transport of weed seeds. Noxious weeds in the Project boundary will be addressed in the proposed VRMP.

Iron Gate to Shasta River

Downstream of Iron Gate dam, the Iron Gate fish hatchery is part of the FERC Project, but is managed by the CDFG. There are no other Project facilities associated with the Iron Gate-Shasta section. There are no weed populations documented near the Iron Gate fish hatchery. Intensive private land uses along the Klamath River play a major role in vegetation resources.

Effects of Vegetation Management on Project Transmission Line ROW

The proposed Project includes 9.8 miles (15.8 km) of transmission lines (see Terrestrial Resources FTR, Section 6.0, Figure 6.7-3) including the following:

- One short transmission line (Line 98 [69 kV]) associated with the J.C. Boyle powerhouse
- Two line segments associated with Line 3 (69 kV) are associated with the Fall Creek powerhouse
- Three lines associated with Copco No. 1 powerhouse (Line 15 [69 kV], Line 26-1 [69 kV], and Line 26-2 [69 kV])
- One line associated with Iron Gate powerhouse (Line 62 [69 kV]) that runs along the north side of the reservoir from the powerhouse to Copco No. 2

Resources along the Project transmission lines vary among the seven segments (Table E5.7-2). Some of the lines have access roads within the ROW to allow Project personnel to access poles to conduct maintenance activities. As crews access the poles they may drive along the ROW either on an existing road or, in open terrain, directly over herbaceous vegetation. Periodically, trees growing on or immediately along the ROW need to be removed to prevent hazards to the lines. The extent of vegetation management necessary depends on the terrain and height of the wires relative to trees. Typically, PacifiCorp maintains a minimum of 50 feet (15 m) clearance under lines and manages vegetation within a 100-foot-wide (30-m-wide) ROW. Only 4.7 miles (7.6 km) of the lines cross forested habitats and could require significant repeated removal or trimming of tall growing tree species (Table E5.7-2). The remaining 5.0 miles (8.0 km) are located in open habitats or already disturbed areas that do not require much vegetation management.

Table E5.7-2. Length (miles) of Project transmission lines in each cover type.

Cover Type	Line Number						Grand Total
	3*	15	62	98	26-1	26-2	
Annual Grassland	0.1	0.0	2.5	0.0	0.0	0.0	**2.6**
Developed	0.0	0.0	0.1	0.0	0.0	0.0	**0.1**
Disturbed	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Industrial	0.2	0.2	0.1	0.0	0.1	0.1	**0.7**
Juniper	0.1	0.0	1.4	0.2	0.0	0.0	**1.7**
Klamath Mixed Conifer	0.0	0.0	0.0	0.1	0.0	0.0	**0.1**
Lacustrine	0.0	0.0	0.6	0.0	0.0	0.0	**0.6**
Montane Hardwood Oak	0.0	0.1	0.6	0.0	0.0	0.0	**0.6**
Montane Hardwood Oak-Conifer	0.3	0.3	0.0	0.0	0.0	0.0	**0.6**
Montane Hardwood Oak-Juniper	0.5	0.2	0.6	0.0	0.0	0.0	**1.3**
Mixed Chaparral	0.3	0.2	0.4	0.0	0.0	0.0	**0.9**
Emergent Wetland	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Forested Wetland	0.0	0.0	0.1	0.0	0.0	0.0	**0.1**
Ponderosa Pine	0.2	0.0	0.0	0.0	0.0	0.0	**0.2**
Scrub-Shrub Wetland	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Riparian Deciduous	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Recreation	0.0	0.0	0.2	0.0	0.0	0.0	**0.2**
Residential	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Riparian Grass	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Riparian Mixed	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Rock/Talus	0.0	0.1	0.0	0.0	0.0	0.0	**0.1**
Riverine	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Grand Total	**1.6**	**1.2**	**6.6**	**0.2**	**0.1**	**0.1**	**9.8**

*Line 3 includes two segments.

In addition to general impacts, there is one large population of fleshy sage (*Salvia dorii* var. *incana*) immediately adjacent to the Iron Gate transmission Line 62 (see Terrestrial Resources FTR, Section 5.0, Figure 5.7-1) that could be affected by Project operations. There are other populations of TES plants on or near other non-Project transmission line ROW (see Terrestrial Resources FTR, Section 5.0, Figure 5.7-1). Noxious weeds are common along most of the transmission line ROW. This is especially true along the Iron Gate line (Line 62) and J.C. Boyle powerhouse line (Line 98) where extensive populations of yellow starthistle occur. Project vehicles and unauthorized vehicles could cause a spread of noxious weeds. However, other land uses that are known to spread weeds (e.g., grazing) are more likely to cause significant spread of weeds in the area. In areas where small populations occur on the ROWs, Project operations may be more significant. Noxious weeds in the Project boundary will be addressed in the VRMP.

E5.7.1.2 Effects of Reservoir Pool Level Fluctuations on Botanical Resources

Pool level fluctuations alter the hydrologic patterns that support wetland and riparian vegetation along the reservoir shorelines. The typical reservoir operation of the three main reservoirs results in drawdown zones totaling up to approximately 324 acres (131 ha) that are mostly devoid of vegetation. The J.C. Boyle powerhouse generally operates as a load-factoring (peaking) facility when flow is not adequate to allow continuous and efficient operations. Such operating conditions can result in a seasonal pool difference of about 5.5 feet (1.5 m) between minimum and full pool elevations, but the average daily fluctuation is about 2 feet (0.6 m). The normal full-pool level is 3,793 feet (1,156 m) and the normal low pool is 3,788 feet (1,155 m). This operation results in the seasonal exposure of approximately 143 acres (58 ha) of drawdown zone in which most species of vegetation, except rooted aquatics, are unable to grow. Copco reservoir normally operates within the elevations ranging from a full pool of 2,607.5 feet (795 m) and a minimum pool of 2,601 feet (792.8 m). A total of approximately 129 acres (52 ha) occurs within this drawdown zone. Iron Gate reservoir's full pool elevation is 2,328 feet (710 m), while the normal minimum pool level is 2,324 feet (708 m). This drawdown zone includes approximately 52 acres (21 ha).

Detailed sampling documented an elevational gradient of wetland and riparian habitats along these reservoirs. The distribution and composition of these habitats could be affected by changes in reservoir pool level management. The proposed operation of the Project, however, is not likely to greatly change the overall pattern of water level fluctuation so the quantity or quality of wetland riparian habitat at the three reservoirs included in the license application is anticipated to remain similar to current conditions. At J.C. Boyle reservoir, the relatively large water level fluctuations currently occurring do not seem to adversely affect wetland habitat; some of the most diverse wetland habitat in the Project vicinity occurs near Sportsman's Park. At Copco and Iron Gate reservoirs, wetland and riparian habitat will continue to be constrained by existing topography. Willow establishment along shorelines will be affected by the low rate of formation of fresh surfaces for colonization, the infrequent occurrence of ideal seasonal and hydrologic conditions, continuing recreational use, and the occurrence of herbivory. For all reservoirs, proposed PM&E measures will reduce grazing and recreation impacts on riparian and wetland habitat values.

Currently, the average shoreline length between riparian habitat patches on Project reservoirs is significantly ($P = 0.02$) larger—between 1,773 and 3,495 feet (540 and 1,065 m) at individual reservoirs—than along the river reaches—270 to 2,134 feet (82 to 650 m) (see Terrestrial Resources FTR, Section 6.0, Table 6.7-11). As the reservoirs age, it is likely that some additional riparian and wetland habitat will develop in areas with gentle shoreline slopes or where bank slumpage creates suitable substrates. The restoration of wetland and riparian habitat under the proposed WHMP will decrease the inter-riparian/wetland patch distance.

Analysis of riparian transect data indicates that several species of noxious weeds occur along the Project reservoirs. The noxious weed and invasive plant species detected in the 110 riparian/wetland transects include medusahead, yellow starthistle, St. John's wort, hoary cress, cheatgrass, bull thistle, and Canada thistle (see Terrestrial Resources FTR, Section 8.0, Table 8.7-3). Noxious weed and non-native invasive plants occurred in 17 percent of riparian/wetland sampling sites at J.C. Boyle reservoir compared with 93 percent at Iron Gate reservoir. Approximately 67 percent of the Copco reservoir riparian sites had noxious weeds. It appears that although the reservoirs may provide a zone of mesic soil conditions for weeds, most of the distribution of such weeds is related to adjacent land uses in upland areas. In most areas, the noxious weeds occur at the upper slopes that are mesic transitions between the hydrophytic species and upland xeric plant species. The mesic conditions created by the reservoirs will continue to provide conditions suitable for noxious weeds. Noxious weeds occurring on

PacifiCorp's land within the proposed FERC boundary will be addressed in the VRMP and may be reduced as shoreline land uses are improved.

Reed canarygrass, a generally undesirable species that is not on the list of noxious weeds, was not particularly common along reservoirs. Reed canarygrass was not a dominant species at any reservoir sampling site, but occurred under a wide range of hydrologic conditions. Thus, although it is possible that the reservoir water level fluctuations create conditions suitable for reed canarygrass, the relative rarity seems to suggest that the species does not gain a significant advantage over existing native and non-native species at the reservoirs. Reed canarygrass exhibited a wide range of inundation duration at J.C. Boyle reservoir—14 to 93 percent of the growing season (average = 58 ± 23 percent). At Copco reservoir, reed canarygrass occurred in plots that were inundated 25 to 67 percent of the growing season (average = 37 ± 13 percent). At Iron Gate reservoir, this species occurred in two plots with inundation durations of 9 and 28 percent of the growing season. Ultimately, it is not known whether reed canarygrass will spread in these reservoirs. Wetland and riparian enhancement PM&E measures and associated monitoring may help track encroachment of this species in Project reservoirs.

Only at J.C. Boyle reservoir are any TES plant populations potentially affected by Project reservoir water level management. The BLM had records of Howell's yampah (PEHO-9) near J.C. Boyle reservoir. However, this species was not located during 2002 field surveys and thus may not occur within the reservoir fluctuation zone.

The condition of riparian communities along the Iron Gate, Copco No. 1, and J.C. Boyle, reservoirs also may be affected by livestock grazing (a non-Project effect). Evidence of recent grazing was noted at between 20 and 46 percent of the riparian vegetation characterization transects sampled along these four reservoirs (see Terrestrial Resources FTR, Section 9.0, Table 9.7-5). It is assumed that livestock grazing will continue throughout the future license period, but that PM&E measures will protect selected shoreline segments where impacts have occurred.

E5.7.1.3 Effects of Riverine Flow Fluctuations and Dams on Botanical Resources

Within the J.C. Boyle peaking reach, the proposed combination of a higher minimum flow and limits on daily ramping (see Exhibit E4.0) will reduce the varial zone width, but probably will cause only minor changes to the riparian/wetland vegetation (see Terrestrial Resources FTR, Sections 3.7.2 and 3.8.2). In the other Project reaches, the Project operations will continue to support riparian/wetland communities similar to what occurs now. The PM&E measures will enhance conditions along up to 10 miles (16.1 km) of reservoir and riverine shoreline. Additional riparian habitat also will be protected in tributaries in the Project boundary.

Only in the reach downstream of J.C. Boyle reservoir, do river flows have any potential of affecting known TES plant populations. Howell's yampah (PEHO-2,3), pendulus bulrush (SCPE-3), and an unverified occurrence of red root yampah (PEER-17) potentially could be affected by flood flows in the peaking reach. However, flows high enough to affect these TES plant sites are beyond the control of Project operations (see Section E5.7.1.4). Other non-Project effects, such as livestock grazing, occur throughout the California portion of the reach, most of which is managed from the Beswick Ranch on PacifiCorp property. Impacts of livestock on riparian and wetland habitat are reduced by the presence of fencing along Shovel Creek and sections of the Klamath River. However, there are small sections of shoreline that are eroded and sites where riparian vegetation has been trampled or severely browsed by livestock.

To various extents, the J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate reservoirs trap sediment (see Water Resources FTR, Section 6.0), which likely alters the amount of fine substrate available for riparian vegetation establishment for some distance downstream of the dams. This has resulted in generally coarse bed material in most reaches with the possible exclusion of the Iron Gate-Shasta reach downstream of Cottonwood Creek.

The Project directly affects flows in the J.C. Boyle bypass, J.C. Boyle peaking, and Copco No. 2 bypass reaches. Flows in the Iron Gate-Shasta section are a result of Upper Klamath River basin irrigation and other uses, regulation of flows by the USBR for ESA requirements, and climate conditions. With the exception of the 1964 peak flows in the Iron Gate reach, the peak annual flows have little effect on most of the riverbanks that generally have high cover of riparian vegetation and appear to be quite stable. There were no river-induced erosion sites identified in the J.C. Boyle bypass or Copco No. 2 bypass reaches. These two reaches are narrow, steep, and dominated by boulders. There are only a few sites where erosion was documented in the J.C. Boyle bypass or peaking reaches (see Water Resources FTR, Section 6.7). It is not entirely clear if any of these erosion sites are caused by the river fluctuations or other land uses. Factors that probably influenced past bank erosion include hydroelectric operations, disturbance from recreation (e.g., camping and hiking), annual high flow, logging, livestock grazing, and ranching activities. The loss of riparian and upland habitat resulting from riverbank erosion is not expected to be significant under continued operation of the Project because proposed flows will include slightly higher minimum flows, a narrower varial zone in the J.C. Boyle peaking reach, and more gradual ramping rates downstream of Project dams.

Erosion at the J.C. Boyle canal emergency spillway has resulted in loss of upland conifer forests. Installation of flow continuation bypass valves at the dam will reduce or eliminate this impact.

The J.C. Boyle peaking operation effectively restricts the width and type of wetland and riparian vegetation that establishes along the river between the minimum and slightly above the elevation of the maximum daily flows. The daily fluctuation also provides higher than natural summer moisture levels to riparian areas that occur just above the varial (fluctuation) zone. Review of instream flow incremental methodology (IFIM) transects analyzed by PacifiCorp (see Exhibit E4.0) indicates that the varial zone width changes depending on aquatic habitat type within the 1.5-mile (2.4-km) Oregon, 4.5-mile (7.2-km) Frain Ranch, and 5.5-mile (8.9-km) California segments of this reach. Within pool habitat, the varial zone increases by 10 to 13 feet (3 to 4 m) as flows drop from 3,000 cfs (85 cms) to 1,600 cfs (45 cms) and an additional 18 to 30 feet (5 to 9 m) between 1,600 and 400 cfs (45 and 11 cms), bringing the total varial zone width to 27 to 35 feet (8 to 11 m). The larger widths occur in the Frain Ranch segment where the river gradient is low (Table E5.7-3). Riffle and riffle/run habitat sections have the greatest varial zone. Multiplying these average widths by the length of mesohabitats provided in the Water Resources FTR, an estimated 58 acres (23 ha) potentially are affected by the varial zone throughout the entire J.C. Boyle peaking reach.

Table E5.7-3. Average change in varial zone width (feet) between 3,000 and 400 cfs.

Segment	Channel Type				
	Pool	**Riffle**	**Run**	**Glide**	**Riffle/Run**
3,000 to 1,600 cfs					
Oregon	13.1	17.1	13.6	--	--
Frain	13.2	13.1	11.6	15.1	15.8
California	9.8	8.2	15.0	--	--
3,000 to 1,600 cfs Average	**12.1**	**12.8**	**13.4**	**15.1**	**15.8**
1,600 to 400 cfs					
Oregon	21.9	50.5	21.4	--	--
Frain	30.4	39.0	32.1	21.8	42.2
California	18.0	43.6	28.5	--	--
1,600 to 400 cfs Average	**23.4**	**44.4**	**27.3**	**21.8**	**42.2**

cfs = Cubic feet per second.

The proposed 100-cfs (2.8 cms) increase in minimum flow in the J.C. Boyle peaking reach should narrow the varial zone by 1 to 19 feet (0.3 to 5.8 m), depending on the location and aquatic habitat type. On average, the changes will be between 3 and 10 feet (1.0 and 3.1 m) depending on habitat. This reduction in the varial zone width will occur because of increasing inundation on the lowest elevations in the channel where vegetation is sparse. Thus, the reduction will not translate directly to increased riparian width. The increased minimum flow, along with the proposed ramping restrictions, which, depending on the inflows, may favor one-unit peaking (rather than two-unit peaking) with flows of 1,400 cfs (39.6 cms) during the summer, may slightly enhance conditions for riparian and wetland habitat by reducing the daily change in soil moisture in the upper portion of the varial zone. Because of the reduced inundation in the upper portions of the varial zone, it is possible that reed canarygrass could become less dense, giving other plant species a chance to develop. Where it already exists in the lower half or the varial zone, reed canarygrass may become more abundant because of increased inundation duration. It is not likely, however, that any major shifts in plant communities will occur from the flow changes.

Clearly, the diversion of most of the water from the J.C. Boyle bypass reach and virtually all of the flow from the Copco No. 2 bypass reach has allowed for encroachment of woody vegetation farther into the channel than if water were not diverted. Along the J.C. Boyle bypass reach, the encroachment does not appear to be significant, at least in terms of woody species. The Project operations (bypass of flow) in the J.C. Boyle bypass reach provides good growing conditions for reed canarygrass. To a large extent, the reduced flow has allowed herbaceous vegetation to encroach into the bypass channel. The narrow floodplain and steep canyon prevent significant riparian vegetation establishment on the adjacent banks above the channel. In the lower portion of the J.C. Boyle peaking reach near Shovel Creek, small-scale changes have occurred in channel form and associated riparian vegetation including changes in island and bar configuration between 1955 and 2000. Extremely low base flows in the Copco No. 2 bypass reach have allowed riparian vegetation to encroach into the active channel.

It is not clear that Project operation is responsible for the presence of reed canarygrass along the Klamath River. Reed canarygrass has increased in many areas of Washington, Oregon, and California during the last several decades (Merigliano and Lesica, 1998). Project operations likely create conditions that are favorable to reed canarygrass in the J.C. Boyle bypass and peaking reaches. Within the J.C. Boyle peaking reach, approximately 74 percent of the reed canarygrass plots occurred in the varial zone; overall, reed canarygrass occurred in nearly half of all riparian plots in the J.C. Boyle peaking reach. The strong pattern of increasing reed canarygrass abundance indicates that this species is well suited to grow there. Dense stands of this vegetation may be one of the factors that affects willow establishment in the peaking reach (dense stands of herbaceous vegetation may shade willow seedlings or potential seed germination sites).

The future operation of J.C. Boyle peaking reach will have higher minimum flows and an altered peaking schedule that likely will reduce the width of the varial zone and may reduce the competitive advantage of reed canarygrass in the upper portions of the varial zone. In the lower portion of the varial zone (which is inundated by one-unit peaking flows of 1,400 cfs [39.6 cms]), increased inundation associated with longer one-unit peaking durations could increase reed canarygrass abundance. In the lowest portion of the varial zone, the increased flow probably would kill some of the reed canarygrass as a result of the increased duration of scouring, although a minimal amount of reed canarygrass has been known to persist low in the varial zone (i.e., below an elevation inundated by 800 cfs [22.7 cms]; Figure E5.2-4). Regardless, this species is likely to continue to dominate sites within the reach.

There is no strong association between willow abundance and position along the inundation/ elevation gradient in the J.C. Boyle peaking reach. Instead, willow likely is dependent on peak flows creating suitable bare substrate for seed germination, suitable timing and rate of decent of the spring hydrograph, and protection from herbivores. Future operation of the J.C. Boyle powerhouse is not likely to change the pattern of peak flows and thus will not cause any significant change in willow distribution without the addition of artificial mechanical manipulation of the riverbank to create bare mineral soil.

Within the Copco No. 2 bypass reach, the drastically reduced flows have allowed large white alder trees to establish relatively low in the channel within the narrow canyon relative to the historical pre-Copco dam conditions. Vegetation in this reach is expected to remain the same under the proposed flows and ramp rate.

The flow downstream of Iron Gate dam is directed by the USBR to meet ESA requirements and is not affected substantially by the Project. Comparison of pre- and post-Project photos indicates little change in riparian vegetation extent or general character except where road projects (I-5) or agricultural irrigation returns seem to have increased woody riparian vegetation. An example of this is just downstream of the Klamathon Bridge. Analysis of riparian transect data indicates that several species of noxious weeds occur in riparian communities. The extent of noxious weeds was lowest in the J.C. Boyle peaking reach and J.C. Boyle bypass reach, with 32 and 17 percent of the riparian/wetland sampling sites having noxious weeds, respectively (see Terrestrial Resources FTR, Section 8.0, Table 8.7-3). In comparison, the Iron Gate-Shasta and Fall Creek areas had higher incidence of weeds in riparian zones, with 60 and 75 percent of riparian sampling sites, respectively. As with the reservoirs, most of the weeds occur at the upper elevations at the upland-riparian transition. Many of the noxious weed species that occur along the river sections are common invasive species that occur throughout wide areas of western North America. The role of Project-induced flows is likely not a significant factor in the distribution of these species of noxious weeds. In other words, the weeds likely would be present regardless of the water management implemented by PacifiCorp. The Noxious Weed Control Plan is likely to improve the habitats that are near Project facilities and roads by reducing weed infestations.

Grazing, a non-Project related factor, also can affect riparian and wetland habitat along river reaches. The J.C. Boyle bypass has no livestock grazing that affects riparian/wetland habitat. However, 57, 50, and 100 percent of the riparian transects had evidence of grazing in the J.C. Boyle peaking reach, Iron Gate-Shasta section, and Fall Creek sections, respectively. The presence of livestock does not necessarily cause adverse effects to the riparian vegetation because the timing and grazing level are important factors. However, there are some small areas of shoreline in the J.C. Boyle peaking reach that have some erosion that may be at least partially the result of livestock. In addition, livestock have trampled and browsed woody vegetation (mostly willows) in some small sections of the Klamath River. Riparian protection practices are included as PM&E measures.

E5.7.1.4 Effects of Recreational Activities on Botanical Resources

There are 23 developed and 18 dispersed recreation sites in the proposed Project boundary. At each of these sites, day use and/or overnight recreational activities result in continued alteration of vegetation within and along the perimeter of the recreation sites. Future operation of the Project will result in similar impacts to vegetation at the recreation sites. Vegetation management will be addressed in the VRMP. Riparian protection will be addressed in the WHMP.

E5.7.2 Wildlife Resources

Continued operation of the Project likely will result in the following general types of impacts to wildlife resources:

- Effects of reservoirs on wildlife habitats and aquatic life stages
- Effects of dams and river flow fluctuations
- Effects of Project facilities (powerhouses, canals and flowlines, transmission lines, fish hatchery, and Project roads)
- Effects of Project-related recreational activity

The following sections describe these impacts.

E5.7.2.1 Effects of Reservoirs on Wildlife

The Project reservoirs may affect wildlife by (1) affecting the distribution of important habitats, (2) affecting the structural characteristics of riparian and wetland habitat, (3) affecting wildlife movement patterns, (4) affecting amphibian and reptiles through direct mortality and habitat alteration, (5) preventing wildlife habitat from becoming established between normal reservoir full and low pool levels, and (6) reducing the availability of big game winter range.

PacifiCorp conducted numerous studies to investigate issues about potential impacts to wildlife. Currently, J.C. Boyle, Copco, and Iron Gate reservoirs operate in a manner that results in approximately 324 acres (131 ha) of drawdown zones being affected (exposed). These reservoirs fluctuate less than 4 feet (1.2 m), 6.5 feet (2.0 m), and 5.5 feet (1.7 m), respectively. During the year, portions of this zone are dewatered on a regular basis, but are not exposed for entire seasons of time (e.g., daily fluctuations during the summer are 1 foot [0.3 m] at Copco No. 1 and Iron Gate and 2 feet [0.6 m] at J.C. Boyle). The drawdown zone is used by some species of wildlife, such as waterfowl, aquatic mammals, shorebirds, and wading birds for foraging and resting. However, most wildlife probably find little habitat (cover) in this zone.

The three Project reservoirs will continue to provide open water and some wetland habitat for waterfowl and waterbirds, especially during the migration and winter periods. Limited breeding also occurs, including a low level of sandhill crane nesting at the Sportsman's Park wetland at J.C. Boyle reservoir. A total of 22 species of pelagic birds and waterfowl was documented on J.C. Boyle, Copco, and Iron Gate reservoirs during 2002-2003 (see Terrestrial Resources FTR, Section 7.7).

The physical presence of the Project reservoirs—particularly J.C. Boyle, Copco, and Iron Gate—affects movement of big game through the area by redirecting movements along shorelines and potentially by limiting the number of locations where animals can cross through the area. However, in many areas along Iron Gate, J.C. Boyle, and the eastern half of the Copco reservoir, the width of the reservoir does not represent a significant barrier to deer and elk, which are strong swimmers. Radio-telemetry data indicate at least some movement of deer and elk across the Klamath River. Deer were observed using various habitats along the northern shores of Iron Gate and Copco reservoirs during the winter and spring of the 2002-2003 field seasons, however, no direct observations of movement across the river or reservoirs were noted. The continuing residential development near the lower two reservoirs will continue to eliminate habitat for deer. Studies at other reservoirs in Idaho (Hells Canyon) have documented some adverse effects of reservoirs as a result of predators using the reservoirs to trap animals. Because of the moderate shoreline terrain surrounding the three Project reservoirs, this association is not likely significant.

The large gaps in riparian/wetland habitat that exist along the reservoir shorelines—particularly along Iron Gate and Copco reservoirs—limit habitat quality for amphibians, reptiles, and some mammal species by reducing connectivity (see Section E5.7.1.3). In some sections of the reservoirs, the distance among moderate to large-sized wetland/riparian habitat patches may limit the use of those portions of the Project vicinity by breeding bird species that often require large areas of dense shrub and forest habitat. Before development, the connectivity of riparian/wetland habitat was more consistent, with breaks occurring only where steep and narrow canyons prevented riparian vegetation from developing. The small patch size may contribute to increased nest predation and nest parasitism. Examination of the historical aerial photos indicates that riparian zones were always narrow, except in a few locations (western Copco reservoir), before Project construction.

Habitat structure of riparian habitat varies greatly among the Project reservoirs. For example, the HSIs for song sparrow shrub habitat quality range between 0.18 to 0.74 along Project reservoirs while herbaceous habitat quality ranged between 0.57 and 0.88 (see Terrestrial Resources FTR, Section 7.7.2.2). Only the 0.18 HSI value at J.C. Boyle reservoir was substantially lower than the range of habitat values observed along river reaches in the study area. Yellow warbler habitat quality, which is a function of deciduous shrub height and density and the percent of the shrub cover composed of hydrophytic species, was relatively uniform (0.38 to 0.65) along Project reservoirs, except on J.C. Boyle reservoir, where yellow warbler habitat value averaged 0.28. Given the general lack of wetland shrub habitat at J.C. Boyle reservoir, it seems that there are factors at play that limit shrub establishment in the area. However, the diversity of herbaceous wetland habitat is quite high at undisturbed sites along J.C. Boyle reservoir and shrub habitat occurs nearby in Spencer Creek. Along other Project reservoirs, habitat quality for these two riparian-associated species is of at least moderate value. PM&E measures will protect and enhance wetland and riparian habitat.

The wetland habitat directly connected to Project reservoirs provides poor habitat for breeding amphibians. Surveys of wetlands adjacent to reservoirs found little breeding activity at sites not isolated from the reservoirs (see Terrestrial Resources FTR, Section 4.7). Most wetlands connected to Project reservoirs, although having suitable structure for egg deposition, are adversely affected by wave action caused by wind and boats, and by water level fluctuations that sometimes occur frequently enough to desiccate egg masses. This situation was documented (1 year out of 2 years studied) at Iron Gate reservoir, where western toad egg mass sites were exposed by dropping water levels. Reservoir wetlands also provide poor amphibian breeding habitat because the reservoirs harbor potentially large populations of predator fish and non-native bullfrogs. PM&E measures will protect existing isolated wetlands and develop additional backwater habitat areas to enhance amphibian breeding habitat.

Western pond turtles that occur in Project reservoirs are preyed on by bullfrogs and may be affected by water level fluctuations that make basking logs and rocks less accessible or useable by turtles. If logs or rocks become disconnected from the water during water level fluctuation, turtles cannot use them for basking. In addition, because juvenile turtles often use emergent wetlands for cover, any large water level fluctuations that isolate the shoreline wetlands may make it difficult for turtles to use the habitats. Clearly, the largest pond turtle population occurs on Keno reservoir, which has the largest surface area, and a relatively stable water level, while the other reservoirs have smaller numbers of turtles. Although it should be noted that because the intent of the surveys was not to quantitatively compare turtle densities, but rather document use areas, no attempt was made to calculate relative turtle abundance. Water level fluctuation at all three reservoirs may affect the availability of terrestrial nesting and overwintering sites for turtles, which can be 50 to 1,640 feet (15 to 500 m) from water (Holland, 1994; Reese and Welsh, 1996).

Aquatic furbearers, such as mink, muskrat, and beaver, occur along the Klamath River and many of its tributaries. These species were documented as occurring along portions of the Project reservoirs that have significant wetland and riparian habitat. The large fluctuations in water level may make bank dens less accessible or secure and possibly reduce prey availability in the near-shore zone.

Proposed PM&E measures are expected to improve conditions around the reservoirs for riparian habitat connectivity and quality, pond turtle basking habitat, and upland deer winter range within the Project boundary.

E5.7.2.2 Effects of Dams and River Flow Fluctuations on Wildlife

As discussed in Section E5.7.1.4, river flows are significantly affected in the J.C. Boyle bypass, J.C. Boyle peaking, and Copco No. 2 bypass reaches. Project-induced flow patterns have the potential to cause similar types of effects on amphibians and pond turtles as along reservoirs (see Section E5.7.2.1). Numerous wildlife species are undoubtedly affected by the reduced flows in the three bypass reaches (Fall Creek, J.C. Boyle, and Copco) and the daily peaking in the J.C. Boyle peaking reach. However, on rare occasions, flows are passed through the river channels instead of the water conveyance system, which results in dramatically higher flows. Depending on the time of year, such flows could affect amphibians, reptiles, and small mammals that occur along the river. In the J.C. Boyle peaking reach in the summer, daily load factoring fluctuates water levels in a varial zone that is exposed during the night and early morning hours and then flooded during most of the daytime hours. This fluctuation likely reduces the amount of shoreline habitat available (i.e., creates a gap between vegetation edge and river and it exposes unvegetated shoreline so there is no hiding cover) for aquatic furbearers, makes adjacent wetlands less accessible for amphibians and pond turtles, and could eliminate potential habitat for riverine breeding amphibians, such as foothill yellow-legged frogs. No foothill yellow-legged frogs were found at any of the ten river/tributary sites surveyed in 2003, however, and they are not likely to occur in the Project area. This fluctuation also may alter the prey availability for wildlife that forage in the river or riparian zones.

The continuing operation of the Project can affect the western pond turtle through the effects on habitat availability and quality. Western pond turtles are generalists, occupying a striking variety of lentic, lotic, and even ephemeral waterways (Stebbins, 1985). Reese (1996) reported that dam-induced changes, including filling of pools with sediment, increased water velocities along the shoreline, and lowered water temperatures, are probably deleterious to turtles on the Trinity River in California. Large rivers with food, cover, and basking site resources restricted to the shorelines, as is the case in portions of the J.C. Boyle peaking reach, tend to have lower densities of pond turtles (Reese, 1996). Analysis of basking site characteristics by Reese (1996) revealed that basking sites used by turtles could be distinguished from random basking sites primarily by their lower slope and association with deeper, more lentic waters. Deeper pools in the river are likely to accumulate more underwater cover objects, such as large woody debris, and potentially decrease the risk of predation by aquatic mammals (e.g., otters, minks). Basking sites may be particularly important to females during the month following oviposition (usually in the summer) on the Trinity River. Juvenile and adult basking sites had similar characteristics, with the exception of lower water flows at juvenile sites. Rock perches, because they are so radiant, in some cases may be too warm to serve as long-term basking sites. Given that basking serves functions besides heating (e.g., drying; Boyer [1965]), wood perches might be preferred in some circumstances. Previous research indicated that juvenile pond (Holland, 1991) and other emydid turtles (Congdon et al. 1992) inhabit shallower, more lentic areas than adults. Gravid females might, for example, inhabit warmer, shallower waters with greater risks of predation, but higher metabolic potential for egg production (Hammond et al. 1988; Kepenis and McManus, 1974). At both dammed and undammed sites, turtles appear to select for deep water with low flow velocities and the presence of underwater refugia.

Proposed changes in the operation of the J.C. Boyle powerhouse that would promote these conditions would include increasing the minimum flow by 100 cfs (2.9 cms) and ramping restrictions that may limit the range of peaking during the summer. There still likely would be some effect on habitat availability.

It appears that western pond turtles may select a moderate condition between the extremes of unvegetated gravel bars and advanced-stage riparian vegetation for basking habitat. To the extent that flow fluctuations promote dense reed canarygrass along the shorelines, the flows may reduce the availability of these habitats and possibly may affect routes to upland nesting and overwintering sites as well. This probably is not significant overall. PM&E measures will include the addition of turtle basking structures in selected areas.

In general, dams and water diversions on rivers can be responsible for fragmenting aquatic habitat directly, by acting as barriers to migration, and indirectly, by creating patches of unsuitable habitat (Reese, 1996). When populations are fragmented and barriers to migration imposed, the fragments in effect become smaller populations. Given that smaller populations are more subject to the deleterious effects of inbreeding and loss of genetic variability, fragmentation can threaten persistence (Gilpin and Soule, 1986). For example, DNA from spotted turtles (*Clemmys guttata*) sampled from small bodies of water isolated by human impact were less diverse than those from a large wetland complex including multiple bodies of water (Parker and Whiteman, 1993).

Shallow, edgewater habitats that are important for western pond turtle hatchlings and juveniles are particularly vulnerable to alterations in flow (Reese, 1996). There is evidence that western pond turtles generally use aquatic sites for overwintering in lacustrine habitats, but travel onto land in lotic habitats (Holland, 1994). Thus, terrestrial overwintering may be a response to conditions of high flow (Reese, 1996). Because there is potential for some life stage of western pond turtle to be on land during every month of the year, all management approaches must regulate human uses of the terrestrial environment, whether they be urbanization, cattle grazing, road construction, logging operations, agriculture, or recreation. The long-term viability of populations may require the availability of linked pond/wetland habitats, which together offer a variety of attributes (Burke et al. 1995). Riparian and wetland PM&E measures will enhance habitat connectivity.

The analysis of river hydrology and riparian and wetland vegetation indicates that the Project has a role in (1) creating large gaps in riparian habitat along reservoirs relative to the river reaches, (2) contributing to the dominance of reed canarygrass, which can become dense enough to exclude native species, and (3) contributing to the factors limiting new willow establishment in some reaches (see Sections E5.7.1.2 and E5.7.1.3). These effects on vegetation generally degrade habitat quality for most wildlife species native to the Project area.

Yellow warbler habitat quality was moderate in value and relatively uniform (HSIs of 0.40 to 0.65 on a scale of 0.0 to 1.0) along Project river sections, except along J.C. Boyle peaking reach, where yellow warbler habitat value was much lower at HSI 0.28. It is possible that the daily flow fluctuation in J.C. Boyle peaking reach reduces habitat quality of shrub habitat along this reach because of the reduced abundance of hydrophytic plant species, such as willow. However, the lower HSIs in the canyon instead could be caused by the naturally steep gradient and narrow floodplain in many areas of this reach that may limit the density of hydrophytic shrubs compared to what might occur on a wider floodplain. Comparison of pre- and post-Project aerial photos indicates that little structural change in riparian habitat conditions have occurred over time. Only under what is now Copco reservoir were there any expansive riparian forests. The vast majority of the historical river channel appears to have been bordered by narrow bands of shrub and herbaceous wildlife habitat. Current vegetation distribution and structure are not likely to change greatly with the proposed flow changes. Riparian habitat protection measures, however, will enhance species diversity and, to the extent possible given the existing topography, widen the riparian habitat in selected areas.

E5.7.2.3 Effects of Project Facilities (Powerhouses, Canals and Flowlines, Transmission Lines, and Project Roads) on Wildlife Movement

An ongoing effect of the existing dams and hatchery program is how they alter the availability of anadromous fish for wildlife. Numerous species of wildlife have been documented to be associated with anadromous fish carcasses (Cedarholm et al. 2000, 2001). In many areas, eagles, bears, and other species congregate along rivers during spawning to forage on the high-energy food source (Willson and Halupka, 1995). Within the Klamath Project vicinity, dead anadromous salmonids are available for scavenging species, such as bald eagle, black bear, and various furbearers downstream of Iron Gate dam. Only non-anadromous salmonids are available along the California portion of the J.C. Boyle peaking reach, the J.C. Boyle bypass reach, Shovel Creek, Spencer Creek, and other tributaries. Unlike many other western U.S. rivers that are dependent on nutrient input from anadromous fish carcasses (Cedarholm et al. 2000, 2001), the Klamath River appears to be productive biologically because of the high nutrient content of the water flowing from Upper Klamath Lake. Currently, there are many wildlife species occurring in the Project area that use anadromous fish carcasses when available. Since Iron Gate dam construction, however, these animals have used other food sources. Prey remains collected from active bald eagle nests in the Project vicinity documented widely varying diets. Waterfowl, small mammals, and warm water fish species were found to be the most common forage items in nests near the Project (see Terrestrial Resources FTR, Section 5.7). The degree to which breeding eagles would forage on anadromous fish is not known, but it would depend on the availability during the breeding season. Wintering bald eagles in the Upper Klamath River basin tend to concentrate on the easily available waterfowl at the Upper Klamath Wildlife Refuge, although small numbers of eagles also forage at Keno and J.C. Boyle reservoirs. Periodically, small numbers of eagles are seen at Copco and Iron Gate reservoirs throughout the year. During studies for the Salt Caves Hydroelectric Project, bald eagle foraging in the J.C. Boyle peaking reach was reported to be related to waterfowl availability (City of Klamath Falls, 1990).

The physical structures that are part of the Project present some degree of barriers or hazards to wildlife moving through the Project vicinity. There are approximately 3 miles (5 km) of aboveground canals, flowlines, and penstocks associated with the Project (see Terrestrial Resources FTR, Section 6.0, Table 6.7-6). There are 9.8 miles (16 km) of Project transmission lines associated with the Project (Table E5.7-2). The following sections describe the effects of the various Project facilities on wildlife.

Canals and Flowlines

PacifiCorp has maintained records of deer mortalities in the Project canals since 1988. Since then, five deer and one striped skunk mortalities have been documented in the J.C. Boyle canal (see Terrestrial Resources FTR, Section 6.0, Table 6.7-2). There have been no confirmed wildlife mortalities in the Fall Creek canal.

The 3 miles (4.8 km) of canals and flowline present potential barriers to wildlife (amphibian, reptile, and mammal) movement. The Fall Creek canal and Copco No. 2 flowline have minor impacts because most animals can swim across the narrow open canals, can pass under elevated pipes, or move around the ends of the diversions. The J.C. Boyle canal is 11,000 feet (3,353 m) long and does not have any bridges. There are four locations where any wildlife that might be trapped in the canal may be able to exit safely (see Terrestrial Resources FTR, Section 6.0, Figure 6.7-2). This canal is on the side of a steep canyon that is not likely to be used as a travel corridor for large mammals (see Terrestrial Resources FTR, Section 6.0, Figure 6.7-1, for known deer and elk movement corridors). However, small mammals and reptiles that may want to move from the rocky slopes and open woodlands above the canal to the riparian zone below the canal may be blocked from moving through.

Less than 8 percent of the canal wall is both less than 4 feet (1.2 m) tall and is not adjacent to cliff or steep topography. These moderate terrain areas next to low walls or animal escape ramps would be the most likely areas where animals could enter the canal.

Transmission Lines

PacifiCorp operations personnel have been trained to report avian mortality at Project power lines, although there have been no documented electrocutions or avian collision deaths along the 9.8 miles (16 km) of Project transmission lines associated with the Klamath Hydroelectric Project (see Terrestrial Resources FTR, Section 6.0, Figure 6.7-3) since mortalities have been tracked in the late 1980s. With only a few exceptions, none of the Project lines appears to have obviously unsafe line configurations in terms of electrocution hazard because the distance between wires is too wide to allow birds to be electrocuted. There are a few poles on Line 15 that have crossarm configurations or distribution line underbuilds with wires that are closer than current standards. There are no records of avian mortalities on either of these lines. Line 98, near J.C. Boyle powerhouse, is not energized.

There are two Project line segments that occur near areas of regular waterfowl use: Upper Iron Gate reservoir and the Jenny Creek inlet of Iron Gate reservoir (see Terrestrial Resources FTR, Section 6.0, Figure 6.7-3). The line that crosses the Jenny Creek and Mirror Cove areas of Iron Gate reservoir may represent some low-level risk to waterfowl and waterbirds that forage there. Information in the literature indicates that the rates of collision with transmission lines are infrequent to rare, with one estimate of between 0.01 and 0.05 percent of flights that cross lines resulting in collisions (APLIC, 1994). The lack of significant croplands and large wetlands near the Project transmission lines that would attract foraging waterfowl and other water-associated birds (i.e., those most susceptible to collision) reduces the likelihood that waterfowl and other birds occurring along Project reservoirs would fly through the transmission line ROWs and, therefore, reduces the chances of avian collisions (see Terrestrial Resources FTR, Section 6.7.3). Additionally, Project line configurations are horizontal (less profile across potential flight paths than vertical configurations) and do not have the thinner overhead ground wires that are less visible and are believed to be more likely to cause collisions. The short transmission line near the J.C. Boyle powerhouse is not much of risk because of its short length and its orientation going up the slope as opposed to across the river. Collision of waterfowl, waterbirds, and large wading birds, which are the species most at risk of colliding with lines, is likely to cause at least temporary power outages. No such outages have been reported from the Project. Thus, collisions are likely to be extremely rare events.

PacifiCorp has a corporate program to document all bird mortalities on its lines (both Project and non-Project lines) and to remedy the lines whenever feasible to prevent future mortalities at problem sites. PacifiCorp has an MOU filed with both California and Oregon state wildlife agencies, as well as the USFWS regional office. The MOUs have been in place since the late 1980s and provide guidelines for the reporting, removal, and disposal of electrocuted birds. The following is a summary of these PacifiCorp guidelines (Liguori and Burruss, 2002):

- Mortality Reporting: Employees are required to report any large dead bird found in or around Project facilities. The PacifiCorp internal website contains a database titled BMTS, where all observations are documented.

- Bird Power Line Management Program Guidelines: These guidelines were created for the use of PacifiCorp field employees and were distributed to all offices to provide information on mortality reporting forms, agency contacts, and raptor identification. The guidelines also provide information for making existing structures raptor-safe. The latest edition of these guidelines was revised and distributed in early 2003.

- Raptor-safe Distribution Line Construction Standards: Raptor-safe construction standards for new and re-built rural distribution lines require a minimum of 60 inches (152 cm) of clearance between conductive or conductive and grounded parts of a distribution line. "Problem poles" are identified (where an eagle or other birds have been killed) and, when feasible, retrofitted with insulator covers, brushing caps, triangles or perches, or jumper wire hose. Other more extreme options include the replacement of problem poles that cannot be retrofitted adequately. Additional monitoring proposed in PM&E measures along with PacifiCorp's corporate Bird Powerline Management Program will enhance avian safety in the Project area.

Powerhouse and Other Structures

Bats (Yuma myotis) roost in the Copco No. 1 powerhouse and gatehouse, as well as the J.C. Boyle forebay spillway house and several other Project buildings. These bats likely will continue to use the structures for both day and night roosting. PacifiCorp has installed false ceilings between the roof and electrical equipment so that bats or their excrement do not interfere with the Project. There is no plan to close access to the buildings. A small number of bats (three or four) unintentionally can be killed by operation of the overhead crane system in the Copco No. 2 powerhouse. This occurs once per year during maintenance. The Project structures will continue to be used by bats and it is likely that a small number of mortalities will occur each year. The addition of artificial roost structures will provide safer roost sites and is expected to mitigate the impact.

Roads

There are approximately 300 miles (483 km) of roads of all types in the terrestrial resources study area. Of these, 11 miles (18 km) bisect or are adjacent to the more sensitive habitats (wetlands, riparian, river, and lake). About 59 miles (95 km) or 20 percent of the roads are on PacifiCorp property. By far, most of the road length is associated with the most common vegetation types in the study area: montane hardwood oak-conifer, montane hardwood oak, ponderosa pine, and annual grassland. PacifiCorp identified 37 sites where potential resource damage was occurring along the roads in the study area. Most of these damage sites are concentrated between the Sportsman Park at J.C Boyle reservoir to J.C. Boyle powerhouse, around several sites on the north side of Copco Reservoir, and at various locations along both sides of Iron Gate reservoir. Road erosion was found at 63 sites in the same general areas as the environmental damage sites. There are 48 miles (77 km) of roads within the FERC boundary, of which, approximately 54 percent is on PacifiCorp land. Project personnel documented 30 wildlife mortalities along roads that they traveled during the spring and summer of 2003. Most wildlife mortalities were ground squirrels, rattlesnakes, or gopher snakes and none of the mortalities was on roads that are strictly Project facility roads, but rather were on public roads that have higher speed limits. This impact is likely to continue into the future, although the implementation of the TRMP may make some PacifiCorp-owned roads inaccessible to the public, thereby making a minor reduction in mortality.

E5.7.2.4 Effects of Project-Related Recreational Activity

Recreational activities including flat water boating, fishing, camping, and whitewater rafting have the potential to reduce habitat for wildlife and cause disturbances to various wildlife species. There are 28 developed and 27 dispersed recreation sites associated with the Project vicinity, although four are at Link River and Keno reservoir and not associated with the proposed Project.

Recreational activity, mostly boating and camping, is anticipated to increase somewhat during the next license period (see Exhibit E7). This increased recreational pressure will be most evident at Iron Gate, J.C. Boyle, and Keno reservoirs. Copco reservoir also will receive increased recreational use, but not as substantial as at the other reservoirs. Most of the boating activity occurs during April through September. Boating on the reservoirs probably creates a relatively minor disturbance to waterfowl, waterbirds, and shorebirds. However, most waterfowl use occurs during the winter when boating use is low. The increased recreational demand also may trigger the need to greatly expand the Long Gulch recreation area. Boating also causes increased wave action, which causes shoreline erosion and loss of riparian habitat. This will eliminate additional wildlife habitat.

Whitewater rafting currently attracts approximately 6,000 boaters per year (see Exhibit E7). Assuming four persons per boat, this equates to about 1,500 boat trips between April and mid-October. This activity is projected to increase approximately 1 percent per year during the next license period. One of the greatest impacts of the rafters is causing basking pond turtles to leave basking sites as boats approach them (Bury, 1995). This causes a short-term energetic expense, but currently is not thought to be significant in terms of population dynamics. There is anecdotal information that private individuals are killing or collecting reptiles—particularly snakes—from various sites in the Project vicinity. This impact can significantly affect a local population and is one of the major threats to reptiles in some areas (Dodd, 2001). Vehicular traffic on public roads was a documented source of mortality for ground squirrels, striped whipsnake, common kingsnake, gopher snake, and rattlesnakes in 2002-2003. Another impact that has been noted on several occasions in the past is rafters stopping at the Salt Caves and entering the cave, which can cause significant disturbance to roosting Pacific western big-eared bats and Yuma myotis.

None of the bald eagle or spotted owl nests known to occur in the area is near Project recreational facilities, and none will be affected by future operation of these facilities.

Recreational activity on Project reservoirs and the J.C. Boyle peaking reach likely cause some disturbance to foraging bald eagles.

Wildlife disturbance by vehicles and off-road vehicles (ORVs) is a serious problem for many species of wildlife, with noise being a major component of these disturbance impacts. Noise can stress (and thus adversely affect) wildlife (Aune, 1981; Baldwin, 1970; Burger, 1981; Bury, 1980; Jeske, 1985; Vos et al. 1985; Ward et al. 1973). Wildlife exposed to noise can suffer high levels of physiological stress even if they appear to fully adapt to the noise (Aune, 1981; EPA, 1971). One potential outcome of disturbance effects is displacement.

PacifiCorp's proposed recreation enhancement measures include closing the Jenny Creek picnic area, developing a parking area near the county road at Jenny Creek, moving the Camp Creek recreation camping sites across the road to a currently undeveloped site, expansion of the Long Gulch recreation site, addition of hiking trails along Bogus Creek and near J.C. Boyle reservoir and Topsy Campground. Implementation of these measures will result in the loss of additional wildlife habitat. A preliminary estimate is that the proposed recreational development, excluding trails, will affect 79 acres (32 ha) of upland habitat. To mitigate for these additional impacts, PacifiCorp will incorporate the following vegetation and wildlife habitat measures: (1) use native plants (when possible) to create visual buffers along the perimeter of new campgrounds and day use sites, (2) revegetate and expand the riparian zone at lower Jenny Creek, and (3) conduct surveys for TES and S/M species before ground disturbance.

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