Section 3.6 Contents

3.6 Other Species of Concern

3.6.1 Introduction

Other species of concern in the Cedar River Watershed are those species for which current population status indicates that there is some decline or a potential risk of future decline, and the potential that the species could be listed at some time in the future (Section 3.4). Most of this group of 69 species are declining or at risk of declining in population numbers because their key habitats are regionally declining, although many are currently believed to be relatively stable within the municipal watershed.

Some of these species, such as the Larch Mountain salamander (*Plethodon larselli*), are highly vulnerable to disturbance. Other species, such as the ground beetles (family Carabidae), have narrow habitat requirements. Some species are both highly vulnerable to disturbance and have narrow habitat requirements, such as the Western Townsend's big-eared bat (*Plecotus townsendii*).

All bat species potentially present in the Cedar River Watershed are considered species of concern. Some invertebrate species that are considered to be at-risk and are potentially present on the Cedar River Watershed are also considered species of concern. Bat and invertebrate species are included in this list partly because information regarding their presence and status in the state is very limited.

Although individual species conservation strategies have not been developed for any of the species of concern other than the 14 species of greatest concern (Section 3.5), the community-based strategies presented in Section 4.2.5 were developed to address these species. If, in the future, any of these other species are listed by the USFWS or NMFS, individual conservation strategies may be developed. A species-by-species discussion follows for each of the other species of concern addressed in this HCP. The status in the municipal watershed and the state and federal status for each species is given in Table 3.6-1.

Table 3.6-1. Status of other fish and wildlife species of concern that are known to occur or potentially could occur in the Cedar River Watershed.

Species	Status in the Cedar River Watershed		Designated Status	
	Status	Notes	State	Federal
Birds				
Band-tailed Pigeon *Columba fasciata*	present	sightings on occasion		
Black Swift *Cypseloides niger*	present		Monitor	
Brown Creeper *Certhia americana*	present, breeding			
Golden Eagle *Aquila chrysaetos*	unknown	historic sighting on adjacent ownership	Candidate	
Great Blue Heron *Ardea herodias*	present	common	Monitor	
Harlequin Duck *Histrionicus histrionicus*	present	Cedar River and major tributaries		Species of Concern
Merlin *Falco columbarius*	present		Candidate	
Olive-sided Flycatcher *Contopus borealis*	present			Species of Concern
Osprey *Pandion haliaetus*	present, breeding	several pairs	Monitor	
Pileated Woodpecker *Dryocopus pileatus*	present, breeding	common	Candidate	
Rufous Hummingbird *Selasphorus rufus*	present	common		
Three-toed Woodpecker *Picoides tridactylus*	unknown		Monitor	
Vaux's Swift *Chaetura vauxi*	present, breeding		Candidate	
Western Bluebird *Sialia mexicana*	incidental	sightings on occasion	Monitor	
Willow Flycatcher *Empidonax traillii*	present, breeding			Species of Concern
Fish				
Kokanee *Oncorhynchus nerka*	present, breeding	present in Walsh Lake and Webster Creek		
Pacific Lamprey *Entosphenus tridentatus*	unknown	below Landsburg (if present)		Species of Concern
River Lamprey *Lampetra ayresi*	unknown	below Landsburg (if present)	Candidate	Species of Concern

Species	Status in the Cedar River Watershed		Designated Status	
	Status	Notes	State	Federal
Sea-run Cutthroat Trout *Oncorhynchus clarki clarki*	unknown	below Landsburg (if present)		
Mammals				
Big Brown Bat *Eptesicus fuscus*	unknown			
California Myotis *Myotis californicus*	unknown			
Canada Lynx *Lynx canadensis*	unknown		Threatened	Proposed Threatened
Fisher *Martes pennanti*	unknown		Endangered	Species of Concern
Fringed Myotis *Myotis thysanodes*	unknown		Monitor	
Hoary Bat *Lasiurus cinereus*	unknown			
Keen's Myotis *Myotis keenii*	unknown		Monitor	
Little Brown Myotis *Myotis lucifugus*	unknown			
Long-eared Myotis *Myotis evotis*	unknown		Monitor	
Long-legged Myotis *Myotis volans*	unknown		Monitor	
Marten *Martes americana*	unknown			
Masked Shrew *Sorex cinereus*	unknown			
Northern Water Shrew *Sorex palustris*	present			
Silver-haired Bat *Lasionycteris noctivagans*	unknown			
Townsend's Western Big-eared Bat *Plecotus townsendii*	unknown		Candidate	Species of Concern
Wolverine *Gulo gulo*	unknown		Candidate	Species of Concern
Yuma Myotis *Myotis yumanensis*	unknown			Species of Concern
Amphibians and Reptiles				
Cascades Frog *Rana cascadae*	present, breeding		Monitor	Species of Concern
Cascade torrent salamander *Rhyacotriton cascadae*	unknown	known range to south	Candidate	

Species	Status in the Cedar River Watershed		Designated Status	
	Status	Notes	State	Federal
Larch Mountain Salamander *Plethodon larselli*	unknown	known range to south	Sensitive	Species of Concern
Long-toed Salamander *Ambystoma macrodactylum*	present, breeding			
Northwestern Salamander *Abystoma gracile*	present, breeding	widely distributed		
Pacific Giant Salamander *Dicamptodon tenebrosus*	present, breeding	widely distributed		
Red-legged Frog *Rana aurora*	present, breeding	widely distributed	Monitor	Species of Concern
Roughskin Newt *Taricha granulosa*	present, breeding	common		
Oregon Spotted Frog *Rana pretiosa*	unknown		Endangered	Candidate
Tailed Frog *Ascaphus truei*	present, breeding	widely distributed in streams and rivers of municipal watershed	Monitor	
Van Dyke's Salamander *Plethodon vandykei*	unknown	known range to south	Candidate	Species of Concern
Western Pond Turtle *Clemmys marmorata*	unknown	no habitat within delineated elevation range	Endangered	Species of Concern
Western Redback Salamander *Plethodon vehiculum*	present			
Western Toad *Bufo boreas*	present, breeding	common	Candidate	
Invertebrates: Insects				
Beller's Ground Beetle *Agonum belleri*	present	found in bogs	Candidate	Species of Concern
Carabid beetle: *Bembidion gordoni*	unknown			
Carabid beetle: *Bembidion stillaquamish*	unknown			
Carabid beetle: *Bembidion viator*	unknown			
Carabid beetle: *Bradycellus fenderi*	unknown			

Species	Status in the Cedar River Watershed		Designated Status	
	Status	Notes	State	Federal
Carabid beetle: *Nebria gebleri cascadensis*	unknown			
Carabid beetle: *Nebria kincaidi balli*	unknown			
Carabid beetle: *Nebria paradisi*	unknown			
Carabid beetle: *Omus dejeanii*	unknown			
Carabid beetle: *Pterostichus johnsoni*	unknown			
Fender's Soliperlan Stonefly *Soliperla fenderi*	unknown			Species of Concern
Hatch's Click Beetle *Eanus hatchi*	unknown		Candidate	Species of Concern
Johnson's (mistletoe) Hairstreak (butterfly) *Mitoura johnsoni*	unknown		Candidate	
Long-horned Leaf Beetle *Donacia idola*	unknown		Candidate	
Invertebrates: Mollusks				
Blue-gray Taildropper (slug) *Prophysaon coeruleum*	unknown		Monitor	
Oregon Megomphix (snail) *Megomphix hemphilla*	unknown		Monitor	
Papillose Taildropper (slug) *Prophysaon dubium*	unknown		Monitor	
Puget Oregonian (snail) *Cryptomastix devia*	unknown		Monitor	
Valvata mergella (snail)	unknown			

3.6.2 Species Accounts

BIRDS

Band-tailed Pigeon

Status

Legal Status. The band-tailed pigeon (*Columba fasciata*) is not a listed species, candidate species, or species of concern at the federal level in Washington. It is considered an upland game species by Washington State (WDNR 1996).

Population Status. Concern for the band-tailed pigeon has been prompted by the population decline reflected in breeding bird surveys (WDNR 1996). Populations in Washington have exhibited the greatest decline (Braun 1994).

Range

The band-tailed pigeon occurs along the west coast of North America, from southwestern British Columbia to southern California, in the southern Rocky Mountain states of Utah, Colorado, New Mexico, and Arizona, and in Mexico and Central America.

In Washington, the band-tailed pigeon occurs west of the Cascade crest (Roderick and Milner 1991; Smith et al. 1997).

Habitat

Band-tailed pigeons are found within the coniferous forest zone and are associated with mixed conifer-hardwood habitats (Larsen et al., in prep., as cited in WDNR 1996). This species typically uses a stick platform in a conifer tree as a nest (Ehrlich et al. 1988; Braun 1994). During the nesting season, band-tails are more common in low-elevation forests (less than 1,000 ft elevation) with various seral stages and openings that are well interspersed (Roderick and Milner 1991). Nesting band-tailed pigeons appear to be negatively associated with old-growth forest, possibly because accipiters and other predators can maneuver more readily through the open understory of old-growth forest (Jarvis, R., Oregon State University, September, 1999, personal communication). The species is also known to occur in west-side residential areas or city parks with suitable large coniferous trees (Smith et al. 1997). Band-tailed pigeons use a variety of open habitats for foraging, including natural meadows, and small patches of early seral forest (Jarvis, R., Oregon State University, September, 1999, personal communication).

Band-tailed pigeons feed on various plant foods, including the buds, flowers, and fruits of hardwood trees and shrubs, such as cascara, elderberry, wild cherry, and huckleberry (Braun 1994). This species depends on the availability of mineral resources (e.g., from mineral springs, intertidal flats) for producing crop milk for juveniles (Braun 1994). Band-tailed pigeons will travel considerable distances to meet their mineral requirements, using mineral springs 15 to 20 miles from their nest sites (Jarvis, R., Oregon State University, September, 1999, personal communication).

Occurrence in the Cedar River Municipal Watershed

Band-tailed pigeons are present in the Cedar River Municipal Watershed, but no comprehensive surveys have been conducted and no nests or breeding activity have been documented to date.

Nesting habitat for the band-tailed pigeon in the Watershed includes low-elevation coniferous or mixed hardwood-conifer forest. Other important habitat elements include red elderberries and huckleberries for foraging, and mineral springs for crop milk. No mineral springs have been identified in the Cedar River Municipal Watershed.

Black Swift

Status

Legal Status. The black swift (*Cypseloides niger*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The black swift is a state monitor species in Washington.

Population Status. Smith et al. (1997) consider the black swift an uncommon breeder in Washington.

Range

In Washington, the black swift occurs in the Cascades north of Mt. Adams and along the rocky coastline from Grays Harbor County to Clallam County (Smith et al. 1997).

Habitat

Smith et al. (1997) described good habitat for the black swift as "mid- to late-seral mixed and conifer forests and rivers/riparian areas in forested zones above the ponderosa pine zone in eastern Washington, and above the Puget Sound Douglas-fir zone in western Washington; and similar habitats, plus rocky shoreline, of the coastal strip in the Sitka spruce zone."

Few black swift nests have been documented in Washington, but they have been found on steep cliffs and behind waterfalls (Smith et al. 1997). Foerster and Collins (1990) described five features that are generally associated with black swift nest sites: (1) water (flowing water is present at every nesting site, ranging in degree from a trickle to a torrent); (2) high relief (the nesting site must have a commanding position above the surrounding terrain so that swifts flying out from the nest are automatically above that terrain); (3) inaccessibility (the site is inaccessible to potential terrestrial predators); (4) darkness (the nest is in a position that the sun will not shine on an occupied nest); and (5) unobstructed flyways (the flyway in front of the nest must be free of obstructions).

Occurrence in the Cedar River Municipal Watershed

Black swifts are present in the Cedar River Municipal Watershed, but no comprehensive surveys have been conducted and no nests or breeding activity have been documented to date.

Potential habitats for the black swift in the municipal watershed include cliffs, rock outcrops, headwalls and inner gorges, waterfalls on streams, and mature to old-growth forests, especially in riparian areas.

Brown Creeper

Status

Legal Status. The brown creeper (*Certhia americana*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The brown creeper is considered to be common throughout its range in Washington (Smith et al. 1997). However, brown creeper populations in Oregon and California have been steadily declining (Sauer et al. 1997).

Range

The brown creeper is widely distributed in the Northern Hemisphere. In North America it occurs from southeastern Alaska east to Newfoundland and south through the western mountain ranges and through Mexico to Nicaragua; in the eastern United States to southern Wisconsin and Massachusetts, and in the Appalachian Mountains to eastern Tennessee and western North Carolina.

In Washington, two subspecies of brown creeper are known to breed: *C. a. montana* of eastern Washington and *C. a. occidentalis* of western Washington (Smith et al. 1997). The brown creeper occurs throughout the forested regions of western Washington, northeastern Washington, and extreme southeastern Washington (Blue Mountains). The species is absent from the hot, dry Columbia Basin.

Habitat

The brown creeper is found in many types of forested areas, but its primary habitat is considered to be mature, moist coniferous forests (Smith et al. 1997). Mariani (1987) demonstrated that brown creepers in southern Washington had a high preference for mature conifer forest.

Usually the nest is under a piece of loose tree bark, typically a hardwood (Mariani 1987), but is reported occasionally in a natural cavity or old woodpecker hole. When built under loose bark, the nest is a crescent-shaped structure of twigs, bark shreds, moss, spider webs, and feathers. Douglas-fir is considered to be a preferred tree for foraging in western Washington, presumably because the highly contoured bark provides a high density of prey, such as insects and spiders (Mariani 1987). The preferred combination of nesting and foraging habitat typically occurs at the transition between riparian hardwood vegetation and forest conifer vegetation. The nest is placed in a hardwood located near the water, while foraging occurs in the nearby conifers (Smith et al. 1997).

Occurrence in the Cedar River Municipal Watershed

Brown creepers are present and known to breed in the Cedar River Municipal Watershed.

Potential habitats for the brown creeper in the watershed include mixed and coniferous forest, and late-successional conifer wetland forest. Because mature coniferous forest

habitat is declining throughout Washington, and exists as fragmented patches, key habitat for brown creepers is assumed to be limited.

Golden Eagle

Status

Legal Status. The golden eagle (*Aquila chrysaetos*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The golden eagle is a Washington State candidate species.

Population Status. The 1990 population estimate for Washington was 80 breeding pairs (Roderick and Milner 1991).

Range

Golden eagles occur across the western United States from the western Dakotas, eastern Colorado, and extreme eastern Texas to central Oregon and Washington and the coast of California (Sauer et al. 1997). Golden eagles are most common in the open dry forests of the east Cascades, northeastern Washington, and southeastern Washington (Smith et al. 1997). They are absent from the Columbia Basin. West of the Cascade crest, golden eagles are found in the rain shadow area of major volcanoes, at high elevations in alpine parkland, and at clearcuts at mid elevations (Smith et al. 1997).

Habitat

Golden eagles nest on large, rocky cliffs or in large trees in areas where suitable small mammal prey, such as rabbits and marmots, is abundant (Smith et al. 1997). East of the Cascades, golden eagles are associated with open ponderosa pine and steppe habitats near cliff and plateau topography (Roderick and Milner 1991). In western Washington, nests are primarily in large trees in mature to old-growth forests near the edges of clearcuts (Anderson and Bruce 1980). Bruce et al. (1982) found that golden eagle tree nests were placed at or below canopy height and were less than 500 m from large clearcuts (less than 10 years old) or open fields.

Hares, rabbits, ground squirrels, and marmots are the golden eagle's principal prey (Snow 1973; McGahan 1967). Mountain beaver are important prey on the west side of the Cascades (Bruce et al. 1982).

Occurrence in the Cedar River Municipal Watershed

Golden eagles are present in the Cedar River Municipal Watershed only intermittently as transients and migrants, and are most often observed above high-elevation ridges. At least one historic (late 1970s) nest site has been documented on lands adjacent to the watershed (City of Seattle, unpublished observations). No comprehensive surveys have been conducted and no nests have been documented within the Cedar River Municipal Watershed to date.

Potential nesting habitat for golden eagles in the municipal watershed includes cliffs and rock outcrops; naturally open habitats (grass-forb meadows and persistent shrub communities) provide potential foraging habitat.

Great Blue Heron

Status

Legal Status. The great blue heron (*Ardea herodias*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The great blue heron is a monitor species at the state level in Washington.

Population Status. The great blue heron is considered common in Washington, especially in the Puget Sound area (Smith et al. 1997).

Range

The great blue heron occurs throughout southern Canada, the United States, and Mexico. It occurs year-round along the west coast, from southern Alaska to the tip of Baja California.

The great blue heron is common in wetlands, mud flats, and agricultural areas at low to mid-elevations on both sides of the Cascade crest (Smith et al. 1997). West of the Cascade crest, great blue herons occur in all vegetation zones below the silver fir zone. Along river valleys they may be found up to fairly high elevations (e.g., along the Skagit River near Ross Lake in Whatcom County). They also occur at Cle Elum, Kachess, and Keechelus lakes in Kittitas County, but these birds may not be breeding (Smith et al. 1997).

Habitat

Great blue herons nest colonially in tall deciduous or coniferous trees near wetlands (Roderick and Milner 1991). Nests are usually constructed in the largest trees available, although smaller trees, bushes, and artificial structures have been used (Bruce 1986; Blus et al. 1980). A study in British Columbia found that most heron colonies were in trees over 46 ft tall, and no nests were found in trees under 33 ft. tall (Mark 1976).

Great blue heron feeding areas can include irrigated agricultural fields, irrigation canals, and the marshy edges of ponds, lakes, and estuarine areas (Smith et al. 1997). Documented distances from an active nesting colony to a foraging area range from 13 to 18 miles, but most feeding areas are located within 2.5 to 3 miles of the colony (Short and Cooper 1985).

Human disturbance has been documented to be a major cause of nest abandonment by great blue herons, causing colony-wide nest failures (Smith et al. 1997). Herons have abandoned colonies because of housing and industrial development, highway construction, logging, actively used roads, and repeated human intrusion into colonies (Werschkul et al. 1976; Kelsall and Simpson 1979; Parker 1980; Leonard 1985). Herons that have experienced few past disturbances are not likely to tolerate human activities near their colonies (Bowman and Siderius 1984). Butler (1992) has recommended that a 1,000-ft buffer zone be established around active heron colonies to prevent nest failure. In contrast, some studies suggest that herons that are frequently or consistently exposed to disturbance may habituate to human activities (Shipe and Scott 1981; Webb and Forbes 1982; Vos et al. 1985; Calambokidis et al. 1985). Thus, herons nesting in different locations may have different tolerance levels to human activity, with colonies

located close to human activity responding less to disturbance than those in more remote areas (Simpson 1984).

Occurrence in the Cedar River Municipal Watershed

Great blue herons are present in the Cedar River Municipal Watershed, but no comprehensive surveys have been conducted and no nests or breeding activity have been documented to date.

Great blue herons nest in trees near water and feed along the edges of lakes, ponds, and wetlands. Thus, breeding and foraging habitat for this species occurs in aquatic and riparian habitats in the watershed.

Harlequin Duck

Status

Legal Status. The harlequin duck (*Histrionicus histrionicus*) is a federal species of concern in Washington State. The harlequin duck is not listed as a threatened species, endangered species, or candidate species by the State of Washington.

Population Status. The breeding population south of the Canadian border has been estimated at 500 to 600 pairs (Harlequin Duck Working Group 1993). Schirato (1993) estimated that Washington State had a minimum of 275 pairs, but that the stability of the breeding population was unknown.

Range

The harlequin duck occurs in northeast Asia, Alaska, Canada, the western United States, Greenland, and Iceland (Peterson 1990). In the western United States, the species breeds in mountainous areas from the Aleutian Islands to northern California, and in the northern Rocky Mountains south to Yellowstone National Park (Roderick and Milner 1991).

In Washington, the harlequin duck breeds along fast-moving streams and rivers throughout the Cascade, Olympic, and Selkirk mountains (Bellrose 1976; Brown 1985b). Wintering areas include saltwater habitats within about 150 ft of the shore (Gaines and Fitzner 1987) in northern Puget Sound, northern Hood Canal, the Strait of Juan de Fuca, the San Juan Islands, and the outer coast (Wahl and Paulson 1991; WDFW 1994a).

Habitat

Harlequin duck nests are typically located close to clear mountain streams with rocky substrates and rapids (Harlequin Duck Working Group 1993). Nests may be on the ground in dense vegetation, in piles of woody debris, in undercut stream banks, between rocks, or in hollow trees (Harlequin Duck Working Group 1993). Most harlequin nests are found within 16 ft of streams (Bengston 1972), but they have been found up to 82 ft away (Harlequin Duck Working Group 1993). Dense shrub and/or forest cover on streambanks near nest sites is also considered important (Harlequin Duck Working Group 1993). The species is thought to show a preference for mature or old-growth forests in the Pacific Northwest (Harlequin Duck Working Group 1993; Roderick and Milner 1991). Harlequin ducks nest from April to June. Broods usually remain near the

nest site for the first few weeks, then move downstream during the summer to lower-gradient streams that support an abundant macroinvertebrate fauna (Bengton and Ulfstand 1971; Kuchel 1977; Wallen 1987; Cassirer and Groves 1989). Principal food items include crustaceans, molluscs, and aquatic insects (Cottam 1939, as sited in Roderick and Milner 1991).

Foraging habitat includes fast-moving streams (Harlequin Duck Working Group 1993), while resting habitat is generally described as mid-stream loafing sites (Roderick and Milner 1991), such as gravel bars or large woody debris.

Human disturbance greatly affects this species, therefore, WDFW (1994a) recommends that roads and trails should be located farther than 165 ft from streams used by harlequin ducks.

Occurrence in the Cedar River Municipal Watershed

Harlequin ducks are present in the Cedar River Municipal Watershed on the mainstem Cedar River to at least an elevation of 2,100 ft, and on one major tributary downstream of Cedar Falls. However, no comprehensive surveys have been conducted and no nests or breeding activity have been documented to date.

Potential nesting and foraging habitat for the harlequin duck in the watershed includes fast-flowing rivers and streams, and associated bank vegetation and large woody debris.

Merlin

Status

Legal Status. The merlin (*Falco columbarius*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The merlin is a state candidate species in Washington.

Population Status. According to Smith et al. (1997), the status of merlins in Washington "is very much a mystery."

Range

The merlin is found throughout the northern hemisphere. Two distinct subspecies of merlin occur in Washington (Smith et al. 1997), with the Taiga merlin (*F.c. columbarius*) the subspecies most likely to occur in the Cedar River Municipal Watershed. It is likely that the Taiga merlin occurs as a rare breeder in high-elevation Cascades forests that mimic boreal conditions, such as Engelmann spruce and subalpine fir forests (Smith et al. 1997).

Habitat

Merlins are typically found along wooded edges adjacent to open habitats such as meadows, wetlands, and shrubby areas. Merlins utilize old nests of other species, such as crows, and natural cavities for breeding (Smith et al. 1997). They are also known to nest on cliffs. The merlin preys mainly on small, open-country birds such as larks, swallows, and finches. Small mammals and insects are eaten occasionally. Merlins in the Cascade Mountains are found at higher elevations, from the Pacific silver fir zone up, using forest edges and meadows along the Cascade crest (Smith et al. 1997).

Occurrence in the Cedar River Municipal Watershed

Merlins are present in the Cedar River Municipal Watershed, but no comprehensive surveys have been conducted and no nests or breeding activity have been documented to date. Large trees, cliffs, and rock outcrops may provide nesting habitat for merlins in the Cedar River Municipal Watershed; potential foraging habitat includes naturally open upland habitats (grass-forb meadows and persistent shrub communities) and open wetlands (palustrine emergent and palustrine scrub-shrub wetlands).

Olive-sided Flycatcher

Status

Legal Status. The olive-sided flycatcher (*Contopus borealis*) is a federal species of concern in Washington. The olive-sided flycatcher is not listed as an endangered species, threatened species, or candidate species in Washington State.

Population Status. Based on data from the North American Breeding Bird Surveys, the olive-sided flycatcher has apparently been in significant decline throughout much of the western United States and across its boreal North American range as well (DeSante and George 1994; Dobkin 1994; Hejl 1994; Peterjohn et al. 1994).

Range

The olive-sided flycatcher breeds from Alaska east through much of Canada to the Great Lakes region and the northeastern United States, and southward through the mountains of the Pacific Northwest, the Rocky Mountains, and the mountains of California. The species winters in montane Central and South America from southern Mexico through Colombia and Venezuela, south to Peru (Ehrlich et al. 1988).

The olive-sided flycatcher occurs in virtually all forested areas of Washington State (Smith et al. 1997).

Habitat

The olive-sided flycatcher inhabits primarily mature forest, old-growth forest, and wet conifer forest, especially those forests with an abundance of snags (Ehrlich et al. 1988; Sharp 1992). These flycatchers were found to occur in relatively similar abundance in young, mature, and old-growth forest stands in the southern Washington Cascades (Carey et al. 1991; Gilbert and Allwine 1991a; Manuwal 1991; Ruggiero et al. 1991). This species may also use mixed woodlands near edges and clearings. Smith et al. (1997) consider the olive-sided flycatcher an edge species that occurs throughout forested areas where forest stands are adjacent to open areas, such as clear-cuts, burns, montane meadows, and western Washington agricultural areas.

Nests are often located high in conifer trees, usually on a horizontal branch far from the trunk. Olive-sided flycatchers typically forage by sallying for flying insects from prominent, high hunting perches (live trees or snags) with a view of openings (Ehrlich et al. 1988; Marshall 1988; Sharp 1992).

Occurrence in the Cedar River Municipal Watershed

Olive-sided flycatchers are present in the Cedar River Municipal Watershed, but no comprehensive surveys have been conducted and no nests or breeding activity has been documented to date.

Potential nesting habitat for the olive-sided flycatcher in the Cedar River Municipal Watershed includes mature and old-growth forest, and wet conifer forest, especially those forests with an abundance of snags. Adjacent and interspersed open habitats (e.g., meadows, persistent shrub communities, early seral forest) provide potential foraging habitat.

Osprey

Status

Legal Status. The osprey (*Pandion haliaetus*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The osprey is a monitor species at the state level in Washington.

Population Status. In Washington, Breeding Bird Survey data show a significant population increase of 10.2 percent per year from 1966 to 1991 (Peterjohn 1991) and an increase of 11.7 percent per year from 1982 to 1991. There is an extremely high concentration of nesting ospreys along the Pend Oreille River in northeastern Washington (Smith et al. 1997).

Range

The osprey breeds along the seacoasts, rivers, and lakes of coastal North America, and winters in the West Indies, Central America, and South America (Roderick and Milner 1991).

In Washington, the osprey is common along large water bodies (the ocean, lakes, and large rivers) in lower-elevation forested landscapes throughout the state except for the Columbia Basin (Smith et al. 1997). Ospreys are less common at higher elevations, but have been found nesting as high as Ross Lake (1,600 ft elevation), and foraging in the Snoqualmie Pass and White Pass areas (Smith et al. 1997).

Habitat

Ospreys build large nests in live trees, on dead snags with flat, broken tops, or on artificial nest platforms, always near water (Smith et al. 1997; Roderick and Milner 1991). Nest trees are typically as tall or taller than surrounding structures. Sites that have additional perches within view of the nest are particularly attractive to ospreys (Zarn 1974).

Osprey pairs apparently vary in their tolerance of human disturbance (Van Daele and Van Daele 1982). Human activities initiated during early nesting and incubation are probably most disturbing to ospreys (Roderick and Milner 1991). Disturbance during this period may cause adults to leave the nest frequently or for extended periods, which can be fatal to embryos and nestlings (Van Daele and van Daele 1982; Levenson and Koplin 1984).

Ospreys feed almost exclusively on live fish captured at the water's surface. Although nests are generally built near productive water bodies, osprey hunting ranges have been estimated to extend as much as 6 to 9 miles from the nest (Henny 1986; Poole 1987; Sidle and Suring 1986).

Occurrence in the Cedar River Municipal Watershed

One to several pairs of osprey have nested annually within the Cedar River Municipal Watershed throughout the last three decades.

Potential foraging areas for osprey in the watershed include lakes, the reservoir, and riparian areas, especially Chester Morse Lake, Masonry Pool, Rattlesnake Lake, and Walsh Lake. Tall trees and snags adjacent to these bodies of water provide potential nesting habitat.

Pileated Woodpecker

Status

Legal Status. The pileated woodpecker (*Dryocopus pileatus*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The pileated woodpecker is a state candidate species in Washington.

Population Status. In the State of Washington, Breeding Bird Survey data show a significant population decline of 5.5 percent per year from 1966 to 1991 for the pileated woodpecker (Peterjohn 1991).

Range

The pileated woodpecker occurs from northern British Columbia south through the Pacific states to central California; in the northern Rockies through Idaho and western Montana; across southern Canada to Nova Scotia; and south to the Gulf Coast and Florida.

The pileated woodpecker is found throughout forested areas of Washington State, primarily at low to moderate elevations (Smith et al. 1997). They can exist in the city when there are suitable trees, and are found in several parks in Seattle including Seward Park, Discovery Park, and Camp long. The species does not occur in the dry, non-forested portions of the Columbia Basin (Smith et al. 1997).

Habitat

Pileated woodpeckers typically utilize mature and old-growth forests and second-growth forests with substantial numbers of large snags and fallen trees. West of the Cascade crest, pileated woodpeckers breed in forest stands older than 70 years (Mellen et al. 1992). They excavate large nest holes (three holes per year per pair on average) in snags or living trees with dead wood, generally excavating through hard outer wood into rotten heartwood. Typical tree species used as nest sites include western larch, black cottonwood, and ponderosa pine east of the Cascade crest, and Douglas fir, grand fir, and western white pine, where available, west of the Cascade crest (Bull 1987; Mellen 1987; Nelson 1988; Lundquist and Mariani 1991). Most nest trees are hard snags with bark and broken tops (Roderick and Milner 1991). In a study in the Oregon Coast Range, nest

trees averaged 28 inches dbh, while in a northeastern Oregon study nest trees averaged 33 inches dbh (Bull 1987; Mellen 1987; Mellen et al1992). Typical nest trees in the northeastern Oregon study had been dead more than 10 years, had a broken top, and an absence of limbs near the cavity.

Pileated woodpeckers also use tree cavities for roosting. In the northeastern Oregon study, these cavities were in hollow live or dead trees, mainly in stands of old-growth grand fir (Bull et al. 1992; Mellen et al. 1992)

Pileated woodpeckers forage mainly by excavating wood and chipping bark from large-diameter dead and down logs, stumps, snags, and live trees (USDI 1996d). They feed primarily on ants, beetle larvae, and other insects (Bull et al. 1992). West of the Cascade crest, they spend most time foraging in forest stands older than 40 years, and in deciduous riparian areas (Mellen et al. 1992). They seldom forage in clearcuts, but they are known to feed in timber harvest debris in shelterwood cuts.

Occurrence in the Cedar River Municipal Watershed

The pileated woodpecker is considered common and is known to breed in the Cedar River Municipal Watershed.

Potential nesting and foraging habitat for pileated woodpeckers in the Cedar River Municipal Watershed is found within late-successional and old-growth conifer forests.

Rufous Hummingbird

Status

Legal Status. The rufous hummingbird (*Selasphorus rufus*) currently is not a listed species, candidate species, or species of concern at the federal level or state level in Washington.

Population Status. Concern for this Neotropical migrant species stems from consistent marked declines in rufous hummingbirds detected during the Breeding Bird Survey (BBS) throughout the western portion of its range (Sauer et al. 1997). Between 1966 and 1996, BBS detections of this species exhibited a declining trend of approximately 2.7 percent per year. This translates to population decline of approximately 50 percent over a 25-year period (Sauer 1992). The causes of this decline are unknown.

Range

The rufous hummingbird occurs from southeastern Alaska south through Washington and Oregon, to northwestern California and southern Idaho. It is found throughout western and central Washington, and also in the Blue Mountains and northeastern corner of the state (Smith et al. 1997).

Habitat

Rufous hummingbirds forage over a great variety of habitats, mainly where nectar-producing flowers are available, from valley bottoms to meadows above treeline. They nest in a variety of trees, shrubs, and vines, favoring low, sloping branches of conifers (Zeiner et al. 1994). Diet also includes insects, which are gleaned from flowers and foliage or hawked from the air (Zeiner et al. 1994; Sauer et al. 1997).

Occurrence in the Cedar River Municipal Watershed

Rufous hummingbirds are considered common and are known to breed in the Cedar River Municipal Watershed.

Potential habitat for the rufous hummingbird in the watershed includes meadow complexes, riparian areas, shrub communities, and other areas where nectar-producing flowers are abundant.

Three-toed Woodpecker

Status

Legal Status. The three-toed woodpecker (*Picoides tridactylus)* is not a listed species, candidate species, or species of concern at the federal level in Washington. The three-toed woodpecker is a state monitor species in Washington.

Population Status. Smith et al. (1997) consider the species to be uncommon in Washington. Some of the concern for this species is related to its need for mature, insect-infested timber that has heart rot and bark beetles (Goggans, et al. 1989).

Range

The three-toed woodpecker occurs throughout boreal forests from Alaska, across Canada to Newfoundland, and south into forests of Washington and Oregon, the Rocky Mountains, and New England. It also occurs in northern boreal forests of Eurasia (American Ornithologists' Union 1983).

In Washington, the three-toed woodpecker is an uncommon species that occurs in high-elevation conifer forests in the Cascades, in the northeastern part of the state, and the southeastern part of the state in the Blue Mountains (Smith et al. 1997).

Habitat

Three-toed woodpeckers are generally found in high-elevation, closed-canopy, dense forests, but will utilize open habitats and burns (Smith et al. 1997). This species is found primarily in spruce and true fir forests, but it is also found in lodgepole pine and mixed-conifer forests above 4,500 ft elevation (Bull et al. 1986; Goggans et al. 1989).

Three-toed woodpeckers are cavity nesters. In the Deschutes National Forest of Oregon, three-toed woodpeckers were found to excavate nest cavities in dead and, occasionally, live lodgepole pine trees with heart rot and a mean dbh of 11 inches (Goggans et al. 1989). In addition, roosting occurred in cavities of soft snags in dense, unlogged stands of lodgepole pine or mixed conifer with lodgepole pine (Goggans et al. 1989). This woodpecker feeds mainly on wood-boring insects in dying or recently dead lodgepole pines or Engelmann spruce (Goggans et al. 1989).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of the three-toed woodpecker have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date.

Potential habitat for the three-toed woodpecker in the municipal watershed includes high-elevation mature to old-growth forests.

Vaux's Swift

Status

Legal Status. Vaux's swift (*Chaetura vauxi*) is not a listed species, candidate species, or species of concern at the federal level in Washington. Vaux's swift is a candidate species at the state level in Washington.

Population Status. Breeding Bird Survey data for Washington indicate a significant decline in the number of Vaux's swifts during the 1982-1991 period (Bull and Collins 1993). Concern over the welfare of the Vaux's swifts relates primarily to their use of large, hollow trees for nesting and roosting (Roderick and Milner 1991; Bull and Collins 1993).

Range

Vaux's swifts breed in western North America, from southeastern Alaska and British Columbia south and east into northern Idaho, western Montana, and northeastern Oregon, and south into Washington, Oregon, and northern California (Bull and Collins 1993). The species winters from central Mexico to northern South America (Ehrlich et al. 1988).

Vaux's swift occurs throughout Washington State except for the driest parts of the Columbia Basin (Smith et al. 1997).

Habitat

The species nests in late-successional coniferous forests (Manuwal and Huff 1987; Bull and Collins 1993). In a survey of forests in the southern Washington Cascades, significantly more Vaux's swifts were counted in old-growth forest stands compared with younger seral-stage stands (Lundquist and Mariani 1991).

Vaux's swifts require large, hollow snags or cavities in the broken tops of live trees for nesting and night roosting (WDNR 1996). Nest snags on the west side of the Cascades are at least 39 ft tall and 25 in dbh (Brown et al. 1985). Bull and Cooper (1991) documented 21 Vaux's swift nests in a study in northeastern Oregon. All 21 nests were in large grand fir trees (26.4 inches mean dbh) hollowed out by a fungus and with an entrance excavated by pileated woodpeckers. The nest trees were mainly in old-growth forest stands. In a second study in northeastern Oregon, Bull and Hohmann (1993) found considerably more Vaux's swift nests in old-growth forest stands than in stands that had been logged in some manner. Occurrence of swifts appeared to be related to the number of dead grand fir trees that were at least 20 inches dbh (Bull and Hohmann 1993). Interestingly, swift nests were found in harvested areas if hollow trees remained (Bull and Hohmann 1993).

In fall, Vaux's swifts congregate in large flocks, and hundreds of swifts may use a single large hollow tree for night roosting. Bull (1991) described two roosts in broken-topped, hollow, live grand fir trees in old-growth forest stands in northeastern Oregon. Up to 400 swifts roosted in one of the trees.

Vaux's swifts feed on flying insects (Bull and Collins, 1993), primarily over the forest canopy or open water. Brown (1985b) reported that swifts forage over all seral stages of forest. Bull and Beckwith (1993) reported that they show a strong preference for foraging over open water.

Occurrence in the Cedar River Municipal Watershed

Vaux's swift are present and known to breed in the Cedar River Municipal Watershed.

Potential nesting habitat in the watershed for Vaux's swift includes hollow snags in old-growth forests.

Western Bluebird

Status

Legal Status. The western bluebird (*Sialia mexicana*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The western bluebird is a monitor species at the state level in Washington.

Population Status. In western Washington, the western bluebird has undergone a drastic and well-documented decline during the twentieth century, which has been attributed to a combination of competition with house sparrows (*Passer domesticus*) and European starlings (*Sturnus vulgaris*), widespread removal of snags used as nest trees (bluebirds are cavity nesters), and overall reductions in prey populations (Sharpe 1993, as cited in Smith et al. 1997).

Range

The western bluebird breeds in southern British Columbia and central Montana, south in mountainous areas to northern Baja California and Mexico (Terres 1980). In Washington, the western bluebird is locally common in open conifer forests, farmlands, and steppe habitats on the east side of the Cascades, and in the northeastern and extreme southeastern parts of the state (Smith et al. 1997). It has been virtually eliminated from western Washington except for the Fort Lewis area and a few other locations (Smith et al. 1997).

Habitat

The western bluebird occurs in open oak and coniferous woodlands, natural forest openings and small clearings, burned areas with snags, small agricultural fields (especially fallow fields) and pasture areas, and the forest-steppe ecotone (eastern Washington) (Smith et al. 1997).

The western bluebird builds its nest in natural cavities of oaks and pines and in abandoned nest holes of woodpeckers. Western bluebirds are attracted to and often use nest boxes placed in open areas near forest edge.

The western bluebird is primarily an insectivore (Bent 1949). Typical insects in the diet include grasshoppers, beetles, ants, flies, and caterpillars. Plant items include small fruits such as currants and elderberries.

Occurrence in the Cedar River Municipal Watershed

Western bluebirds are present intermittently in the Cedar River Municipal Watershed and their occurrence is considered incidental. No comprehensive surveys have been conducted and no nests or breeding activity have been documented within the Cedar River Municipal Watershed to date.

Potential habitat for the western bluebird in the watershed includes naturally open habitats, open wetlands, open riparian habitats, and natural forest openings and other forest clearings, particularly where snags are present.

Willow Flycatcher

Status

Legal Status. A subspecies of the willow flycatcher (*Empidonax traillii*), the "little" willow flycatcher (*E. t. brewsteri*), is a federal species of concern in Washington. The willow flycatcher is not a Washington State threatened, endangered, or candidate species.

Population Status. According to Smith et al. (1997), "Washington breeders are representative of the western subspecies *E. t. brewsteri* (American Ornithologists' Union 1957)…Breeding Bird Survey data for Washington show a significant population increase of 8.4 percent per year from 1966 to 1991 (Peterjohn 1991)."

Range

The willow flycatcher breeds throughout most of the coterminous United States, and into southern Canada. The species winters from Mexico to Panama.

In Washington, the willow flycatcher is a common breeding species in lower-elevation wetlands, shrub wetlands, riparian areas, and clearcuts on both sides of the Cascades, on the Olympic Peninsula, in the southwestern part of the state, and in the northeastern and extreme southeastern parts of the state (Smith et al. 1997).

Habitat

The willow flycatcher is commonly associated with low, dense shrubby vegetation, including riparian areas (especially willow thickets), shrubby wetlands, alder thickets, and dense stands of salmonberry and blackberry. In drier areas, the willow flycatcher is almost exclusively a riparian species (Sedgwick and Knopf 1992), occurring in willow thickets and stands of non-native tamarisk. In western Washington lowlands (western hemlock zone), willow flycatchers have been observed using shrubby habitats in regenerating clearcuts (Sharp 1992) and in sapling stands between 10 and 20 years old (WDNR 1996).

Nests are typically built in slanting or upright forks of deciduous shrubs or small trees between 3 and 25 ft above the ground (DeGraaf et al. 1991). They commonly nest in such species as alder, dogwood, willow, elderberry, blackberry, and viburnum (WDNR 1996).

Willow flycatchers feed primarily on flying insects by sallying from a perch (Ehrlich et al. 1988). They often use exposed perches for singing and foraging (Sharp 1992).

Occurrence in the Cedar River Municipal Watershed

Willow flycatchers are present and known to breed in the Cedar River Municipal Watershed.

Potential habitats for the willow flycatcher in the municipal watershed include wetlands, riparian areas, persistent shrub communities, natural forest openings, and meadow complexes, primarily within the western hemlock zone, at lower elevations.

FISH

Coastal Cutthroat Trout, Sea-Run

Status

Legal Status. The anadromous or sea-run form of the coastal cutthroat trout (*Oncorhynchus clarki clarki*) is currently under status review for listing under the Endangered Species Act. One stock, in the Umpqua River in Oregon, has been listed as Endangered under the ESA because of its geographic isolation, genetic distinctiveness, and low population size.

Population Status. Although the status of all Washington sea-run stocks has not been fully assessed, most are considered depressed or critical because of severe habitat degradation and chronically low returns (NOAA 1997). Habitat degradation has resulted from many factors, including stream diversion, urban development, agriculture, timber harvest, and road construction. Adverse impacts of habitat degradation include increased stream temperature and light regime, decreased supply of large woody debris, reduced dissolved oxygen concentration, altered streamflow, increased fine sediment, increased coarse sediment, altered nutrient supply, and blockage to migration (Palmisano et al. 1993). All forms of the coastal cutthroat trout appear to be highly vulnerable to logging activities, showing marked population declines for 6-8 years following clearcutting in Oregon (Behnke 1992). Sea-run coastal cutthroat are at some risk of extinction due to pervasive continuing declines (Nehlsen et al 1991 as reported in Behnke 1992).

In the Lake Washington Basin, the coastal cutthroat trout is the only species of cutthroat trout known to naturally occur and is present in both resident and anadromous forms. The population of sea-run cutthroat in the Lake Washington Basin is most likely a native stock, although coastal cutthroat were stocked in numerous Lake Washington streams as early as 1895 by the U.S. Bureau of Fisheries (Crawford 1979). Between 1932 and 1946, cutthroat trout brood stock were also obtained from several Lake Washington tributaries (Crawford 1979). Hatchery programs for sea-run cutthroat trout are no longer in operation in Puget Sound (Leider 1995).

In recent years, resident cutthroat trout have increased in abundance in the Lake Washington Basin (Fresh 1994). Widespread urbanization around Lake Washington has created more marginal conditions that cutthroat trout are able to use more successfully than other trout and salmon. (Ludwa et al. 1997, Scott et al. 1986). Notably, in areas of co-occurrence with other salmonid species, cutthroat trout appear to take a subdominant role (Johnson et al. 1994); therefore, apparent population increases in the Lake Washington Basin may reflect increased availability of marginal habitats, from which other salmonid species have disappeared as a result of habitat degradation. Cutthroat trout are also the primary fish caught recreationally, as documented by recent creel

surveys conducted by the WDFW, although some of these fish are a cutthroat trout/rainbow trout hybrid (Pfeifer, B., WDFW, 1998, personal communication). Data on the number of adult sea-run cutthroat trout entering the basin via the fish ladder at the Ballard Locks is unavailable.

Range

The coastal cutthroat trout (*O. c. clarki*) is one of 13 subspecies of cutthroat trout (*O. clarki*) indigenous to North America. The range of this subspecies extends northward along the Pacific Coast from the Eel River in northern California to the Prince William Sound region of southeast Alaska, with the Cascade Mountain Range creating the eastern boundary (Johnson et al. 1994). This subspecies exhibits both resident fluvial and adfluvial life history patterns (nonmigratory) and is the only subspecies to also exhibit an anadromous (sea-run) life history pattern (Behnke 1992).

Habitat

The life history of the coastal cutthroat is probably the most complex and flexible of any Pacific salmonid (Wydoski and Whitney 1979; Johnson et al. 1994). Cutthroat trout in the Lake Washington Basin exhibit fluvial, adfluvial, and anadromous life histories. Little is known about the relative proportion of each life history in this population, however there is little evidence that a large portion of the Lake Washington population exhibits an anadromous life history pattern.

Coastal cutthroat trout spawn in the smallest headwater streams and tributaries used by any salmonid species, and the young usually remain in these streams about a year before moving down into larger streams (Palmisano et al. 1993). Individuals that migrate to the sea live in these larger streams for another 2 - 5 years (usually 3) before migrating to the Pacific Ocean (Wydoski and Whitney 1979; Johnson et al. 1994). Because sea-run cutthroat spend a considerable proportion of their life cycle in fresh water, stream rearing habitat is a major factor in their survival and productivity (Palmisano et al. 1993). Some stocks, primarily those with limited or no possibility of return migration from the ocean, remain as residents of small headwater tributaries, or migrate only into rivers or lakes (Scott and Crossman 1973; Johnson et al. 1994). Sea-run cutthroat do not migrate to the open ocean; rather, they stay in estuarine habitats near the mouths of their migratory streams for 5-8 months of the year (Palmisano et al. 1993; Johnson et al. 1994). Upstream migration to freshwater feeding/spawning areas occurs from late June through March; re-entry timing is consistent from year to year within streams, but varies widely between streams (Johnson et al. 1994). Spawning generally occurs between December and May in the tails of pools located in streams with low gradient and low flows or in shallow riffles (Wydoski and Whitney 1979; Johnson et al. 1994). Eggs are usually laid under coarse gravel about the size of a walnut (Wydoski and Whitney 1979). Preferred water temperatures for spawning and incubation range from 6°C to 17°C; cutthroat are generally not found in waters above 22°C (Johnson et al. 1994).

Occurrence in the Cedar River Municipal Watershed

The City's water diversion structures prevent coastal sea-run cutthroat from potentially accessing stream habitat in the watershed above the Landsburg Dam. Prior to construction of the dam, returning adults would have been able to access 17 stream miles in the mainstem Cedar River and tributaries between the naturally impassable Cedar

Falls and the Landsburg Dam location. Currently, only the Walsh Lake subbasin in the watershed is potentially accessible to coastal sea-run cutthroat because this subbasin is connected to the Cedar River at a location below the dam (see Map 1). Although coastal cutthroat trout are widespread in this subbasin, it is unknown if sea-run individuals use this habitat.

Resident cutthroat trout are also widely distributed in many of the tributaries downstream of Cedar Falls (see Map 7). They have not been found in the upper municipal watershed. Potential habitats for this species in the watershed include well-shaded headwater streams with areas of low-gradient gravels suitable for redd construction.

Kokanee

Status

Legal Status. Kokanee (*Oncorhynchus nerka*) is not listed as an endangered, threatened, or candidate species at the federal level in Washington State. Kokanee is a resident freshwater form of the sockeye salmon, and is classified as a game fish species in Washington (WDW 1993).

Population Status. Kokanee populations generally exist independently of anadromous sockeye runs, although both forms can be found seasonally in the same lake. Kokanee and sockeye salmon presumably diverged from a common anadromous stock in recent geological time (Ricker 1940, as cited in Burgner 1991).

Range

Kokanee occur naturally in lakes from Japan around the Pacific Rim along the northwest coast of North America to Oregon, and into the Columbia Basin (Scott and Crossman 1973). Native kokanee are present in many Washington lakes, including Lake Washington and Lake Sammamish (Wydoski and Whitney 1979). They have also been successfully introduced into a number of inland lakes. Historical records indicate that kokanee were stocked throughout King County during the first half of the twentieth century, although the locations of where fish were planted is often nondescript.

Habitat

Kokanee typically inhabit deep, cool lakes and reservoirs. Their life history patterns and habitat needs are similar to those of the sockeye salmon, except that kokanee remain in fresh water and do not migrate to marine waters. Also, their smaller body size necessitates the use of smaller gravels for redd construction (Burgner 1991). Adults migrate into tributaries where spawning occurs in clean riffles, usually at temperatures between 37° and 45° F (Scott and Crossman 1973).

From Lake Washington, kokanee spawn in some of the smaller tributaries such as Juanita Creek, Bear Creek, and Swamp Creek (Wydoski and Whitney 1979). In the lake, some spawning also occurs along gravel lakeshores (WDW 1993). In this system, spawning takes place between early November and mid-January, with a peak in mid-November. Fry migrate to the lake between January and April, mostly in March (Wydoski and Whitney 1979).

Generally, kokanee spend 4 years in lake habitats before they mature, spawn, and die (Scott and Crossman 1973). Kokanee living in lakes exhibit a temperature preference of 50° to 59° F; the upper lethal temperature for young sockeye salmon is about 75° F (Scott and Crossman 1973). Kokanee use the upper third of a lake's water column, feeding primarily on zooplankton and aquatic insect larvae (Scott and Crossman 1973; Wydoski and Whitney 1979).

Because of the kokanee's diet and open water habitat, it competes very little with other fish, even those that feed upon plankton (Scott and Crossman 1973). Ongoing studies in Lake Washington however, have identified longfin smelt as a potential competitor during the first 1 or 2 months of lake rearing by sockeye fry. Although it is not uncommon for a lake to support both sockeye salmon and kokanee, the similarity of their diets suggests the potential for competition between these two forms (Burgner 1991).

Occurrence in the Cedar River Municipal Watershed

The presence of kokanee in Walsh Lake has been known to several people for at least a decade. The first systematic scientific survey that confirmed and documented their presence, however, was conducted only recently, in 1997 (Appendix 23). The same survey discovered bright-red kokanee spawning in October in Webster Creek, a small Walsh Lake tributary. It is unknown whether this population is native to the lake or was planted, but the probability is that the fish were most likely planted sometime during the recent past or during the first half of the twentieth century. Kokanee were not collected during a 1977 University of Washington fish survey (Congelton et al. 1977), and they were not mentioned in water quality reports from the 1920s.

Walsh Lake is the only lake within the Cedar River Municipal Watershed that was historically accessible to the anadromous form of sockeye because of the natural barrier to anadromous fish at lower Cedar Falls on the mainstem Cedar River. Kokanee are not known to have been stocked or to presently occur in any other lake or basin within the Cedar River Municipal Watershed.

Pacific Lamprey

Status

Legal Status. The Pacific lamprey (*Lampetra tridentatus*) is a federal species of concern in Washington. The species has no designated listing status at the state level in Washington.

Population Status. The limited amount of ecological information currently available about Pacific lamprey is insufficient to evaluate the species' population status in Washington State. However, in Oregon, this species is considered a species of concern, due primarily to its apparent widespread decline. Although the reasons for this decline are poorly understood, it is likely due to conditions both in oceanic and freshwater habitats; passage past hydroelectric and irrigation dams may also be a contributing factor (ODFW 1996). Notably, a related species, the Arctic lamprey (*Lampetra japonica*), faces significant mortality in late spring and summer when low stream levels leave burrowed ammocoetes (larvae) stranded in dry stream edges (Scott and Crossman 1973).

Range

The Pacific lamprey is found in coastal streams from southern California to the Gulf of Alaska; in Washington it occurs in most large coastal rivers (Wydoski and Whitney 1979). Scott and Crossman (1973) describe this species as "penetrating all major rivers, often to headwaters." Pacific lamprey have been seen in the Green River, sometimes spawning on steelhead redds (Foley, S., WDFW, June 29, 1998, personal communication).

Habitat

Like the river lamprey, the Pacific lamprey exhibits an anadromous life history, although landlocked populations have been reported from California, Oregon, and British Columbia (Wydoski and Whitney 1979; ODFW 1996). Adults are parasitic on a wide variety of fish, including sockeye and pink salmon (Scott and Crossman 1973). Between July and October, maturing Pacific lampreys enter streams, gradually move upstream, and spawn the following spring (Hart 1973). The nest usually consists of a shallow depression built in gravel and rock substrates, or in sandy gravel at the upstream edge of a riffle (Hart 1973; Scott and Crossman 1973). Eggs hatch in 2 - 4 weeks (19 days at 59° F); newly hatched larvae remain in their nests for 2 - 3 weeks before drifting downstream and burying themselves in mud at the bottom of pools, or other areas of soft mud and sand (Hart 1973; Moyle 1976). They remain as filter-feeders, subsisting on algae and organic matter for at least 5 years; if a particular area's food supply is exhausted, ammocoetes may emigrate to another area of the stream (Moyle 1976). Increased water flows during runoff can also encourage outmigration, by washing away sand and silt the larvae require for anchoring themselves to the bottom (Hardisty and Potter 1971). After transformation, Pacific lampreys migrate downstream in spring and start parasitic life soon thereafter. The length of the parasitic life phase is uncertain (Hart 1973; Wydoski and Whitney 1979). Adults die after spawning.

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Pacific lamprey have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, some dead Pacific lamprey been confirmed below the Landsburg Diversion Dam (Foley, S., WDFW, June 29, 1998, personal communication).

Potential habitat for this species probably includes streams with gravel and small rock substrates for spawning, and downstream areas of soft mud or sand for rearing.

River Lamprey

Status

Legal Status. The river lamprey (*Lampetra ayresi*) is a federal species of concern in Washington, and is a candidate species at the state level in Washington.

Population Status. Little is known regarding the status of river lamprey populations in Washington. Population declines of the related Pacific lamprey (*Lampetra tridentatus*), primarily the result of destruction of spawning and rearing habitat, have prompted concern for the river lamprey species. Results of trawl surveys and surveys of sockeye

smolts at the Ballard Locks indicate that river lamprey are a relatively common species in Lake Washington (Fresh, K., WDFW, 1998, personal communication).

Range

River lamprey have been collected from coastal streams and rivers from San Francisco Bay north to Juneau, Alaska (Wydoski and Whitney 1979). Scott and Crossman (1973) report that this species has been found in fresh and salt water across the same range. According to Wydoski and Whitney (1979), no detailed distribution records are available for Washington, but the species probably occurs in most major rivers. The regional distribution or river lamprey is relatively unknown because species identification of juvenile fish is rarely performed during river and stream surveys.

Habitat

Little is known regarding the habitat requirements of the river lamprey. Adults are anadromous and parasitic on a wide variety of fish, including coho salmon and kokanee (Scott and Crossman 1973), and on sockeye smolts while in the freshwater phase in Lake Washington (Warner, E., Muckleshoot Indian Tribe, 1998, personal communication). River lamprey larvae (ammocoetes) remain in their natal streams for several years, usually in silt-sand backwaters and eddies near the bank (Hart 1973). The ammocoetes are toothless, and they feed on microscopic plants and animals (Scott and Crossman 1973; Hart 1973). In the final stages of metamorphosis, lampreys congregate just upstream from salt water, entering the ocean in late spring (Moyle et al. 1995). After transformation, lampreys apparently spend only 3-4 months in salt water, where they grow rapidly. Adults migrate back into freshwater in the fall, and spawn in the winter and spring in clean gravel areas of small tributaries (Moyle et al. 1995). Adults die after spawning.

Occurrence in the Cedar River Municipal Watershed

River lampreys are present and known to breed in tributaries of the Cedar River as far upstream as the Landsburg Diversion Dam. However, no comprehensive surveys have been conducted upstream of the Diversion Dam and no determination of the species' presence or absence within the Cedar River Municipal Watershed has been established.

Similar to the Pacific lamprey, potential habitat for the river lamprey probably includes streams with gravel and small rock substrates for spawning, and downstream areas of soft mud or sand for rearing.

MAMMALS

Big Brown Bat

Status

Legal Status. The big brown bat (*Eptesicus fuscus*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about big brown bats is insufficient to evaluate the species' population status in Washington State.

Range

The big brown bat occurs from Alaska and Canada south through the United States and Mexico to northern South America, including the Caribbean islands. It occurs throughout Washington, however, it is less common in alpine areas and perhaps less common in the driest parts of the Columbia Basin (Johnson and Cassidy 1997).

Habitat

The big brown bat is considered one of the most versatile of bats (Johnson and Cassidy 1997). In Washington, it has been found in almost every location where surveys have been conducted, although it is less common in alpine and steppe habitats (Johnson and Cassidy 1997). In wet coniferous forests such as those in western Washington, males occur at higher elevations than females (Johnson and Cassidy 1997). The big brown bat is closely associated with man, and uses human structures readily, even in urban areas (Johnson and Cassidy 1997).

Favored roost sites of the big brown bat are in buildings (Barbour and Davis 1969). In summer, the bats form colonies in attics and barns, behind shutters or unused sliding doors, between expansion joints beneath bridges or in similar shelters. Occasionally hollow trees and bark are used. West of the Mississippi River, these bats frequently use rock crevices and sometimes quarry tunnels. Maternity roosts are in buildings, under bridges, in snags, and in caves and mines (Christy and West 1993). In winter, they hibernate singly or in small groups in buildings, caves, mines, tunnels, quarries, storm sewers, and other similar shelters (Barbour and Davis 1969).

Big brown bats are insectivorous. The bulk of their diet consists predominantly of moths, flies, bugs, and beetles. They forage in a variety of locations, including over water, under forest canopies, along roads, in clearings and even in urban areas (Johnson and Cassidy 1997).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of big brown bats have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, Perkins (1988) documented big brown bats at two sites within 3 miles of the watershed during surveys in July 1988. Based on this observation and because the watershed is within the geographic and elevation range of the species in Washington, and because suitable roosting and foraging habitat is present, there is high likelihood that big brown bats occur, at least during summer, in the Cedar River Municipal Watershed. However, few potential natural hibernacula have been identified within the watershed, although a limited number of potential human-created hibernacula (buildings, mines) do exist.

Potential foraging habitats for big brown bats in the municipal watershed include mature to old-growth forests, forested areas in aquatic and riparian areas, open wetlands and other open water bodies, and naturally open habitats (meadows and persistent shrub communities). Potential roosting habitat includes bridges, buildings, snags, caves, cliffs, and rock outcrops.

California Myotis

Status

Legal Status. The California myotis (*Myotis californicus*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. Johnson and Cassidy (1997) consider the California myotis to be common in forested areas, and widely distributed but less common in steppe habitats in Washington. Little quantitative information is published on the status of California myotis populations in Washington.

Range

The California myotis can be found in most forested habitats in Washington, and occasionally in the steppe zone of eastern Washington, especially along watercourses (Johnson and Cassidy 1997).

Habitat

Little is known about the habitat requirements of this species (Johnson and Cassidy 1997). It probably does not breed at high elevations (Johnson and Cassidy 1997). In a field study in the southern Washington Cascades and the Oregon Coast Range, Thomas (1988) captured more California myotis in the western Cascades than in the eastern Cascades and the Oregon Coast Range. He also detected myotis bats (including California myotis) more frequently in old-growth Douglas-fir forests than in mature and young Douglas-fir forest (Thomas 1988). He hypothesized that the higher activity in old-growth stands "likely reflects an increased diversity and/or abundance of day roosts compared with young and mature stands" (Thomas 1988).

Roosting habitat for the California myotis includes buildings, bridges, hardwood foliage, bark, rock crevices, caves, mines, and snags (Christy and West 1993). Maternity roosts are in buildings, under bridges, and in caves and mines (Christy and West 1993). Buildings, caves, and mines are used as hibernacula (Christy and West 1993). Perkins et al. (1990) found hibernating bats in two caves in Oregon, and documented 19 records of California myotis hibernating in buildings.

California myotis are insectivorous. The bulk of their diet consists predominantly of moths, flies, bugs, and beetles. Thomas (1988) found that feeding rates for myotis bats (including California myotis) in the southern Washington Cascades and Oregon Coast Range averaged 10 times higher over water than in forest stands. He concluded that forest stands are not primary feeding sites for these bats.

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of California myotis have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, because the watershed is within the geographic and elevation range of the species in Washington, and because suitable roosting and foraging habitat is present, there is moderate to high likelihood that California myotis occur, at least during summer in the Cedar River Municipal Watershed. However, few potential natural hibernacula have been identified

within the watershed, although a limited number of potential human-created hibernacula (buildings, mines) do exist.

Potential foraging habitat for the California myotis in the municipal watershed includes open wetlands and other open water bodies, and naturally open habitats (meadows and persistent shrub communities). Potential roosting habitat includes old-growth forest, bridges, buildings, caves, cliffs, and rock outcrops.

Canada Lynx

Status

Legal Status. The Canada lynx (*Lynx canadensis*) has been proposed for listing as threatened under the Endangered Species Act by the U.S. Fish and Wildlife Service (Fed. Reg., July 8, 1998, Vol. 63, No. 130, pp. 36993-37013). The Canada lynx is a threatened species at the state level in Washington. The lynx is also considered a sensitive species by the U.S. Forest Service.

Population Status. Washington's lynx population is estimated to be between 96 and 191 individuals, with the populations responding largely to the abundance of their primary prey, snowshoe hare (WDW 1993c). In northern regions, where hare populations are strongly cyclical, lynx populations fluctuate widely; this pattern appears to be absent in the southern portion of the lynx's range (including Washington State), where lynx and snowshoe hares exhibit life history characteristics similar to those occurring during hare populations lows further north (Ruggiero et al. 1994). In this region, Koehler (1990) found high rates of kitten mortality during the snow-free season in north-central Washington, with only one kitten surviving to the winter from eight kittens present among three litters in July. Primary human-associated threats to lynx populations include the elimination of winter habitat for snowshoe hare and excessive trapping (Roderick and Milner 1991). Roads also provide a threat to lynx populations: lynx use roads for hunting and travel, which may make them more vulnerable to human-caused mortality (Ruggiero et al. 1994).

Range

Canada lynx in Washington are typically found at elevations above 3,200 ft (Brittell et al. 1989), and ranges from Canada into northeast and north-central Washington, eastward over the Cascade Crest and through the Okanogan Highlands into northern Idaho (McCord and Cardoza 1990; WDW 1993c; Ruggiero et al. 1994). Recent research has placed this species reliably as far south as the Yakima Indian Reservation, the Blue Mountains, and the Oregon Cascades (Thomas, T., Wildlife Biologist, U.S. Fish and Wildlife Service, Olympia, Washington, February 17, 1998, personal communication). In recent years, lynx have been found on the west side of the Cascade Crest only in the northern part of the North Cascades (Ruggiero et al. 1994). Ruediger and Naney (1994) identified primary and secondary habitat important to conservation of the lynx as part of the Lynx Conservation Strategy for the Western United States. In Washington, primary lynx habitat occurs primarily north of I-90 north to the Canadian border, while secondary lynx habitat occurs mostly in the Cascade Mountains from I-90 south to the Oregon border.

Habitat

Much of the information on lynx habitat use has been established in ecosystems (e.g., Okanogan Highlands, North Cascades) that are substantially different from those present within the municipal watershed (McCord and Cardoza 1990; Ruggiero et al. 1994). Therefore, the applicability of habitat associations documented in these areas to any lynx that may occur in the Cedar River Watershed is largely speculative.

Lynx are extremely wide-ranging, with home range size varying from between 7 and 115 square miles, depending on sex, age, season, and prey availability (WDW 1993c). This species typically occurs in very remote areas, using extensive tracts of dense forest that are interspersed with rock outcrops, bogs, and thickets (McCord and Cardoza 1990; Ruggiero et al. 1994). Lynx use a mosaic of forest types from early successional to mature coniferous and deciduous forest, as long as snowshoe hares are present (Ruggiero et al. 1994). In most areas, lynx forage primarily in early successional forests where snowshoe hares are plentiful; as a result, most lynx populations tend to rise and fall dramatically, tracking cyclical changes in snowshoe hare availability (Ruggiero et al. 1994). Populations in the southern portion of the range of the Canada lynx, however, do not exhibit the strong cyclical relationship with snowshoe hare abundance characteristic of more northern populations (Koehler 1990). Den sites for lynx tend to be located in patches of mature forest (less than 150 years) that are at least 5 acres in size; have abundant downed woody material; are undisturbed by humans; are within 3.4 miles of foraging areas; and are adjacent to natural travel corridors such as ridges and riparian areas (Koehler 1990; WDW 1993c).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Canada lynx have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, the Lynx Conservation Strategy (Ruediger and Naney 1994) places the watershed in the area designated as secondary lynx habitat within Washington State. High-elevation areas in the Cedar River Municipal Watershed offer vegetation types (mainly clearcuts), which may support adequate concentrations of snowshoe hare, and adjacent late-seral stands with potentially suitable denning structures. However, the small size of the watershed relative to lynx space requirements make it likely that only a few lynx would ever be resident in and include the watershed as a portion of their home range. In addition, the occurrence of reliable lynx sightings south of the watershed within the past 10 years suggests that an occasional individual may travel through the Cedar River Municipal Watershed (e.g., while dispersing).

Potential denning habitat for the lynx in the watershed includes late-successional forest above 3,500 ft elevation. Potential foraging habitat likely includes early seral coniferous forest, and other habitats where snowshoe hare are present.

Fisher

Status

Legal Status. The fisher (*Martes pennanti*) is a federal species of concern, and is listed as endangered at the state level in Washington.

Population Status. Fishers historically occurred at low densities throughout most of the forested areas of Washington (Lewis and Stinson 1998). The fisher was over-trapped in Washington in the 1800s and early 1900s, leading to population declines. Predator control programs and habitat loss and alteration (i.e., timber harvest) nearly caused the extirpation of the fisher in Washington early in the 1900s (Lewis and Stinson 1998). The fisher has been protected from legal harvest in Washington since 1933, but populations have not recovered.

Currently, the fisher is very rare in Washington (Lewis and Stinson 1998). Infrequent sighting reports and incidental captures indicate that a small number may still be present, but no one has been able to document the existence of a viable population in the state (Lewis and Stinson 1998). The lack of fisher detections despite extensive carnivore surveys since 1990, an average of less than four fisher sightings per year since 1980, and very few incidental captures by trappers all indicate that fishers are very rare in Washington and could be extirpated without intensive management efforts (Lewis and Stinson 1998).

Range

The present range of the fisher includes much of the forested region of Canada, New England, northern New York, and northern portions of Michigan, Minnesota, and Wisconsin. Historically, the fisher occurred as far south as Tennessee and North Carolina in the Appalachian Mountains. In the western United States, the fisher occurs in the northern Rocky Mountains, and in the Cascades, Coast Ranges, and Sierra Nevada of Washington, Oregon, and California (Lewis and Stinson 1998).

On the basis of Aubry and Houston's (1992) review of fisher records and sighting reports in Washington from 1985-1991, the fisher is currently believed to occur in the Cascades (north of Skamania County), in the Olympic Mountains, and in eastern Washington in portions of the Okanogan Highlands. It probably occurs in very low numbers and in a patchy distribution (Aubry and Houston 1992). The fisher apparently is no longer found in the Blue Mountains, southern Coast Range, southernmost Cascades, Kitsap Peninsula, and eastern edge of Puget Sound (Aubry and Houston 1992). West of the Cascade crest, all trapping records of this species are from locations below 5,400 ft elevation and most (87 percent) are from locations below 3,000 ft (Aubry and Houston 1992).

Habitat

Fishers typically use forests with high canopy closure, abundant large woody debris, large snags and cavity trees, and understory vegetation (Buck et al. 1983; Arthur at al. 1989; Jones 1991; Powell 1993; Seglund 1995). They also use a wide variety of vegetation types, including mixed conifer, western hemlock, Pacific silver fir, Sitka spruce, grand fir/Douglas-fir, subalpine fir, and lodgepole pine forests; riparian zones; and swamps (Brown 1985b; Aubry and Houston 1992). Riparian areas, cliffs, ridgelines, and lakeshores located in and adjacent to forests are used by fishers for foraging and as travel corridors (Buck et al. 1983). Buck et al. (1983), Jones and Garton (1994), and Seglund (1995) have shown the importance of riparian habitats for fishers, especially as travel corridors and rest sites (Lewis and Stinson 1998).

Good quality fisher habitat appears to be very diverse, including multi-aged stands interspersed with small openings and containing wetland and riparian habitats that help support a diverse prey base (Banci 1989). Mature and old-growth forests and forested

riparian areas with high canopy closure (at least 80 percent) seem to provide the most suitable habitat for this species, although second-growth and clearcuts can be used if sufficient cover is present (Buck et al. 1983; Jones 1991; Roy 1991; ODFW 1992; Jones and Garton 1994; Weir 1995). Stand age may not be as important as stand structural characteristics (e.g., large trees, snags, and large woody debris) that provide foraging, resting, and denning sites for fishers and also affect snow depth and density (Buskirk and Powell 1994; Powell and Zielinski 1994).

Fishers use a variety of structures in live trees and snags as rest sites, including cavities, witches' brooms, mistletoe clumps, large lateral branches, squirrel and woodrat nests, stick nests and forks (Lewis and Stinson 1998). Large diameter trees are used most often (Buck 1982; Seglund 1995; Weir 1995; Zielinski et al. 1997a). Fishers will also use hollow logs, stumps, log and brush piles, burrows, rock outcrops, and dense understory vegetation as rest sites (Lewis and Stinson 1998). Fishers appear to select rest sites based on thermal cover requirements; cavities and ground dens appear to be used more often in winter than are the more open live tree sites (Seglund 1995).

Female fishers typically use elevated cavities in live trees or snags as natal dens (Buck et al. 1983; Weir 1995; Aubry et al. 1996; Paragi et al. 1996). Maternal den trees are typically large (Lewis and Stinson 1998). When the young are older, the female may move them to a maternal den in a hollow, down log (Aubry et al. 1996). These conditions are usually found in forests greater than 80 years old (Thomas 1979). Holthausen et al. (1994) speculated that this specialized requirement for natal and maternal dens might have contributed to the fisher's decline in the Northwest as old-growth forests were cut and converted to even-age stands.

Allen (1983) estimated that at least 100 square miles of suitable, contiguous habitat with 80 percent tree canopy coverage is necessary for a population of fishers. Fisher home range sizes vary widely by region, but male home ranges in the Northwest typically are 15 to 31 square miles, while female home ranges are 8 to 15 square miles (Lewis and Stinson 1998). The fisher is characterized as a species that avoids humans (Douglas and Strickland 1987; Powell 1993).

The fisher's diet generally consists of snowshoe hares, small mammals, squirrels, porcupines, birds, and ungulate carrion (Lewis and Stinson 1998).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of fishers have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. A fisher sighting was recorded in the Cedar River Municipal Watershed in 1963, but despite numerous systematic surveys using track plates and camera stations (summarized in Lewis and Stinson 1998), no fishers have been detected in the vicinity of the Cedar River Municipal Watershed in recent years. Thus, although the watershed is within what is considered to be the current geographic and elevation (less than 5,900 ft) ranges of the fisher in Washington, and although at least some apparently suitable resting and foraging habitat occurs in the watershed, there is low probability that fishers presently occur in the Cedar River Municipal Watershed as resident individuals.

Potential denning and foraging habitat for the fisher in the municipal watershed includes mature, late-successional, and old-growth forests, particularly those below 3,000 feet

elevation. Forested riparian areas provide additional foraging habitat and travel corridors.

Fringed Myotis

Status

Legal Status. The fringed myotis (*Myotis thysanodes*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The fringed myotis is a monitor species at the state level in Washington.

Population Status. As with most bats, data regarding population levels and trends for this species are unavailable; as a group, bats in Washington remain virtually unstudied (Christy and West 1993). Reliable records for the fringed myotis in Washington are few and limited to the eastern portion of the state (Johnson and Cassidy 1997). This species may be uncommon in Washington (Perkins et al. 1990). Causes for concern about this species include its general rarity, sensitivity to disturbance, and reduced availability of foraging habitat.

Range

The fringed myotis is patchily distributed over a broad range, extending from south-central British Columbia south to southern Mexico, and east to western Colorado and New Mexico (ODFW 1996). In Washington, the known distribution of the fringed myotis is limited to drier areas in the southeastern part of the state, and possibly the foothills of the southwestern Cascades near Vancouver, Washington (Johnson and Cassidy 1997). Bats that were probably fringed myotis were found in Ape Cave near Mount St. Helens in the 1960s, but heavy human use of the cave apparently caused the bats to move (Johnson and Cassidy 1997).

Habitat Needs

Habitat for the fringed myotis varies considerably, depending on seasonal and diurnal activity patterns. Between October or November and March or April, this species hibernates in caves, mines, rock crevices, or buildings (Christy and West 1993). After springtime emergence, the fringed myotis usually forages over water, along forest edges, and over open habitats; diet consists of beetles, moths, arachnids, and orthopterans, which are caught on the wing or gleaned from foliage (Christy and West 1993; Zeiner et al. 1990). During the day, fringed myotis roost singly in caves, mines, rock crevices, buildings, or under bridges. Similar habitats, although often in separate locations, provide nighttime roosts between feeding forays (Christy and West 1993). Most temperate bat species migrate relatively short distances (6.2 - 310.7 miles) to and from hibernation sites, although some individuals or populations may not migrate at all (Christy and West 1993). The fringed myotis is susceptible to human disturbance at roost sites (ODFW 1996; Zeiner et al. 1990).

From late April to September, pregnant and nursing females collect in large maternity colonies of up to 200 individuals; maternity roosts occur in caves, mines, and buildings (Zeiner et al. 1990; Christy and West, 1993). Temperature and humidity within hibernacula and maternity colonies must fall within certain narrow ranges to be suitable for most bat species, including the fringed myotis. Sites of maternity colonies are generally quite warm, while hibernacula must be cool (Christy and West 1993).

Reproductive rates for myotis species are generally low, with females giving birth to one offspring per season (Christy and West 1993).

Although nonbiotic habitat features, such as caves, rock crevices, and water, appear to provide the crucial elements of the fringed myotis' life requisites, forest age also appears to play a role. Foraging activity drops substantially in areas that have been recently clearcut (Christy and West 1993). In the Oregon Coast Range, Thomas and West (1991) detected big brown bats and fringed myotis in old-growth forest 3.3 times more frequently than in mature and young forest.

The fringed myotis appears to be associated primarily with xeric forest types. In British Columbia, the fringed myotis is associated with arid grassland and ponderosa pine/Douglas-fir forest (Johnson and Cassidy 1997). Optimal habitats in California are pinyon-juniper, valley foothill hardwood, and hardwood-conifer, generally between 4,000 and 7,000 ft elevation (Zeiner et al. 1990). In Oregon however, most records for this species come from counties along the coastal strip, where mesic and moist forest types are more common (ODFW 1996).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of fringed myotis have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. In addition, the watershed is not within the recognized or expected range of fringed myotis (reliable censuses lack in the region), no caves have been identified within the watershed, and although potential roost sites (rock crevices, buildings) do exist, it is unknown whether these provide suitable temperature and humidity regimes to support hibernacula or maternity colonies. Also, because ecological information about this species is severely lacking, it is not possible to evaluate the habitat suitability or assess habitat quality of forest types present in the watershed for fringed myotis. However, despite these potential constraints, there is a low to moderate likelihood that fringed myotis may occur in the Cedar River Municipal Watershed.

Potential foraging habitat for the fringed myotis in the municipal watershed includes open wetlands and other open water bodies, forest edges, and naturally open habitats (meadows and persistent shrub communities). Potential roosting habitat includes bridges, buildings, caves, cliffs, and rock outcrops.

Hoary Bat

Status

Legal Status. The hoary bat (*Lasiurus cinereus*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about hoary bats is insufficient to evaluate the species' population status in Washington State.

Range

The hoary bat is the most widespread of all bat species in the United States, occurring in all 50 states (Peterson 1964). It also occurs in the southern two-thirds of Canada and most of Mexico (Peterson 1964).

The hoary bat occurs primarily as a summer resident in low- to mid-elevation wooded areas throughout Washington. In the Columbia Basin it is found only where trees occur. It does not occur at high elevation (Johnson and Cassidy 1997). To date, no breeding females have been found in Washington (Johnson and Cassidy 1997).

Most hoary bats that are summer residents of the Pacific Northwest, Canada, and Alaska apparently winter in coastal areas of southern California and Mexico (Shump and Shump 1982).

Habitat

Hoary bats spend summer days roosting in the foliage of trees, and foraging at night in open areas, fields, and even around streetlights (Johnson and Cassidy 1997). In hardwood forests, they choose roost sites that are well covered above but open beneath, generally 10-15 ft above the ground (Constantine 1966) and usually at the edge of a clearing. Results of a survey in northwestern Oregon (Perkins 1983) suggest that hoary bats prefer mature or old-growth Douglas-fir forests, presumably because larger trees provide better roosts (Johnson and Cassidy 1997).

Hoary bats are insectivores that feed on the wing (aerial foragers) using echolocation to locate prey, and also glean insects from the ground and foliage using sight to locate prey (van Zyll de Jong 1985). Moths make up the bulk of the hoary bat's diet, but the species is also known to feed on flies, beetles, small wasps, grasshoppers, termites, and dragonflies. Hoary bats commonly feed along forest edges, roads, or open areas within the forest (Christy and West 1993).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of hoary bats have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, because the watershed is within the geographic and elevation range of the species in Washington and because suitable roosting and foraging habitat is present, there is moderate to high likelihood that hoary bats occur in the Cedar River Municipal Watershed.

Potential foraging habitat for the hoary bat in the municipal watershed includes forest edges and adjacent openings. Potential roosting habitat includes hardwoods and mature to old-growth conifer forest.

Keen's Myotis

Status

Legal Status. Keen's myotis (*Myotis keenii*) is not a listed species, candidate species, or species of concern at the federal level in Washington. Keen's myotis is a monitor species at the state level in Washington.

Population Status. Little is known about the status of Keen's myotis populations in the wild (Christy and West 1993). Keen's myotis is listed as an endangered species in British Columbia. Keen's myotis may be the least known of all bat species in the Pacific Northwest; virtually no research has been conducted on the species' basic ecology since it was proposed as a distinct species in 1979 (Christy and West 1993).

Range

Keen's myotis (*Myotis keenii*) has only been found in low-elevation forests in Puget Sound and the Olympic Peninsula in Washington, in coastal British Columbia, and in Alaska (Johnson and Cassidy 1997; Parker 1996). Difficulty in distinguishing Keen's myotis from long-eared myotis, which are sympatric over much of their range, has led to uncertainties about the range of Keen's myotis in Washington (Johnson and Cassidy 1997; van Zyll de Jong 1979). After reviewing the taxonomy and distribution of Keen's myotis and long-eared myotis, van Zyll de Jong and Nagorsen (1994) concluded that Keen's myotis is restricted to a relatively narrow coastal strip, largely coinciding with the distribution of coastal forest, while long-eared myotis occurred predominantly further inland.

Habitat

Little is known about the habitat requirements of Keen's myotis, but some data suggest that it prefers old-growth coniferous forests to younger forests (Thomas and West 1991), possibly because of the structural diversity of the older forests (Parker 1996; Johnson and Cassidy 1997).

According to Christy and West (1993), Keen's myotis has not been found roosting in man-made structures, and may rely entirely on natural roost sites. Keen's myotis were observed hibernating in a cave at 3,000 ft elevation on northern Vancouver Island, British Columbia in 1996 (Davis 1996). Air temperature within the cave (greater than 330 ft from an entrance) was stable at 37.7° F, with an outside daily variation of 0.9° F (Davis 1996). Relative humidity was at or near 100 percent (Davis 1996).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Keen's myotis have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, on the basis of current knowledge of the distribution of Keen's myotis in Washington State (Johnson and Cassidy 1997), the species is unlikely to occur in the Cedar River Municipal Watershed.

The specific habitat elements which may provide foraging habitat for the Keen's myotis in the municipal watershed are unknown, but are probably similar to those of other *Myotis* species: naturally open habitats and open water. Potential roosting habitat likely includes caves, cliffs, and rock outcrops.

Little Brown Myotis

Status

Legal Status. The little brown myotis (*Myotis lucifugus*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. Little quantitative information has been published regarding the status of little brown myotis populations in Washington. It is considered to be one of the most abundant bats in the Pacific Northwest. Perkins (1988) found them at a number of locations throughout Olympic and Mt. Baker-Snoqualmie National Forests during surveys in summer 1988.

Range

The little brown myotis occurs throughout North America, and is considered the most abundant bat in the United States (Bourber and Davis 1969).

The little brown myotis occurs throughout Washington except at high elevations and in the driest parts of the Columbia Basin (Johnson and Cassidy 1997).

Habitat

The little brown myotis occurs in most forested habitats in Washington, as well as along riparian areas in the shrub-steppe zone of eastern Washington (Johnson and Cassidy 1997). It is one of the most common bats in urban areas because it readily uses human structures for roosts and will forage around streetlights (Johnson and Cassidy 1997). In the southern Washington Cascades and the Oregon Coast Range, Thomas (1988) detected *Myotis* bats (including little brown myotis) more frequently in old-growth Douglas-fir forests than in mature and young Douglas-fir forest. He hypothesized that the higher activity in old-growth stands "likely reflects an increased diversity and/or abundance of day roosts compared with young and mature stands" (Thomas 1988).

Roosting habitat for the little brown myotis includes buildings, bridges, bark, rock crevices, caves, and mines (Christy and West 1993). Maternity roosts are in buildings, under bridges, in snags, and in caves and mines (Christy and West 1993). Buildings, caves, and mines are used as hibernacula (Christy and West 1993). Perkins et al. (1990) found hibernating bats in a barn and a mine in Oregon. Little brown myotis were observed hibernating in a cave at 2,700 ft elevation on northern Vancouver Island, British Columbia in 1996 (Davis 1996). Air temperature within the cave was stable at 37.7° F, and relative humidity was at or near 100 percent (Davis 1996).

Little brown myotis are insectivorous. The bulk of their diet consists predominantly of moths, gnats, flies, bugs, and beetles. They concentrate on insects with aquatic larval stages, which is likely why they frequently forage over open water. Thomas (1988) found that feeding rates for myotis bats (including little brown myotis) in the southern Washington Cascades and Oregon Coast Range averaged 10 times higher over water than in forest stands. He concluded that forest stands are not primary feeding sites for these bats. In a Canadian study, little brown myotis were 75 times more active over lakes than in forested habitats (Lunde and Harestad 1986). Detections of little brown myotis declined substantially following forest clearcutting in British Columbia (Lunde and Harestad 1986), which may be a result of reduced availability of prey insects within recently clearcut areas or of nearby roosting structures in adjacent areas. Little brown myotis occur in urban areas, and commonly forage around street lights, over parks, and along city streets (Barbour and Davis 1969; Furlonger et al. 1987).

Occurrence in the Cedar River Municipal Watershed

Perkins (1988) documented the little brown myotis in the Cedar River Municipal Watershed in July 1988. They were seen, presumably foraging, at a beaver pond (Perkins 1988). Few potential natural hibernacula or mines have been documented in the watershed.

Potential foraging habitat for the little brown myotis in the municipal watershed includes open wetlands and other open water bodies, and naturally open habitats (meadows and persistent shrub communities). Potential roosting habitat includes bridges, buildings, snags, caves, cliffs, and rock outcrops.

Long-eared Myotis

Status

Legal Status. The long-eared myotis (*Myotis evotis*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The long-eared myotis is a monitor species at the state level in Washington.

Population Status. The amount of ecological information currently published about long-eared myotis and their population status in Washington State is limited. However, according to Johnson and Cassidy (1997), the long-eared myotis "is said to be the most widely distributed bat in eastern Oregon, the most abundant bat in northeastern Oregon, and the most abundant bat in lodgepole pine forests in Washington." The species may be relatively more abundant on the east side of the state than the west (Johnson and Cassidy 1997).

Range

The long-eared myotis occurs in western North America, from British Columbia, southern Saskatchewan and Alberta south along the Pacific coast to Baja California and east to Montana, Idaho, the Dakotas, Utah, Nevada, Wyoming, Colorado, New Mexico and Arizona (ODFW 1996).

The long-eared myotis occurs throughout Washington except in the driest parts of the Columbia Basin (Barbour and Davis 1969; Johnson and Cassidy 1997).

Habitat

Long-eared myotis have been found in a variety of habitats such as mature and immature conifer, alder/salmonberry, arid grasslands, and shrub-steppe (Maser et al. 1981; Nagorsen and Brigham 1993). Cross (1976) found them across southern Oregon in mixed conifer, ponderosa pine, and shrub-steppe habitats. Perkins (1982, 1983) found long-eared myotis in agricultural and riparian areas, oak woodlands, mature conifer forest, Douglas-fir forest (all age classes), and old-growth true fir forest in western and northwestern Oregon. In the southern Washington Cascades and the Oregon Coast Range, Thomas (1988) detected *Myotis* bats (including long-eared myotis) more frequently in old-growth Douglas-fir forests than in mature and young Douglas-fir forest. He hypothesized that the higher activity in old-growth stands "likely reflects an increased diversity and/or abundance of day roosts compared with young and mature stands" (Thomas 1988).

Long-eared myotis use buildings, bridges, rock crevices, pieces of loose bark attached to trees, and snags as day roosts (Maser at al. 1981; Christy and West 1993). Maternity roosts and hibernation sites have been documented in buildings, caves, mines, and rock fissures (Cross 1977; Cross and Schoen 1989; Perkins et al. 1990; Nagorsen and Brigham 1993). Maternity colonies of 12 - 30 individuals have been found in buildings and hollow trees (Maser et al. 1981).

Long-eared myotis are insectivores. Major food items in two Oregon studies were found to be moths, flies, beetles, bees, and ants (Whitaker et al. 1977; Whitaker et al. 1981). The species obtains its prey by aerial foraging and gleaning from foliage. Thomas (1988) found that feeding rates for myotis bats (including long-eared myotis) in the southern Washington Cascades and Oregon Coast Range averaged 10 times higher over water than in forest stands. He concluded that forest stands are not primary feeding sites for these bats.

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of long-eared myotis have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, because the watershed is within the geographic and elevation range of the species in Washington, and because suitable roosting and foraging habitat is present, there is moderate to high likelihood that long-eared myotis occur, at least during summer, in the Cedar River Municipal Watershed. However, few potential natural hibernacula have been identified within the watershed, although a limited number of potential human-created hibernacula (buildings, mines) do exist.

Potential foraging habitat for the long-eared myotis in the municipal watershed includes open wetlands and other open water bodies, forest edges, and riparian corridors. Potential roosting habitat includes bridges, buildings, snags, caves, cliffs, and rock outcrops.

Long-legged Myotis

Status

Legal Status. The long-legged myotis (*Myotis volans*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The long-legged myotis is a monitor species at the state level in Washington.

Population Status. The amount of ecological information currently published about log-legged myotis and their population status in Washington State is limited. However, Perkins (1988) found them at several locations in Olympic and Mt. Baker-Snoqualmie National Forests during surveys in summer 1988. According to Johnson and Cassidy (1997), “One researcher estimated that this species is probably the second most abundant bat in northeastern Oregon forests.”

Range

The long-legged myotis occurs in western North America from southeast Alaska and western Canada to central Mexico.

The long-legged myotis can be found throughout Washington except for the driest parts of the Columbia Basin (Barbour and Davis 1969; Johnson and Cassidy 1997). According to Johnson and Cassidy (1997), the long-legged myotis "is one of the few myotis bats that regularly occurs at high elevations in cool, wet forests."

Habitat

The long-legged myotis occurs in a variety of habitats such as immature and mature conifer forests, alder forests, and arid rangelands (Maser et al. 1981; Nagorsen and Brigham 1993). Foraging habitat includes all seral stages, but there is a preference for young forest (Brown 1985); they also forage over open water (ODFW 1996). Cross (1976) found them across southern Oregon in all major habitats outside the coastal zone, including oak woodland, mixed evergreen, mixed conifer, ponderosa pine, and shrub-steppe; greatest numbers were encountered in ponderosa pine. Perkins (1982, 1983) reported them from agricultural and riparian areas, oak woodlands, Douglas-fir forest (all age classes), and old-growth true fir forest in western and northwestern Oregon. In the southern Washington Cascades and the Oregon Coast Range, Thomas (1988) detected long-legged myotis more frequently in old-growth and mature Douglas-fir forests than in young Douglas-fir forest. He hypothesized that the higher activity in old-growth stands "likely reflects an increased diversity and/or abundance of day roosts compared with young and mature stands" (Thomas 1988).

Roosts are located in buildings, bridges, crevices in rock cliffs, fissures in the ground, snags, and under large pieces of still-attached tree bark (Nagorsen and Brigham 1993). Ormsbee (no date, as cited in ODFW 1996) found females day-roosting in large-diameter (greater than 39 inches) snags of western redcedar and Douglas-fir along forest edges and in open habitat. The long-legged myotis uses buildings, rock crevices, and trees for maternity colonies (Barbour and Davis 1969; Nagorsen and Brigham 1993). Maternity colonies may contain several hundred individuals (Maser et al. 1981). Hibernation sites occur in caves and mines (Cross 1976; Cross and Schoen 1989; Perkins et al. 1990; Cross and Walden 1994 and 1995; Cross and Kerwin 1995). Long-legged myotis were observed hibernating in a cave at 2,700 ft elevation on northern Vancouver Island, British Columbia in 1996 (Davis 1996). Air temperature within the cave (greater than 300 ft from an entrance) was stable at 37.7° F, with an outside daily variation of 0.9° F (Davis 1996). Relative humidity was at or near 100 percent (Davis 1996).

The long-legged myotis is insectivorous, with moths, flies, bugs, and beetles forming the bulk of the diet (Whitaker et al. 1977; Whitaker et al. 1981). Thomas (1988) found that feeding rates for *Myotis* bats (including long-legged myotis) in the southern Washington Cascades and Oregon Coast Range averaged 10 times higher over water than in forest stands. He concluded that forest stands are not primary feeding sites for these bats.

Occurrence in the Cedar River Municipal Watershed

Long-legged myotis are present in the Cedar River Municipal Watershed. (This determination is based on a single observation of several individuals, presumably foraging, at a beaver pond in July 1988 (Perkins 1988)). No comprehensive surveys to determine the distribution, population size, or to detect breeding activity of long-legged myotis have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented since the July 1988 sighting.

Potential foraging habitat for the long-legged myotis in the municipal watershed includes open wetlands and other open water bodies, forests (all seral stages), and riparian corridors. Potential roosting habitat includes bridges, buildings, snags, caves, cliffs, and rock outcrops.

Marten

Status

Legal Status. The marten (*Martes americana*) is not a listed species, candidate species, or species of concern at the federal level in Washington State. It is considered a game species by Washington State (WDFW 1996).

Population Status. Marten populations in Washington State are considered to be healthy enough to manage as a game species.

Range

The marten occurs throughout the coniferous forests of Canada, Alaska, and the 11 western states except Arizona (Roderick and Milner 1991). To the east, its range includes northern Michigan and Minnesota, northern New York, and the New England states. It was extirpated from the southeastern portion of its historic range between 1850 and 1875, and from adjacent areas by the early 1900s (Hagmeier 1956).

In Washington, the marten occurs in mountain ranges that provide preferred coniferous forest habitat (Cascades, Olympics, Selkirks, Okanogan Highlands, Blue Mountains) (Johnson and Cassidy 1997).

Habitat

Martens are closely associated with late-successional stands of mesic conifers, especially those with complex physical structure at ground level, such as fallen trees, lower branches of living trees, rock fields, dense ground vegetation (Buskirk and Powell 1994). Martens may inhabit talus fields above tree line (Grinnell et al. 1937; Streeter and Braun 1968), but are seldom found in xeric forest types (Buskirk and Ruggiero 1994) or below the lower elevational limit of trees (i.e., forest-steppe ecotone). Jones and Raphael (1990) reported that old-growth forests within the Pacific silver fir and western hemlock zones in the western Cascades were preferred by marten. Canopy closure averaged 71 percent (Jones and Raphael 1990). Clearcuts were used less than expected from their availability (Buskirk and Ruggiero 1994). In Okanogan County, Koehler et al. (1990) found most marten tracks in stands dominated by Engelmann spruce, subalpine fir, and lodgepole pine greater than 82 years of age. In the northern Rocky Mountains, marten have preferred forest stands dominated by mesic subalpine fir, and lodgepole pine (Buskirk and Ruggiero 1994).

Marten use of riparian areas has been reported in several studies. Buskirk et al. (1989) reported that marten showed a preference for riparian areas for resting, while Spencer and Zielinski (1983) reported marten foraging in riparian areas. Jones and Raphael (1990) also reported that marten made heavy use of areas close to streams.

Snags and down woody debris are important to marten because they provide resting spots and den sites, and habitat for prey (Johnson and Cassidy 1997). In a study in the western Washington Cascades, Jones and Raphael (1990) reported that marten preferred larger

trees, snags, and fallen trees for resting. In a study in the central Oregon lodgepole pine ecosystem, marten were most frequently found resting in artificial structures (debris piles, tree stumps, cabins); natural woody debris, snags, and live trees were also used (Raphael and Jones, in press). Denning sites were primarily in natural woody debris, but artificial structures, standing dead trees, and live trees were also used (Raphael and Jones, in press). Corn and Raphael (1992) showed that marten gain access to subnivean spaces via openings created by coarse woody debris at low snow depths, and lower branches of live trees in deep snow. In the central Oregon study, Raphael found that many subnivean resting sites were in windthrown areas with stacked, multiple logs.

Marten normally avoid habitats that lack overhead cover (Buskirk and Ruggiero 1994). Martens will use small clearcuts, burns, and meadows for feeding in the summer if suitable prey are available (Johnson and Cassidy 1997). Summer use of nonforested habitats above tree line, especially talus fields, in mountainous area has been reported (Buskirk and Ruggiero 1994).

Marten eat small mammals such as red-backed voles, meadow voles, tree squirrels, and ground squirrels. Snowshoe hares, birds and their eggs, fruits, and insects may also constitute an important part of the marten's diet on a seasonal basis (Strickland et al. 1982).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of martens have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, in numerous systematic surveys using track plates and camera stations conducted in recent years (summarized in Lewis and Stinson 1998), marten have been detected in the vicinity of the Cedar River Municipal Watershed (e.g., at Hyak Lake on Snoqualmie Pass, which is within 4 miles of the eastern end of the watershed). In addition, the Watershed is within what is considered to be the current geographic and elevation ranges of the marten in Washington and suitable resting and foraging habitat appears to be present. Thus, it is likely that marten presently occur in the Cedar River Municipal Watershed.

Potential denning and foraging habitat for the marten in the municipal watershed includes mature, late-successional, and old-growth forests. Forested riparian areas also provide resting and foraging habitat.

Masked Shrew

Status

Legal Status. The masked shrew (*Sorex cinereus*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. Johnson and Cassidy (1997) state that the masked shrew "is rare over much of Washington," but also note that it is locally common in such places as southern Stevens County.

Range

According to Johnson and Cassidy (1997), the masked shrew occurs "in a wide variety of

habitats on this continent (and in Asia)…." In Washington, it occurs on the Olympic Peninsula as far south as Ocean City, on both sides of the Cascade Range, and in northeastern Washington from 2,300 ft up to 6,000 ft elevation (Johnson and Cassidy 1997). It avoids dry habitats such as the shrub-steppe zone of eastern Washington, and is not found in the Puget Trough.

Habitat

The masked shrew occurs in a variety of habitats in Washington, ranging from sea level near the Strait of Juan de Fuca to timberline in the Cascades. It appears to be limited to forested habitats, including alder and willow thickets and forested riparian areas (Johnson and Cassidy 1997). In the Cascades it occurs in all forest types up to tree line. In northeastern Washington, it has been found in all forest types ranging from Douglas-fir at lower elevations up through subalpine fir at higher elevations (Johnson and Cassidy 1997). The masked shrew is said to prefer moist woodlands with abundant plant cover, thick leaf litter, and decaying logs (Kurta 1995).

The masked shrew is insectivorous, and feeds on a wide variety of invertebrates such as caterpillars, beetles, grubs, crickets, moths, ants, slugs, snails, spiders, earthworms, and centipedes.

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of masked shrews have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, because the watershed is well within the masked shrew's geographic range and because suitable habitat for the shrew occurs in the watershed, it is highly likely that the masked shrew is both present and breeding in the Cedar River Municipal Watershed.

Potential habitat for the masked shrew in the watershed includes wetlands (especially scrub-shrub and forested), streams, and riparian areas.

Northern Water Shrew

Status

Legal Status. The northern water shrew (*Sorex palustris*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. Little information is available regarding the status of water shrew populations in Washington, but they are assumed to be relatively common wherever appropriate habitats occur.

Range

The water shrew occurs in montane and boreal areas of North America below tree line, from Alaska to the Sierra Nevada, and in the Rocky and Appalachian mountains.

In Washington, the water shrew is found in forested areas of the state where topography is steep enough to produce small, clear, cold streams. This type of topography can be found in the Olympic Peninsula, on both sides of the Cascades, in northeastern

Washington, and in southeastern Washington (Blue Mountains) (Johnson and Cassidy 1997). The species does not occur in the relatively flat southwestern portion of the state, the Puget Trough, or the dry Columbia Basin (Johnson and Cassidy 1997).

Habitat

The northern water shrew is strongly dependent on microhabitats associated with cold, clear water in small streams, ponds, and forested wetlands with abundant cover, such as overhanging banks, holes in banks, and overhanging vegetation on banks (Johnson and Cassidy 1997). These requirements are most frequently met in relatively steep, mid- to high-elevation forested areas in Washington. The species does not occur along large streams and rivers or large lakes, presumably because the water is too warm (Johnson and Cassidy 1997).

Water shrews are divers, and often enter the water to feed or to elude predators (Banfield 1974). They are primarily insectivorous, feeding on a variety of primarily aquatic macroinvertebrates, such as stonefly nymphs, mayflies, and caddis flies (Beneski and Stinson 1987). They also eat earthworms, crickets, leeches, spiders, and may even eat fish (Beneski and Stinson 1987).

Occurrence in the Cedar River Municipal Watershed

The northern water shrew is known to be present in the Cedar River Municipal Watershed.

Potential habitat for the northern water shrew in the watershed includes wetlands (especially scrub-shrub and forested), streams, and riparian areas.

Silver-haired Bat

Status

Legal Status. The silver-haired bat (*Lasionycteris noctivagans*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about silver-haired bats is insufficient to evaluate the species' population status in Washington State.

Range

The silver-haired bat occurs in suitable habitat throughout much of North America, from Alaska to the Mexican border (Kunz 1982). It is found throughout forested areas of Washington from sea level probably into alpine parkland (Johnson and Cassidy 1997). The majority of silver-haired bats in the Pacific Northwest are apparently migratory, although a small portion of the population winters in the Pacific Northwest (Perkins et al. 1990). No hibernating silver-haired bats were located during cave and mine searches in Oregon and Washington from 1982 to 1989 (Perkins et al. 1990), but a number of individuals, primarily juvenile males, have been found during winter in Oregon, Washington, and British Columbia (Schowalter et al. 1978b). There appears to be some sexual segregation in the silver-haired bat during the breeding season. In Washington,

females generally occur only east of the Cascades during spring and summer, but the distribution of sexes becomes more even by August (Perkins and Cross 1991).

Habitat

Silver-haired bats are closely associated with forests (Johnson and Cassidy 1997) and appear to be most abundant in old-growth Douglas-fir/western hemlock forests. They are less abundant in ponderosa pine types and even less likely to be found in arid areas. Across southern Oregon, Cross (1976) found this species most frequently in areas having high snag densities. Thomas and West (1991) reported this species to be almost 10 times more likely to be detected in old-growth than younger stands in the Oregon Coast Range.

Roost sites are in cavities in snags, in crevices under the bark of old-growth Douglas-firs where the bark has separated from the bole of the tree, and in other types of cracks and crevices resulting from wind and lightning damage. Other day roosts have been documented in buildings, caves, and mines (Christy and West 1993). Maternity roosts are almost exclusively in cavities and crevices in snags and trees, including cavities excavated by woodpeckers. Hibernacula and solitary roosts are found in buildings, rock crevices, caves, mines, and in snags, and under bark (Christy and West 1993).

The silver-haired bat is insectivorous, with flies, beetles and moths comprising most of the diet. On a continental scale, Kunz (1982) reported this species forages over water at ponds, streams, and other water bodies, usually near conifers and/or mixed deciduous forests.

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of silver-haired bats have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, because the watershed is within the geographic and elevation range of the species in Washington, and because suitable roosting and foraging habitat is present, there is moderate to high likelihood that silver-haired bats occur in the Cedar River Municipal Watershed. However, few potential natural hibernacula have been identified within the watershed, although a limited number of potential human-created hibernacula (buildings, mines) do exist.

Potential foraging habitats for silver-haired bats in the municipal watershed include mature to old-growth forests, forested areas in aquatic and riparian areas, open wetlands and other open water bodies, and naturally open habitats (meadows and persistent shrub communities). Potential roosting habitat includes bridges, buildings, snags, caves, cliffs, and rock outcrops.

Townsend's Big-eared Bat

Status

Legal Status. Townsend's big-eared bat (*Plecotus townsendii*) is a federal species of concern and a state candidate species in Washington.

Population Status. According to Johnson and Cassidy (1997), "this bat is relatively widespread [in Washington], but there is much concern about the species' future because *P. townsendii* bats in hibernacula and maternity colonies are sensitive to disturbance."

Range

Townsend's big-eared bat occurs in western North America from southern British Columbia to northern Mexico and as far east as South Dakota, Oklahoma, and Texas (ODFW 1992). A narrow range extension extends into the central Atlantic states (Appalachian Mountains).

The species has been documented from a number of locations throughout Washington at elevations lower than 9,600 ft, except in the driest portions of the Columbia Basin (Johnson and Cassidy 1997).

Habitat

Townsend's big-eared bats have been documented from sea level to 9,600 ft (Pearson et al. 1952), but they occur chiefly at low to mid-elevations (Johnson and Cassidy 1997). The presence of suitable undisturbed roost, nursery, and hibernation sites is the most important habitat component dictating the presence of this species (ODFW 1992). Townsend's big-eared bat can occur in nearly any forest type as long as suitable roost, nursery, and hibernation sites are present (Roderick and Milner 1991). In a northwestern Oregon study, these bats were captured (by mist nets) only in mature or old-growth Douglas-fir forests (Perkins 1983).

These bats use caves, mines, buildings, and the undersides of bridges with appropriate temperature and humidity for maternity roosts, day roosts, and hibernation (ODFW 1992; Christy and West 1993). However, caves within clearcuts may not be suitable because the lack of vegetation can affect the cave's microclimate, depending on characteristics of the cave (e.g., number and size of entrances, length and overall volume of cave) (Roderick and Milner 1991). In addition, timber harvest activities around the mouth of a cave may disturb roosting, nursing or hibernating bats, causing them to die or abandon the cave. Townsend's big-eared bats are particularly sensitive to arousal during hibernation, as this can deplete necessary fat reserves and lead to death. Townsend's big-eared bats prefer cold areas near the entrance of caves as hibernacula (Barbour and Davis 1969; Humphrey and Kunz 1976). This makes them particularly susceptible to disturbance around the mouth of the cave. Townsend's big-eared bats are also very sensitive to disturbance while day roosting, because they hang directly from the ceiling of the roost and do not go into torpor during the day in summer colonies (Barbour and Davis 1969).

Food habits studies found that while Townsend's big-eared bat feeds on a variety of insects, its primary prey items are moths (Whitaker et al. 1981), which are obtained both by aerial foraging and gleaning from foliage (ODFW 1992). Townsend's big-eared bats have been observed foraging in upland habitats (forest edges, roads, open areas within the forest) more often than over water (Christy and West 1993).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Townsend's big-eared bats have been conducted in the Cedar River Municipal Watershed and no

incidental observations of this species have been documented to date. However, because the watershed is within the geographic and elevation range of the species in Washington, and because suitable roosting and foraging habitat is present, there is moderate to high likelihood that Townsend's big-eared bats occur in the Cedar River Municipal Watershed. However, few potential natural hibernacula have been identified within the watershed, although a limited number of potential human-created hibernacula (buildings, mines) do exist.

Potential foraging habitats for the Townsend's big-eared bat in the municipal watershed include aquatic and riparian habitats, wet meadows, and old-growth forests. Potential roosting habitat includes bridges, buildings, snags, caves, cliffs, and rock outcrops.

Wolverine

Status

Legal Status. The wolverine (*Gulo gulo*) is a federal species of concern in Washington State. The wolverine is a candidate species at the state level in Washington.

Population Status. Wolverines historically occurred at low densities in the Cascades and in northeastern Washington (Johnson and Cassidy 1997). Wolverines declined throughout their range as a result of trapping and habitat loss and modification (Banci 1994). Johnson (1977) suggested that wolverines were present in the Cascade Range of Washington between 1890 and 1919, became absent or rare throughout the state from 1920 through 1959, and then expanded their range in the 1960s and 1970s by dispersal from Canada. Three wolverines, all adult males, were killed and another was seen in central and southern Washington counties in 1964 and 1965 (Patterson and Bowhay 1968). There are approximately 20 records for Washington for the period 1983 to 1993 (Maj and Garton 1994). The wolverine's current distribution and abundance in Washington are unknown (Banci 1994), but the population is certainly very low (Johnson and Cassidy 1997).

Range

Wolverines occur across the boreal and tundra zones of Europe and Asia as well as Canada and Alaska (Banci 1994). In the western United States, wolverines occur in Montana, Idaho, Wyoming, Colorado, Washington, Oregon, and California (Banci 1994).

In Washington, wolverines historically occurred in the Cascades and in northeastern Washington (Johnson and Cassidy 1997).

Habitat

Wolverines are wide-ranging animals that inhabit a variety of habitats, but are generally restricted to boreal forests, tundra, and remote, montane forest areas (Butts 1992). According to Banci (1994), researchers have generally agreed that wolverine "habitat is probably best defined in terms of adequate year-round food supplies in large, sparsely inhabited wilderness areas, rather than in terms of particular types of topography or plant associations" (Kelsall 1981). Banci (1994) believes this is true at the landscape level, but that stand-level habitat use has not been adequately investigated. In a Montana study, wolverines were relocated most frequently in medium density or scattered mature

timber, and showed a preference for *Abies* forest types (Hornocker and Hash 1981). Wolverines tend to avoid clearcuts, although they have been observed crossing them (Hornocker and Hash 1981).

Limited information is available on natal dens in forested regions (Banci 1994). Natal dens in Montana were most commonly associated with snow-covered tree roots, log jams, or rocks and boulders (Hash 1987). In northern Lapland, most dens were associated with spruce trees; five were holes dug under fallen spruce trees, two were in standing spruce trees, and one was in a decayed, hollow spruce tree (Pulliainen 1968).

Wolverines appear not to tolerate land-use activities that permanently alter habitats, such as agriculture and urban development (Banci 1994). Remaining populations have been relegated to the last available habitat that has not been developed, extensively modified, or accessed by humans (Banci 1994). The presence of humans may conflict directly with wolverines (Banci 1994). Hornocker and Hash (1981) suggested that human access on snowmobiles or all-terrain vehicles in winter and early spring could disturb wolverine behavior.

All studies conducted to date have shown the importance of large mammal carrion as a principal constituent of the wolverine diet (Banci 1994). Banci (1994) states that "the availability of large mammals underlies the distribution, survival and reproductive success of wolverines." Snowshoe hares, porcupines, red squirrels, ground squirrels, and marmots can be important prey items depending on the geographic areas and season (Banci 1994).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of wolverines have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. No wolverines have been detected in the vicinity of the Cedar River Municipal Watershed, despite numerous systematic surveys conducted in recent years using track plates and camera stations (summarized in Lewis and Stinson 1998). Thus, there is low probability that wolverines presently occur in the watershed as resident individuals.

Patches of large-sized talus/felsenmeer, and mature to old-growth forest provide potential denning habitat for the wolverine in the municipal watershed, and prey species are available both inside and outside the boundaries of the watershed. In addition, the City of Seattle's policy of restricting public access to the Cedar River Municipal Watershed results in a significantly lower level of human activity within the watershed than on adjacent lands. The small size of the watershed relative to wolverine requirements for large amounts of space, however, make it likely that only a few resident wolverines (perhaps two or three at most) would ever use the watershed as a portion of their home range.

Yuma Myotis

Status

Legal Status. The Yuma myotis (*Myotis yumanensis*) is a federal species of concern in Washington State. The Yuma myotis is not listed as a threatened species, endangered species, or candidate species by the State of Washington.

Population Status. The amount of ecological information currently published about Yuma myotis and their population status in Washington State is limited. However, Perkins (1988) found Yuma myotis at a few locations in both Olympic and Mt. Baker-Snoqualmie National Forests during surveys in the summer of 1988.

Range

In Washington, the Yuma myotis is widespread in low- to mid-elevation coastal forests, ponderosa pine forests, Douglas-fir forests, and arid grasslands (Johnson and Cassidy 1997). The species is more closely associated with water than any other bat in Washington (Johnson and Cassidy 1997).

Habitat

The Yuma myotis uses a variety of low- to mid-elevation habitats, including coastal forests, Douglas-fir forests, and arid grasslands, as long as open water is nearby (Barbour and Davis 1969; Nagorsen and Brigham 1993). In the southern Washington Cascades and the Oregon Coast Range, Thomas (1988) detected *Myotis* bats (including Yuma myotis) more frequently in old-growth Douglas-fir forests than in mature and young Douglas-fir forest. He hypothesized that the higher activity in old-growth stands "likely reflects an increased diversity and/or abundance of day roosts compared with young and mature stands" (Thomas 1988).

Breeding habitats (maternity colonies) are frequently located in caves, mines, under bridges, and in buildings (Barbour and Davis 1969; Brown 1985b). This species is known to use snags in old-growth forests for maternity roosts (WDNR 1996). A colony of 2,000 female Yuma myotis had a nursery roost in the attic of an old church in British Columbia (Nagorsen and Brigham 1993) before the church was destroyed by fire. Yuma myotis may use buildings and rock crevices (Nagorsen and Brigham 1993), and cavities in snags as day roosts (WDNR 1996). Their roost sites are almost always located close to open water (Barbour and Davis 1969; Herd and Fenton 1983). Yuma myotis are known to hibernate in caves and mines (Christy and West 1993).

Yuma myotis are closely associated with water for foraging (Maser at al. 1981). Almost two-thirds of foraging time is spent over water (Brigham et al. 1992). Other foraging habitats include grass, shrub, and open sapling stages of hardwood and coniferous forests, as well as hardwood and coniferous wetlands (Brown 1985b).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Yuma myotis have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, because the watershed is within the geographic and elevation range of the species in Washington, and because suitable roosting and foraging habitat is present, there is moderate to high likelihood that Yuma myotis are present, at least during summer, in the Cedar River Municipal Watershed. However, few potential natural hibernacula or mines have been identified within the watershed.

Potential foraging habitat for the Yuma myotis in the municipal watershed includes open wetlands and other open water bodies, and naturally open habitats (meadows and

persistent shrub communities). Potential roosting habitat includes bridges, buildings, snags, caves, cliffs, and rock outcrops.

AMPHIBIANS AND REPTILES

Cascades Frog

Status

Legal Status. The Cascades frog (*Rana cascadae*) is a federal species of concern, and is a monitor species at the state level in Washington.

Population Status. Since the mid-1970s, populations of this species have experienced marked declines in Oregon and California (ODFW 1996; Blaustein et al. 1995). One estimate is that 80 percent of 30 populations that have been monitored since the mid-1970s have disappeared at least temporarily (Blaustein and Wake 1990). Causes of population declines may include drought conditions, fish introductions, pathogens, habitat loss, and sensitivity to increased levels of ultraviolet radiation (Blaustein et al. 1995). Lehmkuhl and Ruggiero (1991) compiled a list of species associated with late-successional Douglas-fir forests in the Pacific Northwest and modeled the risk of local extinction for each species from habitat loss or fragmentation. This model was based on frequency of occurrence, abundance, body size, and vagility of various species. The Cascades frog was determined to be a species at moderately high risk (score of 8, where 1 is lowest and 10 is highest).

Range

The Cascades frog is a montane species found in the Olympic Mountains of Washington, and in the Cascade Mountains of Oregon, Washington, and northern California. This species generally occurs above 2,600 ft in elevation in montane meadows and slow-moving streams and ponds.

Habitat

Cascades frogs often are typically found in relatively small bodies of water rather than large lakes. Commonly used habitats include relatively small, unvegetated potholes and marshy areas (Blaustein et al. 1995), however Cascades frogs are occasionally found in forests away from water (Nussbaum et al. 1983). Breeding sites generally occur in shallow, gently sloping margins of pond or lakeshores, generally over soft substrates; eggs usually are laid in shallow water and may be partially exposed to the air (Leonard et al. 1993; Blaustein et al. 1995). Breeding begins as soon as the ice and snow melts in spring. Although the Cascades frogs' association with upland habitats is unknown, dispersal is limited by moisture-temperature conditions (Blaustein et al. 1995). Availability of closed-canopy forest and large woody debris may be a limiting factor in the ability of this species to disperse between potential breeding sites.

Occurrence in the Cedar River Municipal Watershed

Cascade frogs are present and known to breed in the Cedar River Municipal Watershed.

Potential breeding habitat for this species in the municipal watershed includes high-elevation ponds and meadows.

Cascade Torrent Salamander

Status

Legal Status. The Cascade torrent salamander (*Rhyacotriton cascadae*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The Cascade torrent salamander is a candidate species at the state level in Washington.

Population Status. Populations of this species are threatened by removal of riparian old-growth forests, changes in seep hydrology, and increased deposition of fine sediments in streams, primarily resulting from timber management activities (Corn and Bury 1989; Jennings and Hayes 1994; Diller and Wallace 1996). The apparently long (at least 6 years) sexual maturation period of this species makes populations particularly vulnerable to habitat disturbance (Nussbaum and Tait 1977; Jennings and Hayes 1994). Notably, the southern torrent salamander is intolerant to desiccation (Jennings and Hayes 1994).

Range

Until 1992, this species was considered to be part of a species complex known as the Olympic salamander, whose range extended from northern California to the Olympic Peninsula. This complex has now been split into four distinct species. The Cascade torrent salamander occurs along the western slopes of the Cascade Range from northeastern Lane County, Oregon, north to the vicinity of Mount St. Helens (Blaustein et al. 1995). The Washington GAP Analysis Project indicates the Nisqually River as the northern boundary of this species' range (Dvornich et al. 1997).

Habitat

Little has been written specifically about the habitat requirements of the Cascade torrent salamander because of its obscure life history and recent reclassification to species status. Most information comes from studies that did not distinguish among *Rhyacotriton* species, or that focused on other members of this species group. Much of the following discussion is based on studies of the southern torrent salamander (*Rhyacotriton variegatus*); because these two species were similar enough to be considered conspecific until very recently, the Cascade torrent salamander likely has similar habitat needs.

Small cold streams with water seeping through moss-covered gravel are preferred habitats for torrent salamanders (Blaustein et al. 1995). Breeding habitat for these species is generally considered to be forested permanent seeps, streams, and waterfalls with rocky substrates and cold temperatures (optimum 46 to 55°F); foraging occurs in moist areas in or near streams and seeps (Corn and Bury 1991; Leonard et al. 1993; Diller and Wallace 1996; Welsh and Lind 1996). Eggs may be laid at almost any time, but apparently most are laid in May (Blaustein et al. 1995). In California, oviposition appears to occur during fall or winter (Jennings and Hayes 1994).

Welsh and Lind (1996) found that the presence of seep habitat was the single best variable for predicting abundance of the southern torrent salamander in northwestern California. The ecological conditions found in late-successional forests (complex structure, deep litter layer, abundant downed woody debris, and dense herbaceous layer) are assumed to provide the adequate terrestrial and aquatic habitat conditions for torrent salamanders (Bury and Corn 1988; Welsh and Lind 1996). Significantly greater

numbers of torrent salamanders have been found in older (greater than 200 years old) forest stands than in younger stands (Welsh and Lind 1988, 1991; Welsh 1990; Corn and Bury 1991). However, undisturbed forests and forests greater than 100 years old are also known to provide habitat for this species (Bury and Corn 1989; Diller and Wallace 1996; Welsh and Lind 1996). The Cascade torrent salamander does not seem to be as closely associated with mid- to late-seral forests as Columbia torrent (*R. kezeri*) and Olympic torrent salamanders (*R. olympicus*) (Dvornich et al. 1997).

Optimum substrate size and proportions to maintain adequate interstitial space used for cover and oviposition by this species consist of at least 68 percent gravel, boulder, and bedrock, and less than 50 percent cobble with gravel, with a low percent sand component (Diller and Wallace 1996; Welsh and Lind 1996). High-gradient stream reaches provide suitable habitat because they are transport areas where finer sediments do not accumulate and gravel and cobble do not become embedded (Diller and Wallace 1996).

Torrent salamanders apparently require fairly low ambient temperatures and high relative humidity. Extremely sensitive to body water loss, or desiccation, they die quickly in a dry environment. Other species of terrestrial salamanders can tolerate body water loss of 29 to 39 percent, but torrent salamanders can tolerate only a 19 percent loss (Nussbaum et al. 1983). Adults may occasionally be found under objects a few feet from water after heavy rains, but this is unusual (Nussbaum et al. 1983). Adults are highly aquatic, often occurring with the larvae in microhabitats. Torrent salamanders, especially larvae, use the crevices and interstitial spaces among and within rocks and rock surfaces to hide from predators. This microhabitat selection makes them highly sensitive to loss of these cover areas by infiltration of fine sediments. Large quantities of fine sediments can effectively fill these crevices making them inaccessible to even the smallest larva. Cloudy water from suspended sediment may also hamper hunting of small aquatic invertebrates (USDI 1996).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Cascade torrent salamanders have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. Based on range and habitat availability, torrent salamanders may potentially occur within the Cedar River Municipal Watershed. (Although the watershed is not within the range currently predicted for torrent salamanders, the range limit as currently defined may be an artifact of survey effort.)

Potential habitat for this species in the municipal watershed includes small cold streams and seeps within mature and old-growth forest habitats.

Larch Mountain Salamander

Status

Legal Status. The Larch Mountain salamander (*Plethodon larselli*) is a federal species of concern, and is a sensitive species at the state level in Washington. The species is also considered a “Survey and Manage” and a “Protection Buffer” species in the Northwest Forest Plan (USDA 1994), and a sensitive species by the U.S. Forest Service.

Population Status. Known populations of the Larch Mountain salamander are somewhat isolated, separated by large expanses of unsuitable habitat. The limited distribution, specialized habitat requirements, and low genetic diversity of this species suggest that populations are declining (Herrington and Larsen 1985). The ability of Larch Mountain salamanders to colonize new, unoccupied habitat is unknown. Thus, the future of this species depends upon protection of existing occupied habitat.

Removal of late successional habitat and destruction of talus fields by road construction, timber harvest, and gravel mining and development, are the primary threats to the Larch Mountain salamander (WDW 1993a). Lehmkuhl and Ruggiero (1991) compiled a list of species associated with late-successional Douglas-fir forests in the Pacific Northwest and modeled the risk of local extinction for each species from habitat loss or fragmentation. This model was based on frequency of occurrence, abundance, body size, and vagility of various species. The Larch Mountain salamander was determined to be a species at high risk (score of 9, where 1 is lowest and 10 is highest).

Range

Until recently, the Larch Mountain salamander was thought to be endemic to a narrow region where the Columbia River cuts through the Cascade Mountains between Washington and Oregon (Herrington and Larsen 1987). More recently however, populations of this species have been documented as far north as the vicinity of Kachess Lake, Kittitas County (Darda 1995; Foster Wheeler Environmental field survey data, 1997), and from the Green River Watershed immediately south of the Cedar River Municipal Watershed (Foster Wheeler Environmental field survey data, 1998).

Habitat

In the Columbia River Gorge area, suitable habitat for this species generally consists of forested and non-forested talus areas (Olson 1996). Such areas can occur on or near steep (greater than 40 percent) slopes, and in sites with sparse understories and high litter. Suitable habitat for the Larch Mountain salamander in the Washington Cascade range generally consists of forested talus or boulder fields, cave entrances (basalt tubes), and mature and old-growth forest. Individuals may also occur under exfoliated bark of large Douglas-fir snags and on steep (greater than 40 percent) slopes (Olson 1996). Notably, at two sites found in 1997 on the Mt. Baker-Snoqualmie National Forest, Larch Mountain salamanders were associated with Douglas-fir/western hemlock immature forest and rocky substrates, and one was found on a relatively flat slope. Two other sites also found in 1997 were on the Wenatchee National Forest in the Cle Elum Ranger District. On these sites, Larch Mountain salamanders were associated with fairly open talus (less than 30 percent canopy cover) near mature or old-growth forest.

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Larch Mountain salamanders have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, based on range and habitat availability, Larch Mountain salamanders may potentially occur within the Cedar River Municipal Watershed.

Potential habitats for this species in the municipal watershed include forested areas with rocky substrates, talus patches with organic debris, and old-growth forest on steep slopes.

Long-toed Salamander

Status

Legal Status. The long-toed salamander (*Ambystoma macrodactylum*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington. (An isolated subspecies, *A. m. croceum* is federally listed as endangered in Santa Cruz and Monterey Counties, California).

Population Status. Concern for this species derives primarily from concern over population declines observed in other amphibian species both regionally and globally, although population trends for this species remain unknown. However, long-toed salamanders occur in a wide variety of habitats, and may be the most versatile amphibian in the Pacific Northwest (Corkran and Thoms 1996). Of 14 native amphibian species with the potential to occur in the western Washington Cascades, the long-toed salamander was the only species not included in a review of amphibians associated with old-growth forests in the Pacific Northwest (Blaustein et al. 1995).

Range

The long-toed salamander ranges from northern British Columbia south to northeastern California, and east to western Montana (Behler and King 1979). This species occurs throughout much of Washington except for the driest parts of the Columbia Basin (Nussbaum et al. 1983). It is also rare in or absent from most wet forest types of the western Cascades and Olympic Peninsula, occurring only in isolated open areas that might have once supported west-side prairies or bog meadows (Dvornich et al. 1997).

Habitat

The long-toed salamander occurs in a variety of habitats – including sagebrush steppe, dry woodlands, conifer forests, alpine meadows, and disturbed areas – from sea level to about 9,000 ft (Nussbaum et al. 1983; Corkran and Thoms 1996). Breeding occurs during winter to early spring, in seasonal pools, shallow lake edges, or very slow streams through wet meadows. Eggs are attached to submerged vegetation or pebbles (Leonard et al. 1993). Adults remain underground except when breeding, and may be found under rocks and logs during the rainy season (Corkran and Thoms 1996).

Occurrence in the Cedar River Municipal Watershed

Long-toed salamanders are present and known to breed in the Cedar River Municipal Watershed.

Potential breeding habitat for this species in the municipal watershed includes ponds, lakes, marshes, and slow-moving portions of rivers and streams.

Northwestern Salamander

Status

Legal Status. The northwestern salamander (*Ambystoma gracile*) (Figure 3.6-1) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. Egg masses of the northwestern salamander are frequently encountered in ponds in and near forested habitats throughout the western Washington Cascades; adults, however, are rarely seen (Leonard et al. 1993). Similar to those of the Cascades frog and western toad, eggs of the northwestern salamander are sensitive to ultraviolet light, showing decreased hatching success with increased levels of UV-B radiation; population declines have not been documented for this species, however (Hays 1996). Thomas et al. (1993) identified northwestern salamanders as being closely associated with old-growth forest conditions, and Lehmkuhl and Ruggiero (1991) put them at a medium risk of extinction, based on an assessment of their frequency of occurrence, abundance, body size, and vagility.

Figure 3.6-1. Northwestern salamander.

Range

The northwestern salamander ranges from southwestern Alaska through coastal British Columbia, western Washington and Oregon, south to northwestern California (Blaustein et al. 1995; Corkran and Thoms 1996). It occurs throughout western Washington and at a few sites immediately east of the Cascade crest (Dvornich et al. 1997).

Habitat

The northwestern salamander is found from sea level up to about 10,200 ft elevation in humid coniferous forests and subalpine forests (Nussbaum et al. 1983). Breeding occurs in early to mid spring, in relatively permanent quiet bodies of water (e.g., ponds, lakes, and slow parts of streams). Northwestern salamanders are absent from areas lacking aquatic habitat (Beatty et al. 1991; Blaustein et al. 1995; Corkran and Thoms 1996). Eggs are attached to the stems of emergent vegetation, 1.5-6 ft below the water surface (Corkran and Thoms 1996). Larvae remain in their natal ponds for 1-2 years before metamorphosis (Behler and King 1979). Terrestrial adults spend most of their lives underground, and may be found up to 1 mile from their breeding ponds (Nussbaum et al. 1983; Dvornich et al. 1997). Different studies have documented varying degrees of association with old forest, but northwestern salamanders generally show increased abundance with increasing forest age (Blaustein et al. 1995).

Occurrence in the Cedar River Municipal Watershed

Northwestern salamanders are widely distributed and known to breed in the Cedar River Municipal Watershed.

Potential breeding habitat for this species in the municipal watershed includes ponds, lakes, marshes, slow moving portions of streams.

Pacific Giant Salamander

Status

Legal Status. The Pacific giant salamander (*Dicamptodon tenebrosus*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. Concern for this species derives primarily from declines observed in other amphibian species regionally and globally, although population trends for this species remain unknown. Pacific giant salamander populations seem to be sensitive to land management practices, although the mechanism of their sensitivity is unclear (Blaustein et al. 1995).

Range

The Pacific giant salamander occurs from lower Sonoma County, California, through southwestern British Columbia (Blaustein et al. 1995). In Washington, it occurs in the Cascades primarily west of the Cascade crest, although it is also found in the east-central Cascades (Dvornich et al. 1997). It is also found in the eastern Puget Sound lowlands and in the southwestern part of the state (Dvornich et al. 1997).

Habitat

Pacific giant salamanders are restricted largely to moist coniferous forests and mountain lakes and streams from sea level to 7,100 ft elevation (Nussbaum et al. 1983). Terrestrial adults are common in many areas, but are nocturnal and secretive. They can be found under bark, logs, and rocks, and wandering about on the forest floor (Beatty et al. 1991). During the breeding season, they can be found in or near streams (Nussbaum et al. 1983; Stebbins 1985; Beatty et al. 1991). Eggs are laid in secluded microhabitats within cold,

clear, lotic and lentic biological systems (Blaustein et al. 1995). Gomez (1992) found Pacific giant salamanders to be most abundant in riparian areas of mature and old-growth forests as compared to upland sites in young, deciduous forests.

This species requires access to large cover to avoid predators and to aid in hunting prey. Individuals often "sit and wait" under cover while hunting, although they will actively hunt. They are affected by increased sedimentation, as sediment-clouded water makes prey detection difficult. When substantial amounts of sediment fill spaces under large cover, these cover areas become unavailable to salamanders (Welsh and Ollivier 1992). Corn and Bury (1989, as cited in Blaustein et al. 1995) found high densities of giant salamanders only in high-gradient sections of logged reaches of streams; in uncut reaches, giant salamanders were found in both high- and low-gradient areas. These results were attributed to the increased levels of fine sediment present in low-gradient, logged areas.

Occurrence in the Cedar River Municipal Watershed

Pacific giant salamanders are widely distributed and known to breed in the Cedar River Municipal Watershed.

Potential habitats for this species in the municipal watershed include riparian areas and associated closed-canopy forest.

Northern Red-legged Frog

Status

Legal Status. The northern red-legged frog (*Rana aurora aurora*) (Figure 3.6-2) is a federal species of concern and a monitor species at the state level in Washington.

Population Status. Concern for this species derives from alarm at declining populations of ranid frogs regionally and worldwide. Red-legged frog populations seem to be declining in areas outside of old-growth forest; factors contributing to losses may include bullfrog introductions, pesticides, and herbicides (ODFW 1996).

Range

The red-legged frog is endemic to the Pacific coast of North America. The northern subspecies occurs from northern California to Vancouver Island, British Columbia (Behler and King 1979). In Washington, it occurs in the western Cascades (all vegetation zones up to and including western hemlock), in the Puget Sound lowlands, on the Olympic Peninsula, and in the southwestern part of the state (Dvornich et al. 1997).

Habitat

This species is found at lower elevations (below 2,800 ft) in moist and riparian forests, marshes, bogs, ponds, springs, seeps, and slow-moving streams (Nussbaum et al. 1983; Stebbins 1985; Blaustein et al. 1995). Although not restricted to old-growth habitat, red-legged frogs are frequently found in old-growth stands (Bury and Corn 1988). In southern Washington, Aubry and Hall (1991) found that this species was most abundant in mature stands and least abundant in young stands. Breeding occurs in small temporary ponds, relatively large lakes, in potholes, in overflows of lakes and rivers, or

in slow-moving portions of a river (Blaustein et al. 1995). Early embryos can tolerate temperatures between 39°F and 69°F, a narrow range compared to other ranid frogs, and the time from hatching to metamorphosis is longer than in other species (Licht 1971 as cited in Blaustein et al. 1995). These findings suggest that red-legged frogs are more sensitive than other amphibians to changes in water levels and temperatures resulting from modification of adjacent forested habitat.

Occurrence in the Cedar River Municipal Watershed

Northern red-legged frogs are widely distributed and known to breed in the Cedar River Municipal Watershed

Potential breeding habitat for this species in the municipal watershed includes low- and mid-elevation ponds, wetlands, and slow-moving streams, particularly in areas of mature forest.

Figure 3.6-2. A clasped pair of red-legged frogs.

Roughskin Newt

Status

Legal Status. The roughskin newt (*Taricha granulosa*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The roughskin newt is perhaps the most common salamander in the Pacific Northwest (Nussbaum et al. 1983). Lehmkuhl and Ruggiero (1991) considered the roughskin newt to be at a medium risk of extinction when they assessed the viability

risks of species associated with late-successional Douglas-fir forests in the Pacific Northwest.

Range

Roughskin newts range from southeast Alaska to central California, generally west of the crest of the Cascade Range (Blaustein et al. 1995). In Washington they are found in the western and the east-central and southeast Cascades, in the Puget Sound lowlands, on the Olympic Peninsula, and in the southwestern part of the state (Dvornich et al. 1997).

Habitat

The roughskin newt occurs in a variety of habitats in hilly or mountainous country from sea level up to 8,400 ft (Nussbaum et al. 1983). Roughskin newts are most common in mesophytic forests of conifers or hardwoods, although they also occur in open valleys and farmland (Nussbaum et al. 1983). Adults can be found in lakes, ponds, and sluggish streams or on land, either above or just under surface litter (Nussbaum et al. 1983; Dvornich et al. 1997). Most metamorphosed juveniles and adults live in or under soft logs, foraging on the forest floor during damp conditions; some adults however, remain wholly aquatic (Corkran and Thoms 1996).

Breeding occurs in ephemeral and permanent ponds and lakes, as well as streams in areas of slow-moving water (Blaustein et al. 1995). Quiet water with aquatic vegetation seems necessary for breeding, and sites with vegetation surrounding aquatic habitats may be preferred (Pimentel 1960 as cited in Blaustein et al. 1995). Eggs are laid singly, scattered throughout a pond, often attached to the undersurface of vegetation or under rocks (Blaustein et al. 1995; Corkran and Thoms 1996).

This species has been associated with old-growth forest in Washington, exhibiting a trend of increasing abundance with increasing forest age (Blaustein et al. 1995). This newt is the only member of the family Salamandridae to occur in the Pacific Northwest, and is the most aquatic species of its genus (Blaustein et al. 1995).

Occurrence in the Cedar River Municipal Watershed

Roughskin newts are present and known to breed in the Cedar River Municipal Watershed.

Potential breeding habitat for roughskin newts in the municipal watershed includes lakes, ponds, emergent wetlands, and slow-moving streams, particularly in close association with late-successional and old-growth forests.

Oregon Spotted Frog

Status

Legal Status. The Oregon spotted frog (*Rana pretiosa*) is a federal candidate species and a Washington State candidate species. The species is considered a sensitive species by the U.S. Forest Service.

Population Status. This species was considered conspecific with the Columbia spotted frog (*R. luteiventris*) until very recently, when spotted frog populations east of the Cascade Crest were reclassified as Columbia spotted frogs (Green et al. 1996). Limited

distribution and isolation of Oregon spotted frog populations have prompted concern for this species' survival (WDFW 1994a). Loss of wetland habitat and/or alteration of the character of wetlands (i.e., introduction of non-native plants such as canary grass, grazing) have been the main reasons for decline of this species (McAllister and Leonard 1997). Other threats to this species include introduction of bullfrogs and predatory fishes, and susceptibility to toxic chemicals (WDFW 1994a; Hayes and Jennings 1986).

Range

Historically, the range of the Oregon spotted frog in Washington State was distributed through the lowlands of the Puget Trough from the Canada border south to Vancouver, Washington, and east into the southern Washington Cascades (McAllister et al. 1993; McAllister 1995; McAllister and Leonard 1997). It has been estimated that this species has been lost from over 90 percent of its original range (Hayes 1997). Three extant populations are known in Washington today: one in the south Puget Sound lowlands (Dempsey Creek) and two in the south-central Cascade Mountains (Trout Lake and Conboy Lake) (McAllister and Leonard 1997). No historical records are known within 6 miles of the Cedar River Municipal Watershed (Dvornich et al. 1997).

Habitat

This species is highly aquatic, inhabiting marshy ponds, streams, and lakes as high as 9,000 ft in parts of its range (Nussbaum et al. 1983). Wetlands must include a shallow emergent component to be capable of supporting spotted frogs (McAllister and Leonard 1997). Though not typically found under a forest canopy, Oregon spotted frogs have been found in riparian forests and areas with dense shrub cover (McAllister and Leonard 1997). This frog is not an old-growth forest obligate, but forested areas may represent important refugia from further population losses (Blaustein et al. 1995).

Stebbins (1985) suggests that this species is more common in relatively coldwater habitats than in warm, stagnant ponds; in Wyoming, however, stagnant pools are used for mating (Turner 1958). In Wyoming, oviposition sites usually occur in the shallow and warmest portions of a breeding pond (Morris and Tanner 1969). In Wyoming and British Columbia, eggs are laid in the open, in clear water, and are not attached to vegetation (Licht 1969; Morris and Tanner 1969). Washington Department of Fish and Wildlife (1994) reports that courtship and breeding occur in the warm, shallow margins of ponds or rivers, or in temporary ponds. Eggs are laid in water that is only a few inches deep, and are usually half-exposed to air. In the lowlands, western spotted frogs are active during February through October and hibernate in muddy bottoms in winter (WDW 1994).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Oregon spotted frogs have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date.

Potential breeding habitat for this species in the municipal watershed includes ponds and marshy areas at all elevations.

Tailed Frog

Status

Legal Status. The tailed frog (*Ascaphus truei*) is a federal species of concern and a monitor species at the state level in Washington.

Population Status. Populations of this species may be on the decline in Oregon (ODFW 1996). Local populations are highly susceptible to extirpation for several reasons, including narrow niche requirements combined with isolated population distribution, long generation time, and loss of mature forest along headwater stream habitats (Welsh 1990). Of seven Pacific Northwest anurans associated with old-growth forest, the tailed frog is probably the species most likely to be affected by old-growth habitat loss and degradation (Blaustein et al. 1995).

Range

The range of the tailed frog extends from southwest British Columbia through western Washington south to northwestern California (Leonard et al. 1993). In Washington, this species occurs in the Olympics, Cascades, and Blue Mountains, and the Willapa Hills of southwest Washington (Dvornich et al. 1997).

Habitat

Tailed frogs are adapted to cold, rocky streams, and their tadpoles are highly specialized for living in fast-moving streams (Leonard et al. 1993). Adults forage mainly on land along streambanks but also underwater, and seek cover under rocks and woody debris in streams (Zeiner et al. 1988). Numerous studies have documented a close association between tailed frogs and late-successional forest (Blaustein et al. 1995). Tailed frogs are sensitive to canopy disturbance and increased sedimentation associated with timber harvest and management operations, modification of historical flooding regimes, and grazing (Corn and Bury 1989; Welsh 1990; Jennings and Hayes 1994).

The tailed frog has been associated with many different forest types, including Douglas-fir, redwood, Sitka spruce, ponderosa pine, and western hemlock (Jennings and Hayes 1994). Older (greater than 200 years) multi-layer forests, downed woody material, ground-level vegetation, ground cover, and canopy closure are all important predictors of the occurrence of tailed frogs in northwestern California and southern Washington (Aubry and Hall 1991; Welsh et. al. 1993). Tailed frogs have also been found in younger-age stands, indicating that on occasion suitable microhabitat conditions appear to be met in forests less than 200 years old (Corn and Bury 1989; Aubry and Hall 1991); however, the quality of these stands for tailed frogs may be greatly reduced by timber management activities.

Breeding and developmental habitat for the tailed frog generally consists of permanent, cool (usually less than 59° F) streams with cobble/boulder substrate and woody debris (DeVlamin and Bury 1970; Welsh et al. 1993). These microclimatic conditions are typically associated with cold, clear headwater to mid-order streams in older forest ecosystems (Welsh et al. 1993). Breeding occurs during late August and September, eggs are laid during the summer, and larvae remain in water for 2 - 3 years (Nussbaum et al. 1983). Because of the tailed frog's exceptionally long period of larval and pre-reproductive adult development (estimated 7 to 9 years), populations are particularly

vulnerable to habitat disturbance, and are slow to recover (Brown 1973; Daugherty and Sheldon 1982; Jennings and Hayes 1994).

Occurrence in the Cedar River Municipal Watershed

Tailed frogs are widely distributed and known to breed in the Cedar River Municipal Watershed. Larvae have been observed in numerous streams in both the upper and lower sections of the municipal watershed, and have been incidentally captured during fish distribution surveys and other stream monitoring activities (City of Seattle, unpublished data).

Potential habitat for the tailed frog in the municipal watershed includes clear, cool streams, particularly where associated with mature or old-growth forest.

Van Dyke's Salamander

Status

Legal Status. Van Dyke's salamander (*Plethodon vandykei*) is not a listed species, candidate species, or species of concern at the federal level in Washington. Van Dyke's salamander is a candidate species at the state level in Washington. Its apparent association with riparian habitats in mature and old-growth forests led to this species' inclusion in the list of Survey and Manage species in the Northwest Forest Plan (USDA 1994).

Population Status. Limited distribution and isolation of Van Dyke's salamander populations have prompted concern for this species' survival (WDW 1994). Lehmkuhl and Ruggiero (1991) compiled a list of species associated with late-successional Douglas-fir forests in the Pacific Northwest and modeled the risk of local extinction for each species from habitat loss or fragmentation. This model was based on frequency of occurrence, abundance, body size, and vagility of various species. The Van Dyke's salamander was determined to be a species at high risk (score of 9, on a scale of 1 to 10, with 10 being the highest). Similarly, Thomas et al. (1993) identified this as a high-risk species, closely associated with old-growth forest conditions.

Range

Van Dyke's salamander is endemic to Washington, occurring in three population centers: the Cascade, Willapa, and Olympic Ranges (Leonard et al. 1993). In the Cascade Range, it is known from 26 sites west of the crest to the Puget Trough, from central Skamania County in the south to the north end of Mt. Rainier in the north (Jones 1998). Populations are patchily distributed and of low density; much potential habitat appears to be unoccupied (Blaustein et al. 1995; Jones 1998). Although it is more than 20 miles north of any known Van Dyke's salamander populations, the Cedar River watershed is included within the potential range of this species as it is defined for the Northwest Forest Plan Survey and Manage requirements (Jones 1998).

Habitat

Van Dyke's salamanders are most commonly associated with headwater streambank or seep habitats, often in mature and old-growth coniferous forests (Roderick and Milner 1991; Jones 1998). The Van Dyke's salamander is considered to be the most aquatic

species of woodland salamander (Leonard et al. 1993); it has also been collected at considerable distances from free water, however, usually in microhabitats that retain moisture, such as north-facing slopes (Blaustein et al. 1995; Jones 1998). The species is typically located in the splash zone of creeks under rocks, logs, and wood debris (Leonard et al. 1993). It has also been found in wet talus, forest litter, lava tubes, and along montane lakeshores (Roderick and Milner 1991; Jones 1998). Two nests have been reported for this species: one was inside a partially rotten log alongside a stream (Jones 1989 as cited in WDW 1994), another was under a moss-covered stone (Nussbaum et al. 1983)

The principal management recommendation of WDW (1991) is the maintenance of riparian corridors along all stream types, but especially Type IV and V Waters. Additional recommendations exist for protection of wet talus where the species is known to occur.

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Van Dyke's salamander have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, based on range and habitat availability, Van Dyke's salamanders may potentially occur within the Cedar River Municipal Watershed, although the northernmost recorded observation of this species is in Pierce County, approximately 31 miles south of the watershed.

Potential habitats for the Van Dyke's salamander in the municipal watershed include forested seeps and springs, wet talus, and riparian habitats along Type IV and V streams in mature and old-growth coniferous forest.

Western Pond Turtle

Status

Legal Status. The western pond turtle (*Clemmys marmorata*) is a federal species of concern and is listed as a state endangered species in Washington.

Population Status. Removal of habitat, predation from introduced bullfrogs, introduction of non-native species, and pollution are some factors known to negatively affect western pond turtle populations (Holland and Bury 1991).

Range

Documented observations of western pond turtles in Washington appear to be clustered around the southeastern edge of Puget Sound and along a small portion of the Columbia River (Nussbaum et al. 1983; WDW 1993b). Populations are confirmed only in Klickitat and Skamania counties, with recent individual sightings documented in Pierce and King counties (WDW 1993b). Historical records also exist in Clark and Thurston counties (WDW 1993b). One historical record exists near the western end of the Cedar River Municipal Watershed (Dvornich et al. 1997).

Habitat

The western pond turtle forages in marshes, sloughs, moderately deep ponds, and slow-moving portions of creeks and rivers. Resting habitat includes emergent basking sites such as partially submerged logs, vegetation mats, rocks, and mud banks (Nussbaum et al. 1983). Evenden (1948) reported two records of pond turtles occurring in rapid-flowing, clear, cold, rock and gravel streams in the Cascade foothills. Pond turtles hibernate in bottom mud of streams or ponds, or on land up to 1,600 ft from water (Ernst and Barbour 1972; Holland 1989; Slavens 1992).

Breeding habitat for this species is primarily located near the margin of a pond or stream, but pond turtles have also been found hundreds of feet from water (Stebbins 1954; Nussbaum et al. 1983) and will use meadows as well as young seral stages of most forest types including hardwoods, mixed hardwoods, and conifer forests. The western pond turtle appears to be limited to lower elevations, and is not expected to occur above 1,000 ft (Hays, D., WDFW, January 5, 1998, personal communication).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of western pond turtles have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. Based on known range and habitat availability, this species is not likely to occur within the municipal watershed. All recent observations have come from Skamania and Klickitat counties, along the Columbia River.

Potential foraging habitat for the western pond turtle within the municipal watershed includes low-elevation ponds, lakes, marshes, and sloughs. Potential breeding and hibernation habitat includes adjacent areas with a substrate that allows burrowing.

Western Redback Salamander

Status

Legal Status. The western redback salamander (*Plethodon vehiculum*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The western redback salamander appears to be common and widespread throughout its range. Although it has shown no clear association with old-growth forest (Blaustein et al. 1995), Lehmkuhl and Ruggiero (1991) considered the western redback salamander to be at a moderately high risk of extinction when assessing the viability risks of species associated with late-successional Douglas-fir forests in the Pacific Northwest.

Range

The western redback salamander occurs mainly west of the crest of the Cascade Range from southwestern British Columbia (including Vancouver Island) to southern Oregon (Blaustein et al. 1995). In Washington, it occurs in the western Cascades, on the Olympic Peninsula, and in the southwestern part of the state (e.g., Willapa Hills) (Dvornich et al. 1997).

Habitat

The western redback salamander is a common terrestrial salamander that occurs primarily in dense forests from sea level up to 3,600 ft (Nussbaum et al. 1983; Dvornich et al. 1997). It is common in talus slopes, but also occurs in decaying logs, leaf litter, bark piles, and under other surface debris on the forest floor (Nussbaum et al. 1983; Blaustein et al. 1995). Adults and juveniles are often found on steeper slopes, in talus or under logs (Blaustein et al. 1995). Eggs are laid in clusters of 6 - 19 (mean 10.4); nest sites have been found in moist talus, guarded by adults (Nussbaum et al. 1983; Blaustein et al. 1995). Individual females generally lay eggs every other spring, with hatchlings emerging in fall and taking approximately 2 ½ years to reach maturity (Blaustein et al. 1995; Behler and King 1979).

Occurrence in the Cedar River Municipal Watershed

Western red-backed salamanders are present in the Cedar River Municipal Watershed, but no comprehensive surveys have been conducted and no breeding activity has been documented to date.

Potential habitats for this species in the municipal watershed include talus slopes and moist coniferous forests, particularly those with large accumulations of debris (e.g., late-successional and old-growth forests).

Western Toad

Status

Legal Status. The western toad (*Bufo boreas*) is a federal species of concern in Washington, and a candidate species at the state level in Washington.

Population Status. Precipitous declines in populations of this and other amphibian species have prompted concern for amphibians as a group; whole populations of western toads have disappeared for unknown reasons in the Cascade Range and elsewhere (Leonard et al. 1993; Corn 1994). Massive die-offs of fertilized eggs and reduced numbers of adults have been documented in remote, undisturbed parts of the Cascades (Blaustein and Wake 1995).

Range

The western toad occurs from southeast Alaska eastward through British Columbia, western Alberta, and western Montana, south to Baja California and east to northern Colorado (ODFW 1996; Behler and King 1979). It is found throughout western Washington and in the mountainous portions of eastern Washington (Dvornich et al. 1997).

Habitat

Western toads occur in forested and brushy areas from sea level to high mountains (ODFW 1996). Moist areas with dense cover are considered optimal (ODFW 1996). During dry weather, toads will spend the day under damp, woody debris or in burrows of other animals; they will also bury themselves in loose soil (Nussbaum et al. 1983; Leonard et al. 1993). Western toads breed in springs, ponds, shallow areas in lakes, and slow-moving streams, and also use stock ponds and reservoirs in arid areas (ODFW

1996). Tadpoles form huge aggregations, generally in the warmest portion of a particular water body; western toad tadpoles are found in a wider variety of water bodies than the tadpoles of Pacific Northwest frogs (Blaustein et al. 1995). Because they can be locally abundant, can live in a relatively wide variety of habitat types, disperse overland, and live many years as adults, western toads may be less affected by land use practices than other anurans (Blaustein et al. 1995).

Occurrence in the Cedar River Municipal Watershed

Western toads are considered common and are known to breed in the Cedar River Municipal Watershed.

Potential breeding habitat for this species in the municipal watershed includes ponds, lakes, wetlands, and slow-moving streams, particularly within densely forested or brushy areas.

INVERTEBRATES: INSECTS

Background

Insects are arthropods, which represent a major source of biodiversity in late-successional forests of the Pacific Northwest and account for about 7,000 species across the range of the northern spotted owl (Olson 1992). The diversity of arthropods in the litter layer approaches the greatest number found anywhere in the Northern Hemisphere, sometimes reaching 250 species per 3.6 square ft (Lattin 1990). Invertebrates, including insects as well as mollusks (discussed below), play many essential ecological roles, especially with regard to nutrient recycling; they begin the process of breaking down forest litter, prey on microbes and microbivores, mix humus and mineral soil, spread microbial inocula, and aerate the soil (Lattin and Moldenke 1992). Twelve of the 14 insects addressed by the HCP are beetles (Order Coleoptera); the remaining insects include one butterfly (Johnson's (mistletoe) hairstreak) and one stonefly (Fender's soliperlan stonefly).

Background Beetle Information (Order Coleoptera)

Twelve species of beetles are covered under the HCP and are discussed below in addition to the other 2 species of insects and 5 species of mollusks addressed and discussed below. The Beller's ground beetle and Hatch's click beetle are listed as candidate species by the U.S. Fish and Wildlife Service. Three beetle species are listed as candidate species by the Washington Department of Fish and Wildlife. These species are Beller's ground beetle (*Agonum belleri*) in the Family Caribidae, Hatch's click beetle (*Eanus hatchii*) in the Family Elateridae, and the long-horned leaf beetle (*Donaica idola*) in the Family Chrysomelidae. All 3 species are associated with lowland sphagnum bogs - a rare habitat in King County, and one that is probably at a higher risk of extinction than any other terrestrial lowland habitat (Bergdahl 1997) (note: sphagnum is defined here as terrestrial habitat because it is '"above water" primarily, regardless of whether there is open water or not on the wetland" (Bergdahl, J., Northwest Biodiversity Center, September 14, 1998, personal communication).

In addition to the above three beetle species, ten species were identified as regional endemics and habitat specialists with the potential to occur in the Cedar River Municipal

Watershed: *Bembidion gordoni*, *B. stillaguamish*, *B. viator*, *Bradycellus fenderi*, *Nebria paradisi*, *N. gebleri cascadensis*, *N. kincaidi balli*, *Omus dejeanii*, *Pterostichus johnsoni*, and *P. pumilus* (Bergdahl 1996). All ten of these species are in the Family Caribidae, and all but one species (*P. pumilus*) are covered under the HCP. The U.S. Fish and Wildlife Service (1996) identified individual species from four of these five genera as species that might be significantly affected in a negative way by changes in forest management practices resulting from exemptions for private landowners from the Draft Recovery Plan for the Northern Spotted Owl (USDI 1992b). These genera include *Bembidion*, *Nebria*, *Omus*, and *Pterostichus*.

Beetles in the Family Caribidae, or ground beetles, are primarily ground-dwelling predators of soft-bodied invertebrates. As a group, carabid beetles occur in a wide variety of habitat types, although many individual species are highly specialized in their habitat requirements (Bergdahl 1997). Many carabid species are wingless, which limits their dispersal capability, indicating the species have developed over a long period of time in a stable environment (Lattin and Moldenke, 1992). Carabid beetles exhibit a fairly high level of endemism: of approximately 700 species known to occur in the Pacific Northwest, 89 are found nowhere else in the world (Bergdahl, 1997). Because of their strong habitat specificity and low dispersal rates, carabids are excellent bioindicators of habitat quality or change (Kavanaugh 1992). Also, because they are a very rich and abundant group of highly specialized species occurring in a wide variety of habitats, carabid beetles are excellent tools for habitat assessment and monitoring research (Bergdahl 1997).

Each of the 13 carabid species listed above faces a risk of local extinction from stochastic events (e.g., floods, fires) because of their habitat specificity, patchy distribution, and low recolonization potential. Forest management poses a major threat to this species group. One study in the Andrews Experimental Forest in the western Oregon Cascades reported a 90 percent loss of total soil arthropods after clearcutting and burning (Moldenke and Lattin 1990). In addition to relying on the cool moist conditions found at ground level in riparian forests, most of these species require coarse woody debris and litter that provide shelter and habitat for necessary food resources (USDI 1996). Log removal (e.g., through salvage operations) can result in decreased habitat availability, damage to soil horizons, and elimination of sources of recolonization (Olson 1992). Seven of these 13 carabid species are associated with high-order non-fish bearing streams, which historically have received no protection under Forest Practices Rules (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication).

Additional concern for these species stems from the popular misconception that efforts to protect critical habitat for the northern spotted owl will assure the viability of old-growth forests and associated species in the Pacific Northwest (Olson 1992). Most forest floor species, however, are narrowly adapted to conditions of low light, abundant moisture, and moderate temperatures found in late-successional and old-growth forests. Although some types of thinning (e.g., ecological thinning) have been found to accelerate the development of old-growth conditions in conifer forests, thinning may actually cause substantial damage to the fragile understory environment (Olson 1992).

Beller's Ground Beetle

Status

Legal Status. The Beller's ground beetle (*Agonum belleri*) is a federal species of concern, and is a candidate species at the state level in Washington.

Population Status. The limited amount of ecological information currently available about Beller's ground beetle is insufficient to evaluate the species' population status in Washington State. However, threats to this species include the limited availability of healthy lowland sphagnum bogs, land-use practices that may affect water levels in such bogs, and the introduction of non-native fish species into occupied habitat because the fish might eat the larvae (Larsen et al. 1995).

Range

Beller's ground beetle occurs from the Queen Charlotte Islands in British Columbia, south through coastal Washington to Oregon (Opler and Lattin 1998; Larsen et al. 1995). This species has been documented in two sphagnum bogs south of Little Mountain at the east end of Chester Morse Lake (Bergdahl 1997).

Habitat

Beller's ground beetles are restricted to low-elevation (below 3,000 ft) sphagnum bogs. Individuals have been found inhabiting areas immediately adjacent to open water, and not in the surrounding drier areas of the bog (Larsen et al. 1995). This flightless species can be locally abundant at some sites, and may be spotted running around on open sphagnum mats on warm sunny days (Bergdahl 1997). It may be a form of a parasite of the insectivorous sundew (*Drosera* spp.) plants, stealing insects trapped on the sticky leaves (Bergdahl 1997).

Management recommendations for this species include prevention of peat mining or other activities that may disturb bogs (including filling, draining, and removing or damaging natural vegetation), prevention of activities that may affect natural water levels or flow regimes, and restrictions on pesticide use in adjacent areas (Larsen et al. 1995). Because the larval stage of this species is aquatic, prohibitions on the introduction of non-native fish into lakes or wetlands with sphagnum bogs inhabited by this beetle is also a management recommendation.

Occurrence in the Cedar River Municipal Watershed

Beller's ground beetles have been documented at two sites in the Cedar River Municipal Watershed (both bogs south of Little Mountain) (Bergdahl 1997). However, no comprehensive surveys to determine the extent of the distribution of the species within the watershed have been conducted. Potential habitat for Beller's ground beetles in the municipal watershed includes low-elevation sphagnum bogs.

Carabid Beetle (*Bembidion gordoni*)

Status

Legal Status. *Bembidion gordoni*, a Carabid beetle, is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about *Bembidion gordoni* is insufficient to evaluate the species' population status in Washington State. However, threats to this species include activities that may influence microclimate conditions along small, steep, montane streams, such as tree cutting (clearcut logging or thinning), road construction, and removal of large woody debris.

Range

Bembidion gordoni has been found in Oregon, Washington, and British Columbia (Smithsonian 1998).

Habitat

Little is known about the distribution and habitat requirements of this species (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication). As with other *Bembidion* species, it may be found on gravel banks of running waters where its staple food consists of dead and dying insects drifting ashore (Lindroth 1961-1969). Bergdahl (1996) associates this species with fast-running montane streams.

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of *Bembidion gordoni* have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date.

Carabid Beetle (*Bembidion stillaguamish*)

Status

Legal Status. *Bembidion stillaguamish*, a Carabid beetle, is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about *Bembidion stillaguamish* is insufficient to evaluate the species' population status in Washington State. However, threats to this species include activities that may influence microclimate conditions along fairly large streams, such as tree cutting (clearcut logging or thinning), road construction, and removal of large woody debris.

Range

Bembidion stillaguamish has been found in Oregon, Washington, and British Columbia (Smithsonian Institution 1998). This species is widespread, and is likely to be found in the watershed (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication).

Habitat

Bembidion stillaguamish is most commonly found along the margins of fairly large mid-montane streams, often on stabilized sand/gravel bars (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication). It is also found in streamside vegetation (*Salix* and *Equisetum* species) with sandy soil, often at the margins of large pools (Bergdahl 1996).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of *Bembidion stillaguamish* have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, the species is widespread and based on range and habitat availability, it is likely that *Bembidion stillaguamish* is present in the Cedar River Municipal Watershed (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication).

Carabid Beetle (*Bembidion viator*)

Status

Legal Status. *Bembidion viator*, a Carabid beetle, is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about *Bembidion viator* is insufficient to evaluate the species' population status in Washington State. However, threats to this species include activities that may influence microclimate conditions along low-elevation wetlands, such as tree cutting (clearcut logging or thinning), road construction, and removal of large woody debris. Native and non-native fish introductions and water level manipulation may also pose a threat.

Range

This species is known from only a few sites. The Smithsonian Institution (1998) lists its known range as British Columbia. Bergdahl (1997) collected it from four bogs in King County. Because of its range and habitat requirements, *Bembidion viator* is likely to occur in the watershed although it was not found at two bogs sampled in 1996 (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication).

Habitat

Bembidion viator has been found at low-elevation swamps, bogs, and forested marshes (Bergdahl 1996).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of *Bembidion viator* have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. In addition, the species was not found in two bogs (south of Little Mountain) sampled in 1996 (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication). However, based on range and habitat availability, it is likely that *Bembidion viator* is present in the Cedar River Municipal Watershed (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication). Potential habitat for *Bembidion viator* in the municipal watershed includes low-elevation swamps, bogs, and forested marshes.

Carabid Beetle (*Bradycellus fenderi*)

Status

Legal Status. *Bradycellus fenderi*, a Carabid beetle, is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about *Bradycellus fenderi* is insufficient to evaluate the species' population status in Washington State. However, threats to this species include activities that may influence microclimate conditions along low-elevation wetlands, such as tree cutting (clearcut logging or thinning), road construction, and removal of large woody debris. Native and non-native fish introductions and water level manipulation may also pose a threat.

Range

This species is known only from about a dozen wetlands in Washington and Oregon. Based on its range and habitat requirements, *Bradycellus fenderi* is likely to occur in the Cedar River Municipal Watershed, although it wasn't found at two bogs sampled in 1996 (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication).

Habitat

Bradycellus fenderi is associated with low-elevation swamps and forested marshes, and foothill streamsides (Bergdahl 1996). In contrast with other carabid beetles, most species of *Bradycellus* are primarily herbivorous (Lindroth 1961-1969).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of *Bradycellus fenderi* have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. In addition, the species was not found in two bogs (south of Little Mountain) sampled in 1996 (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication). However, based on range and habitat availability, it is likely that *Bradycellus fenderi* is present in the Cedar River Municipal Watershed (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication). Potential habitat for *Bradycellus fenderi* in the municipal watershed includes low-elevation swamps and forested marshes, and foothill streamsides.

Carabid Beetle (*Nebria gebleri cascadensis*)

Status

Legal Status. *Nebria gebleri cascadensis*, a Carabid beetle, is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about *Nebria gebleri cascadensis* is insufficient to evaluate the species' population status in Washington State. However, threats to this species include activities that may influence microclimate conditions along small, steep, montane streams, such as tree

cutting (clearcut logging or thinning), road construction, and removal of large woody debris.

Range

This species ranges from central Oregon north to southwestern British Columbia (Smithsonian, 1998; Bergdahl, 1996). It has been documented in the watershed, and is probably widespread (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication).

Habitat

The genus *Nebria* is adapted to cold temperatures and represented in northern and mountain regions; most species are strongly hygrophilous (strongly associated with water), but confined to stony, barren margins of running waters. These beetles are carnivorous and nocturnal (Kavanaugh 1992; Lindroth 1961-1969). This species is associated with streams and streamside habitats at most elevations (Bergdahl 1996).

Occurrence in the Cedar River Municipal Watershed

Nebria gebleri cascadensis is present in the Cedar River Municipal Watershed and is probably widespread (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication). However, no comprehensive surveys to determine the extent of the distribution of the species within the watershed have been conducted.

Carabid Beetle (*Nebria kincaidi balli*)

Status

Legal Status. *Nebria kincaidi balli*, a Carabid beetle, is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about *Nebria kincaidi balli* is insufficient to evaluate the species' population status in Washington State. However, threats to this species include activities that may influence microclimate conditions along small, steep, high-elevation streams, such as tree cutting (clearcut logging or thinning), road construction, and removal of large woody debris. The U.S. Fish and Wildlife Service (USDI 1996) includes this species in a list of riparian predators that may be negatively affected by exemptions for private landowners from the Draft Recovery Plan for the Northern Spotted Owl (USDI 1992b).

Range

This species is known from a few sites in Oregon and Washington (Smithsonian Institution 1998).

Habitat

Nebria kincaidi balli occurs along small high-elevation (subalpine) streams (Bergdahl 1996).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of *Nebria kincaidi balli* have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date.

Carabid Beetle (*Nebria paradisi*)

Status

Legal Status. *Nebria paradisi*, a Carabid beetle, is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about *Nebria paradisi* is insufficient to evaluate the species' population status in Washington State. However, threats to this species include activities that may influence microclimate conditions along small, steep, high-elevation streams, such as tree cutting (clearcut logging or thinning), road construction, and removal of large woody debris.

Range

This species has been found in northwestern Oregon and southwestern Washington (Bergdahl 1996; Smithsonian 1998).

Habitat

Nebria paradisi, like *N. kincaidi*, occurs in small high-elevation (subalpine) streams (Bergdahl 1996).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of *Nebria paradisi* have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date.

Carabid Beetle (*Omus dejeanii*)

Status

Legal Status. *Omus dejeanii*, a Carabid beetle, is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about *Omus dejeanii* is insufficient to evaluate the species' population status in Washington State. However, threats to this species include activities that may influence microclimate conditions in low-elevation forests, such as tree cutting (clearcut logging or thinning), road construction, and removal of large woody debris.

This flightless, nocturnal beetle is considered by some to be a member of the Family Cicindelidae, or tiger beetles. However, the habits of species of the *Omus* genus are uncharacteristic of its family, and more similar to those of the ground beetles, which are generally diurnal and good fliers (Lattin and Moldenke 1992).

Range

O. dejeanii ranges from southern British Columbia south through the coast ranges of Oregon and Washington, to Jackson County, Oregon. Nearby known localities include Seattle, Easton (Kittitas County), and Electron (Pierce County) (Opler and Lattin 1998).

Habitat

This species is often common in low-elevation forests and forest glades, and along stream banks (Bergdahl 1996). It has been encountered at non-sphagnum swamps in Snohomish County (Bergdahl 1997).

Occurrence in the Cedar River Municipal Watershed

Omus dejeanii is present in the Cedar River Municipal Watershed (Bergdahl , J.C., Northwest Biodiversity Center, June 19, 1998, personal communication). However, no comprehensive surveys to determine the extent of the distribution of the species within the watershed have been conducted. Potential habitat for *Omus dejeanii* in the municipal watershed includes low-elevation forests and forest glades, and stream banks.

Carabid Beetle (*Pterostichus johnsoni*)

Status

Legal Status. *Pterostichus johnsoni*, a Carabid beetle, is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. The limited amount of ecological information currently available about *Pterostichus johnsoni* is insufficient to evaluate the species' population status in Washington State. However, threats to this species include activities that may influence microclimate conditions along small, steep, montane streams, such as tree cutting (clearcut logging or thinning), road construction, and removal of large woody debris.

Range

Pterostichus johnsoni is endemic to the west slopes of the Cascades, occurring from northern Oregon to the Skagit River in Washington (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication).

Habitat

The habitat associations of this flightless species are atypical of the genus *Pterostichus*, which is usually found in forested areas. *P. johnsoni* is a stream-dependent species, found at middle elevations in headwaters of wall-based channels and in steep, wet, unstable sand-mud-scree slopes (Bergdahl 1996).

Occurrence in Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of *Pterostichus johnsoni* have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date.

Fender's Soliperlan Stonefly

Status

Legal Status. Fender's soliperlan stonefly (*Soliperla fenderi*, Order Plecoptera) is a federal species of concern in Washington State. The species has no designated listing status at the state level in Washington.

Population Status. Concern for this species stems from its extremely limited known distribution, and the sensitivity of stonefly species to changes in water temperature and chemistry. The U.S. Fish and Wildlife Service (1996) included this species in a list of aquatic detritivores that may be negatively affected by exemptions for private landowners from the Draft Recovery Plan for the Northern Spotted Owl (USDI 1992b).

Range

Fender's soliperlan stonefly has been collected from only a few sites on the south and west flanks of Mount Rainier (Opler and Lattin 1998).

Habitat

Stoneflies spend most of their lives in water as larvae (nymphs). Nearly all members of this relatively small group of insects depend on cool, well-oxygenated water and are found in rocky streams with a noticeable current (Nelson 1996). The length of the larval life cycle ranges from 1 to 4 years; mature nymphs climb out of the water (mostly at night) before their final molt, and live only a few days to a few weeks as adults (Gustafson 1995). Adults feed little (if at all) and do not disperse over great distances, as indicated by the rarity of stoneflies on many islands (Gustafson 1995; Ramel 1995). Because of their sensitivity to changes in water temperature and dissolved oxygen levels as larvae, and poor dispersal capability as adults, stoneflies serve as indicators of stream health (Nelson 1996; Gustafson 1995).

Soliperlan stoneflies are members of the Family Peltoperlidae, a small group of medium sized stoneflies found in the mountains of eastern and western North America, whose nymphs function as shredder-detritivores (Stark 1983; Gustafson 1995). Peltoperlids are commonly associated with very shallow flowing water, such as seeps on rock faces (Nelson 1996). Fender's soliperlan stonefly appears to typify this group; known sites are often described as seeps and streams (Opler and Lattin 1998).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Fender's soliperlan stonefly have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. In addition, all sites where this species has been documented in Washington occur more than 31miles south of the watershed, in Mount Rainier National Park. However, despite this potential constraint, based on range and habitat availability, there is a very low likelihood that Fender's soliperlan stoneflies may be present in the Cedar River Municipal Watershed.

Potential habitats for Fender's soliperlan stonefly in the municipal watershed are seeps, streams and riparian areas.

Hatch's Click Beetle

Status

Legal Status. The Hatch's click beetle (*Eanus hatchii*) is a federal species of concern, and is a candidate species at the state level in Washington.

Population Status. The limited amount of ecological information currently available about Hatch's click beetle is insufficient to evaluate the species' population status in Washington State. However, threats to this species include the limited availability of healthy lowland sphagnum bogs, and land-use practices that may affect water levels in such bogs (Larsen et al. 1995).

Range

Hatch's click beetle (Family Elateridae) historically occurred in Snohomish and King counties, but is presently confirmed only at three bogs in King County (Larsen et al. 1995; WDNR 1996). The nearest known site is approximately 6 miles from the Cedar River Municipal Watershed. Presence of this species can be confirmed only by thorough searches during April, which appears to be the only period when this species is active above ground (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication).

Habitat

Similar to the Beller's ground beetle, this species is restricted to eutrophic sphagnum bogs in or near lakes below 3,000 ft (Larsen et al., 1995; Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication). Adults have been found in very low, floating sphagnum mats; larvae have been found near bog margins, above the water line (Larsen et al. 1995). Adults are active during day, probably feeding on pollen, nectar, honeydew, and small soft insects (pers. comm., P. Johnson, as cited in Larsen et al. 1995). Adults are poor fliers, with limited ability to colonize new habitat or recolonize bogs from which they have been extirpated (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, personal communication).

Management recommendations for this species include prevention of peat mining or other activities that may disturb bogs (including filling, draining, and removing or damaging natural vegetation), prevention of activities that may affect natural water levels or flow regimes, restrictions on pesticide use in adjacent areas, and prohibitions on the introduction of non-native fish into lakes or wetlands with sphagnum bogs inhabited by this beetle (Larsen et al. 1995).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Hatch's click beetle have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. Potential habitat for Hatch's click beetles in the municipal watershed includes low-elevation sphagnum bogs.

Johnson's (mistletoe) Hairstreak

Status

Legal Status. Johnson's (mistletoe) hairstreak (*Mitoura johnsoni*, Order Lepidoptera) is not a listed species, candidate species, or species of concern at the federal level in Washington. Johnson's (mistletoe) hairstreak is a candidate species at the state level in Washington.

Population Status. Threats to this species include the limited availability of its key habitat (low-elevation old-growth forest), efforts to control dwarf mistletoe infestation, and insecticide use. The U.S. Fish and Wildlife Service (1996) included this species in a list of canopy herbivores that may be negatively affected by exemptions for private landowners from the Draft Recovery Plan for the Northern Spotted Owl (USDI 1992b).

Range

Johnson's (mistletoe) hairstreak is found from southern British Columbia south through the Cascades and Coast Range to Mariposa and Solano counties, California (Opler and Lattin 1998; Larsen et al. 1995). In Washington, it is known from low-elevation old-growth forests west of the Cascade crest and on the Olympic peninsula (Larsen et al. 1995).

Habitat

This butterfly species requires conifer forests containing dwarf mistletoes of the genus *Arceuthobium*, on which its caterpillars feed (Opler and Lattin 1998; Larsen et al. 1995). These mistletoes occur mainly on western hemlock, and occasionally on true firs (Larsen et al. 1995; Pojar and MacKinnon 1994). This species does best in low-elevation mature and old-growth forests where western hemlock grows densely enough to support high levels of dwarf mistletoe (Larsen et al. 1995). Younger forests have the potential to support Johnson's (mistletoe) hairstreak, if *Arceuthobium* mistletoes are present (pers. comm., D. McCorkle, as cited in Larsen et al. 1995). Adults spend most of their time in the upper layer of the forest canopy near host trees, but will come down to nectar at plants such as buckbrush (*Ceanothus* spp.), pussy-toes (*Calyptridium* spp.), dogwood, and Oregon-grape (Opler and Lattin 1998; Pyle 1974).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of Johnson's (mistletoe) hairstreak have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. The nearest documented location for this species is in the Green River Watershed, approximately 10 miles south of the Cedar River Municipal Watershed. Therefore, based on range and habitat availability, it is likely that Johnson's (mistletoe) hairstreak is present within the Cedar River Municipal Watershed.

Potential habitat for Johnson's (mistletoe) hairstreak in the municipal watershed includes low-elevation mature to old-growth coniferous forests containing dwarf mistletoe of the genus *Arceuthobium*.

Long-horned Leaf Beetle

Status

Legal Status. The long-horned leaf beetle (*Donacia idola*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The long-horned leaf beetle is listed as a candidate species at the state level in Washington.

Population Status. The limited amount of ecological information currently available about the long-horned leaf beetle is insufficient to evaluate the species' population status in Washington State. However, threats to the long-horned leaf beetle include an extremely limited distribution, producing populations susceptible to disturbance and limited availability of healthy sphagnum bogs in the Puget Trough (Larsen et al. 1995).

Range

The long-horned leaf beetle has been found in lowland sphagnum bogs in Washington and southwest British Columbia. In Washington, it is currently known to occur in only one site, which is in Snohomish County (Larsen et al. 1995; WDNR 1996).

Habitat

Larsen et al. (1995) associate this species solely with low-elevation sphagnum bogs, offering a habitat description and management recommendations nearly identical to those for Beller's ground beetle and Hatch's click beetle. In contrast, Bergdahl (Northwest Biodiversity Center, June 19, 1998, personal communication) says that long-horned leaf beetles can be found in rushes next to open water in a variety of wetland habitats. Adults feed on exposed portions of aquatic plants, especially water lilies and *Potamogeton* (pondweed) species, while the larvae feed inside the submerged portions of aquatic plants (Larsen et al. 1995).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of long-horned leaf beetles have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. Potential habitat for long-horned leaf beetles in the municipal watershed includes low-elevation sphagnum bogs, and possibly other wetland habitats.

INVERTEBRATES: MOLLUSKS

Background

The U.S. Fish and Wildlife Service (USDI 1996d) has identified about 350 species of mollusks (slugs, snails, and bivalves) in the range of the northern spotted owl, and speculates that many new species remain to be discovered. Little information is available about the ecology of individual species. The following background information was excerpted from An Environmental Alternatives Analysis for a 4(d) Rule for the Northern Spotted Owl (USDI 1996d).

Freshwater mollusks occur in permanent water bodies and ephemeral streams or seeps in well oxygenated, silt-free, cold water associated with a riparian zone with a closed canopy. They are prey for a variety of insect, fish, amphibian, bird, and mammal

species. Many aquatic mollusks in the range of the spotted owl are narrowly endemic and are restricted to a single spring or a complex of nearby springs separated by less suitable habitat. Because these populations are highly localized, they are susceptible to extirpation as a result of land disturbance activities that affect water quality or stream habitat. For such geographically restricted species, the loss of a single population could be crucial to the continued existence of that species or directly result in its extinction. Some species endemic to the Pacific Northwest and northern California have much broader distributions, yet may be susceptible to the cumulative impacts of a variety of land use and water management practices throughout their ranges.

Terrestrial snails and slugs are mainly herbivores or detritivores and eat fungi, lichens, leaves, and inner bark layers, although a few species are carnivores. Mollusks are prey for insects, amphibians, reptiles, birds, and mammals, and are important in the recycling and redistribution of nutrients and minerals in the forest. Because desiccation is a major source of mortality of terrestrial snails and slugs, most species occur in the moist, temperature-modulated microhabitats in the dense understory of undisturbed, closed-canopy riparian zones (including those around small springs or wetlands) and late-successional forests. Woody debris, damp leaves or vegetation, and rocks shelter other those mollusk species occurring primarily on talus slopes from predation and adverse climatic conditions. Low rates of dispersal, coupled with the isolation of colonies, contributes to the evolution of geographically restricted endemics, making terrestrial mollusks particularly susceptible to localized extinctions resulting from fires and various land use practices.

All mollusks addressed by the HCP are either snails or slugs. Only one mollusk species addressed by the HCP, *Valvata mergella*, is an aquatic mollusk; all others are terrestrial species.

Blue-Gray Taildropper

Status

Legal Status. The blue-gray taildropper (*Prophysaon coeruleum*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The blue-gray taildropper is a monitor species at the state level in Washington. Because the blue-gray taildropper is apparently closely associated with old-growth forest and riparian habitats, it is considered a Survey and Manage species in the Northwest Forest Plan (USDA 1994; Frest and Johannes 1993).

Population Status. The blue-gray taildropper is a relatively small slug, distinctive in its eponymous coloration and the equally spaced reticulations along the length of its body (Burke 1994a). Desiccation is the greatest threat to any mollusk species; risk of desiccation increases with activities that reduce forest canopy cover, reduce the availability of large woody debris, or decrease available moisture (Frest and Johannes 1993). Urban development has also likely eliminated some populations of this species. Branson (1977) reported unsuccessful searches for blue-gray taildroppers at the type locality in Olympia, Washington. Other sites of historic records include Portland, Oswego, and Corvallis, Oregon, (Burke 1994a), all of which now have substantial urban development.

Frest and Johannes (1993) reported no success locating blue-gray taildroppers in recent extensive searches across the range of the northern spotted owl. Frest and Johannes (1993) estimated that the Northwest Forest Plan has a 30 percent chance of providing sufficient habitat to maintain well-distributed, interacting populations of this species across its range on federal lands in the next 100 years, and a 20 percent chance of extirpation.

Range

The blue-gray taildropper has been collected from western Oregon and Washington, primarily in counties that overlap the Cascades and the Puget/Willamette Trough. It has been reported as far south as Jackson County, Oregon, and as far north as King County, Washington (Burke 1994a; Frest and Johannes 1993).

Habitat

Habitat associations for this species are not well known. Frest and Johannes (1993) describe the blue-gray taildropper's habitat needs as "Probably similar to other Washington slugs with restricted distributions; i.e., relatively undisturbed, moist coniferous forest, from low to middle elevations." Burke (1994a) reports Randolph (as cited in Pilsbry 1948) found this species "solitary in dark fir woods under damp logs." Branson and Branson (1984) collected it from high woodlands and dry, volcanic areas in Clackamas, Marion, Lane, and Jackson counties, in Oregon. Slugs of the genus *Prophysaon* are found largely in perpetually very moist areas, often in riparian forests or spring and seep borders (Frest and Johannes 1993).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of the blue-gray taildropper have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, based on range and habitat availability, the blue-gray taildropper may occur within the Cedar River Municipal Watershed.

Where microhabitat conditions are adequate, this species may occur at low to middle elevations in mature and old-growth forest, and possibly along streams.

Oregon Megomphix

Status

Legal Status. The Oregon megomphix (*Megomphix hemphilli*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The Oregon megomphix is a monitor species at the state level in Washington. Because the Oregon megomphix is apparently closely associated with old-growth forest and riparian habitats, it is considered a Survey and Manage species in the Northwest Forest Plan (Frest and Johannes 1993; USDA 1994).

Population Status. The Oregon megomphix is a medium-sized snail with a glossy, translucent shell that has a pale, dull green-yellow tint (Burke 1994a). Desiccation is the greatest threat to any mollusk species; risk of desiccation increases with activities that reduce forest canopy cover, reduce the availability of large woody debris, or decrease

available moisture (Frest and Johannes 1993). Where it occurs, this species is never abundant (Branson 1980), indicating that local populations are susceptible to extirpation. Frest and Johannes (1993) found the Oregon megomphix increasingly rare over the last decade, and absent from many sites from which it had been previously reported. Frest and Johannes (1993) estimated that the Northwest Forest Plan has a 30 percent chance of providing sufficient habitat to maintain well-distributed, interacting populations of this species across its range on federal lands in the next 100 years, and a 20 percent chance of extirpation.

Range

The Oregon megomphix has been found on the west side of the Cascades, from northern Oregon to northern Washington (Frest and Johannes 1993). Branson (1977) collected it from 14 sites on the Olympic Peninsula, and he found it at 3 sites on the Mount Baker National Forest (Branson 1980).

Habitat

Habitat associations for the Oregon megomphix are not well known. Frest and Johannes (1993) describe the habitat needs of this species as "moist, low-middle elevation, relatively undisturbed forest." Burke (1994a) says Baker (as cited in Pilsbry 1946) found this species along the banks of the Willamette River, and that Baker said of habitat associations, "the aestivating individuals … burrow a few inches into the loose loam under fallen logs on quite steep hillsides, which are dominated by *Pseudotsuga*/*Tsuga* forest. They usually live under those trunks which are supported off the ground by other debris, which insures the snail plenty of air and comparative freedom from excessive accumulations of decaying humus."

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of the Oregon megomphix have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, based on range and habitat availability, the Oregon megomphix may be present within the Cedar River Municipal Watershed. Potential habitat for the Oregon megomphix within the watershed includes moist, low- to mid-elevation, mature and old-growth forest.

Papillose Taildropper

Status

Legal Status. The papillose taildropper (*Prophysaon dubium*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The papillose taildropper is a monitor species at the state level in Washington. Because the papillose taildropper is apparently closely associated with old-growth forest and riparian habitats, it is considered a Survey and Manage species in the Northwest Forest Plan (Frest and Johannes 1993; USDA 1994).

Population Status. The papillose taildropper (*Prophysaon dubium*) is a relatively small slug with a brownish body and prominent papillae on its mantle (Burke 1994a). As with most mollusks, this species has been very poorly studied. Data regarding range, habitat associations, and even the species description are very scarce, based on only a few

specimens and sites. Desiccation is the greatest threat to any mollusk species; risk of desiccation increases with activities that reduce forest canopy cover, reduce the availability of large woody debris, or decrease available moisture (Frest and Johannes 1993). Frest and Johannes (1993) estimated that the Northwest Forest Plan has a 50 percent chance of providing sufficient habitat to maintain well-distributed, interacting populations of this species across its range on federal lands in the next 100 years, and a 10 percent chance of extirpation. This was the most optimistic ranking given to any of the 104 mollusk taxa they assessed.

Range

The papillose taildropper has been collected from a few sites in Clackamas County, Oregon, and Pierce, Thurston, and Kittitas Counties, Washington, (Burke 1994a, 1994b; Foster Wheeler Environmental field survey data, 1997). More recently, it has been collected in northern California (Frest and Johannes 1993).

Habitat

The papillose taildropper appears to be strongly associated with riparian vegetation in moist coniferous forests (Frest and Johannes 1993). In the Taneum Creek Watershed (Kittitas County), it was found with moderately decayed woody debris at the outer edges of the vegetated floodplain, shaded by immediately adjacent conifer stands (Burke 1994b). At two other sites in Kittitas County, it was found in vine maple leaf litter within or adjacent to small streams; one site was within old-growth forest, while the other was in a clearcut (Foster Wheeler Environmental field survey data, 1997). Notably, at a third site in Kittitas County, a papillose taildropper was found on the rain-moistened surface of a patch of mossy talus surrounded by old-growth forest, more than 300 ft from the nearest riparian area (Foster Wheeler Environmental field survey data, 1997). Habitat associations from other localities in Washington and Oregon are vague, including “mushroom growth at the edge of a mountain meadow within a few feet of a stream…” (Pilsbry 1948 as cited in Burke 1994a), and “571 m elevation; soil, marginal oak forest” (Branson 1984, as cited in Burke 1994a). Although no clear forest-type association emerges from these sightings, Burke (1994b) notes that old-growth forest may expand the width of suitable microhabitat conditions along streamside habitats where this species is found. Slugs of the genus *Prophysaon* are found largely in perpetually very moist areas, often in riparian forests or spring and seep borders (Frest and Johannes 1993).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of the papillose taildropper have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. In addition, no censuses for this species are known from the vicinity of the watershed. However, it has been collected from sites to the east and southwest of the watershed, the nearest site less than 12.4 miles to the east. Therefore, based on range and habitat availability, the papillose taildropper may be present within the Cedar River Municipal Watershed.

Where microhabitat conditions are adequate, this species may occur along streams and possibly within forested talus in the watershed.

Puget Oregonian

Status

Legal Status. The Puget Oregonian (*Cryptomastix devia*) is not a listed species, candidate species, or species of concern at the federal level in Washington. The Puget Oregonian is a Washington State monitor species. Because the Puget Oregonian is apparently closely associated with old-growth forest and riparian habitats, it is considered a Survey and Manage species in the Northwest Forest Plan (Frest and Johannes 1993; USDA 1994).

Population Status. The Puget Oregonian is a medium-sized snail with a pale yellowish to tan shell (Burke 1994a). Desiccation is the greatest threat to any mollusk species; risk of desiccation increases with activities that reduce forest canopy cover, reduce the availability of large woody debris, or decrease available moisture (Frest and Johannes 1993). Frest and Johannes (1993) estimated that the Northwest Forest Plan has a 0 percent chance of providing sufficient habitat to maintain well-distributed, interacting populations of this species across its range on federal lands in the next 100 years, and a 50 percent chance of extirpation. This was the second-highest risk of extirpation given to any of the 104 mollusk taxa they assessed.

Range

The Puget Oregonian was historically reported from scattered sites extending from southern Vancouver Island, British Columbia, to the west end of the Columbia Gorge in Multnomah County, Oregon (Frest and Johannes 1993; Burke 1994a). Recent collections have occurred in King, Thurston, Lewis, and Skamania counties in Washington (Frest and Johannes 1993; Foster Wheeler Environmental field data, 1997). Branson (1980) collected five specimens from Lake Chelan State Park in Chelan County east of the Cascade crest, but Frest and Johannes (1993) and Burke (1994a) say this record bears further examination.

Habitat

Habitat associations for the Puget Oregonian are not well known. Frest and Johannes (1993) describe the habitat needs of this species as "low to middle elevations; old growth and riparian associate; habitat includes leaf litter along streams, under logs, seeps and springy areas." Burke (1994a) says Baker (as cited in Pilsbry 1940) found this species "… at bases of east-facing slopes along the lake north of Seattle, near damp places with maples and sword ferns." Recent collections from Lewis County near Randle, Washington come from mature conifer forest with patches of hardwoods along streams, and among vine maple leaf litter in roadside talus (Foster Wheeler Environmental field data, 1997).

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of the Puget Oregonian have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, based on range and habitat availability, the Puget Oregonian may be present within the Cedar River Municipal Watershed.

Potential habitat for the Puget Oregonian in the municipal watershed includes low- to mid-elevation mature to old-growth coniferous forests.

Snail (*Valvata mergella*)

Status

Legal Status. *Valvata mergella*, a species of snail, is not a listed species, candidate species, or species of concern at the federal or state level in Washington.

Population Status. *Valvata mergella* is a freshwater snail whose only known population in North America occurs at Paradise Lake in Snohomish County.

Range

Valvata mergella was observed historically in the Pacific Northwest and Alaska in the 1800s, but had not been recorded during the twentieth century until it was confirmed at Paradise Lake, in September 1995 (Richter 1995).

Habitat

Based on historical accounts and the most recent finding, *Valvata mergella* requires lakes with a muddy substrate and well-oxygenated water. Inputs of sediment, nutrients, and aquatic plant growth (which might cause eutrophication) are likely fatal, which probably explains the absence of this species from its former range in the Pacific Northwest (Richter 1995). The snail is a voracious detritivore, consuming large amounts of plant material that drops to the bottom of the lake (personal comm., T. Frest, as cited in Richter 1995). This species may depend on conditions found at low elevations: Paradise Lake is only 255 ft above sea level.

Occurrence in the Cedar River Municipal Watershed

No comprehensive surveys to determine the presence or absence of *Valvata mergella* have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. Because the only known population of this species is approximately 25 miles northwest of the watershed, it is unlikely that this species is present in the Cedar River Municipal Watershed.

Potential habitat for this species in the watershed includes lakes with mud substrates and well-oxygenated water; other water bodies may provide suitable habitat as well.